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Abstract

This paper argues that political institutions play an important role in shaping the evolutionary trajectory of preferences. We consider a population with two preference groups. A political institution provides the platform and a set of rules for the two groups to battle over the relative representativeness of their preference traits for the high positions in the social hierarchy. This political process affects the economic outcomes of the two groups, subsequently the intergenerational transmission of preferences. We study how conducive different political institutions are to spreading preference traits that induce better economic outcomes. We find that any preference trait can be prevalent under "exclusive" political institutions. Therefore, a society can be trapped in a state in which preference traits associated with unfavorable economic outcomes persist. On the other hand, preference evolution under "inclusive" political institutions has stronger selection power and only the preference traits that result in the largest comparative advantage in holding a high position can be prevalent.

Keywords: Preference evolution, Political institutions, Evolutionary Game Theory.

JEL Code: C7, D7, Z1.

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"It is always necessary to examine the possible bearing of deep-rooted social and economic changes upon the nature of the values held by the members of a given stratum or society."

—— Max Weber (1896)

1 Introduction

A large body of works in the literature of political economy is devoted to understanding the role of political institutions in economic performance.[1] Most of them are premised on the assumption that preferences of the members in a society are exogenous and fixed. However, in the real world, the distribution of preferences in a population can endogenously evolve across generations over time and historical evidence demonstrates that political institutions have considerable influence on this evolutionary process.[2] On the other hand, evolutionary game theorists provide the fundamental methodologies for studying the evolutionary foundation of preferences.[3] Yet, they have not taken political institutions into consideration.

Preferences, such as time discounting, risk aversion, social preferences, work ethics and the like are crucial for technology advancement or the emergence of more efficient economic institutions.[4] Therefore, to have a better understanding of the long run impacts of political institutions on economic outcomes, it is necessary to examine how political institutions shape the evolution of

[1] See for example, North and Thomas (1973), Olson (1982), March and Olsen (1984), North (1990), Przeworski and Limongi (1993), Saint-Paul and Verdier (1993), Alesina and Rodrik (1994), Persson and Tabellini (1994, 2003, 2008, 2009), Barro (1996, 1997), Bénabou (1996), Acemoglu et al. (2001, 2002, 2006), Tavares and Wacziarg (2001), Glaeser et al. (2004), Lizzeri and Persico (2004), Rodrik and Wacziarg (2005), Papaioannou and Siourounis (2008), Besley and Persson (2011), Acemoglu and Robinson (2012), among many others.

[2] For example, the "Americanization" policy in the early 20th Century effectively induced cultural integration in the United States (See Kuran and Sandholm (2008)). In some circumstances, immigrants' values may be able to spread through the whole society because they have better opportunities to access scarce resources through political institutions. Chinese minorities in South-East Asia serve as good examples. As discussed by Landes (1998), "the same value thwarted by "bad government" at home can find opportunity else where, as in the case of China."

[3] This paper closely follows the works on indirect evolutionary approach including Güth and Yaari (1992), Güth (1995), Bester and Güth (1998), McNamara, Gasson and Houston (1999), Sethi and Somanathan (2001), Ok and Vega-Redondo (2001), Van Veelen (2006), Dekel, Ely and Yilankaya (2007), Heifetz, Shannon and Spiegel (2007a, 2007b), Kuran and Sandholm (2008), Akçay et al. (2009), Alger (2010) and Alger and Weibull (2010, 2012, 2013). See Robson (2001) and Robson and Samuelson (2011) for a survey on another important approach for studying preference evolution.

[4] As argued by Weber (1930), the spread of the "spirit of capitalism", including patience, prudence, frugality and a work ethic for both entrepreneurs and laborers, is the key to the rise of modern enterprises. See also the discussion by Doepke and Zilibotti (2008).

preferences at the first place. This paper attempts to fill in the gaps between these two streams of literature by comparatively investigate preference evolution under different political institutions.

We construct the following model. A population is divided into two groups: a majority preference group in which agents carry a certain preference trait and an alternative preference group in which agents carry another preference trait. We emphasize that these preference groups do not necessarily coincide with groups defined by members' ancestries, ethnicity or cultural origins.[5] Moreover, each preference group acts as a voting bloc and is represented in a political institution. As argued by Congleton (2011), interest groups can be organized by the members' cultural traits such as preferences, norms and ideologies, these groups can include members with various occupations and incomes and may have considerable influence on political decision making.

A society generally has different social positions, constituting a social hierarchy. Some are granted with power and privilege and are linked to leadership roles (e.g., those of a civil servant or manager), while others are not.[6] Assume that there are two types of positions in the social hierarchy: high and low. Political institution provides a platform and set of rules for the political representatives from the two groups to battle over the representativeness of their preference traits for the high positions in the social hierarchy (to determine the allocation of high positions between the two groups). In particular, the set of rules determine the *de jure* distribution of political powers between the two groups. Following the recent works on political economy including Besley and Persson (2011) and Acemoglu and Robinson (2012), who emphasize the importance of the distribution of political powers on the economic consequences of different societies, we index different political institutions by their degrees of "inclusiveness." We call a political institution more "exclusive" if the alternative preference group is excluded from high positions or faces barriers to acquire high positions. On the other hand, a political institution is more "inclusive" if the

[5] For example, as discussed in Landes (1998), in Thailand, the Thai government strongly discourages separate Chinese schooling and Chinese have taken Thai names to better fit in. In Malaysia, affirmative actions urge Chinese minorities to adopt Malay partners. Hence, the industrious values brought by the Chinese immigrants spread without ethnic or cultural boundaries.

[6] Guilds in the Middle Ages serve as a good historical example of a source of high positions in the social hierarchy. At the time, the guilds enjoyed certain privileges granted by the king or the state and had strong control over the urban economy (Acemoglu and Robinson (2012)). Civil positions in Ancient China are another examples as they were usually linked with land and wealth (the main channel for Chinese citizens to achieve these positions was the imperial exam, which tested knowledge of Confucian morals). As stated in Bai and Jia (2015), the exam system created a gentry class. In the society today, higher education and professional degrees are often associated with high positions in the social hierarchy since most occupations corresponding to favorable economic outcomes require such degrees.

political representatives from the two groups interact more equally to determine allocation of high positions.[7]

After the allocation of high positions between the two groups is determined, agents from the two groups enter a random matching process that pairs each high position holder with a low position holder to engage in pairwise economic activity. The matching and interaction paradigm we develop follows Alger and Weibull (2012, 2013).[8] Note that the interaction between positions and preferences is crucial for the economic outcome generated by each pair of agents as well as how they divide the economic outcome.[9] We impose one weak and natural assumption on the dividing rule between each pair of agents: the agent with high position has a larger share of the economic outcome than the agent with low position. After the economic outcomes in one generation are realized, a new generation of agents is born. Each agent has one child who is born without preference. Parents are motivated to exert effort to inculcate their own preferences into their children; when inculcation fails, a child inherits preference trait from a randomly drawn role model as in Bisin and Verdier (2001).[10]

Given the cultural transmission process, we derive an explicit dynamic describing the evolution of preferences. The main solution concept for analyzing the dynamic is called *locally evolutionarily stable preference* (LESP). LESP examines whether a gradual change in the distribution of preferences (the emergence of a small alternative preference group with a similar preference to the one that dominates the society) can result in a new thriving preference trait or merely one that is quickly assimilated. By analyzing LESP of the dynamic, we are able to determine which preferences can be prevalent in the long run under a certain political institution.[11]

[7] Exclusive political institutions defined in this paper are different from extractive political institutions defined in Acemoglu and Robinson (2012), in which control rights are given to a small group of elites. In this paper, we do not discuss extractive political institutions.

[8] However, our paradigm is essentially different from theirs because their paradigm is only suitable for ex-ante symmetric interactions while ours are designed to handle ex-ante asymmetric interactions because of the existence of different positions in the social hierarchy.

[9] For example, Akerlof (1982) pioneers the study of gift exchange and labor contracts and argues that labor workers' preferences for fairness should be taken into consideration to induce more efficient production. Recent work in experimental economics such as Fehr, Klein and Schmidt (2007) demonstrates that inequality aversion can lead to an informal contract between the employer and the employee enhancing productivity more than a formal contract. Francois and Zabojnik (2005) analyze the role of trustworthiness in economic development. They argue that whether new technologies can be adopted and spread depends on whether firm owners can trust contractors.

[10] Since we are considering preference groups instead of cultural/ethnic groups, there is no barrier for a child to adopt a preference trait different from his parent's.

[11] Note that if we strengthen the assumption on the dividing rule of economic outcome in each pair of agents, all

By establishing this evolutionary model, we seek to answer how conducive different political institutions are to spreading preferences that induce better economic performance.

We first investigate the most exclusive political institution, in which the majority has exclusive right to determine the allocation of positions in the social hierarchy. This political institution is referred to as *unadulterated majoritarianism* (see Reynolds (2000)). We show that any preference trait can be LESP under this exclusive political institution because the majority members are able to obtain all the high positions through its group's political power and achieve higher economic outcomes than the alternative preference group members. This result suggests that poor economic performance may persist because such a political institution is able to trap a society into a state populated with agents with preference traits associated with unfavorable economic outcomes.[12]

We then examine the most inclusive political institution in which political representatives from the two groups enter a negotiation on the allocation of high positions and the bargaining powers (political powers) of the two groups are proportional to their group sizes. We call this political institution *egalitarianism*.[13] This political institution represents the common form of proportional representative democracy. The equilibrium allocation of high positions between the two groups is determined by comparing groups' marginal benefits of getting more high positions. This in turn determines if the majority's preference trait is able to assimilate the alternative preference trait through preference evolution. We find that only the preference traits that locally result in *the largest comparative advantage in holding a high position* (the largest marginal benefit of getting more high positions) can be LESP.

We generalize our analysis to a range of political institutions between unadulterated majoritarianism and egalitarianism. These political institutions represents the historical incidents in which the alternative preference group faces entry barriers to participating in politics such as voting restrictions. The results obtained unites the conclusions drawn previously on unadulterated majoritarianism and egalitarianism: preference evolution has stronger selection power under more

our results will still hold if we employ a stronger solution concept, *evolutionarily stable preference* (ESP), in which the small alternative preference group does not need to carry a preference trait similar to the majority (this can be thought as a breakthrough in the primitives).

[12]Note that preference evolution under unadulterated majoritarianism hinges on the majority's preference. So if the majority's preference trait is associated with favorable economic outcomes, the society would not be trapped in a poor state.

[13]Under this political institution, the bargaining power of each group exactly reflects the number of voters from the group. In other words, this political institution promotes equality of opportunities. We emphasize that egalitarianism in our model refers to equality of opportunities rather than equality of outcomes.

inclusive political institutions because the advantage in bargaining power of the majority becomes less important in determining the allocation of high positions.

We believe that our context is especially suitable for analyzing scenarios in which a homogeneous population faces cultural importations, invasions or immigration. For example, in the 16th century, the Catholic Europe faced challenges brought by the Protestant Reformation. The religious dissents carried preference traits different from that of the incumbents and they tried to climb up the social hierarchy predominated by the incumbents. In Western Europe, where political institutions were more inclusive, Protestants disproportionately occupied more of the high positions and their industrious values spread; the opposite occurred in the more exclusive Southern Europe.

We extend the model in three directions: 1) We allow the alternative group to segregate itself from the majority and we investigate how different political institutions affect the decision of self-segregation. Our result can explain why certain immigrant groups establish closely connected business networks and enclave labor markets and they are able to preserve their own cultures over generations.[14] 2) We consider different outside options for the two groups because outside options serve as an important source of *de facto* political powers for the groups. We show that high outside option for the majority can account for the persistence of economic backwardness under inclusive political institutions. 3) We incorporate "imperfect empathy" into the cultural transmission process as in Bisin and Verdier (2001) and find that the main results of the paper are robust.

Note that several recent theoretical works on cultural/preference evolution account for the effects of political institutions.[15] The critical difference between our paper and these works is that the primary aspect of political institutions we consider is that of determining the allocation of positions in the social hierarchy rather than fiscal policies, legal enforcement, school financing or regulations. Moreover, we comparatively study a range of different political institutions and we consider the evolution of a general set of preference traits instead of some specific preferences.

In addition, an important recent literature documents the long-term persistence and long lasting effects of different institutional arrangement on the transmission of cultural traits including

[14] For example, tracing back at the history of immigration to the United States, certain groups such as some Asian groups, had strong economic performance and have been able to preserve their own cultural identities even when they were under-represented in politics, while other groups have not. See Hirschman and Wong (1986) for a discussion on Asian minorities.

[15] For example, Bisin and Verdier (2000b, 2005), Tabellini (2008a), Gradstein and Justman (2002, 2005), Fershtman and Heifetz (2006), Dixit (2009), Aghion et al. (2010), Aghion et al. (2011), Alesina et al. (2012) and Alesina et al. (2014).

preferences.[16] We hope that the model proposed in this paper can further contribute to this line of research.

The paper is organized as follows. Section 2 lays out the model. Section 3 develops our notions of evolutionarily stability. Section 4 applies these notions to study the evolution of preferences under different political institutions. Section 5 considers three extensions of the model. Section 6 presents concluding remarks.

2 The Model

2.1 Population and preferences

Consider a continuum population. Each agent in the population carries a preference trait θ. The set of potential preferences is denoted by a metrizable set Θ. This set can capture fundamental preferences or "character" traits such as time discounting, risk aversion, social preferences, work ethics, conscientiousness, perseverance, sociability, attention, self-regulation, self-esteem, the ability to defer gratification, and the like.

The population is divided into groups by preferences: a majority preference group with preference trait $\theta \in \Theta$ and an alternative preference group with preference trait $\theta' \in \Theta$. The distribution of preferences in each generation is captured by a single parameter μ. The size of the majority group is $1 - \mu$ and the size of the alternative preference group is μ, where $0 \leq \mu < \frac{1}{2}$.

2.2 The Matching Process and Pairwise Interaction

There is a social hierarchy in the population, which consists of two types of positions: high and low. Each agent will have either one of these two positions. The total number of high positions and the total number of low positions available each equals half of the population.[17]

An agent's position in the social hierarchy corresponds to his role in the subsequent economic activities. For the purpose of illustration, we use "manager," denoted by role h, to represent the high position, and "worker," denoted by role l, to represent the low position hereafter.

[16] See for example, Bainfield (1958), Putnam (1993), Alesina and Fuchs-Schuündeln (2007), Guiso, Sapienza and Zingales (2008), Tabellini (2008b), Grosjean (2011), Nunn and Wantchekon (2011), Alesina, Giuliano and Nunn (2013), among many others. Also see Bisin and Verdier (2011) and Alesina and Giuliano (2014) for excellent surveys.

[17] Relaxing this assumption would be a possible extension of the model. For example, if the mass of high positions is less than $\frac{1}{2}$, one can study a context in which some agents are unmatched, or the agents instead engage in interactions with more than two players.

The matching process is dictated by $k(\mu)$, which describes allocation of managers and workers between the majority and the alternative preference group. In particular, $k(\mu)$ captures how high positions are disproportionally allocated (to the majority group). Let $\frac{1-\mu}{2}+k(\mu)$ of the majority and $\frac{\mu}{2}-k(\mu)$ of the alternative preference group to be managers. When $k(\mu)>0$, the number of managers among the majority is more than 50 percent of its group size; when $k(\mu)<0$, the number of managers among the alternative preference group is more than 50 percent of its group size. Assume $k(\mu)$ is continuous in μ. How $k(\mu)$ is determined under different political institutions is one of the main results of this paper; we delay that discussion to Section 4. For now, we start our discussion by assuming $k(\mu)$ to be exogenous.

The range for $k(\mu)$ is $[-\frac{\mu}{2},\frac{\mu}{2}]$, ensuring neither the number of managers nor the number of workers among the alternative preference group is negative. Note that $k(\mu)$ is constructed such that exactly half of the population is managers and the other half is workers, ensuring that no agent is unmatched. Figure 1 provides a graphic illustration of $k(\mu)$.

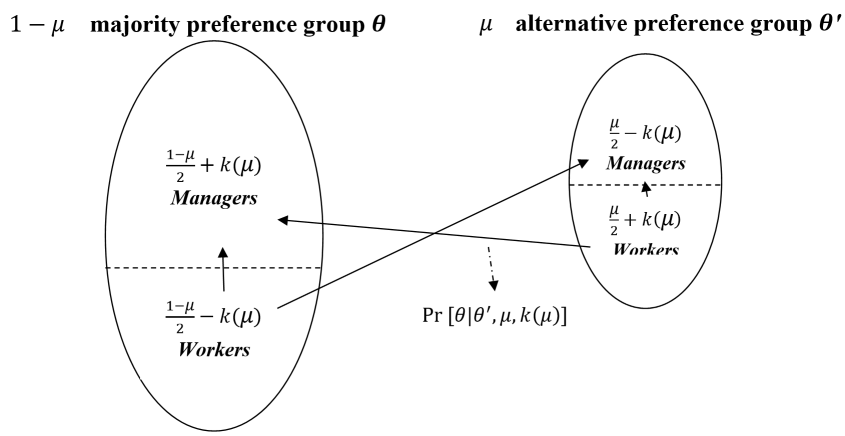

Figure 1

Let $\Pr[\theta_1|\theta_2,\mu,k(\mu)]$ denote the probability that a θ_2 worker matches with a θ_1 manager, for $\theta_1,\theta_2\in\{\theta,\theta'\}$. We have

$$\Pr[\theta|\theta,\mu,k(\mu)] = \Pr[\theta|\theta',\mu,k(\mu)] = 1-\mu+2k(\mu) \tag{1}$$

$$\Pr[\theta'|\theta,\mu,k(\mu)] = \Pr[\theta'|\theta',\mu,k(\mu)] = \mu-2k(\mu). \tag{2}$$

Each matched pair of agents engages in some identical pairwise interactions. For example, they form a farming cooperative to harvest crops or a factory to produce goods. The preferences of the two agents determine how much economic outcome is generated and how it is divided.[18]

[18]For example, consider a pairwise contractual game between an manager and a worker. The manager offers a

For $\theta_1, \theta_2 \in \{\theta, \theta'\}$, let $V_h(\theta_1, \theta_2)$ denote the equilibrium payoff of the manager (role h) whose preference is θ_1 and matched with a worker (role l) whose preference is θ_2. Similarly, let $V_l(\theta_1, \theta_2)$ denote the equilibrium payoff of the worker whose preference is θ_2 and matched with a manager whose preference is θ_1. Define $T(\theta_1, \theta_2) = V_h(\theta_1, \theta_2) + V_l(\theta_1, \theta_2)$ as the total surplus of a firm with a θ_1 manager and a θ_2 worker.[19] Assume that V_h and V_l are continuous in both arguments. The following assumption on the equilibrium payoffs provides a simple but natural division rule between the two agents in each pair: the manager earns a higher payoff than the worker.

Assumption [A1] *$V_h(\theta_1, \theta_2) > V_l(\theta_1, \theta_2)$, for any $\theta_1, \theta_2 \in \Theta$.*

Given the matching process and pairwise interactions, one can calculate the average payoffs of each group. Let $F(\mu, k(\mu))$ denote the average payoff of the majority.

$$\begin{aligned} F(\mu, k(\mu)) \quad = \quad & \frac{1}{1-\mu} \cdot \Big[\left(\frac{1-\mu}{2} - k(\mu) \right) \Pr\left[\theta | \theta, \mu, k(\mu)\right] T(\theta, \theta) + \left(\frac{\mu}{2} + k(\mu) \right) \Pr[\theta | \theta', \mu, k(\mu)] V_h(\theta, \theta') \\ & + \left(\frac{1-\mu}{2} - k(\mu) \right) \Pr[\theta' | \theta, \mu, k(\mu)] V_l(\theta', \theta) \Big]. \end{aligned} \tag{3}$$

The right hand side of equation (3) implies that the expectation number of majority members matched intra-group is $2 \times \left(\frac{1-\mu}{2} - k(\mu) \right) \Pr[\theta | \theta, \mu, k(\mu)]$. The expected number of majority man-

contract to the worker and the worker exerts effort to produce goods accordingly. Different preferences may affect the incentive schemes provided by the manager as well as the productivity of the worker. For instance, if both the manager and the worker have certain social preferences, then the manager may reward the worker voluntarily and the worker may reciprocate by exerting more effort. This results in higher economic outcome as well as a fairer division of the outcome between the two as opposed to the case in which they are both individualistic. See Fehr, Klein and Schmidt (2007) for theory and experimental studies on behavioral contracts involving inequality aversion.

[19] Here, we adopt two common assumptions from the literature of preference evolution. First, the pairwise interaction has a unique equilibrium for each pair of agents with any preference traits in the set of potential preferences Θ. Methods of handling the potential problem of multiple equilibria in specific contexts have been discussed in the literature (see for example, Alger and Weibull (2013)). Nevertheless, since we seek general results that can hold across a variety of contexts, we maintain our assumption of uniqueness. Second, the agents have complete information (see Eswaran and Neary (2014) for a discussion on the justification of observability of preferences by appealing to the psychology of deception). If instead the agents have incomplete information, the equilibrium payoffs would be functions of $k(\mu)$. The interesting point about the incomplete information scenario is that when political representatives determine the allocation of high positions ($k(\mu)$), they need to take into consideration how $k(\mu)$ affects agents' information and their corresponding behaviors. Hence, the predictions of preference evolution may differ significantly from the previous analysis of incomplete information in preference evolution without political institutions (see Ok and Vega-Redondo (2001), Dekel, Ely and Yilankaya (2007) and Alger and Weibull (2013)). We leave this for future research.

agers hiring workers from the alternative preference group is given by $\left(\frac{\mu}{2}+k(\mu)\right)\Pr[\theta|\theta',\mu,k(\mu)]$. The expected number of workers from the majority that are employed by managers from the alternative preference group is $\left(\frac{1-\mu}{2}-k(\mu)\right)\Pr[\theta'|\theta,\mu,k(\mu)]$.

Similarly, let $G(\mu,k(\mu))$ denote the average payoff of the alternative preference group given the matching process, we have

$$\begin{aligned} G(\mu,k(\mu)) &= \frac{1}{\mu}\cdot\Big[\Big(\frac{\mu}{2}+k(\mu)\Big)\Pr[\theta'|\theta',\mu,k(\mu)]T(\theta',\theta')+\Big(\frac{1-\mu}{2}-k(\mu)\Big)\Pr[\theta'|\theta,\mu,k(\mu)]V_h(\theta',\theta) \\ &\quad +\Big(\frac{\mu}{2}+k(\mu)\Big)\Pr[\theta|\theta',\mu,k(\mu)]V_l(\theta,\theta')\Big]. \end{aligned} \tag{4}$$

The matching process defined here is role-specific and thus different from the random matching process defined in the literature of preference evolution (see for example, Alger and Weibull (2012, 2013)), which is only suitable for situations in which agents take homogeneous roles, and consequently does not have a role assignment mechanism.

2.3 Inter-Generational Cultural Transmission

In this section, we model the process by which preferences are transmitted across generations. Here, we develop a cultural transmission mechanism based on Bisin and Verdier (2001).[20]

After engaging in the economic activities described in Section 2.2, each agent gives birth to a child and becomes a parent. Preferences are not inheritable, that is, children are not born with any particular preference trait. Assume that parents prefer their children to adopt the preference which maximizes the children's expected payoffs.[21] The parent can exert effort in influencing his child to adopt his own preference.[22] When the parent fails in inculcation, the child inherits a preference trait from a role model randomly drawn from the population. In other words, the parents display *perfect empathy* (toward their children): this idea captures the fact that preferences that are well aligned with economic interests are often culturally supported (see Congleton (2011)).[23]

[20] Also see the early contributions by Cavalli-Sforza and Feldman (1981) and Boyd and Richerson (1985).

[21] For discussions on humans' tendency of imitating the success, see Boyd and Richerson (1985, 2005).

[22] We assume that a parent can only instill his own preference into his child because in many circumstances it is difficult for a parent to convince his child to adopt a particular preference while he himself behaves in a different way.

[23] Note that Bisin and Verdier (2001) make an alternative assumption called *imperfect empathy* in which the parents' incentive to inculcate their own preferences is biased toward their own traits. As shown by Bisin and Verdier (2001), strong "imperfect empathy" can lead to the phenomenon of cultural heterogeneity, since the alternative preference group has strong tendency to resist assimilation by the majority, even when the majority is more economically successful. In Section 5.3, we investigate the impact of "imperfect empathy" in our model.

Time is discrete. In generation t, the size of the majority group with preference trait θ is $1-\mu_t$, and the size of the alternative preference group with preference trait θ' is μ_t.

Let $d(\mu_t, x)$ denote the probability of successful parent-to-child inculcation. $d : [0,1] \times [0,\infty) \to [0,1]$ is twice differentiable in x. Assume $\frac{\partial d(\mu_t,x)}{\partial x} > 0$ and $\frac{\partial^2 d(\mu_t,x)}{\partial x^2} \leq 0$: the probability of success is strictly increasing and concave in parent's effort. In addition, assume $d(\mu_t, 0) = 0$; that is, when a parent exerts no effort, transmission fails with probability 1. There is a cost associated with exerting effort to inculcate. Let $c : [0,\infty) \to [0,\infty)$ be the cost function. The cost function is identical for all parents and $c(0) = 0, c' > 0, c'' > 0$.

Let $P_t^{\theta\theta}(x) = d(\mu_t, x) + (1-d(\mu_t, x))(1-\mu_t)$ denote the probability that a child from a majority family adopts the preference of his parent's group. $(1-d(\mu_t, x))(1-\mu_t)$ is the probability that a parent fails to inculcate his child with his own preference but his child ends up finding a role model with the same preference as his. Let $P_t^{\theta\theta'}(x) = (1-d(\mu_t, x))\,\mu_t$ denote the probability a child from a majority family adopts the preference of the alternative preference group. This only happens when a parent fails to inculcate his child with his own preference.

Each majority parent of generation t solves the following maximization problem to maximize his child's expected payoff minus the cost of effort[24]:

$$(\circledast) \;\; \max_x [P_t^{\theta\theta}(x) F(\mu_t, k(\mu_t)) + P_t^{\theta\theta'}(x) G(\mu_t, k(\mu_t))] - c(x).$$

When $F(\mu_t, k(\mu_t) \geq G(\mu_t, k(\mu_t))$, the optimal effort $x^*(\mu_t, \theta)$ of $(\circledast)$ solves:

$$\mu_t(F(\mu_t, k(\mu_t)) - G(\mu_t, k(\mu_t)))\frac{\partial d(\mu_t, x)}{\partial x} = c'(x).$$

Assume that interior solution always exists, $x^*(\mu_t, \theta)$ is strictly positive. When $F(\mu_t, k(\mu_t)) < G(\mu_t, k(\mu_t))$, a majority parent exerts no effort so that the probability that his child can meet an alternative preference group adult is maximized. The optimal effort $x^*(\mu_t, \theta) = 0$.

Similarly, we can write down the decision problem faced by an alternative preference group parent and obtain the corresponding optimal effort level $x^*(\mu_t, \theta')$.

[24] Note that we assume that the parents use their own generation's average payoffs of the two groups to measure the expected payoffs of their children. A reasonable alternative assumption would be that the parents form expectations about the average payoffs of the two groups in the next generation. Nevertheless, the predictions of preference evolution would be the same under the two assumptions since we consider the stability of a homogeneous population in the later analysis. That is, we consider situations in which the size of the alternative preference group shrinks to zero.

In the continuum population, $P_t^{\theta\theta'}(x^*(\mu_t,\theta))$ also represents the fraction of children from θ families who adopt preference θ' and $P_t^{\theta'\theta}(x^*(\mu_t,\theta'))$ represents the fraction of children from θ' families who adopt preference θ. The following difference equation describes the dynamic of preference evolution:

$$\mu_{t+1} = \mu_t + (1-\mu_t)P_t^{\theta\theta'}(x^*(\mu_t,\theta)) - \mu_t P_t^{\theta'\theta}(x^*(\mu_t,\theta')), \text{ with initial } \mu_0. \tag{5}$$

3 Evolutionarily Stable Preferences

This section establishes the concepts of evolutionarily stable preferences. To start, we first express the average payoffs of the two groups in the limit as μ goes to zero.

Let $k_0 = \lim_{\mu\to 0}\frac{k(\mu)}{\mu}$. Substitute (1)-(2) into (3)-(4) and take μ to zero. We have:

$$\lim_{\mu\to 0} F(\mu,k(\mu)) = \frac{1}{2}T(\theta,\theta); \tag{6}$$

$$\lim_{\mu\to 0} G(\mu,k(\mu)) = (\frac{1}{2}-k_0)V_h(\theta',\theta) + (\frac{1}{2}+k_0)V_l(\theta,\theta'). \tag{7}$$

Equations (6) and (7) represent the respective average payoffs of the majority group and the alternative preference group in the limit. Fixing θ and θ', we say θ is *stable against* θ' if the size of the alternative preference group with θ' converges to zero in a population dominated by θ type agents. We seek to identify θ that remains prevalent given the presence of different θ'. If the preference trait of the majority group can assimilate all possible different preference traits, we call this majority's preference *stable*. We give the general definition for evolutionary stability:

Definition 1 *A preference $\theta\in\Theta$ is an evolutionarily stable preference (ESP) if for any alternative preference group with $\theta'\neq\theta$, there is a $\overline{\mu}_0\in(0,1)$ such that $\lim_{t\to\infty}\mu_t = 0$ in the difference equation (5) given any $\mu_0\in(0,\overline{\mu}_0)$.*

The following result provides the necessary and sufficient conditions for $\theta\in\Theta$ to be an ESP:

Lemma 1 *(i) If for any alternative preference group with preference $\theta'\neq\theta$,*

$$\lim_{\mu\to 0} F(\mu,k(\mu)) > \lim_{\mu\to 0} G(\mu,k(\mu)), \tag{8}$$

then preference θ is an ESP.

(ii) If preference θ is an ESP, then $\lim_{\mu\to 0} F(\mu,k(\mu)) \geq \lim_{\mu\to 0} G(\mu,k(\mu))$, for any alternative preference group with $\theta'\neq\theta$.

Proof: See Appendix.

Definition 1 states that preference θ is evolutionarily stable preference (ESP) if any alternative preference group with preference $\theta' \neq \theta$ enters a population dominated by θ agents, the size of the alternative preference group eventually shrinks to zero. The cultural transmission mechanism specified in Section 2.3 implies that the size of the group with the higher average payoff increases. Hence, if the average payoff of the majority is always larger than that of the alternative preference group, the alternative preference group would eventually die out. Given θ and θ', the condition $\lim_{\mu\to 0} F(\mu, k(\mu)) > \lim_{\mu\to 0} G(\mu, k(\mu))$ ensures that the average payoff of the majority is always larger than that of the alternative preference group if the size of the alternative preference group is sufficiently small. Therefore, there always exists an initial condition such that the dynamic described in (5) converges to zero.[25]

We first consider a benchmark case in which the allocation of high positions between the two groups is exogenously given as equal, i.e., $k(\mu) = 0$. We call this *proportional assignment*. In this case, Lemma 1 implies that the majority's preference is evolutionarily stable under proportional assignment if the average payoff of a majority member is higher than the average payoff of an alternative preference group member when both of them have an equal chance to be a manager. Note that Alger and Weibull (2012, 2013) also consider preference evolution in asymmetric pairwise interactions with different roles and they arrive at a similar criterion for evolutionary stability as in the proportional assignment case in our model. This is because in their works, after the agents are matched in pairs, their roles are assigned randomly with equal probability as if there were a proportional assignment. Therefore, the criterion for evolutionary stability for asymmetric pairwise interactions in Alger and Weibull (2012, 2013) is a special case of Lemma 1.

We also introduce a weaker stability concept: *locally evolutionarily stable preference*:

Definition 2 *A preference $\theta \in \Theta$ is a* ***locally*** *evolutionarily stable preference (LESP) if there exists $\delta > 0$ such that for any alternative preference group with $\theta' \in B(\theta, \delta)\backslash\{\theta\}$, there is a $\overline{\mu}_0 \in (0, 1)$ such that $\lim_{t\to\infty} \mu_t = 0$ in the difference equation (5) given any $\mu_0 \in (0, \overline{\mu}_0)$.*

LESP allows us to analyze how gradual changes in the distribution of preferences (i.e., the emergence of alternative preference groups with preference traits that are similar to the majority) affect long-run economic outcomes in a society under different political institutions. In Section 4,

[25] In addition, from Lemma 1, one can see that the concept of evolutionarily stable preference (ESP) is an analog to the concept of evolutionarily stable strategy (ESS) in evolutionary game theory (see a discussion in Alger and Weibull (2012)).

we show that given only assumption [A1], we can obtain sharp predictions by analyzing LESP.[26]

4 Preference Evolution under Different Political Institutions

This section studies preference evolution under a range of political institutions indexed by their degrees of inclusiveness (Acemoglu and Robinson (2012)). The main players in the political institutions are the political representatives from the two groups.[27] Since agents in each group have the same preferences as well as common interests and shared goals, we assume here that selecting political representatives is effective among each group.[28] In addition, for simplicity, we do not model the incentive problems between the group members and their elective representatives explicitly.[29] Instead, we assume the political representatives from both groups willingly represent the common interests of their own groups.

Inclusiveness measures how much scope groups have to determine the allocation of high positions. We call a political institution more "exclusive" if the alternative preference group is excluded from high positions or faces high barriers to acquire such positions. On the other hand, we call a political institution more "inclusive" if the political representatives from the two groups interact more equally to determine the allocation of high positions.

4.1 Unadulterated Majoritarianism

First, consider the evolution of preferences under the most exclusive political institution in which the majority can exploit the alternative preference group without constraints. We call it "unadulterated majoritarianism." This refers to the general case of "winner takes all."[30]

[26] Although the concept of an evolutionary stable preference (ESP) can be applied to study how a big breakthrough in primitives (i.e., the emergence of an alternative preference group with a preference trait that is distinct from the majority) affects long-run economic outcomes under different political institutions, we need assumptions much stronger than Assumption [A1] to obtain analytic results.

[27] As stated in Macleod (2013), all successful human institutions delegate control rights to those individuals (the political representatives in our context) that have the best information and the best incentive to decide appropriately.

[28] Note that there is an important literature considering the formation of interest groups and parties (Olson (1965), Buchanan, Tollison and Tullock (1980), Becker (1983), Congleton (1986), Austin-Smith (1987)). They mainly study solutions to the free rider problem through political action as well as rent seeking and voting issues.

[29] See Persson and Tabellini (2000) for a textbook treatment on incentive problems in political economy.

[30] For example, in ancient China, since the Sui Dynasty (AD 605), the imperial examination was an important channel for people to obtain high positions in the social hierarchy. Although this examination system was open to every citizen, it only tested the knowledge of Confucian morals (see Bai and Jia (2015)). Hence, those who disagreed with the Confucian value system were completely excluded from accessing high positions. Today, systems of direct

In this exclusive political institution, the political representatives of the majority group have full authority in determining the allocation of high positions to maximize majority group's average payoff. If $F(\mu, \sigma(\mu), k(\mu))$ increases in $k(\mu)$, then the majority would take all the high positions. We have the following result:

Proposition 1 *Every $\theta \in \Theta$ is a LESP under unadulterated majoritarianism.*
Proof: See Appendix.

When the alternative preference group's preference θ' is close enough to the majority preference θ, $F(\mu, k(\mu))$ always increases in $k(\mu)$. Therefore, under unadulterated majoritarianism, the majority's political representatives set $k(\mu)$ to its maximum. The majority group members thus have a higher average payoff and can assimilate the alternative preference group.

Although, majority voting is one of the most prevalent voting rules adopted in democratic countries, Proposition 1 suggests that in a highly homogeneous society where the incumbents' preferences are associated with unfavorable economic outcomes, simple majority voting may not be a good rule for determining the allocation of scarce resources, because the majority would rob itself of the opportunity to better itself over multiple generations.

This result also helps to explain cultural assimilation. In our model, if the political institution is exclusive, cultural transmission leads to cultural assimilation because the parents from the alternative preference group are less tempted to inculcate their own preference into their children given that assimilating to the majority group leads to a higher chance of obtaining a high position in the social hierarchy. As discussed in Kuran and Sandholm (2008), in the early 20th century, American government and civic leaders actively promoted "Americanization" by rewarding immigrants who opted for assimilation with promotions and status. This pressure to conform induced immigrants to make compromises and eventually lead to integration.

4.2 Egalitarianism

In this section, we study a political institution in which the two group negotiates on the allocation of high position and the bargaining power of a group is proportional to its group size. We call this political institution "egalitarianism," since the bargaining power of each group exactly reflects the number of voters from the group. Egalitarianism serves as the most inclusive political institution in

democracy that simply follow majority voting but without sufficient constitutional checks and balances may also be considered as versions of this exclusive political institution.

our context, since it provides equality of opportunity for the two groups. It represents the common form of proportional representational democracy.

Note that we have used the parsimonious notation $k(\mu)$ to denote the allocation of high positions in the previous sections. Here, allocation of high positions is endogenously determined by the two groups. Hence, it is a function of θ and θ' and we use $k(\mu, \theta, \theta')$ instead of $k(\mu)$.

Negotiation between the majority and the alternative preference group is modeled as a Nash bargaining problem. Both the majority and the alternative preference group want to maximize the average payoffs of their members. Therefore, the representatives of the two groups collectively bargain over the division of high positions (i.e., role h in the pairwise interaction). If they cannot come to an agreement, both groups get zero.[31] The solution $k^*(\mu, \theta, \theta')$ to the Nash bargaining problem solves

$$(\dagger) \max_{k(\mu,\theta,\theta')} F(\mu, k(\mu, \theta, \theta'))^{1-\mu} G(\mu, k(\mu, \theta, \theta'))^{\mu}.$$

The interior solution $k^*(\mu, \theta, \theta')$ to $(\dagger)$ satisfies the following first order condition:

$$G(\mu, k^*(\mu, \theta, \theta'))(1-\mu)F_k(\mu, k(\mu, \theta, \theta')) + F(\mu, k^*(\mu, \theta, \theta'))\mu G_k(\mu, k(\mu, \theta, \theta')) = 0. \tag{9}$$

The marginal average payoff of the majority group with respect to the allocation of high positions is represented by $(1-\mu)F_k(\mu, k(\mu, \theta, \theta'))$. If $(1-\mu)F_k(\mu, k(\mu, \theta, \theta')) > 0$, the majority benefits from acquiring more high positions. The marginal average payoff of the alternative preference group with respect to the allocation of high positions is represented by $\mu G_k(\mu, k(\mu, \theta, \theta'))$. If $\mu G_k(\mu, k(\mu, \theta, \theta')) < 0$, the alternative preference group benefits from acquiring more high positions.

Let $k_0^*(\theta, \theta') = \lim_{\mu \to 0} \frac{k^*(\mu,\theta,\theta')}{\mu}$. As μ approaches zero, the marginal benefits of acquiring high positions for the two groups, $(1-\mu)F_k(\mu, k(\mu, \theta, \theta'))$ and $-\mu G_k(\mu, k(\mu, \theta, \theta'))$, are given as follows:

$$\lim_{\mu \to 0} (1-\mu)F_k(\mu, k(\mu, \theta, \theta')) = V_h(\theta, \theta') - V_l(\theta', \theta); \tag{10}$$

$$\lim_{\mu \to 0} -\mu G_k(\mu, k(\mu, \theta, \theta')) = V_h(\theta', \theta) - V_l(\theta, \theta'). \tag{11}$$

To study the LESPs of the preference evolution under this political institution, we first need to determine the signs of the limit derivatives shown in (10) and (11). Given assumption [A1], we have the following result:

[31] As long as the outside options for both groups are equal constant and less than $\lim_{\mu \to 0} F(\mu, 0)$, the results on stability do not change. When the outside options of the two groups are unequal, they become a type of *de facto* powers and affect the predictions of stability. We discuss unequal outside options in Section 5.2 in details.

Lemma 2 *Under assumption [A1], for each* $\theta \in \Theta$*, there exists* $\delta > 0$*, such that for any* $\theta' \in B(\theta, \delta)$*,* $\lim_{\mu \to 0}(1-\mu)F_k(\mu, k(\mu, \theta, \theta')) > 0$*,* $\lim_{\mu \to 0} -\mu G_k(\mu, k(\mu, \theta, \theta')) > 0$*.*
Proof: See Appendix.

Lemma 2 shows that when θ' is close enough to θ, being a manager is always better than being a worker for both groups' members. Hence, both groups benefits from acquiring more high positions in the social hierarchy. In addition, when θ' and θ are sufficiently close, the interior solution always exists and it is unique for the Nash bargaining problem. In other words, when considering local stability, we do not worry about corner solutions . Lemma 2 also implies that when θ' and θ are close enough, the second order condition for the Nash bargaining problem is satisfied. We have the following proposition:

Proposition 2 *(1) If there exists a* $\delta > 0$ *such that for any alternative preference group with* $\theta' \in B(\theta, \delta) \backslash \{\theta\}$*,*

$$\lim_{\mu \to 0}(1-\mu)F_k(\mu, k(\mu, \theta, \theta')) > -\lim_{\mu \to 0} \mu G_k(\mu, k(\mu, \theta, \theta')), \tag{12}$$

then θ *is a LESP under egalitarianism.*
(2) If θ *is a LESP under egalitarianism, then there exists a* $\delta > 0$ *such that we have* $\lim_{\mu \to 0}(1-\mu)F_k(\mu, k(\mu, \theta, \theta')) \geq -\lim_{\mu \to 0} \mu G_k(\mu, k(\mu, \theta, \theta'))$*, for any alternative preference group with* $\theta' \in B(\theta, \delta) \backslash \{\theta\}$*.*
Proof: See Appendix.

Proposition 2 states that a preference θ is a LESP if the majority with preference θ marginally benefits more from getting high positions than any alternative preference group with some similar preference trait. Inequality (12) can be rewritten as:

$$T(\theta, \theta') > T(\theta', \theta). \tag{13}$$

Inequality (13) implies that when a majority member matches with an alternative preference group member, the firm they form yields a higher total surplus if the majority member is the manager. In other words, a majority member "suits" the role of manager better than an alternative preference group member.

Although inequality (13) demonstrates that the criterion for local stability is related to productivity of the firms the agents form, it does not necessarily induce the locally highest average payoff for the society as a whole if all of the members in the society adopt such a preference. To see this, consider the case in which $\Theta \in \mathbf{R}^n$ and $T(\cdot,\cdot)$ is differentiable in both augments, then inequality (13) indicates that the necessary condition for θ to be LESP is that $D_{\theta'}T(\theta,\theta')|_{\theta'=\theta} = D_{\theta'}T(\theta',\theta)|_{\theta'=\theta}$. However, this condition does not implies that θ solves $\max_{\theta'} T(\theta',\theta')$. Therefore, it is possible that preference traits associated with unfavorable economic outcomes can still be prevalent under egalitarianism.

4.3 Asymmetric Power Sharing

Unadulterated majoritarianism entitles the majority to exclusive power to determine the allocation of high positions. While egalitarianism provides a political "level playing field" for both groups. In the real world, more commonly seen are political institutions in which each group enjoys certain political power but not necessarily proportional to its group size. For example, if suffrage is not universal, some groups may be excluded from being represented in the parliament. New immigrants in some countries may face voting restrictions. We call these political institutions *asymmetric power sharing political institutions*. To model asymmetric power sharing political institutions, we extend the political bargaining model we developed in Section 4.2 to allow for different distributions of bargaining powers between the two groups. The distribution of bargaining power can serve as a measure of inclusiveness or cohesiveness of a political institution, as suggested by Acemoglu and Robinson (2012) and Besley and Persson (2011). For example, a proportional electoral system is more inclusive than a majoritarian electoral system. We modify the Nash bargaining problem as follows,

$$(\ddagger) \max_{k(\mu,\theta,\theta')} F(\mu, k(\mu,\theta,\theta'))^{p(\mu)} G(\mu, k(\mu,\theta,\theta'))^{q(\mu)},$$

where $p(\mu)$ denotes the bargaining power of the majority and $q(\mu)$ denotes the bargaining power of the alternative preference group. First, to normalize these bargaining powers, we assume that $\lim_{\mu\to 0} p(\mu) = 1$. Second, in order to obtain interesting predictions, we focus on the case in which the bargaining power of the alternative preference group decreases at the same speed as the size of the alternative preference group, that is, $\lim_{\mu\to 0} \frac{q(\mu)}{\mu} = q_0 > 0$.[32]

Note that when $p(\mu) = 1-\mu$ and $q(\mu) = \mu$, we have egalitarianism. On the other hand, when $q_0 = 0$, we have unadulterated majoritarianism. In this section, we allow q_0 to take any value in $[0,1]$, and we call a political institution an asymmetric power sharing political institution if

[32] If we instead assume $\lim_{\mu\to 0} q(\mu) > 0$ or assume $\lim_{\mu\to 0} \frac{q(\mu)}{\mu} = 0$, then the bargaining power of the alternative preference group is either too strong or too weak for the existence of an interior solution of the Nash bargaining problem.

$q_0 \in [0, 1)$.

The interior solution $k^*(\mu, \theta, \theta')$ to (‡) satisfies the following first order condition:

$$G(\mu, , k^*(\mu, \theta, \theta'))p(\mu)F_k(\mu, k(\mu, \theta, \theta')) + F(\mu, k^*(\mu, \theta, \theta'))q(\mu)G_k(\mu, k(\mu, \theta, \theta')) = 0. \quad (14)$$

To facilitate the characterization of the relationship between bargaining power and the allocation of high positions, we define the following function for the bargaining process, which measures the comparative advantage in holding a high position of the alternative preference group:

$$\begin{aligned} \hat{M}(\theta, \theta') &= \lim_{\mu \to 0} \left[\left(\frac{-\mu G_k(\mu, k(\mu, \theta, \theta'))}{G(\mu, 0)} \right) / \left(\frac{(1-\mu) F_k(\mu, k(\mu, \theta, \theta'))}{F(\mu, 0)} \right) \right] \\ &= \lim_{\mu \to 0} \left[\left(\frac{\mu}{1-\mu} \right) \left(\frac{E_{G,k}}{E_{F,k}} |_{k=0} \right) \right], \end{aligned} \quad (15)$$

where $E_{F,k}$ is the elasticity of a majority member's average payoff with respect to the allocation of high positions and $E_{G,k}$ is the elasticity of an alternative preference group member's average payoff with respect to the allocation of high positions.

Function $\hat{M}$ always exists and that $\lim_{\theta' \to \theta} \hat{M}(\theta, \theta') = 1$. The following lemma shows that why $\hat{M}$ is good measure of the comparative advantage of holding a high position of the alternative preference group:

Lemma 3 *When* $\lim_{\mu \to 0}(1-\mu)F_k(\mu, k(\mu, \theta, \theta')) > 0$ *and* $\lim_{\mu \to 0} -\mu G_k(\mu, k(\mu, \theta, \theta')) > 0$, *we have (i) if* $\frac{1}{q_0} > \hat{M}(\theta, \theta')$, *then* $k_0^*(\theta, \theta') > 0$; *(ii) if* $\frac{1}{q_0} = \hat{M}(\theta, \theta')$, *then* $k_0^*(\theta, \theta') = 0$; *(iii) if* $\frac{1}{q_0} < \hat{M}(\theta, \theta')$, *then* $k_0^*(\theta, \theta') < 0$.
Proof: See Appendix.

Lemma 3 shows that when both groups benefit from acquiring more high positions, the allocation of high positions is determined by the comparison of the relative political power of the majority $\frac{1}{q_0}$ and comparative advantage of holding a high position of the alternative preference group $\hat{M}(\theta, \theta')$. For example, case (i) states that when the majority group's relative political power is higher than the alternative preference group's comparative advantage in holding a high position, the majority group is able to obtain proportionally more high positions than the alternative preference group.

We characterize the relationship between bargaining power and the interior solution of the Nash bargaining problem for every $\theta \in \Theta$, when θ' approaches θ.

Lemma 4 *Under assumption [A1], for any* $\theta \in \Theta$, *if* $q_0 < 1$, *then there exists* $\delta > 0$ *such that for all* $\theta' \in B(\theta, \delta)$, $k_0^*(\theta, \theta') > 0$.
Proof: See Appendix.

Lemma 4 is induced by Lemma 2, Lemma 3 and the fact $\lim_{\theta'\to\theta}\hat{M}(\theta,\theta') = 1$. The lemma states that when θ and θ' is close enough, if the majority has a fixed advantage in political power ($q_0 < 1$), the majority can acquire high positions for more than half of its members through bargaining. We have the following result:

Proposition 3 *In an asymmetric power sharing political institution, every $\theta \in \Theta$ is a LESP.*
Proof: See Appendix.

The proof of this proposition utilizes the fact that playing role h is always better than playing role l when θ' is sufficiently close to θ, and Lemma 4, which states that when $q_0 < 1$, the majority with θ can acquire more role h through political bargaining as long as the alternative preference group's preference θ' is close to θ.

In other words, even a tiny advantage in bargaining power grants the majority more high positions proportional to its group size, which allows the majority's preference to prevail locally. At first glance, Proposition 3 provides a similar prediction to that of Proposition 1. It would seem that an asymmetric power sharing political institution that is close to egalitarianism is no different from unadulterated majoritarianism. However, this impression is incorrect. To see the distinction between these two types of political institutions, we introduce the following definition:

Definition 3 *The assimilation set $S(\theta, q_0)$ of preference $\theta \in \Theta$, given bargaining power $q_0 \in [0,1]$, is the largest open ball in Θ centered at θ such that for any $\theta' \in S(\theta, q_0)/\{\theta\}$,*
(1) $\lim_{\mu\to 0}(1-\mu)F_k(\mu, k(\mu,\theta,\theta')) > 0$ and $\lim_{\mu\to 0} -\mu G_k(\mu, k(\mu,\theta,\theta')) > 0$;
(2) there is a $\overline{\mu}_0 \in (0,1)$, such that $\lim_{t\to\infty}\mu_t = 0$ for the difference equation (5),$\forall \mu_0 \in (0,\overline{\mu}_0)$.

The assimilation set $S(\theta, q_0)$ of preference θ, given q_0, is defined as the largest open ball surrounding θ such that for a population with majority group θ and alternative preference group $\theta' \in S(\theta, q_0)/\{\theta\}$, both groups would benefit from getting more high positions and the majority would eventually assimilate the alternative preference group. We are interested in how the size of such a set varies as the bargaining power changes. We have the following result:

Proposition 4 *When q_0 increases from q_0^1 to q_0^2, where $0 \le q_0^1 < q_0^2 \le 1$, for any $\theta \in \Theta$, we have $S(\theta, q_0^1) \supseteq S(\theta, q_0^2)$.*
Proof: See Appendix.

Proposition 4 shows that in political bargaining, as the inclusiveness of the political institution increases ($q_0 \uparrow$), the assimilation set shrinks. This result establishes that preference evolution has stronger selection power under more inclusive political institutions.

Proposition 4 implies that, given fixed θ and q_0, for any $\theta' \in S(\theta, q_0)$, θ and θ' satisfy

$$\frac{1-q_0}{q_0}(V_h(\theta,\theta') - V_l(\theta',\theta)) + T(\theta,\theta') > T(\theta,\theta'). \tag{16}$$

This inequality states that the majority group with preference trait θ can assimilate the alternative preference group with preference trait θ' if the total surplus generated by a firm with a majority manager and an alternative preference group worker plus a premium $\frac{1-q_0}{q_0}(V_h(\theta,\theta') - V_l(\theta',\theta))$ is higher than the total surplus generated by a firm with an alternative preference group manager and a majority worker. The difference between inequality (16) and inequality (13) is the premium term. Moreover, the premium increases as the level of inclusiveness q_0 decreases. This implies that as a political institution becomes more exclusive, whether a majority member actually "suits" the high position better than an alternative preference group member becomes less important. This unites the conclusions drawn previously on unadulterated majoritarianism and egalitarianism.

4.4 Discussion

Social scientists have long considered the impact of political institutions on economic outcomes through the channel of preference evolution. Weber (1930) argues that the spirit of capitalism, including hard work, prudence and thrift, as opposed to economic traditionalism,[33] was the key to the development of technologies and modern enterprises that gave rise to the Industrial Revolution. Weber also emphasizes the importance of political institutions. He asserts that as opposed to India and China, one of the fundamental socioeconomic prerequisites for the emergence and prevalence of the spirit of capitalism was the unique European phenomenon of semi-autonomous city, organized and known as Commune, where residents enjoyed exceptional civil power. The transition of political institutions from agrarian feudalism to bourgeois society in Western European countries laid down the foundation for economic traditionalism to give way to the spirit of capitalism. More specifically, the more inclusive political institutions allowed those who had the spirit of capitalism to own their innovations and permitted them to use those innovations to enter traditional industries. This allowed them to establish more efficient modern enterprises and accumulate more wealth, which at the same time forced the "economic traditionalists" to give up their way of living. Soon, the spirit of capitalism spread through Western Europe and detached from its religious roots of Protestantism.

[33] Weber (1930) describes "economic traditionalists" as those who do not ask how much they can earn in a day if they do as much work as possible, but ask how much they must work in order to earn the wages which take care of their traditional needs.

Our model provides a theoretical support for Weber's (1930) observation. We show that under more exclusive political institutions, the majority is the "winner" in the competition for high positions regardless of the preference trait its members carry. Therefore, a society can be locked in a bad state associated with unfavorable economic outcomes. For example, before the Industrial Revolution, in the Southern European countries, the Catholic Church succeeded in asserting itself politically. Instead of meeting the challenge imposed by the Protestant Revolution, these countries responded by closure and censorship. As argued in Tremor-Roper (1967), anti-Protestant reaction more than Protestantism itself sealed the faith of the south. Imperial China serves as another example. Before the 20th century, China was a culturally and intellectually homeostatic country, the totalitarian government regulated every aspect of life by Confucianism, which impeded the birth of capitalism.

On the other hand, our results suggest that preference evolution has stronger selection power in more inclusive political institutions; only the preference traits which result in the locally largest comparative advantage of holding a high position have high probabilities being the "winners. Landes (1998) pointed out that, in Western Europe, the reach of the Catholic Church was limited by the competing secular authorities. The fragmented political environment provided a "level play field" for preference evolution. As a result, in manufacturing centers in France and Western Germany, Protestants were typically the employers, Catholics the employed. In Switzerland, the Protestant cantons were the centers of export manufacturing industry. In England, which by the end of the 16th Century, was overwhelmingly Protestant, the Dissenters were disproportionally active and influential in the factories and forges of the nascent Industrial Revolution. This explains why the spirit of capitalism was able to spread.

5 Extension

5.1 Assimilation Pressure, Self Segregation and Cultural Heterogeneity

Under many circumstances, the alternative preference group is disadvantaged in political decision making. When the alternative preference group fails to have sufficient political power in the political institution, do they have an alternative way to offset the majority's political power?

New immigrant groups and minorities often form enclaves in which they establish their own business networks and labor markets to provide businesses or employments for members because they may not be able to access to work opportunities and resources that are controlled in the hands of the incumbents. Hence, self-segregation can be an effective way for these groups to protect themselves.

In this section, we extend the matching process to allow for segregation and explore how different political institutions interact with the matching process to affect the evolution of preferences.

Let $\sigma(\mu) \in [-1, 1]$ be the difference between the probability that a θ worker is matched with a θ manager and the probability that a θ' worker is matched with a θ manager:

$$\sigma(\mu) = \Pr[\theta|\theta, \mu, k(\mu)] - \Pr[\theta|\theta', \mu, k(\mu)]. \tag{17}$$

Quantity $\sigma(\mu)$ measures the degree of segregation in the matching process. It is essentially a generalization of the concept of *algebra of assortative encounters* developed by Bergstrom (2003) and it is adopted in the study of preference evolution by Alger and Weibull (2012, 2013). Segregation of matching process is commonly observed because people tend to interact with those in the same geographical area or sharing similar arbitrary neutral cultural markers such as dialects (see Boyd and Richerson (2005)). For consistency, the following balancing condition needs to be satisfied:

$$(\frac{1-\mu}{2} - k(\mu))\Pr[\theta|\theta, \mu, k(\mu)] + (\frac{\mu}{2} + k(\mu))\Pr[\theta|\theta', \mu, k(\mu)] = \frac{1-\mu}{2} + k(\mu). \tag{18}$$

This condition states that the sum of majority workers matched with majority managers and the alternative preference group workers matched with majority managers is equal to the total number of managers in the majority. Let $\sigma_0 = \lim_{\mu \to 0} \sigma(\mu)$.[34]

Equations (17) and (18) together imply

$$\begin{aligned} \Pr[\theta|\theta, \mu, k(\mu)] &= 1 - \mu + 2k(\mu) + \sigma(\mu)(\mu + 2k(\mu)), & (19) \\ \Pr[\theta|\theta', \mu, k(\mu)] &= 1 - \mu + 2k(\mu) - \sigma(\mu)(1 - \mu - 2k(\mu)). & (20) \end{aligned}$$

And $\Pr[\theta'|\theta, \mu, k(\mu)] = 1 - \Pr[\theta|\theta, \mu, k(\mu)]$ and $\Pr[\theta'|\theta', \mu, k(\mu)] = 1 - \Pr[\theta|\theta', \mu, k(\mu)]$.

We now endogenize $\sigma(\mu)$. We assume that leaders of the alternative preference group, such as political leaders or cultural activists whose interests aligns with their group members' interests, can segregate their group from the majority, so that their group members have a higher probability of matching with one another.[35] For example, the leaders can promote unique cultural markers

[34] Note that σ_0 can only take values in [0,1], because the range of $\sigma(\mu)$ shrinks as μ decreases and σ_0 must be non-negative to ensure that the balancing equation (18) is not violated in the limit.

[35] See Kuran and Sandholm (2008) for a discussion of cultural activists. The tendency of self-matching is also called *homophily*, which have been studied extensively in both sociology and economics. See McPherson et al. (2001), Ruef et al. (2003), Jackson et al. (2009, 2010).

such as manners of dress and dialects that increase the utility gain of self-matching. They can also relocate the alternative preference group so that they are geographically segregated from the majority.

In our model, the allocation of high positions is determined through the political institution. On the other hand, more self-matching guarantees a group to have more managers. Hence, by increasing the rate of self-matching, the alternative preference group may effectively reduce the impact of the political advantage of the majority group. This in turn may change its members' effort to inculcate and help the group to resist assimilation. Historically, certain ethnic groups, such as the Maghribi traders (see Grief (1993, 1994)), had both a strong tendency to self-match as well as a strong incentive to preserve their own culture across generations.

Assume that the main motivation for leaders of the alternative preference group is to maximize the average payoff of its members.[36] Whether a certain preference trait can survive through intentional segregation depends on various factors such as the leaders' ability to induce segregation as well as the cost of segregation. Nevertheless, the most fundamental question is if the alternative preference group members would benefit from segregation at the first place. We formally explore this question. First, we examine the benchmark case of proportional assignment ($k(\mu) = 0$), in which a political institution is absent:

Proposition 5 *Under proportional assignment, there exists a* $\overline{\mu} > 0$ *such that for any* $0 < \mu < \overline{\mu}$*, an alternative preference group with preference* $\theta' \in \Theta$ *would benefit from increasing segregation against a majority with preference* $\theta \in \Theta$ *if*

$$V_h(\theta', \theta') + V_l(\theta', \theta') > V_h(\theta', \theta) + V_l(\theta, \theta'). \tag{21}$$

Proof: See Appendix.

Proposition 5 shows that under proportional assignment, if on average, the alternative preference group members achieve a higher payoff by self-matching than by matching with the majority members, their leaders have an incentive to increase segregation.

Next, we investigate exclusive political institutions:

Proposition 6 *There exists a* $0 < \underline{q}_0 < 1$ *such that for any* $0 \leq q_0 \leq \underline{q}_0$*, there exists a* $\delta > 0$ *such that for any* $\theta \in B(\theta', \delta)$*, there exists a* $\overline{\mu} > 0$ *such that for any* $0 < \mu < \overline{\mu}$*, an alternative*

[36] There are other possible motivations for the leaders of the alternative preference group. One alternative motivation would be to expand their own groups' memberships because they can benefit from group expansion.

preference group with preference $\theta' \in \Theta$ would always benefit from increasing segregation against a majority with preference θ.

Proof: See Appendix.

When the political institution is sufficiently exclusive, the majority exploits its political power to obtain the maximal amount of high positions. However, this maximum is a decreasing function of σ_0. Hence, the alternative preference group's average payoff is an increasing function of σ_0 when μ approaches zero.

Proposition 6 implies that in sufficiently exclusive political institutions, segregation can serve as a self-defense mechanism for the alternative preference group, since the alternative preference group can offset the political advantage of the majority by increasing segregation.

Finally, we investigate inclusive political institutions:

Proposition 7 *There exists a $0 < \overline{q}_0 < 1$ such that for any $\overline{q}_0 \leq q_0 \leq 1$, there exists a $\delta > 0$ such that for any $\theta \in B(\theta', \delta)$, there exists a $\overline{\mu} > 0$ such that for any $0 < \mu < \overline{\mu}$, an alternative preference group with preference $\theta' \in \Theta$ would benefit from increasing segregation against a majority with preference θ, if*

$$V_h(\theta,\theta') + V_l(\theta',\theta) > V_h(\theta,\theta) + V_l(\theta,\theta), \text{ and } V_h(\theta',\theta) + V_l(\theta,\theta') > V_h(\theta',\theta') + V_l(\theta',\theta'). \tag{22}$$

On the other hand, an alternative preference group with preference θ' cannot benefit from increasing segregation against a majority with preference θ if

$$V_h(\theta,\theta') + V_l(\theta',\theta) < V_h(\theta,\theta) + V_l(\theta,\theta), \text{ and } V_h(\theta',\theta) + V_l(\theta,\theta') < V_h(\theta',\theta') + V_l(\theta',\theta'). \tag{23}$$

Proof: See details in Appendix.

Proposition 7 describes the two possible scenarios that can arise under sufficiently inclusive political institutions: 1) if both the majority and the alternative preference group members do worse on average by self-matching than matching with agents from their opposite groups, then the alternative preference group can benefit from increasing segregation; 2) if both the majority and the alternative preference group members do better on average by self-matching than matching with agents from their opposite groups, then the alternative preference group cannot benefit from increasing segregation.[37]

[37] Unfortunately, there is no definite answer for cases in which one group does better on average by self-matching, while the other group does not.

The intuition is as follows. Because of the unbalanced sizes of the two groups, when (22) is satisfied, the marginal benefit of getting more high positions for the alternative preference group is increasing in σ_0 and the marginal benefit of getting more high positions for the majority is decreasing in σ_0. Therefore, even though the alternative preference group members perform worse in self-matching, increasing self-segregation can empower them with high *de facto* political power in the negotiation. The interpretation of condition (23) follows in the same spirit.

Propositions 5 to 7 show that different political institutions may provide distinct motives for the leaders of alternative preference group to segregate their group members from the majority. Segregation in turn affects parents' effort to inculcate. Therefore, it is important for policymakers to consider the underlying political structure when evaluating phenomena such as cultural integration and cultural heterogeneity.[38]

5.2 Asymmetric Outside Options

As noted in Acemoglu and Robinson (2006b, 2008), in many Latin American, Caribbean, and African countries, inefficient economic institutions still persist even when political institutions become more inclusive. Our model can provide an evolutionary explanation for these observations.

To do so, we generalize our model to incorporate an important source of *de facto* political powers that are independent of the political institution: the outside options of the two groups in case an agreement cannot be reached in the political institution. The outside options can be considered as the payoffs generated by individual activities such as traditional handicraft as opposed to more sophisticated form of economic activities involving collaborations and exchange characterized by the pairwise interactions. Here, we model the outside option of a group as a function of the preference trait of its members. Let $H(\cdot) : \Theta \to \mathbf{R}^+$ denote the outside option function and assume that

Assumption [A2] $\frac{1}{2}T(\theta_1, \theta_2) > H(\theta_3)$ *for any* $\theta_1, \theta_2, \theta_3 \in \Theta$.

[38] Note that in the literature of cultural transmission, several works also study the issue of segregation. However, the types of segregation they consider are different from ours, which are driven by "imperfect empathy." For example, Bisin and Verdier (2000a) study segregation in the marriage market. In their paper, people want to segregate themselves in the marriage market because a homogeneous marriage ensures successful parent-to-child transmission. Moreover, since parents have imperfect empathy, they prefer their children to adopt their own preferences; engaging in homogeneous marriage is the most efficient way to achieve such a goal. In addition, Bisin and Verdier (2001) and Saez Marti and Sjögren (2008) study segregation in cultural transmission. When parents with imperfect empathy consider the possible peer effects faced by their children, they attempt to reduce the probability that their children meet a role model from the opposite group.

Assumption [A2] states that the average payoff of a pair of agents engaging in the pairwise interaction is always higher than the payoff generated by individual activity. This assumption provides the incentive for the political representatives to engage in political bargaining at the first place.

The Nash bargaining problem in Section 4.2 can be rewritten as

$$(\oplus) \max_{k(\mu,\theta,\theta')} (F(\mu, k(\mu,\theta,\theta')) - H(\theta))^{1-\mu} G(\mu, k(\mu,\theta,\theta') - H(\theta'))^{\mu}.$$

And we have the following result:

Proposition 8 *If there exists a $\delta > 0$ such that for any alternative preference group with $\theta' \in B(\theta,\delta)\backslash\{\theta\}$, either $H(\theta) > H(\theta') + c$ for some constant $c > 0$, or*

$$\lim_{\mu\to 0}(1-\mu)F_k(\mu, k(\mu,\theta,\theta'))\frac{\frac{1}{2}T(\theta,\theta) - H(\theta')}{\frac{1}{2}T(\theta,\theta) - H(\theta)} > -\lim_{\mu\to 0}\mu G_k(\mu, k(\mu,\theta,\theta')), \tag{24}$$

then θ is a LESP under egalitarianism.

Proof: See Appendix.

Proposition 8 shows that even the majority does not have a higher marginal benefit of getting more high positions, it can still assimilate alternative preference groups as long as the majority members can generate sufficiently high payoffs by engaging in individual activities. Hence, preferences that potentially lead to better economic outcomes in pairwise interactions fail to spread. Abandoning a literal interpretation, Proposition 8 helps to explain why certain backward socioeconomic arrangements, which vanished long ago, still have persistent influence on today's economic performance in societies with inclusive political institutions.

5.3 Imperfect Empathy

In the cultural transmission part of the model, we assume that the parents have "perfect empathy." In this section, we examine the case in which the parents have "imperfect empathy."

For tractability, we assume that a θ parent's optimization problem is:

$$\max_x [P_t^{\theta\theta}(x)F(\mu_t, k(\mu_t)) + P_t^{\theta\theta'}(x)(G(\mu_t, k(\mu_t)) - \Delta(\theta,\theta'))] - c(x), \tag{25}$$

where the additive separable term $\Delta(\theta,\theta')$ denote the "cultural intolerance" of a θ agent has towards the θ' trait. In other words, a θ parent would derive a disutility $\Delta(\theta,\theta')$ if his child becomes a θ' agent.

Similarly, the optimization problem of a θ' parent's optimization problem is given by:

$$\max_x [P_t^{\theta'\theta'}(x)G(\mu_t, k(\mu_t)) + P_t^{\theta'\theta}(x)(F(\mu_t, k(\mu_t)) - \Delta(\theta', \theta))] - c(x), \tag{26}$$

where $\Delta(\theta', \theta)$ is the "cultural intolerance" of a θ' agent has towards the θ trait. The distuilities $\Delta(\theta, \theta')$ and $\Delta(\theta', \theta)$ captures parents' "imperfect empathy."

Assume that $\Delta(\cdot, \cdot) : \Theta \times \Theta \to \mathbf{R}$ is a continuous function, with $\Delta(\theta, \theta) = 0$ for any $\theta \in \Theta$. Moreover, $\Delta(\theta, \theta')$ is increasing in the distance between θ and θ' on the trait space. This captures the fact that people have stronger biases towards those with more distinct preferences.[39]

Maximization problems (25) and (26) implies that when μ_t is sufficiently small, the key for the alternative preference group to expand is that $G(\mu_t, k(\mu_t)) > F(\mu_t, k(\mu_t)) - \Delta(\theta', \theta)$. This inequality ensures that the alternative preference group parents have incentive to exert effort on inculcation and small μ_t ensures that their incentive is much stronger than that of the majority parents because of the rarity of the θ' type role model in the population.

We have the following result:

Proposition 9 *(1)Every $\theta \in \Theta$ is a LESP under unadulterated majoritariansim.*
(2)If there exists a $\delta > 0$ such that for any alternative preference group with $\theta' \in B(\theta, \delta)\backslash\{\theta\}$,

$$T(\theta, \theta') > T(\theta', \theta) + 2\Delta(\theta', \theta)\frac{V_h(\theta, \theta') - V_l(\theta', \theta)}{T(\theta, \theta)}, \tag{27}$$

then θ is LESP under egalitarianism.

Proposition 9 (1) demonstrates that our result under unadulterated majoritarianism is robust when "imperfect empathy" is introduced. The rationale is that under unadulterated majoritarianism, "cultural intolerance" of the alternative preference group members towards the majority cannot counterbalance the payoff advantage of the majority. Therefore, it is still optimal for the alternative preference group's parents not to exert effort on inculcation. This leads to assimilation of the group.

Proposition 9 (2) provide a stronger condition described by (27) for an θ to be LESP than the one described by (13) we obtained in Proposition 2 because in order to dominate the whole society,

[39] As argued in Spolaore and Waacziarg (2009, 2013), differences in cultural traits across populations can hinder development by creating barriers to the flow of technological and institutional innovations, since more closely related societies are more likely to learn from each other and adopt each others' innovations. Guiso, Sapianza and Zingales (2009) find that in the context of economic exchange, people from culturally more similar countries trust each other more. These empirical findings reflect the fact that people are less comfortable with culturally more distant people.

θ type needs to overcome the “cultural intolerance” imposed by the alternative preference group members. This requires θ type to fit the high position even better.

In summary, Proposition 9 indicates that the influence of “imperfect empathy” on preference evolution hinges on the political institution in a society.

6 Conclusion

In this paper, we seek to answer the question of how conducive different political institutions are to spreading preference traits that induce favorable economic outcomes. Our results suggest that whether a certain preference trait can be prevalent or survive in a society is determined by the degree of “inclusiveness” of the political institution.

There are two widely discussed views of growth theory in the literature. The first view is rooted in Solow (1956), who emphasizes that technological change is the engine of long run growth. The second view sterns from Lewis (1954), who links poverty to resource misallocation. In our model, the primary function of political institution is to determine the allocation of one particular type of scarce resources, high positions in the social hierarchy. If high position agents are the ones who decide whether to adopt new technologies, how high positions are allocated to different preference groups would affect the technology adoption rate of the society. Thus, this paper may contribute to unifying these two major views of growth theory from an evolutionary perspective.

The framework we establish is one way to understand the impacts of political institutions on preference evolution and its corresponding economic consequences. It can be extended in many directions. First, in reality, stickiness in upward social mobility is usually rooted in the inheritability of certain positions in the social hierarchy. Hence, it would be an exciting and challenging direction for future research to enrich the cultural transmission mechanism to allow for the inheritability of positions. Second, the primary function of political institutions which we examine in this paper is that of determining the allocation of positions in the social hierarchy because we believe that this function has non-negligible influence on preference evolution. However, it is still necessary to incorporate other important functions of political institutions such as fiscal policies, legal enforcement, school financing and regulations to have a more complete understanding of the effects of political institutions on preference evolution. Third, we treat political institutions as exogenous. Incorporating an endogenously generated dynamic of political institutions into the study of preference evolution would serve as an important research avenue for the future.

Appendix

Proof of Lemma 1 We first prove the necessary part. It is equivalent to prove the contrapositive of the statement. If there exists a $\theta' \neq \theta$ such that $\lim_{\mu\to 0} F(\mu, k(\mu)) < \lim_{\mu\to 0} G(\mu, k(\mu))$, by continuity, we can always find a $\overline{\mu} > 0$, such that for all $\mu \in [0, \overline{\mu})$, $F(\mu, k(\mu)) < G(\mu, k(\mu))$.

Recall that the preference evolution dynamic is given by

$$\mu_{t+1} = \mu_t + (1 - \mu_t) P_t^{\theta\theta'}(x^*(\mu_t, \theta)) - \mu_t P_t^{\theta'\theta}(x^*(\mu_t, \theta')).$$

If at time t, the size of the mutant group μ_t is in the interval $[0, \overline{\mu})$, then $F(\mu_t, k(\mu_t)) < G(\mu_t, k(\mu_t))$. The optimal effort level of a majority parent is $x^*(\mu_t, \theta) = 0$. The optimal effort level of an alternative preference group parent $x^*(\mu_t, \theta')$ is positive.

Hence, $P_t^{\theta\theta'}(x^*(\mu_t, \theta)) = (1 - d(\mu_t, x^*(\mu_t, \theta)))\mu_t = \mu_t$, $P_t^{\theta'\theta}(x^*(\mu_t, \theta')) = (1 - d(\mu_t, x^*(\mu_t, \theta')))(1 - \mu_t) < (1 - \mu_t)$. This implies that $(1 - \mu_t) P_t^{\theta\theta'}(x^*(\mu_t, \theta)) = (1 - \mu_t)\mu_t > \mu_t P_t^{\theta'\theta}(x^*(\mu_t, \theta'))$.

Therefore, for any $\mu_0 > 0$, as long as the dynamic reaches a state $\mu \in [0, \overline{\mu})$ at a finite time t, we have $\mu_{t+1} > \mu_t$. Hence, θ is not an ESP.

Next, we prove the sufficient part. If for all $\theta' \neq \theta$, $\lim_{\mu\to 0} F(\mu, k(\mu)) > \lim_{\mu\to 0} G(\mu, k(\mu))$, then by continuity, we can find a $\overline{\mu}_0 > 0$ such that, for all $\mu \in [0, \overline{\mu}_0)$, $F(\mu, k(\mu)) > G(\mu, k(\mu))$.

Using similar logic, we know $\mu_{t+1} < \mu_t$ if and only if $F(\mu, k(\mu)) > G(\mu, k(\mu))$. Therefore, for all $\mu_0 \in [0, \overline{\mu}_0)$, $\mu_{t+1} < \mu_t$ for any $t \geq 0$. Hence, θ is an ESP. *Q.E.D.*

Proof of Proposition 1 By Assumption [A1], we have $\lim_{\theta'\to\theta} \lim_{\mu\to 0} F_k(\mu, k(\mu, \theta, \theta')) = V_h(\theta, \theta) - V_l(\theta, \theta) > 0$. Hence, under unadulterated majoritarianism, $\exists \delta > 0$, such that for any $\theta' \in B(\theta, \delta)$, $k_0^* = \frac{1}{2}$. The average payoff of the alternative preference group when taking the limit of θ' to θ and μ to 0 is given by: $\lim_{\theta'\to\theta} \lim_{\mu\to 0} G(\mu, k^*(\mu)) = V_l(\theta, \theta)$, while $\lim_{\mu\to 0} F(\mu, k^*(\mu)) = \frac{1}{2}(V_h(\theta, \theta) + V_l(\theta, \theta))$.

Therefore, by Assumption [A1] again, there exists a $\delta > 0$ such that for any $\theta' \in B(\theta, \delta)$, the alternative preference group's average payoff is lower than that of the majority and by Lemma 1, θ is a LESP. *Q.E.D.*

Proof of Lemma 2 From the proof of Proposition 1, we already know that $\lim_{\theta'\to\theta} \lim_{\mu\to 0}(1 - \mu) F_k(\mu, k(\mu, \theta, \theta')) = V_h(\theta, \theta) - V_l(\theta, \theta) > 0$. Similarly, we have $\lim_{\theta'\to\theta} \lim_{\mu\to 0} -\mu G_k(\mu, k(\mu, \theta, \theta')) = V_h(\theta, \theta) - V_l(\theta, \theta) > 0$.

Hence, there exists a $\delta > 0$, such that for $\theta' \in B(\theta, \delta)$, we have both $\lim_{\mu\to 0}(1 - \mu) F_k(\mu, k(\mu, \theta, \theta')) >$

0 and $\lim_{\mu\to 0} -\mu G_k(\mu, k(\mu,\theta,\theta')) > 0$. *Q.E.D.*

Proof of Proposition 2 To prove the sufficient part, we first derive the expression for $k_0^*(\theta,\theta')$ from the first order condition by taking the limit as μ goes to zero, provided that it exists and is unique (by Lemma 2):

$$\begin{aligned} k_0^*(\theta,\theta') = \quad & -\frac{\lim_{\mu\to 0} F(\mu,0)\lim_{\mu\to 0}\mu G_k(\mu,k(\mu,\theta,\theta'))}{\lim_{\mu\to 0}(1-\mu)F_k(\mu,k(\mu,\theta,\theta'))\lim_{\mu\to 0}\mu G_k(\mu,k(\mu,\theta,\theta'))} \\ & -\frac{\lim_{\mu\to 0} G(\mu,0)\lim_{\mu\to 0}(1-\mu)F_k(\mu,k(\mu,\theta,\theta'))}{\lim_{\mu\to 0}(1-\mu)F_k(\mu,k(\mu,\theta,\theta'))\lim_{\mu\to 0}\mu G_k(\mu,k(\mu,\theta,\theta'))}. \end{aligned}$$

Plugging this expression of $k_0^*(\theta,\theta')$ into the expression of $\lim_{\mu\to 0} G(\mu, k^*(\mu,\theta,\theta'))$, we have

$$\lim_{\mu\to 0} G(\mu,k^*(\mu,\theta,\theta')) = \lim_{\mu\to 0} F(\mu,0)\frac{-\lim_{\mu\to 0}\mu G_k(\mu,k(\mu,\theta,\theta'))}{\lim_{\mu\to 0}(1-\mu)F_k(\mu,k(\mu,\theta,\theta'))}.$$

Therefore, if there exists a $\delta > 0$, such that for any $\theta' \in B(\theta,\delta)\backslash\{\theta\}$, an unique interior solution to the Nash bargaining problem exists (guaranteed by Lemma 2 when δ is sufficient small) and $\lim_{\mu\to 0}(1-\mu)F_k(\mu,k(\mu,\theta,\theta')) > \lim_{\mu\to 0} -\mu G_k(\mu,k(\mu,\theta,\theta'))$. Then we have

$$\lim_{\mu\to 0} F(\mu,k^*(\mu,\theta,\theta')) = \lim_{\mu\to 0} F(\mu,0) > \lim_{\mu\to 0} G(\mu,k^*(\mu,\theta,\theta')),$$

for any $\theta' \in B(\theta,\delta)\backslash\{\theta\}$. By Lemma 1, this implies that θ is a LESP.

Next, we prove the necessary part, which is equivalent to proving the contrapositive of the statement. Assume that for any $\delta > 0$, one can find a $\theta' \in B(\theta,\delta)\backslash\{\theta\}$ such that $\lim_{\mu\to 0}(1-\mu)F_k(\mu,k(\mu,\theta,\theta')) < -\lim_{\mu\to 0}\mu G_k(\mu,k(\mu,\theta,\theta'))$ (when δ sufficiently small, $k_0^*(\theta,\theta')$ exists and is unique). Then $\lim_{\mu\to 0} F(\mu,k^*(\mu,\theta,\theta')) < \lim_{\mu\to 0} G(\mu,k^*(\mu,\theta,\theta'))$, for this θ'.

This implies that one can always find $\theta' \neq \theta$ that is arbitrarily close to θ and yields a higher average payoff than θ. Therefore, θ cannot be locally stable. *Q.E.D*

Proof of Lemma 3 Here we only prove the first case. The other two cases follow similar logic. Under asymmetric power sharing political institutions, as μ goes to zero, the first order condition of the Nash bargaining problem can be rewritten as:

$$q_0\frac{-\lim_{\mu\to 0} F(\mu,0)\lim_{\mu\to 0}\mu G_k(\mu,k(\mu,\theta,\theta'))}{\lim_{\mu\to 0}(1-\mu)F_k(\mu,k(\mu,\theta,\theta'))} = \lim_{\mu\to 0} G(\mu,0) + \lim_{\mu\to 0}\mu G_k(\mu,k(\mu,\theta,\theta'))k_0^*(\theta,\theta').$$

Hence, when $\lim_{\mu\to 0}\mu G_k(\mu,k(\mu,\theta,\theta')) < 0$, we have $k_0^*(\theta,\theta') > 0$ if

$$\frac{1}{q_0} > -\frac{\lim_{\mu\to 0} F(\mu,0)\lim_{\mu\to 0}\mu G_k(\mu,k(\mu,\theta,\theta'))}{\lim_{\mu\to 0} G(\mu,0)\lim_{\mu\to 0}(1-\mu)F_k(\mu,k(\mu,\theta,\theta'))} = \hat{M}(\theta,\theta').\ \textit{Q.E.D.}$$

Proof of Lemma 4 By Lemma 2, we know that when θ' is sufficiently close to θ, $\lim_{\mu\to 0}(1-\mu)F_k(\mu,k(\mu,\theta,\theta'))>0$ and $\lim_{\mu\to 0}-\mu G_k(\mu,k(\mu,\theta,\theta'))>0$. Therefore, we can apply Lemma 3. When $q_0<1$, since $\lim_{\theta'\to\theta}\hat{M}(\theta,\theta')=1$, for any $\theta\in\Theta$, we can find a $\delta>0$ such that $\frac{1}{q_0}>\hat{M}(\theta,\theta')$ for any $\theta'\in B(\theta,\delta)$. By Lemma 3, we know that $k_0^*(\theta,\theta')>0$ for $\theta'\in B(\theta,\delta)$. *Q.E.D.*

Proof of Proposition 3 For any $\theta\in\Theta$, we have

$$\lim_{\theta'\to\theta}\lim_{\mu\to 0}G(\mu,k^*(\mu,\theta,\theta'))=(\frac{1}{2}-\lim_{\theta'\to\theta}k_0^*(\theta,\theta'))V_h(\theta,\theta)+(\frac{1}{2}+\lim_{\theta'\to\theta}k_0^*(\theta,\theta'))V_l(\theta,\theta).$$

Lemma 4 states that under assumption [A1], if $q_0<1$, $\exists\delta>0$ such that $\forall\theta'\in B(\theta,\delta)$, $k_0^*(\theta,\theta')>0$. Hence $\lim_{\theta'\to\theta}\lim_{\mu\to 0}F(\mu,k^*(\mu,\theta,\theta'))=\frac{1}{2}(V_h(\theta,\theta)+V_l(\theta,\theta))>\lim_{\theta'\to\theta}\lim_{\mu\to 0}G(\mu,k^*(\mu,\theta,\theta'))$. This implies that one can find a $\delta'\in(0,\delta)$ such that for all $\theta'\in B(\theta,\delta')\backslash\{\theta\}$, the sufficient condition in Lemma 1 holds. Hence, any $\theta\in\Theta$ is a LESP. *Q.E.D.*

Proof of Proposition 4 For any $\theta'\in S(\theta,q_0)/\{\theta\}$, by definition, both groups would benefit from getting more high positions. This in turn implies that $k_0^*(\theta,\theta')$ is weakly decreasing in q_0 (only weakly since when $k_0^*(\theta,\theta')$ reaches its upper boundary $\frac{1}{2}$, it cannot increase any more when q_0 decreases). Hence, if a majority with θ can assimilate an alternative preference group with $\theta'\in S(\theta,q_0^2)$, it can still assimilate the alternative preference group with the same θ' given bargaining power $q_0^1<q_0^2$, since the majority can get weakly more high positions. This implies that $S(\theta,q_0^2)\subseteq S(\theta,q_0^1)$. *Q.E.D.*

Proof of Proposition 5 By solving the first order condition of the modified Nash bargaining problem with asymmetric outside options (if the interior solution exists), and taking the limit of θ' to θ, we have $\lim_{\theta'\to\theta}k_0^*(\theta,\theta')=\frac{H(\theta)-\lim_{\theta'\to\theta}H(\theta')}{V_h(\theta,\theta)-V_l(\theta,\theta)}$.

Hence, as long as there exists a $\delta>0$, such that for any $\theta'\in B(\theta,\delta)\backslash\{\theta\}$, $H(\theta)>H(\theta')+c$, for some constant $c>0$. $k_0^*(\theta,\theta')>0$ (it is possible that $k_0^*(\theta,\theta')=\frac{1}{2}$ in this case). By a similar argument as in Proposition 3, θ is LESP.

On the other hand, when the above condition is not satisfied, plug the expression of $k_0^*(\theta,\theta')$ into the expression of $\lim_{\mu\to 0}G(\mu,\sigma(\mu),k^*(\mu,\theta,\theta'))$, we have

$$\lim_{\mu\to 0}G(\mu,\sigma(\mu),k^*(\mu,\theta,\theta'))=H(\theta')+(\lim_{\mu\to 0}F(\mu,\sigma(\mu),0)-H(\theta'))\frac{-\lim_{\mu\to 0}\mu G_k(\mu,\sigma(\mu),k(\mu,\theta,\theta'))}{\lim_{\mu\to 0}(1-\mu)F_k(\mu,\sigma(\mu),k(\mu,\theta,\theta'))}.$$

Therefore, if there exists a $\delta>0$, such that for any $\theta'\in B(\theta,\delta)\backslash\{\theta\}$, an unique interior solution to the Nash bargaining problem exists (guaranteed by Lemma 2 when δ is sufficient small) and $\lim_{\mu\to 0}(1-\mu)F_k(\mu,\sigma(\mu),k(\mu,\theta,\theta'))\frac{\frac{1}{2}T(\theta,\theta)-H(\theta')}{\frac{1}{2}T(\theta,\theta)-H(\theta)} > \lim_{\mu\to 0} -\mu G_k(\mu,\sigma(\mu),k(\mu,\theta,\theta'))$, we have

$$\lim_{\mu\to 0} F(\mu,\sigma(\mu),k^*(\mu,\theta,\theta')) > \lim_{\mu\to 0} G(\mu,\sigma(\mu),k^*(\mu,\theta,\theta')),$$

for any $\theta' \in B(\theta,\delta)\backslash\{\theta\}$. By Lemma 1, this implies that θ is a LESP. *Q.E.D.*

Proof of Proposition 6 The average payoff of the alternative preference group under proportional assignment when μ converges to zero is given by $\lim_{\mu\to 0} G(\mu,\sigma(\mu),k(\mu)) = \frac{1}{2}\sigma_0 T(\theta',\theta') + \frac{1}{2}(1-\sigma_0)(V_h(\theta',\theta)+V_l(\theta,\theta'))$, which is an increasing function in σ_0 if inequality (22) is satisfied. *Q.E.D.*

Proof of Proposition 7 When q_0 is sufficiently close to 0 and θ is sufficiently close to θ', the Nash equilibrium problem admits a corner solution in which the equilibrium $k_0^*(\theta,\theta')$ reaches its maximum $\frac{1-\sigma_0}{2(1+\sigma_0)}$, because the maximum amount of high positions that the majority can obtain satisfies: $(\frac{1}{2}-k_0^*)-(\frac{1}{2}+k_0^*)\sigma_0 = 0$.

Given this, when μ converges to zero, the alternative preference group's average payoff equals $\lim_{\mu\to 0} G(\mu,\sigma(\mu),k(\mu)) = \frac{\sigma_0}{1+\sigma_0}(V_h(\theta',\theta')+V_l(\theta',\theta'))+\frac{1-\sigma_0}{1+\sigma_0}V_l(\theta,\theta')$, which is an increasing function of σ_0, as long as θ' and θ are sufficiently close. Hence, the alternative preference group would always want to increase segregation. *Q.E.D.*

Proof of Proposition 8 In asymmetric power sharing political institutions, one can always find $0 < \overline{q}_0 < 1$, such that for any $\overline{q}_0 < q_0 \leq 1$, the Nash bargaining problem has a unique interior solution. Hence, we have $\lim_{\mu\to 0} G(\mu,\sigma(\mu),k^*(\mu)) = \frac{1}{2}(V_h(\theta,\theta)+V_l(\theta,\theta))\frac{-q_0\lim_{\mu\to 0}\mu G_k(\mu,\sigma(\mu),k(\mu,\theta,\theta'))}{\lim_{\mu\to 0}(1-\mu)F_k(\mu,\sigma(\mu),k(\mu,\theta,\theta'))}$.

If we take the derivatives of the marginal benefit of getting more high positions for the two groups with respect to $\sigma(\mu)$, we have $\lim_{\mu\to 0}(1-\mu)\frac{\partial}{\partial\sigma(\mu)}F_k(\mu,\sigma(\mu),k(\mu)) = V_h(\theta,\theta)+V_l(\theta,\theta) - (V_h(\theta,\theta')+V_l(\theta,\theta'))$; $-\lim_{\mu\to 0}\mu\frac{\partial}{\partial\sigma(\mu)}G_k(\mu,\sigma(\mu),k(\mu)) = V_h(\theta',\theta)+V_l(\theta,\theta')-(V_h(\theta',\theta')+V_l(\theta',\theta'))$.

When $V_h(\theta,\theta')+V_l(\theta',\theta) > V_h(\theta,\theta)+V_l(\theta,\theta)$, and $V_h(\theta',\theta)+V_l(\theta,\theta') > V_h(\theta',\theta')+V_l(\theta',\theta')$, the average payoff of the alternative preference group is an increasing function of $\sigma(\mu)$ when μ is sufficiently small. Hence, the alternative preference group would benefit from increasing segregation.

On the contrary, when $V_h(\theta,\theta')+V_l(\theta',\theta) < V_h(\theta,\theta)+V_l(\theta,\theta)$, and $V_h(\theta',\theta)+V_l(\theta,\theta') < V_h(\theta',\theta')+V_l(\theta',\theta')$, the average payoff of the alternative preference group is a decreasing function of $\sigma(\mu)$, when μ is sufficiently small. Hence, the alternative preference group cannot benefit from increasing segregation. *Q.E.D.*

Proof of Proposition 9

(1) Under unadulterated majoritarianism, we know $\lim_{\theta'\to\theta}\lim_{\mu\to 0} G(\mu, k^*(\mu)) = V_l(\theta,\theta)$, which is strictly smaller than $\lim_{\mu\to 0} F(\mu, k^*(\mu)) = \frac{1}{2}(V_h(\theta,\theta) + V_l(\theta,\theta))$. Given that $\lim_{\theta'\to\theta} \Delta_{\theta,\theta'} = 0$. By continuity, there exists a $\delta > 0$, such that for any $\theta' \in B(\theta,\delta)\backslash\{\theta\}$, there exists a $\overline{\mu}$, such that for any $\mu_t \in (0,\overline{\mu})$, $G(\mu_t, \frac{1}{2}) < F(\mu_t, \frac{1}{2}) - \Delta(\theta,\theta')$. Therefore, any $\theta \in \Theta$ is LESP.

(2) From the proof of Proposition 2, under egalitarianism, we know

$$\lim_{\mu\to 0} G(\mu, k^*(\mu,\theta,\theta')) = \lim_{\mu\to 0} F(\mu, 0)\frac{-\lim_{\mu\to 0}\mu G_k(\mu, k(\mu,\theta,\theta'))}{\lim_{\mu\to 0}(1-\mu)F_k(\mu, k(\mu,\theta,\theta'))}.$$

Hence, if $\lim_{\mu\to 0} F(\mu,0)\frac{-\lim_{\mu\to 0}\mu G_k(\mu,k(\mu,\theta,\theta'))}{\lim_{\mu\to 0}(1-\mu)F_k(\mu,k(\mu,\theta,\theta'))} < \lim_{\mu\to 0} F(\mu,0) - \Delta(\theta,\theta')$ for any $\theta' \in B(\theta,\delta)\backslash\{\theta\}$ for some $\delta > 0$, then θ is LESP. This is equivalent to

$$T(\theta,\theta') > T(\theta',\theta) + 2\Delta(\theta',\theta)\frac{V_h(\theta,\theta') - V_l(\theta',\theta)}{T(\theta,\theta)}.$$

Q.E.D.

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