Ethnic inclusiveness of the central state government and economic growth in sub-Saharan Africa

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Ethnic inclusiveness of the central state government and economic growth in sub-Saharan Africa*

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Abstract

We estimate the effect of the share of ethnic groups included in the central government on economic growth, distinguishing between democracies and autocracies in a panel of 41 sub-Saharan African countries over the period 1950-2000. We exploit evidence from the Ethnic Power Relations database that categorizes the politically relevant ethnic groups in terms of access to state power. We are taking advantage of the within-country variation and using Fixed-Effects, Difference-GMM and System-GMM estimations. Our dynamic panel data and error-correction growth models display a robust positive effect of the proportion of included groups in democracies. This effect is offset in autocracies and the difference is often significantly negative. This finding withstands the introduction of various controls and specification checks. We provide a theoretical rationalization of this observed phenomenon in the form of a mechanism involving the opposition of forces linked to efficiency gains, coordination failures and inclusiveness.

JEL codes : N17, O11, O43.

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1 Introduction

The role played by ethnic divisions in the incidence of conflicts and in the deterioration of macroeconomic policies has been recognized as an essential explanation for the underdevelopment of sub-Saharan Africa (Alesina and La Ferrara, 2004; Banful, 2009; Blattman and Miguel, 2010). However some aspects of this issue have been neglected by the literature so far. This research provides answers to the following questions. How does the distribution of power across organized ethnic factions affect the efficiency of macroeconomic policies and economic development in weakly-institutionalized polities? Recently, new measures on the inclusion of the elite representatives of ethnic groups in the central state decision instances have become available. How does this inclusion affect economic prosperity in sub-Saharan African countries and what is the role played by the quality of institutions in this process? Can the observed relationship be rationalized by a properly microfounded underlying mechanism?

Because low income and divisions have been identified among the root causes of internal conflicts (Blattman and Miguel, 2010; Collier and Rohner, 2008), it is important to understand the conditions that facilitate the economic success of divided societies in periods of stability because this is the way out of the conflict trap (Collier et al., 2003). Pinkovskiy and Sala-i-Martin (2014) insists that this is not a vain hope as most African countries are going to be on time for the 2015 Millennium Development Goals in terms of poverty reduction and human development. In order to stimulate this expansion, it is important to figure out whether promoting inclusiveness and power-sharing arrangements is beneficial (Cammett and Malesky, 2012). But because the organization of these societies follows the logic of clientelism and ethnic politics where kinship bonds are prevalent in determining the features of patron-client relationships (Bates, 1981; Posner, 2004b), it is not clear that including more groups in the coalition will be helpful in all situations. For instance Besley and Kudamatsu (2007) and Easterly (2011) confirm that autocracies can be economically prosperous. Still, the detrimental consequences of exclusion cannot be understated (Abdulai, 2014).

The literature usually attributes a negative effect on economic growth to ethnic diversity (Easterly and Levine, 1997; Alesina et al., 2003) and this effect is thought to operate through the efficiency of macroeconomic policies. But the way ethnic diversity is accounted for in the economic growth empirical literature is still unsatisfactory. The Ethno-Linguistic Fractionalization index, the most commonly used measure of diversity suffers from the absence of time-variation accordingly preventing the estimation of dynamic models and relegating the analysis to cross-country studies that are plagued by a multitude of serious issues in this context, mainly endogeneity and omitted variable bias (Caselli et al., 1996). In addition, the aggregation problem subsists most of the time i.e. there is no definite way to assess which fault line across groups is relevant concerning growth in each specific country.

Regarding these concerns, we propose an alternative methodology in this paper that employs the information contained in the Ethnic Power Relations database on the inclusion in the central government of all politically organized ethnic groups across time for a

global sample of countries (Cederman et al., 2009).[1] This alternative methodology has the advantage of benefiting from the panel dimension of the database and thus embraces the possibility to estimate dynamic panel data and error-correction growth models. It consists in estimating the effect of the number of groups included in the central state coalition relative to the total number of ethnopolitically relevant groups in the country instead of traditional diversity measures. We interact this variable with an indicator reflecting the general ease to divert public resource towards ethnic specific purposes and study the effect on economic growth.

Using Fixed-Effects, Difference-GMM and System-GMM estimations, we find a statistically significant positive effect of inclusion in sub-Saharan African countries in the period 1950-2000 for country-years with strong institutions. When institutions are weak, the effect is indistinguishable from zero and the difference compared with the strong-institutions impact is often significantly negative. All estimations have country and year fixed-effects to account for constant country characteristics and global shocks. The baseline controls include investment and government expenditure as shares of GDP. We show that the results are robust to the inclusion of additional controls for internal conflicts, natural resources, life expectancy and schooling and to various specification checks. The baseline error-correction estimations imply that a change in the number of included groups from 2 to 3 out of 4 ethnopolitically relevant groups like the one that occurred in Benin in 1970, a country with weak institutions at that time, would decrease per capita GDP growth by about 0.15% the next year. The same change would instead have brought a 1.5% increase in a strongly-institutionalized country. This figure compares well with the 13% long-run impact on the level of GDP as estimated in the dynamic panel data specification that displays an autocorrelation coefficient in GDP series around 0.9.

We restrict the sample to sub-Saharan African countries because of the particular relevance of ethnicity in politics there (Fearon, 1999). We use a binary variable based on an underlying threshold condition on the Polity Index from Marshall and Cole (2011) to denote the ability to capture public resources. This index tells how a country fares on an autocracy-democracy scale and the components of this index are related to the openness of the political process and how entrenched incumbent politicians are.[2] Banful (2009) and Keefer and Vlaicu (2008) shows that the ability to embezzle and institutions are intricately tied.

[1] Cederman et al. (2009) empirically studies the likelihood of armed rebellion and center infighting in ethnically divided societies. They find that a large excluded portion of the population makes rebellion more likely and that the number of competing elites in the power-sharing arrangement increases the probability of infighting. We use the approach of Cederman et al. (2010) who, instead of considering conflicts between ethnic groups under the condition state failure or assuming that it is ethnically neutral, place the functioning of the state at the center of their analysis. Like them, we consider the state as an institution that is captured by the elites of some ethnic factions. The new element here is that we deduct the aftermath of this rivalry in terms of economic development. We adopt the constructivist idea of Posner (2004a) that ethnic groups are products of political and historical processes rather than fixed entities with foundations extending way back in time. Because ethnic groups are social constructions that experience contractions, expansions, amalgamations and divisions, the ethnic demographies are fluid and thus the measure of a country's ethnic diversity must be variable over time.

[2] By any means, the results are robust to the alternative use of the Constraints on the Executive index.

The theoretical part of this paper proposes the following advances compared to the existing literature. First, it rationalizes the basic mechanism connecting ethnic divisions and economic performance.[3] Previously, there was no theoretical justification of the Herfindahl formula used to compute the Ethno-Linguistic Fractionalization Index. Here the mechanism rests on strategic contributions to the public good made by power-sharing ethnic elites who have limited control on the public budget.[4] The second theoretical contribution of this paper is to integrate the dynamical aspect of efficiency and development in a model of coalition formation in weakly-institutionalized polities. Francois et al. (2012) and Driscoll (2012, 2014) leave this aspect out and concentrate rather on the conditions that allow the existence of such coalitions.[5]

In this paper, we construct a model of government coalition formation between ethnic groups and inter-elite strategic contributions to the public good.[6] In line with the empirical evidence, this model predicts that the inclusion of additional groups in the coalition is beneficial for economic growth as long as the institutions of the country are good enough. The reason is that when institutions are weak, the negative externality resulting from having one more player in the public good common-pool game offsets the positive impact of the workforce included in the formal production process. We provide a theoretical justifica-

[3]The most commonly given explanations are based on the quality of public good provision and on the risk of conflict. Still, no palatable answer exists to why diversity has a negative repercussion yet controlling for internal conflict occurrences. To understand the present day underdevelopment of many weakly institutionalized African countries, the explanation need to be sought in the inherent functioning of these neopatrimonial societies where patron-client relationships based on ethnic ties are prevalent. The particular justification of this paper is a mechanism deriving from the strategic nature of the contributions to a public good made by the different power-sharing ethnic factions jointly controlling the state.

[4]We use the evolution of GDP per capita as a measure of efficiency because it is not possible to distinguish productive from wasteful public spending in time-series macro-data. The fact that public spending as a share of GDP receives a negative coefficient in our estimations confirms this intuition.

[5]The idea staking out of our analysis is that in the absence of the first-best outcome of democracy, the second-best is a control shared by a limited number of insiders. We are not the firsts to support this type of idea. Glaeser et al. (2004) uncovers that poor countries get out of poverty thanks to the good policies pursued by dictators and improve their institution in the aftermath. Besley and Kudamatsu (2007) studies successful autocracies in which a selectorate is able to depose a poorly performing dictator. The motivation to the modeling strategy used here comes from Rainer and Trebbi (2012) and Francois et al. (2012). These authors gathered the evidence of a proportionality between political representation and demographic shares shown by the ethnic belonging of minister cabinet members in 15 African states. Rainer and Trebbi (2012) describes the internal functioning of African polities alongside intra-elites bargaining and patron-client relationship based on ethnic ties.

[6]In the model, a ruler forms a winning coalition of ethnic groups. The choice of excluding or including a group is guided by the risk of being overturned by a rebellion. At the same time, the ruler assigns the seats in the ministerial cabinet in order to eliminate the incentive that the insiders have to mount a coup. We assume that the factions composing the winning coalition play an investment game for the reason that each side controls the public resources proportionally to his seats share in the cabinet and weighs spending on ethnic specific patronage and on a general interest public good (Abdulai, 2014). Thus there are negative externalities because an increase in patronage by one group reduces the amount of resources available for the growth-enhancing public good that benefits everyone and the intensity of these negative externalities depends on the number of insiders and on their ability to divert public resources towards members of their ethnicity embodied in the institutional index.

tion of these two opposing forces. First, the productivity of workers from excluded ethnic groups does not benefit from the improvement of the growth-promoting public good thus making exclusion detrimental. At the opposite, a larger number of groups included in the ruling coalition in autocracies create negative externalities that undermine the provision of this growth-enhancing public good as the result of rent-seeking and inefficient ethnically targeted spending.

2 Literature Review and Advances compared to the Existing Literature

It has been widely thought that ethno-linguistic diversity is a burden to economic development. The most extensively used measure of diversity, the Ethno-Linguistic Fractionalization Index has been employed in cross-country growth regressions first in Mauro (1995) as an instrument and subsequently in Easterly and Levine (1997) as an explanatory variable. This index is computed using the Herfindahl formula that expresses the probability that two randomly drawn individuals belong to different groups and has traditionally been built on data collected by Soviet ethnographers and recorded in the Atlas Narodov Mira. Easterly and Levine (1997) and Alesina et al. (2003) for instance find a negative relationship whereas Collier (2000) discovers that it is specific to nondemocratic regimes. Nonetheless, this methodology suffers from various limitations.

First, summarizing the ethnic composition in a single figure conceals the potentially relevant effect of the ethnic structure. Posner (2004b) castigates the use of the ELF index on the account that it is based on outdated data and that it includes all the ethnographically distinct groups irrespective of the effective political organization and access to state power. The ELF index sometimes uses the wrong cleavages with respect to the issue studied. Desmet et al. (2012) tackles this by trying to determine which level of aggregation in a linguistic tree is the most relevant for various types of matters : conflicts, economic performance or efficiency of public good provision. But unfortunately, this methodology does not integrate the possibility that different levels of aggregation are relevant in different countries. To illustrate, Posner (2004c) studies the case of the Chewa and Tumbaka groups both in Zambia and Malawi. These groups are political allies in Zambia where they together account for a small part of the population whereas in Malawi where each group is demographically large, they are adversaries. Another sizable issue lies in the interrelation between post-colonialism, ethnic diversity, underdevelopment and risk of internal conflict in Africa. Any attempt to disentangle these factors with an analysis based on a worldwide sample of countries is probably predestined to failure. This complication manifests itself by the prevailing negative and significant coefficient of the sub-Saharan African dummy in growth regressions, an enigma witnessing that important regularities are still missing from the analysis (Barro, 1991).

In addition, the theory on the relation between diversity and development is still lacking of a clear and satisfactory causation mechanism to account for the underdevelopment of sub-Saharan Africa. The logic of the ELF is wanting because conflicts and inefficiencies are

not the result of every-day encounters between individuals but rather the outcome of the competition between ethnopolitical movements over the control of the central state (Cederman et al., 2009). For instance, Caselli and Coleman (2006) presents a model with only two ethnic groups which is undoubtedly a too restrictive assumption for our purpose. Ashraf and Galor (2011) for their part present a nice microfounded mechanism relating the cultural diversity among conformists and nonconformists in the population where fractionalization enhances knowledge creation. However because it has only two groups and treats cultural differences and transmission instead, this model is silent on the effect of ethnic divisions. The mechanism in Alesina and La Ferrara (2004) comes under a reduced form where the variety of skills brought by diversity increases the production possibility frontier but diversity as such drives the economy below this frontier.

So far, few papers are interested in the interplay between inclusion, exclusion and comparative development. Birnir and Waguespack (2011) finds a positive effect of inclusion of ethnic groups in the decision process in democracies thanks to the stability and support brought by the included groups to the implemented policies. The variable Ethnic Group Cabinet Inclusion is the proportion of electorally active ethnic groups represented in the cabinet in any given year. One notable improvement of this measure, as opposed to the conventional fractionalization, is that it leaves open the question of which cleavage is salient and mobilized and allows this to vary between countries and over time. More recently and concerning Ghana in particular, Abdulai (2014) establishes that the central origin of the relative advancement of Northern and Southern regions is the exclusion of the lagging Northern regions from productive economic investments. Contrastingly, Amendola and Dell'Anno (2013) constructs a synthetic index of social exclusion for European countries and finds a statistically significant but not very robust positive causal relationship between exclusion and growth.

This paper follows a large empirical literature on economic growth. Barro (1991) is a seminal paper investigating the implications of the Solow and Cass-Koopmans neoclassical growth models, that finds a negative impact of initial GDP and a positive impact of human capital in a cross-section of countries. The development of the Difference-GMM and System-GMM econometric techniques following Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) spurred a multitude of papers on economic growth. Among these, the first is Islam (1995) that finds a higher rate of conditional convergence than what was previously accepted. He uses a panel with 5-years intervals thus reducing the consequences of measurement errors and cyclicality. Islam (1995) uses fixed-effects that curb omitted variable bias and control for productivity differences. Caselli et al. (1996) corroborates the conclusion of Islam (1995) and discusses the theoretical implications. Bazzi and Clemens (2013) criticizes this literature and gives a warning against weak and invalid instruments presumably used there.

3 A Model of Coalition Formation and Inter-Ethnic Strategic Contributions

We present here a concise model of coalition formation and inter-factions bargaining in power-sharing neopatrimonial societies in which some groups are included in the ruling coalition due to a rebellion prevention motive while the other groups are excluded from it due to a cost of political bargaining.[7] This model endorses the view that the exclusion of ethnic groups reduces the potential of an economy by leaving factors unexploited (Abdulai, 2014) and that the number of included factions determines the strength of negative externalities in the delivery of a general interest public good favorable to growth. An implication is that the number of included groups has a positive impact on growth when institutions are good but that this positive impact decreases or even becomes negative as institutions deteriorate. The inspiration employed to construct this model originates from the theoretical findings of Padro i Miquel (2007), Francois et al. (2012, 2014) and the theory of the selectorate (Bueno de Mesquita and Smith, 2005).[8]

Many theoretical and empirical contributions buttress the relevance of ethnic divisions and public good provision for economic development. At the macro-level, North (1990) and Besley and Ghatak (2010) underline the role played by property rights protection. Caselli and Coleman (2006) explains why ethnic divisions are salient while Isaksson (2013) shows that this is effectively the case.[9] The ethnicity of political leaders determines how public spending is allocated (Frank and Rainer, 2012). Abdulai and Hulme (2014) and Abdulai and Hickey (2014) demonstrate that this uneven repartition of spending is responsible for the relative quality of human capital and infrastructures of the regions separated by ethnic cleavages in Ghana.

This model is designed to rationalize the fact that ethnic groups are either included or excluded from the central state coalition and to relate this inclusion or exclusion to economic efficiency. It does not explain the outbreak of civil conflicts apart from the role played by the randomness of the insecurity of the state parameter, an external factor here. Besides, it disregards the collective action problem of the rebel forces and in some sense reduces to the game-theoretic model of peace buying between a ruler and an excluded minority presented in Azam (2006).[10] The fundamental ideas are borrowed from Francois et al. (2014) which is a seminal and prominent contribution to the theory of coalition formation between ethnic factions. These authors construct a model specifically meant for African politics where the likelihood of revolutions from outsiders and coup threats from insiders are the major forces explaining allocations within these regimes. It is able to replicate the inclusion of large fractions of the population in coalitions among ethnic groups and the proportional allocation

[7] Neopatrimonialism also called clientelism or patronage is system of social hierarchy where patrons use state resources in order to secure the loyalty of their clients in the population. An office of power is used for personal gains, as opposed to a strict division of the private and public spheres (Clapham, 1985).

[8] In this theory, the selectorate are those who really choose the leader whose objective is to remain in power.

[9] A finding confirmed by micro-experiments (Habyarimana et al., 2006; Chakravarty and Fonseca, 2014) that show the lack of cooperation and underprovision of public goods induced by ethnic divisions.

[10] Azam (2006) involves only two sides and studies the set of parameter values for which peace can sustained.

of political power.[11] Our model is similar in spirit to Driscoll (2012) where warlords enter in a process of contracting and bargaining to assemble a coalition with sufficient military power to control the central state and its advantages. Driscoll (2012) finds that if the gains associated with extorting the rents of sovereignty are larger than the expected payoffs of outright violence, a cooperative outcome arises even if the warlords are interchangeable and vulnerable to divide-and-rule tactics. The model in Driscoll (2012) is based on the observation that the fragmentation of the rebel forces along with the selective incorporation of some factions in the regime is a strategy often implemented to avert civil wars.

The assumptions of our model leave the elite-subjects coordination problem aside and disregards the collective action problem of the rebels. As well, it assumes that the influence used to rebel and to threaten a coup is the same. All these assumptions are plausible in an ethnic context where intra-group coordination is substantial and inter-group trust is negligible. Moreover we assume that the influence of the rebels simply add up. It is a good assumption as long as being excluded is very undesirable, rebellion being therefore a dominant strategy. It is congruent with the fact that rebel factions are not able to coordinate well to reinforce their strengths. In addition, the implications of the model presented here are consistent the higher probability of conflict linked to exclusion present in Azam (2006) and Cederman et al. (2009) and with the proportionality between demographic and cabinet shares of Francois et al. (2014). By the way, it is not optimal here for a ruler to leave out a potential large, influential opponent because of the actual threat of violence. This is rather a reality of advanced countries where the political rules of the games permit these kind of tactics without having to suffer from the possible ensuing violence.

3.1 Description

The population is composed of a set of N ethnicities, denoted $\mathcal{N}$. Each ethnicity has a size n_i and population size is normalized to unity, hence $\sum_{i\in\mathcal{N}} n_i = 1$. We assume that each ethnicity enjoys an exogenously given level of influence in the society which is denoted P_i. We apply here again the normalization $\sum_{i\in\mathcal{N}} P_i = 1$. These P_i's can be viewed as the de facto power of each ethnic group in the sense of the sway held by its members on the machinery of society or the threat posed to opposing factions (North, 1990; Acemoglu and Robinson, 2006). Every player in the game observes such shares exactly, but not us. It is the inclusion or exclusion from the government that is the only observable outcome.

Initially, a ruling group is selected at random from $\mathcal{N}$ with probabilities proportional to the influence shares of the groups. The elite of this ruling group receives a rent from office equal to Π. These rents are continuation values and we study the Markov Perfect Equilibrium of the stage game.[12] The ruling elite or equivalently the ruler, as we will name it,

[11] However, a preferable feature of our model is that the instigator of a successful coup becomes the ruler, as opposed to what happens in Francois et al. (2014).

[12] The ruler enjoys Π wholly independently of its seat share even if he distributes a fraction of the seats in the minister cabinet to elite members of other ethnicities. This privilege corresponds to the first-tier control over the organizations dedicated to the use of violence i.e. the military and the police forces. It benefits all the elite members of the ruling group seen has a unitary actor.

then selects a winning coalition of ethnic groups $\mathcal{W}$ to surround himself with. Subsequently he assigns a continuum of cabinet positions to the elite members of all groups composing the coalition. The choices made in this process are guided by the possibility of rebellion from outside the coalition and the danger of coup from inside. In addition, we assume that a fixed proportion c of the rents accruing to the ruler and the members of the coalition gets destroyed for each included ethnic group. This is the consequence of the added complexity of the interactions brought by the additional group in the coalition. Thus, the utility of the ruler with a coalition with a total of $N_{\mathcal{W}} - 1$ other groups when neither a rebellion, denoted $r = 0$, nor a coup, denoted $e = 0$, happens is given by[13]

$$U_R(N_{\mathcal{W}}|r = 0, e = 0) = \Pi \cdot (1 - c\ (N_{\mathcal{W}} - 1))$$

We make the following hypothesis on c, the fraction of rents destroyed for each coalition member.

$$c < \frac{1}{N - 1}$$

It insures that rents stay positive even in the extreme case where all groups are included. The risk of rebellion stems from the fact that the excluded groups suffer the resentment from being deprived of the fruits of the control of the state apparatus. These ethnicities left outside $\mathcal{W}$ nevertheless have the opportunity to join the rebel forces. We denote by $\mathcal{R}$ the set of groups participating in the rebellion and we suppose that the insurgency technology is such that the demise of the reigning regime is prevented as long as

$$\sum_{i \in \mathcal{R}} P_i \quad < \quad 1 - \theta \tag{1}$$

where θ is a parameter capturing the insecurity of the state.[14] We assume that θ is random and comes from a uniform distribution over the interval $[\theta_L, \theta_H]$ with $0 < \theta_L < \theta_H < 1$. The randomness of the insecurity of the state parameter implies that choosing a more influential coalition reduces the risk of rebellion incurred by the ruler. If the total influence of the coalition $\mathcal{W}$ is larger than θ_H, there is a zero probability of rebellion. Contrarily, if the total influence of the coalition $\mathcal{W}$ is smaller than θ_L, rebellion takes place for sure. We show in Proposition 2 that the optimal coalition sometimes has a total influence between these two values in which case a rebellion occurs whenever the draw of θ is on the higher end of the $[\theta_L, \theta_H]$ interval.

The expected utility of the ruler, conditional on no coup happening and before the revelation of θ is

$$E_\theta U_R(\mathcal{W}, N_{\mathcal{W}}|e = 0) \quad = \quad \Pi \cdot (1 - c\ (N_{\mathcal{W}} - 1)) \cdot \text{Prob}(\sum_{i \in \mathcal{W}} P_i > \theta) \tag{2}$$

[13] Throughout we use the convention of denoting $N_{\mathcal{X}}$ the cardinal of a set $\mathcal{X}$. It is the finite number of distinct elements of the set.

[14] It is assumed that an excluded group joins the rebel forces for free and this is hence a dominant strategy. If the total rebel forces are insufficient, no insurgency happens. If the total rebel forces are larger than $1 - \theta$, the insurgency is successful and leads to the demise of the reigning regime. The new ruler is chosen at random among the insurgents.

Any insider group can attempt a palace coup which succeeds with probability equal to his share of influence in the cabinet.

$$\text{Prob}(e_i = 1|\mathbf{P}, \mathcal{W}) = \frac{P_i}{\sum_{j\in\mathcal{W}} P_j}$$

In case of success, the conspirator becomes the new ruler. After a failed attempt, the conspirator incurs the cost of losing its seat. The utility of an non-ruler insider in the absence of coups is given by

$$U_i(x_i|e = 0) \quad = \quad x_i\, \Pi \cdot (1 - c\ (N_{\mathcal{W}} - 1)) \tag{3}$$

if $i \in \mathcal{W}\backslash\{R\}$. In this expression, x_i is the fraction of the seats of the ministerial cabinet assigned by the ruling group to the elite of each ethnicity $i \in \mathcal{W}$. These seats engender rents from office equal to $x_i\, \Pi \cdot (1 - c\ (N_{\mathcal{W}} - 1))$ where $\Pi \cdot (1 - c\ (N_{\mathcal{W}} - 1))$ is the total amount of rents generated by the seats of the ministerial cabinet. This amount is exactly equal to the ruler rents even if the ruler enjoys $\Pi \cdot (1 - c\ (N_{\mathcal{W}} - 1))$ fully. The utility of the outsiders is equal to zero.

3.2 Strategic Contributions to the Public Good

If neither a coup attempt nor a rebellion takes place, the elites play an investment game about how to spend government income T which stands for taxes, natural resources rents, foreign aid and seignorage.[15] We assume that clientelism is the political system under which society is organized. It is the exchange of goods for political support between a patron and a client (Robinson and Verdier, 2013; Wantchekon, 2003). Here, the elite plays the role of the patron and the workers act like the client for each ethnicity. The exchange involves rents against patronage spending and these rents are tied to the corresponding patronage because each elite is intrinsically responding towards the workers of their ethnicity due to deeply-rooted kinship bonds (Caselli and Coleman, 2006).

Thus, each elite faction maximizes the utility of its ethnicity given by the function

$$U_i(C_i, G) \quad = \quad \ln C_i + \beta \ln(G) \tag{4}$$

where $\beta < 1$ stands for the taste for public goods.[16] C_i is the amount of patronage directed by the elites of group i towards the members of their ethnicity. It includes geographically or culturally targeted public goods as well as sheer private advantages and does not contribute to productivity gains. G is the amount devoted to the general interest public spending made up of infrastructures, health and education. This is the type of use that raises the productivity of the workers in the formal sector.[17]

[15] T is exogenously given at time t.

[16] The assumption $\beta < 1$ reflects the fact that groups value the ethnicity-specific spending more than the general spending. This relates to the lack of cooperation observed in this context.

[17] See the production function (12) below.

The structure of the preferences of the elite is lexicographic. The first level involves the rents that they receive for being in office. The second level involves the political outcomes that affect the workers. This assumption is realistic for our purpose because self-interested behaviour is rather the rule than the exception in that context. It is also realistic to assume that politicians maximize the utility of their clan members when possible as this is precisely their political support that allows them to achieve their primary objective. In addition, this preference structure permits to separate the decisions at each stage of the game. The government budget constraint is

$$G + \sum_{i \in \mathcal{W}} C_i \;\; = \;\; T. \tag{5}$$

The amount C_i is limited by the fraction of seats x_i enjoyed by the elites of the corresponding ethnicity. This limitation is expressed in the resource constraint (6).

$$C_i \;\; \leqslant \;\; x_i \, T(1-D) \tag{6}$$

where D is an institutional index ranging from 0 to 1. The index D embodies how hard it is to capture and embezzle public resource for patronage purposes. For instance when institutions are entirely autocratic, $D = 0$ and the constraint reduces to $C_i \leqslant x_i \, T$. In that case, all public resources are subject to diversion by the clans. At the opposite when institutions are entirely democratic, $D = 1$ and the constraint reduces to $C_i \leqslant 0$. Diversion is thus impossible and all public resources are devoted to the public good G. Summing up, the timing of the game is as follows.

1. The identity of the ruler is determined at random in $\mathcal{N}$. A ruler of type i is chosen with probability P_i. The ruler chooses the winning coalition $\mathcal{W}$ and the vector of seat shares $\mathbf{x} = (x_i, i \in \mathcal{W})$ by maximising its ex-ante utility given by (2) under the no-rebellion constraint (1) and the no-coup constraint (9).
2. The value of θ is revealed. A rebellion happens if the no-rebellion constraint (1) is violated. If no rebellion takes place the game proceeds to stage 3. Otherwise, the game goes back to stage 1 where a new ruler is chosen among the leaders of the rebellion.
3. A coup is attempted if the no-coup constraint (9) is breached for at least one non-ruler coalition member. In case of success, the game goes back to stage 1 where the coup instigator becomes the new ruler. In case of failure, the game returns to stage 1 with the same ruler who excludes the conspirator from his cabinet. In absence of coup attempt, the game proceeds to stage 4.
4. At that time the ex-post utilities of the elite of each ethnicity are established. These elites now maximize the utility of their subjects. The investment game represented by equations (4), (5) and (6) is played. The utility of the subjects of each ethnicity are settled and then, production takes place following the production function (12).

3.3 Equilibrium

We proceed backwards to determine the equilibrium of the model. We discuss in turn the optimal strategies of the elite in the investment game, the optimal seats attribution by the ruler and the optimal coalition choice by the ruler.

3.3.1 The optimal strategies in the investment game

We assume first that a ruler and a coalition $\mathcal{W}$ with attributed seat shares $\mathbf{x}$ are in place. We assume for now the absence of any kind of social unrest in the form of rebellions or coups. The equilibrium C^* of stage 4 of the game is such that each ethnicity chooses C_i^* to maximize (4) subject to (5) and (6) when the other ethnicities choose C_{-i}^*. In Appendix A, we show that this equilibrium exists and is unique.

Proposition 1 *For a winning coalition $\mathcal{W}$ and seat shares $\mathbf{x}$,*

(i) there exist a unique partition $(\mathcal{S}, \mathcal{J})$ of $\mathcal{W}$ such that the equilibrium values are

$$C_i = \begin{cases} \frac{1-\sum_{j\in\mathcal{J}} x_j(1-D)}{N_{\mathcal{S}}+\beta} T & \text{for } i \in \mathcal{S} \\ x_i\,(1-D)\,T & \text{for } i \in \mathcal{J} \end{cases} \tag{7}$$

(ii) and hence, the equilibrium public good quantity is

$$G \;=\; \frac{\beta}{N_{\mathcal{S}}+\beta}\,(1-\sum_{j\in\mathcal{J}} x_j(1-D))\,T. \tag{8}$$

At the equilibrium, the ethnic groups of the winning coalition $\mathcal{W}$ are partitioned into two sets, $\mathcal{S}$ and $\mathcal{J}$ that contain respectively $N_{\mathcal{S}}$ and $N_{\mathcal{J}}$ elements. $\mathcal{S}$ is the set containing the groups with a larger seat share that have a slack resource constraint (6) and that contribute to the public good G while $\mathcal{J}$ contains the $N_{\mathcal{W}} - N_{\mathcal{S}}$ other groups with relatively fewer seats that have a tight resource constraint (6) and that do not contribute.

Following part (i) of the proposition, the groups in $\mathcal{J}$ distribute as much patronage as their resource constraint allows. Strategically, the groups in $\mathcal{S}$ capture a fraction of the remainder inversely proportional to $N_{\mathcal{S}} + \beta$, where $\beta < 1$ is the taste for public good. Following part (ii) of the proposition, the equilibrium public good provision is given in equation (8) where $N_{\mathcal{S}}$ is the number of contributing groups again and $\sum_{j\in\mathcal{J}} x_j$ is the total seat share of the groups who are not contributing.[18]

[18] $\sum_{j\in\mathcal{J}} x_j(1-D)$ is the fraction of public resources that are used for patronage purposes by the groups belonging to $\mathcal{J}$.

3.3.2 Optimal seats attribution by the ruler

Continuing backwards and now allowing the possibility of coups, the next step is the optimal seats attribution by the ruler among the members of the coalition $\mathcal{W}$. He knows that when considering the possibility of attempting a coup, the conspirators balance the opportunity cost of trying which is $x_i\Pi \cdot (1 - c\ (N_{\mathcal{W}} - 1))$, the value associated with their share of seats in the minister cabinet with the expected value of an attempt, namely

$$\frac{P_i}{\sum_{i\in\mathcal{W}} P_i}\Pi \cdot (1 - c\ (N_{\mathcal{W}} - 1))$$

or the probability of success times the value in case of success. c is the fixed rate of destruction of rents ensuing from an additional member in the coalition. Because of the structure of the preferences, the level of these rents are unrelated to the outcome of the investment game. The size of the preferred ruling coalition of the present ruler is denoted $N_{\mathcal{W}}$. We assume here that it is as well the expected number of coalition members for all groups if they ever come to power.[19] For a simple coalition member i, the standard no-coup constraint can be expressed as

$$x_i\Pi\ (1 - c\ (N_{\mathcal{W}} - 1)) \quad \geqslant \quad \frac{P_i}{\sum_{i\in\mathcal{W}} P_i}\Pi \cdot (1 - c\ (N_{\mathcal{W}} - 1)). \tag{9}$$

This implies that the ruler assigns

$$x_i = \frac{P_i}{\sum_{i\in\mathcal{W}} P_i} \tag{10}$$

of seats to each group i, $i \in \mathcal{W}$ so that the no-coup constraint is respected with equality. The solution in equation (10) asserts that each faction receives seats in proportion to its relative influence in the coalition. It is always possible to respect the no-coup constraint and coups remain off equilibrium-path possibilities in our model.

3.3.3 The optimal coalition choice by the ruler

The ruler chooses the coalition that maximizes (2), its expected utility (before the disclosure of θ) which is equal to

$$E_\theta U_R(\mathcal{W}, N_{\mathcal{W}}|e = 0) = \begin{cases} 0 & \text{if } \sum_{i\in\mathcal{W}} P_i < \theta_L \\ \Pi\ (1 - c\ (N_{\mathcal{W}} - 1))\frac{\sum_{i\in\mathcal{W}} P_i - \theta_L}{\theta_H - \theta_L} & \text{if } \theta_L < \sum_{i\in\mathcal{W}} P_i < \theta_H \\ \Pi\ (1 - c\ (N_{\mathcal{W}} - 1)) & \text{if } \sum_{i\in\mathcal{W}} P_i > \theta_H \end{cases}$$

because θ is uniformly distributed over $[\theta_L, \theta_H]$.

[19] This is an acceptable assumption given that the influence shares of the groups could change during to the transition. $N_{\mathcal{W}}$ is the expected size of the ruling coalition in the following regime.

Proposition 2 describes the optimal coalition choice by the ruler. The basic mechanism in this process is the arbitrage between the decrease in the risk of rebellion that an additional member brings and the proportional destruction of the rents.

Proposition 2 *The optimal coalition $\mathcal{W}$ chosen by the ruler is such that*

(i) The groups are included in decreasing order of influence.

(ii) $\sum_{i\in\mathcal{W}} P_i > \theta_L$.

(iii) a Either $\theta_L < \sum_{i\in\mathcal{W}} P_i < \theta_H$. *Then the most influential group z that is not included in* $\mathcal{W}$ *has an influence* P_z *such that*

$$P_z < \frac{\sum_{i\in\mathcal{W}} P_i - \theta_L}{N_{\mathcal{W}} + \frac{1}{c}} \tag{11}$$

b Or $\sum_{i\in\mathcal{W}} P_i > \theta_H$.

Because the more influential factions abate the risk of rebellion by a greater amount for an identical cost in terms of rents and because the factions are interchangeable, the ruler always includes the most influential groups in priority. It is necessary for the ruler to have a coalition with at least enough influence to neutralize a rebellion when the insecurity of the state is the lowest. Thanks to hypothesis on c, this will always give him a strictly positive payoff. Proposition 2 states that the total influence of the optimal coalition sometimes is such that a rebellion arises when the insecurity of the state happens to be high. If the total influence of the optimal coalition is greater than θ_H which is the level of influence needed to prevent a rebellion in the worst case scenario, then it is avoided for sure.

3.4 Effect of Inclusion on Economic Performance

We assume that the production function takes the following Cobb-Douglas form.

$$Y = A\sqrt{G \cdot \sum_{i\in\mathcal{W}} n_i} \tag{12}$$

A is a parameter capturing total factor productivity, as usual. Only the workers of the included groups are involved in the formal production process while the workers of the excluded groups are limited to the informal sector. Government spending increases the efficiency of workers in a multiplicative way although increasing returns to scale are ruled out by the specification.

Consider that the insecurity of the state changes for an exterior reason. For instance, due to a civil war in a neighbouring country, the insecurity of the state increases and the interval of the distribution of θ shifts from $[\theta_L, \theta_H]$ to $[\theta_L + \Delta\theta, \theta_H + \Delta\theta]$ with $\Delta\theta > 0$. Proposition 2 can be used to determine how the optimal coalition chosen by the ruler will respond to this

shock. The following proposition specifies the consequences in terms of economic performance if the shift in the distribution of θ generates the addition of a set $\mathcal{K}$ of groups to the optimal coalition. Including more groups puts two opposing forces at work. The effect of the greater workforce participating in the formal sector, $\sum_{i\in\mathcal{W}} n_i$ is positive. But the effect of the decrease of G and productivity due to the inefficiencies engendered by the larger number of groups in the ruling coalition is negative. In the following proposition, we express the threshold value for the institutional index above which inclusion is beneficial. This threshold depends on the demographic and power configurations.

Using Proposition 1.(ii), the output with a coalition $\mathcal{W}$ and an institutional index D is[20]

$$Y(\mathcal{W}, D) = A \cdot \sqrt{\sum_{i\in\mathcal{W}} n_i \left(1 - \frac{(1-D)\left(\sum_{i\in\mathcal{J}} P_i\right)}{\sum_{i\in\mathcal{W}} P_i}\right)} \tag{13}$$

The output with the larger coalition $\mathcal{W}' = \mathcal{W} \cup \mathcal{K}$ and an institutional index D is[21]

$$Y(\mathcal{W}\cup\mathcal{K}, D) = A \cdot \sqrt{\left(\sum_{i\in\mathcal{K}} n_i + \sum_{i\in\mathcal{W}} n_i\right)\left(1 - \frac{(1-D)\left(\sum_{i\in\mathcal{J}} P_i + \sum_{i\in\mathcal{K}} P_i\right)}{\sum_{i\in\mathcal{K}} P_i + \sum_{i\in\mathcal{W}} P_i}\right)} \tag{14}$$

To establish Proposition 3, the first step is to demonstrate the intuitive result stated in part (i) i.e. that the difference between the output with a small and large coalition decreases when institutions improve. This is the case because the improvement of institutional quality boosts public spending and production more when the negative externalities in the public good production are stronger that is, when the coalition is more inclusive. The rest of the following proposition expresses $\hat{D}$, the minimum institutional quality level needed so that the negative externality does not counterbalance the positive effect of the greater workforce in the formal sector. This condition guarantees that the output with a larger coalition is above that with a smaller one or

$$Y(\mathcal{W}, D) < Y(\mathcal{W}\cup\mathcal{K}, D). \tag{15}$$

An expression for the threshold can be obtained by reducing (15) with respect to D. This threshold depends on the initial and final coalitions through $\mathcal{W}$ and $\mathcal{K}$ and on the demographic and power configurations through the n_i's and P_i's. Part (iii) of the proposition expresses a condition that makes the larger coalition always more productive irrespective of the institutional quality. Finally, part (iv) states that the threshold above which the large coalition is more productive is always strictly below one.

[20] $\mathcal{J}$ is the subset of $\mathcal{W}$ of less influential groups that do not contribute to the public good. The simplification $T = 1$ is made.

[21] Using Proposition 2.(i), the set $\mathcal{K}$ contains some formerly excluded groups that are more influential than the other formerly excluded groups.

Proposition 3 *(i)* $Y(\mathcal{W}, D) - Y(\mathcal{W} \cup \mathcal{K}, D)$ *is a decreasing function of D.*

(ii) There exists $\hat{D}$ *defined by*

$$\hat{D} = \frac{\left(\sum_{i\in\mathcal{W}} P_i - \sum_{i\in\mathcal{J}} P_i\right)\left(\sum_{i\in\mathcal{W}} n_i \sum_{i\in\mathcal{K}} P_i - \sum_{i\in\mathcal{K}} n_i \sum_{i\in\mathcal{W}} P_i\right)}{\sum_{i\in\mathcal{K}} n_i \sum_{i\in\mathcal{W}} P_i \left(\sum_{i\in\mathcal{J}} P_i + \sum_{i\in\mathcal{K}} P_i\right) + \sum_{i\in\mathcal{W}} n_i \sum_{i\in\mathcal{K}} P_i \left(\sum_{i\in\mathcal{W}} P_i - \sum_{i\in\mathcal{J}} P_i\right)} \quad (16)$$

such that

$$\bullet Y(\mathcal{W}, D) > Y(\mathcal{W} \cup \mathcal{K}, D) \quad \textit{if } D < \hat{D}$$
$$\bullet Y(\mathcal{W}, D) < Y(\mathcal{W} \cup \mathcal{K}, D) \quad \textit{if } D > \hat{D}$$

(iii) $\hat{D} = 0$ *if*

$$\frac{\sum_{i\in\mathcal{K}} P_i}{\sum_{i\in\mathcal{K}} n_i} < \frac{\sum_{i\in\mathcal{W}} P_i}{\sum_{i\in\mathcal{W}} n_i}$$

(iv) $\hat{D} < 1$

The interpretation of (iii) is that if the groups in $\mathcal{K}$ that join the coalition have a smaller average influence per person than that of the former coalition, then $\mathcal{W}'$ is more productive irrespective of the institutional quality. The implication of (iv) is that with best institutions, $\mathcal{W}'$ is always better for growth. Even if no conclusions can be drawn from the expression of $\hat{D}$ as such, some interesting comparative statics results with respect to changes in the demographic and power configurations can be established from it. This is what we do in Proposition 4.

Proposition 4 *Comparative statics of the interior solution for* $\hat{D}$

$$(i)\frac{\partial \hat{D}}{\partial \sum_{i\in\mathcal{K}} n_i} < 0, (ii)\frac{\partial \hat{D}}{\partial \sum_{i\in\mathcal{K}} P_i} > 0, (iii)\frac{\partial \hat{D}}{\partial \sum_{i\in\mathcal{W}} n_i} > 0$$

and the derivative with respect to $\sum_{i\in\mathcal{W}} P_i$ *is undetermined a priori.*

This proposition states that (i) if the groups that join the coalition marginally become more important demographically, then the minimum level of institutional quality required to make this joining beneficial gets less demanding. At the opposite, (ii) if the groups that join the coalition marginally become more important politically, then the minimum level of institutional quality required to make this joining beneficial gets more demanding. Finally, part (iii) states that if the groups that are already in the coalition marginally become more important demographically, then the minimum level of institutional quality required to make the inclusion beneficial increases.

Proposition 3 provides us with a testable implication of the model. The main insight of this section is that inclusion is beneficial when institutions are good enough but becomes detrimental when they are below a threshold. We develop a framework to test this conjecture in the next section.

4 Empirical Strategy

In this section we present an empirical investigation on ethnic inclusiveness of the central government and economic growth in sub-Saharan Africa. The variables of interests are the share of ethnic groups included in the government and its interaction with an institutional dummy. To face potential econometric issues, we estimate dynamic panel data growth models and growth error-correction models with a range of techniques : Fixed-Effects, Difference-GMM and System-GMM. The following subsections present the empirical model, the data, the econometric issues and the results.

4.1 Empirical Model

A particularity of this investigation is that we include an interaction of the share of included groups with institutions in the model specification.[22] There are a few papers that study the effect of a particular variable on growth conditional on institutions. Among these, Collier (2000) finds that the level of ethnic diversity has detrimental effects on economic performance in the context of dictatorships but that this effect disappears in democracies. Boschini et al. (2013) studies a potential reversal of the resources curse by good enough institutions by interacting export shares of different primary commodities with an institutional index.[23]

Usually ethnic diversity is accounted for with the ELF index. However Birnir and Waguespack (2011) is the first paper to integrate ethnic divisions in the form of the share of ethnic groups included in the ruling coalition in an empirical growth setting. In a Fixed-Effects panel estimation restricting the sample to observations with democratic institutions, they find a positive and significant effect of this variable on growth albeit the authors do not tackle the endogeneity issue and do not control for temporary shocks that can affect economic growth.

In a cross-sectional framework, Rodrik et al. (2004) finds that institutions trump openness to trade and geography, two rival explanations. But Acemoglu et al. (2008) finds that once controlling for country fixed-effects, the relationship between institutions and development disappears in both directions. Acemoglu et al. (2009) further adds that, once fixed effects are controlled for, the relationship between income and transitions from and to democracy has no statistical significance. This relieves the potential concerns that the finding of this paper could be engendered by short-term fluctuations in institutions only and that there could be reverse causality from income to institutions even within a given country and in a short time span. This reverse causality is obvious across countries or in the long run, but this is not a concern in our Fixed-Effects framework. In addition, Bueno de Mesquita and Downs (2005) for instance shows that economic recovery does not necessarily imply democratization. Przeworski et al. (2000) discredits any notion of a trade-off between democracy

[22] Rodriguez (2006) criticizes the linear assumption of most growth models and shows that this leads to omitted variable bias if the true relation is nonlinear. He suggests that adding interaction terms to the specification is a step towards resolving this issue.

[23] However the absence of fixed effects in their estimations casts doubts on the existence of omitted variable bias due to unobservable historical fixed country characteristics.

and development. These authors sustain that economic development does not engender democracies, but that democracies are much more likely to survive in wealthy societies.

Equation (17) describes the baseline dynamic panel data growth model used in this paper.

$$y_{i,t} = (1-\beta)\, y_{i,t-1} + \alpha_1\, S_{i,t} + \alpha_2\, S_{i,t} * A_{i,t} + \alpha_3\, A_{i,t} + \alpha_4\, X_{i,t} + \eta_i + \zeta_t + \epsilon_{i,t} \qquad (17)$$

The dependent variable $y_{i,t}$ is the log of real GDP per capita in country i in year t. As usual in this type of model (Moral-Benito, 2010), a lagged dependent variable $y_{i,t-1}$ is present among the independent variables and β is the rate of conditional convergence. $S_{i,t}$ is the explanatory variable of interest along with the interaction $S_{i,t} * A_{i,t}$. $S_{i,t}$ is the share of ethnic groups included in the government in country i at time t. It is computed as the ratio of the number of included groups relative to the total number of politically relevant ethnic groups.[24]

$$\text{Share}_{i,t} = \frac{N_{\mathcal{W},i,t}}{N_{\mathcal{N},i,t}}$$

$A_{i,t}$ is an autocracy dummy-variable that is present in uninteracted level form too. This is necessary to insure that the results are not provoked by institutions only. In the baseline specification, it takes the value one when the Polity Index is negative and zero otherwise.[25]

$$\text{Autocracy}_{i,t} = 1 \text{ if } (polity2_{i,t} \leqslant 0) \text{ and } 0 \text{ otherwise.}$$

The conjecture that we investigate i.e. that the share of included groups has a positive effect on growth with democratic institutions and an attenuated effect with dictatorial institutions can be expressed like this:

$$\alpha_1 > 0 \quad \text{and} \quad \alpha_2 < 0.$$

We control for country specific time-varying factors that influence the dependent variable. The vector $X_{i,t}$ contains investment and government expenditure as shares of GDP and in some specifications controls for internal conflicts, coups, diamond production and oil production per capita. The η_i's are country fixed-effects that are useful to diminish omitted variable bias. The ζ_t's are year fixed-effects. These are important because they incorporate cyclicality at the level of the region and thus temper possible concerns that could arise when using a yearly panel.

For all Fixed-Effects estimations, the error term $\epsilon_{i,t}$ capturing all other omitted factors is assumed to be strictly exogenous i.e.

$$E[\epsilon_{i,t} | y_{i,t-1}, X_{i,t}, S_{i,t}, A_{i,t}] = 0 \qquad (18)$$

for all i and t. Nevertheless, the regressors are allowed to be correlated with the fixed effects η_i under this assumption.

[24] $N_{\mathcal{W},i,t}$ is the number of politically relevant ethnic groups included in the ruling coalition and $N_{\mathcal{N},i,t}$ is the total number of politically relevant ethnic groups.

[25] We consider this relationship using alternative measures of democracy in the robustness check tables of the Appendix.

Based on Bond et al. (2001) and Roodman (2009), for the Difference-GMM estimations, we assume instead that the error term of the equation in first difference is orthogonal to Z, the instruments matrix that comprises the lagged explanatory variables in level, limited to lags up to three. We assume that the moment conditions

$$E[\Delta\epsilon_{it} y_{i,t-s-1}] = 0 \text{ and } E[\Delta\epsilon_{it} x_{i,t-s}] = 0 \tag{19}$$

for $t = 3, \ldots, T$ and $s = 1, 2, 3$ are valid so that we can use the explanatory variables as GMM-style instruments. For the System-GMM estimations we add the standard moment conditions

$$E[u_{it} \Delta y_{i,t-1}] = 0 \text{ and } E[u_{it} \Delta x_{i,t}] = 0 \tag{20}$$

for $i = 1, \ldots, N$ where $u_{it} = \eta_i + \epsilon_{it}$ is the combined error term.

Equation (21) describes the baseline growth error-correction model.

$$\begin{aligned} \Delta y_{i,t} \;=\; & \alpha_1 \, \Delta S_{i,t} + \alpha_2 \, \Delta (S_{i,t} * A_{i,t}) + \alpha_3 \, \Delta A_{i,t} + \alpha_4 \, \Delta X_{i,t} \\ & + \beta_1 \, y_{i,t-1} + \beta_2 \, S_{i,t-1} + \beta_3 \, S_{i,t-1} * A_{i,t-1} + \beta_4 \, A_{i,t-1} + \beta_5 \, X_{i,t-1} \\ & + \xi_i + \nu_t + \epsilon_{i,t} \end{aligned} \tag{21}$$

This specification follows the panel version of the model of Engle and Granger (1987) proposed by Westerlund (2007). If the series are integrated of order one and if there exists a long-run cointegrating relationship between the variables, equation (21) involves only stationary processes and thus permits estimations unobscured by spurious correlations. The dependent variable is the first difference of the log GDP per capita in country i in year t. The short-run dynamics of the equation includes the first differences of the same variables as in the previous model and the α_j's are the short-run impact parameters. As proposed in Engle and Granger (1987), we estimate the error-correction model and the long-run relationship in one step by including the lagged GDP per capita in level and all the lagged regressors in level involved in the long-run relationship. Here the variables of interest are the first differences of $S_{i,t}$ and of its interaction with the autocracy-dummy $S_{i,t} * A_{i,t}$. The conjecture to be tested can be expressed again as[26]

$$\alpha_1 > 0 \quad \text{and} \quad \alpha_2 < 0.$$

Once more, the error term is assumed to be strictly exogenous for the Fixed-Effects estimations. For the Difference-GMM, we assume again the standard moment conditions similar (19) but where the x_i's now are the explanatory variables of (21) instead. For the System-GMM estimations we add the conditions expressed in (20) to the system but where $x_{i,t}$ now includes only the variables in first difference. We consider the lagged variables of the long-run relationship as predetermined in the System-GMM estimations of the ECM.

[26]The focus here is on the short-run dynamics as the standard-errors of parameters of the long-run relationship are not valid due to stationarity.

These variables are in consequence not used as GMM-style instruments. This alternative increases the precision of the estimation because it tames the collinearity caused by the use of the System-GMM estimator that involves moment conditions with levels and first differences together with an ECM model that has explanatory variables in level and first difference as well. Besides, it helps in reducing the instrument count. All the regressions include the ξ_i's country fixed-effects and the ν_t's year fixed-effects for the same reasons as above. The year fixed-effects are used as exogenous IV-style instruments in all estimations.

4.2 Data

The data comes from the Penn world tables (Heston et al., 2012), the Polity IV project (Marshall and Jaggers, 2007) and the Ethnic Power Relation data set version 3 (Cederman et al., 2009). We use data on coup occurrences from Powell and Thyne (2011) and data on natural resources from Lujala et al. (2005). Fearon and Laitin (2003) provides the war data used in our analysis.

1. *Dependent variable and main controls* The log real GDP per capita comes from the Penn world tables version 7.1. The share of investment in GDP and the share of government expenditure in GDP come also from this source. We use openness to trade as well which is computed as the ratio of the sum of exports plus imports to GDP.

2. *Explanatory variables of interest* Our autocracy binary-variable is constructed with the Polity Index. This index is based on evaluations of the competitiveness and openness of the electoral process, the restrictions in the political process and the constraints on the executive. It attributes values on a 21 points discrete scale ranging from -10 for perfect autocracy to +10 for perfect democracy to all countries across time. Later, we use the *constraint on the executive* variable as a robustness check.[27]

   The information on the inclusion and exclusion of politically relevant ethnic groups from the central government is contained in the Ethnic Power Relations data set. Based on experts assessments, this projects codifies the status of each politically relevant ethnic group for each year in a global sample of countries. The status of the groups in power

[27] A critique against our approach that could be expressed is that the interaction between institutions and inclusion is built on elements that measure the same aspects twice. On the contrary, the Polity IV project makes the greatest attempt at measuring the political environment rather than dictatorial choices (Glaeser et al., 2004) and does not already comprise information on the inclusion or exclusion of ethnic groups. There is a variable for Fragmentation in the data set that codes the presence of a separate polity in the territory but this variable does not enter in the Polity Index. The *'polity2'* index comprises elements related to ethnic politics in the PARREG category but all these are related to the political process in general and not to the outcome of whether particular ethnic groups are excluded or included in the central government. In addition, *'polity2'* adopts a coding scheme that attributes specific labels to typical political arrangements. The dichotomous approach that we use in the empirical analysis is well suited to capture the split between polities where the ethnic divisions in the government are likely to create inefficiencies. At the opposite, the fact that Competitiveness of Political Participation and Regulation of Participation involve ethnic elements apprehends precisely the phenomenon that we want to measure.

is either *'monopoly'*, *'dominant'*, *'senior partner'* or *'junior partner'* and that of the groups excluded from central power is either *'separatist'*, *'powerless'* or *'discriminated'*. Like in Birnir and Waguespack (2011), the share of groups included in the government is the ratio of number of the groups with an included status relative to the total number of groups. The reason why we do not need to explicitly incorporate the distinct status types in our analysis is because it does not matter for the particular mechanism under consideration.[28] This data set has a major advantage compared to the Minorities at Risk data (Gurr, 1993) that concentrates exclusively on disadvantaged minorities and is thus unable to relate the dynamics of power in the central decision instances to economic performance outcomes.

3. *Additional controls* Powell and Thyne (2011) delivers a coding of the coups that have occurred throughout the world between 1950 and 2010. It is used in the equation as a control. Coups are sharp illegal attempts by the military or other elites to overthrow the chief executive and that do not necessarily involve violence.

   The war variable is derived from the listing of Fearon and Laitin (2003) that combine various sources of information. These authors have built a list of internal conflicts that have taken place in post-1945 history based on the following criteria : the conflict involved fighting between the state and opposing forces that tried to take over control of the state, take power in a region or to change government policies and for which the thresholds of 1,000 battle deaths per year in general and of 100 battle deaths per year on the side of the government are reached.[29] The variable used is our analysis is a dummy variable equal to one if an internal conflict was ongoing in the country-year and zero otherwise.

   Codings of diamond production and oil production per capita are present in Lujala et al. (2005). The information on diamonds takes the form of an indicator that is equal to one if the country produced diamonds in a given year. The oil per capita variable is the total value of production divided by the population of the country and the initial source is the CIA factbook.

   Some other additional controls stem from the World Bank Development Indicators. We use life expectancy at birth and secondary schooling enrollment rates to stand for health and human capital. Official development aid as a share of GDP and a vector of fixed country characteristics come from this source as well.

4. *Robustness Analysis* We used alternative measures of democracy : Vanhanen (2000)'s Democracy Index and the data set of political regimes by Boix et al. (2013).

Tables 1 and 2 give the main summary statistics for the 30 countries present in our sample in 1965 and for the 41 countries sample of 1995. The mean of deflated GDP per capita was 1,304 dollars in 1965 and 2,148 in 1995. The number of politically relevant groups of a

[28] Equation 8 concisely expresses this idea. If an additional group is added to the coalition, it does matter if it has a large or small influence and belongs to the set of the contributors, $\mathcal{S}$ or the non-contributors, $\mathcal{J}$ for the negative repercussion on G to be present. Besides, all types of excluded groups are deprived of the benefits of this spending to the same extent.

[29] This last condition is meant to reject state-led massacres.

country ranges overall from 1 to 13 and was on average 4.9 (in 1965) and 4.821 (in 1995). The mean shares of included groups were 60.5 % and 68.9 % respectively. The mean value of the Polity Index was -4.103 and 73.3% of the countries had autocratic institutions in 1965. These values were -0.171 and 63.4 % in 1995. The prevalence of diamond production increased from 36.7% to 43.9% while the prevalence of coups went down from 10 % to 2.4 % between these years. A war was going on in 10% of the observations in 1965, 26.8% in 1995.

Figure 1 displays the evolution of the share of included groups $S_{i,t}$ by country and year. The interaction with the autocracy-dummy $S_{i,t} * A_{i,t}$ appears too. Figure 2 presents the evolution of the normalized Polity Index by country and year in our sample. Due to a normalization between zero and one, the horizontal line at 0.5 indicates the threshold that we use to construct our autocracy binary-variable. **It can be observed that this threshold captures most of the large variations of the Polity Index in the sample.** Figure 3 displays the evolution of GDP growth, government expenditure, investment and official development aid as shares of GDP. Finally, Figure 4 shows the data on coups, war occurrences and diamond production.

4.3 Econometric Issues

In this paper, we use a panel data approach. Endogeneity is a prevalent concern in the traditional cross-country growth literature where correlations between the explanatory variables and unobservable productivity differences or fixed historical factors lead to inconsistency of the estimates (Caselli et al., 1996). Using a panel data structure is a reliable method to tackle this issue because Fixed-Effects estimations take advantage of the within countries fluctuations to remove unobserved heterogeneity by differencing the influence of all fixed characteristics. A chief trump of this method is therefore that correlations between the explanatory variables and the fixed effects do not create bias. The attenuation bias that pulls the estimates towards zero in presence of positively auto-correlated series gives even more certainty to the significance of the results (Hauk and Wacziarg, 2009; Griliches and Hausman, 1986). Some other advantages of the panel data structure are the increase in the number of degrees of freedom that leads to a more accurate parameter inference and the ability to uncover dynamic relationships (Hsiao, 2007). Because it ignores between countries differences, this estimation method sometimes suffer from the lack of variation of right-hand side variables and thus possibly gives large estimated standard-errors and insignificant results. Tables 3 to 5 show that this is not the case in our empirical investigation. A disadvantage is that it can only estimate the impact of variables that vary over time even if all constant factors are control for by the fixed effects. However, our Mundlak estimations presented in table A2 somehow circumvent this issue.

To face the potential endogeneity issue due to the presence of a lagged dependent variable among the regressors, we use the Difference and System-GMM estimation methods.[30] In macroeconomic empirical studies most variables are interrelated and thus possibly endogenous hence preventing a causality interpretation. All variables expressed as percent-

[30]The FE estimator is consistent only if residuals are not autocorrelated.

ages of income are necessarily endogenous in growth regressions as the denominator in these variables is GDP.[31] The Difference and System-GMM estimation techniques developed by Holtz-Eakin et al. (1988), Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) use moment conditions on the lagged explanatory variables in level and first difference to solve endogeneity issues. It is assumed that past realizations of the instruments are uncorrelated with the error term. Caselli et al. (1996) was the first to use Difference-GMM in a panel cross-country growth context but later Bond et al. (2001) argued in favor of System-GMM instead because the differenced variables are weak instruments for levels of GDP due to the persistence of the latter. Roodman (2009) warns that SGMM must be handled cautiously and suggests to limit the lag length of the instruments used, a remedy adopted here.

The specification of the Error Correction Model of equation (21) must be justified. Originally the DGMM and SGMM methods were designed to instrument for the endogeneity of a lagged dependent variable in a dynamic panel data model of the form of equation (17). In the ECM expressed in equation (21), this variable would be the lagged growth rate of GDP per capita and is omitted from the regressors of our equation. Despite that, it is still relevant to use these estimation methods when the other explanatory variable are suspected to be endogenous, which is the case here. Moreover, the interpretation of the coefficients in terms of impact on growth is more sensible and straightforward with this specification. In addition, the choice of including this variable should be based on its significance in the regression.[32] Besides, the specification that we use is the ECM formulation proposed by Westerlund (2007).

The preferred specifications of this paper are based on a yearly panel. Usually in cross-country panel growth regressions, averages over 5-years periods or data spaced in time by 5-years intervals are used to diminish the consequences of measurement errors and cyclicality in the series (Durlauf et al., 2005). For instance Islam (1995), Naudé (2004) and Acemoglu et al. (2008) are papers in this line of research. But Cerra and Saxena (2008) find that faster-than-normal recoveries do not necessarily follow crises or growth collapses and argues than it thus makes little sense to average over periods. The yearly panel alternative is performed in Bond et al. (2010), Boschini et al. (2013), Birnir and Waguespack (2011) and Collier and Goderis (2012). The vulnerability of this option to measurement error bias and inconsistency resulting from cyclicality must be acknowledged even though here, the presence of year and country fixed-effects mitigate this issue.[33]

[31] To illustrate, Liberia is the largest commodity exporter but this is because it has a very low GDP of 878 dollar per capita per year and is ranked 181st out of 185 countries in the world.

[32] In the Fixed-Effects and System-GMM estimations this term has a statistically insignificant coefficient if it is added to the regressors. In the DGMM estimations, the new term is significant at 5% but as adding it does not alter the results, we prefer to pull it out altogether to facilitate comparability and interpretation of the results.

[33] Boschini et al. (2013) uses a yearly panel and a global sample of countries and investigates the resource curse. They interact various types of primary exports in GDP with institutional measures in level (Polity, ICRG) and finds that democratic institutions moderate the curse. Although as they admit, due to a lack of variability of institutional variables, their results do not withstand the insertion of country fixed-effects. We believe that using a dichotomous approach instead of the level of the index could better capture the change

Here, a yearly panel is preferable because the aggregation over longer periods is likely to mask the effect as the timing of the institutional changes and variations in the number of included ethnic groups do not necessarily coincide with the period cutoff points.[34] Moreover, with a yearly panel, the persistence of institutions and coalitions diminishes the endogeneity concern for the variables of interest. This is because we observe multiple draws of the same data generating process with identical values of $A_{i,t}$ and $S_{i,t}$ over the years where the regime is maintained and can be regarded as exogenous.

In this paper, the position of the country on the autocracy-democracy scale is accounted for by a binary variable based on an underlying threshold condition on the *'polity2'* score. There is a debate among political scientists with supporters of dichotomous, polychotomous, continuous and multidimensional approaches to democracy (Boix et al., 2013; Przeworski et al., 2000). Dichotomous measures are better at capturing the necessary conditions for democracies and are more transparent whereas continuous measures sometimes sum the components together and disregards how these interact in the political process. Acemoglu et al. (2009) studies transitions from and to democracy using both approaches and finds the same results with both i.e. that the correlation between development and transitions is not statistically significant once fixed-effects are controlled for. Collier and Adcock (1999) argue that this choice must be guided by the particular empirical question.

Here we constructed our autocracy index with a threshold of zero on the combined polity score. This is the same threshold as the one used in Epstein et al. (2006) for instance. The *'polity2'* combined score is constructed by subtracting the autocracy score from the democracy score, both calculated by adding values attributed to categories for each component. A classification associated with a democratic or autocratic functioning of the polity increases the corresponding score. This threshold of zero can thus be interpreted as the cutoff point above which a country is rather democratic than autocratic. Following the practical logic of Collier and Adcock (1999), the instead sometimes used threshold of +5 is not able to capture the different types of functioning between regimes in Africa. The change in the effect of inclusion is observed between autocracies and closed democracies rather than between intermediate regimes and full democracies.[35]

between bad a good institutions and potentially alter the conclusion. Birnir and Waguespack (2011) uses a global yearly panel to estimate a dynamic panel data model. Their panel is unbalanced because they select only the country years with democratic institutions in their empirical analysis. (This leads to sample selection bias.) They find a positive impact of the share of included ethnic groups, the same variable that we use. They have only one Fixed-Effects estimation and do not check the robustness of their result nor address the endogeneity issues. Collier and Goderis (2012) studies the short-run impact of commodity export prices on growth and thus prefer to use the original yearly data. They avoid the introduction of country fixed-effects and rely on regional fixed-effects. They find that commodity export prices booms have favorable consequences for growth in the short-run but that in the long run non-agricultural booms create adverse effects in countries with weak institutions. Bond et al. (2010) use a yearly panel as well and find a positive connection between the investment rate and growth, thanks to the amount of variability in both series. They filter the adjustments to occasional shocks with a dynamic econometric specification. The strategy that we adopt for that is an ECM.

[34] As a trade-off, the measurement error bias and the consequences of cyclicality are not taken care of by time aggregation. Nevertheless as mentioned earlier, the country and year fixed-effects at least partly make up for that.

[35] This +5 threshold would be better suited for advanced economies.

About this matter, our choice must be justified as recommended by Bogaards (2010). We tried the various possibilities among which changing the threshold of the dichotomous index and using three regime categories. We included changes in the level of *polity2* in place of the autocracy-dummy as a control in Appendix Table A5 where the main results subsists. It appears that the threshold that we use is the best one to capture this effect. Figure 4 depicts the evolution of the standardized polity in each country of our sample. **The inspection of the figure shows that when there is a large change in the index, most of the time the threshold of zero is crossed.** The index rarely crosses the +5 threshold. The interpretation of our finding is that when the institutions are above this threshold of zero, even if the country is not meeting with the standards of advanced democracies, the functioning of the state is sufficiently good to make the efficiency gains of inclusion larger than the costs in terms of patronage. The dichotomous approach is pertinent because of the linearity of our empirical models described in equations (17) and (21). Moreover it is hard to sustain that a change in the Polity Index from -8 to -3 would have the same effect as a change from -3 to +2 or a change from 3 to 8. The dichotomous measure that we use handles this problem.

4.4 Results

We divide the presentation of the results in three subsections. Subsection 4.4.1 and 4.4.2 present the estimation results of the baseline dynamic panel data growth model, equation (17) and of the baseline growth error correction model, equation (21). Supplementary controls are added in Subsection 4.4.3 that also summarizes the robustness checks.

4.4.1 Baseline Dynamic Panel Data Growth Regression Estimates

Table 3 presents the estimates of equation (17) by FE in column 1 and 4, by DGMM in columns 2 and 5 and by SGMM in columns 3 and 6. The sample used comprises 41 sub-Saharan African countries over the period 1950-2000. Due to the specific independence date of each country, we use an unbalanced panel with various starting years but once a country joins the sample, we have data for all years. The table displays the estimated coefficients and below each one, the country-level clustered robust standard errors are shown in parentheses.

War, coup, oil per capita and diamond production are four additional controls added to the specification in columns 4 to 6. The estimated coefficient on Share of Included Groups is positive in all estimations while the coefficient on the interaction of SIG with Autocracy is always negative. In addition, in all FE and DGMM estimations, the coefficient on the variable Share of Included groups is positive and statistically significant at the 5% level. In all estimations but the last one the negative coefficient on the interaction is significant at least at 10%. The additional controls receive the expected signs. Oil and diamonds have a favorable effect in the short run. War and coup have negative estimated coefficients.

The FE coefficient estimate of column 4 of 0.0578 implies for instance that if the number of included groups rose from 2 to 3 out of 4 politically relevant ethnic groups like in Benin in 1970, then the GDP per capita would increase by around 13% in the long run if the country

had been a democracy.[36] In a dictatorship like Benin in 1970, this increases would be of only 2%.[37] Using the figures of column 1, this estimated increase would be 17% instead.

For the DGMM and SGMM regressions, we present the p-values of the AR(1) and AR(2) tests of serial autocorrelation in the residuals. The null hypothesis of the AR(1) test is the absence of first order serial correlation. As Roodman (2009) explains, this order of autocorrelation is expected in the residuals of DGMM and SGMM estimations and a rejection of the null is a normal situation. The null hypothesis of the AR(2) test is the absence of second order serial correlation. If this hypothesis is not rejected, the dependent variable lagged two periods or more and the other explanatory variables lagged one period or more can be used as instruments. The p-values of the Sargan- and Hansen-test for joint validity of the instruments are displayed. The Sargan test is not valid in the presence of heteroskedasticity while the Hansen test is robust to that. The null hypothesis states that the instruments are valid and these statistics suggest that our instruments are valid. A caveat is stated in Roodman (2009) that warns against instruments proliferation that could break the validity of the Hansen-stat. We take measures to minimize this concern.[38]

4.4.2 Baseline Growth Error Correction Model Regression

In table 4, we present the estimates of equation (21) in a similar layout as the one of table 3.[39] The short-run coefficient of the Share of Included Groups is positive and significant at least at the 5% level in all estimations. In the DGMM estimations of table 4, we find that the coefficient of the interaction is negative and significant at 10 % in column 2 and at 1% in column 5 with the additional controls where the negative short-run effect even becomes larger in absolute value than the positive effect. This suggest that including more groups in the coalition would at least not have a positive effect on growth in nondemocracies.

The numerical values of these coefficients must be interpreted in term of short-run dynamics. For column 5 for instance, a change from 2 to 3 included groups in a country with four ethnopolitical factions as considered before would bring a growth of GDP per capita 1.52% higher the next year in a democracy. This compares well with a 13% long-run impact on the level of GDP as estimated in the previous section. The estimated coefficient on lagged

[36] The short-run elasticity must be divided by one minus 0.887, the coefficient on lagged GDP per capita to obtain the long-run elasticity. $\frac{0.0578}{1-0.887}\frac{1}{4} = 0.1279$.

[37] $\frac{0.0578-0.0484}{1-0.887}\frac{1}{4} = 0.02079$ where 0.0484 is the coefficient on the interaction between Autocracy and SIG.

[38] The strategy adopted in this paper is to limit the lag length of the instruments to 3. Another verification is that using a range of estimations methods (FE, DGMM and SGMM) keeps the conclusion intact. This addresses the suspicion that the lack of transparency of SGMM could have been used to present significant results. An arbitrage must be carried out between the facts that FE and DGMM are more transparent than SGMM but that DGMM and SGMM are better when endogeneity is present. In this study, the lagged variables are credible instruments for DGMM and SGMM estimations. Moreover in this paper, all estimations have year fixed-effects and the year dummies are used as IV-style instruments in the GMM estimations. The explanatory variables lagged 1 to 3 periods are used as GMM-style instruments. The standard errors shown in parentheses are always robust to heteroskedasticity clustered at the country level.

[39] Columns 1 and 4 display FE estimates, columns 2 and 5 show DGMM estimates and columns 3 and 6 contain SGMM estimates. Columns 4 to 6 add the controls War, Coup, Oil per capita and Diamond Production in the short-run dynamics and in the long-run equilibrium relation compared to columns 1 to 3.

GDP was 0.887 which means that long-run impacts are a bit less than ten times larger than short-run impacts, almost exactly what we get here. The short-run impact would be -0.15% in a nondemocracy. We find that the coefficient on $\Delta\text{Autocracy}_t$ is small and insignificant and changes sign across models which is consistent with Acemoglu et al. (2009).

For the SGMM estimations, we adapt the instrumentation to gain precision and to diminish the instrument count. Only the explanatory variables that appear in first difference in equation (21) lagged 1 to 2 periods are used as GMM-style instruments. The lagged variables in level are considered predetermined and accordingly not included as GMM-style instruments. Again, all estimations have year fixed-effects and standard errors displayed in parentheses are robust to heteroskedasticity clustered at the country level. The year dummies are used as IV-style instruments in the all GMM estimations.

The signs of the explanatory variables of interest confirm the previous analysis. The share of included groups has a positive coefficient in the short run as well as in the long-run relation. The interaction receives a negative coefficient in all estimations both in the short-run and long-run and is most of the time significant in the short-run. The controls receive the expected signs as well.

4.4.3 Supplementary Controls in the ECM and Robustness Analysis

Table 5 reports the results of FE and DGMM estimations of the Error-Correction Model of equation (21) with supplementary controls compared to table 4. The instrumentation is similar to that of the previous table. In columns 1 and 2, life expectancy and secondary schooling are added to the long-run relation and in the short-run dynamics. This substantially diminishes the sample size as these variables are not available for all country-years of the initial sample. Nevertheless this does not alter the main finding of this paper. These two new control variables receive very small coefficients reflecting the fact that they are already accounted for in the fixed effect due to their small time variability.

In columns 3 and 4, openness is added to the specification. Again, this does not change the conclusion. Openness has a negative and significant coefficient. In the DGMM estimation of column 4, we see again like in table 4 column 5 that the coefficient on the interaction is larger in absolute value that the coefficient on SIG. In columns 5 and 6, aid is added to the specification. Likewise, this does not change the conclusion. Aid receives a negative coefficient but this is probably due to a reverse causality. This coefficient certainly cannot be interpreted as a causal effect. In the DGMM estimation of column 6, the coefficient on the interaction is again larger in absolute value that the coefficient on SIG.

In table A1, we verify the robustness of the results of table 4 to changes in the lag structure of the GMM instrumentation. In columns 1 to 4, we use lags 1 to 4 instead of lags 1 to 3 of the explanatory variables as instruments. In columns 5 and 6, we use lags 1 to 5 instead. The result does not change substantially. In table A2, we estimate a Random-Effects Model with the specification proposed by Mundlak (1978) as expressed in equation (22).

$$\begin{aligned} y_{i,t} &= (1-\beta)\, y_{i,t-1} + \alpha_1\, S_{i,t} + \alpha_1\, S_{i,t} * A_{i,t} + \alpha_3\, A_{i,t} \\ &\quad + \alpha_4\, X_{i,t} + \alpha_5\, \overline{Z}_i + \zeta_t + \nu_{i,t} \end{aligned} \tag{22}$$

This equation is similar to (17) but estimated with random effects. The country means $\overline{Z}_i$'s of all explanatory variables are added to the regressors and stand for the fixed effects. Mundlak (1978) has shown that this estimation exactly reproduces the Fixed-Effects estimates for the time varying-controls in case of a perfectly balanced panel. This is result is generalized to the case of an unbalanced panel in Verheyden (2014) and is verified here, except for a small imprecision due to machine roundings. These results confirm the conclusions of our paper.

In table A3, instead of using a yearly panel, we estimate a model of the form (17) using 5-years data with FE and DGMM. The estimated coefficients are approximately five times larger than with the yearly panel. The results are the same but less significant due to a smaller number of degrees of freedom and to the problems treated in the previous subsection. In table A4, we display the estimates of the error correction model in (21) but instead using the Constraints on the Executive to construct the autocracy index in columns 1 to 3 and then using Vanhanen's Democracy Index instead in columns 4 to 6. The finding is still there except that the interaction is not significant anymore. The conclusion that the sum of the coefficients of the short-run impacts of inclusion $\alpha_1 + \alpha_2$ is not statistically different from zero however subsists. In table A5, in the ECM model (21) instead of controlling for the autocracy index, we substitute it for the level of autocracy normalized between 0 and 1. The significance of the explanatory variables of interest becomes even stronger than before and the conclusion remains.

5 Conclusion

Since their independence, the countries of sub-Saharan Africa, all ethnically and politically divided, have been confronted to various degrees of success in terms of inclusiveness of the political process, quality of institutions and economic performance. We have explored both theoretically and empirically the conditions that make the inclusion of ethnic groups in the central state government beneficial for efficiency. We have suggested that the general enhancement of the production brought by a larger coalition may be offset in autocracies due to the coordination failure problem among ethnic factions in the provision of public goods. We have shown empirically that the positive effect of inclusiveness is at least partially reduced in autocracies and that the total effect could even be negative in these regimes. This positive effect is estimated to be a 1.5 % gain in yearly GDP growth for an increase of the relative number of included groups of a quarter, an estimate almost perfectly in line with the 13% long-run estimate. We have found an institutional threshold below which the effect of inclusion on performance in autocracies is significantly lower than that in democracies. It means that occasionally, a narrow coalition may be preferable with low quality institutions.

Even though this result is disconcerting, it does not necessarily cast doubt on the promotion of ethnic inclusiveness in these societies. Rather, it might imply that in low-income and weakly-institutionalized countries, the promotion of inclusiveness must be accompanied by institutional improvements.

Figure 1: Share of Included Groups by country and year.

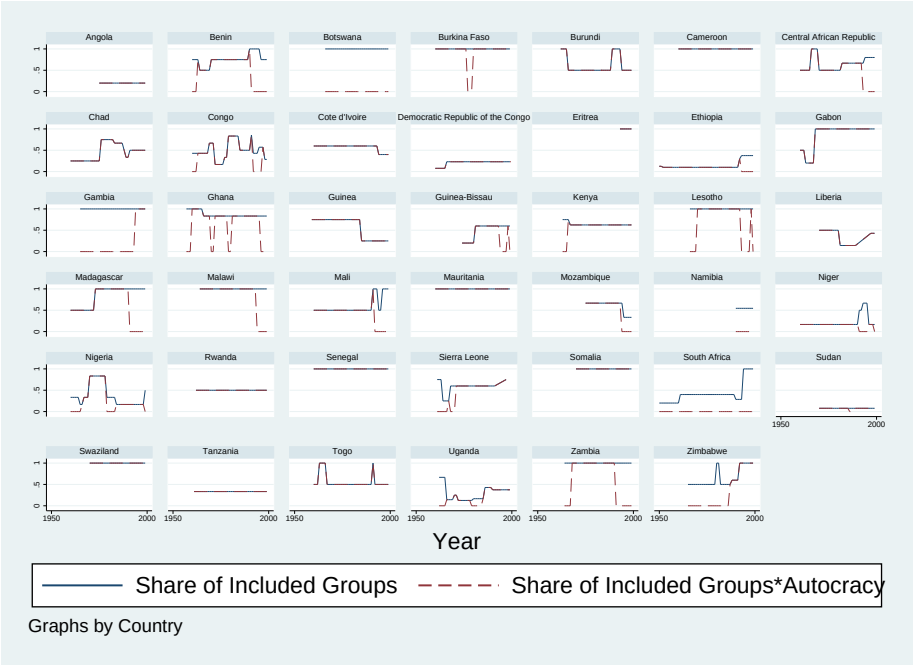

Figure 2: Normalized Polity Index by country and year.

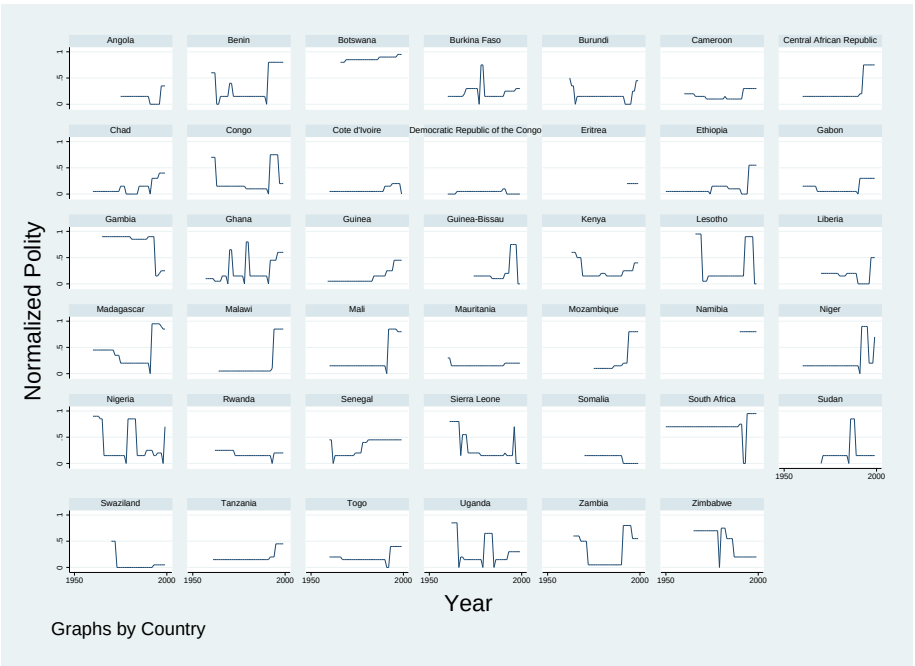

Figure 3: Dependant variable and baseline controls by country and year.

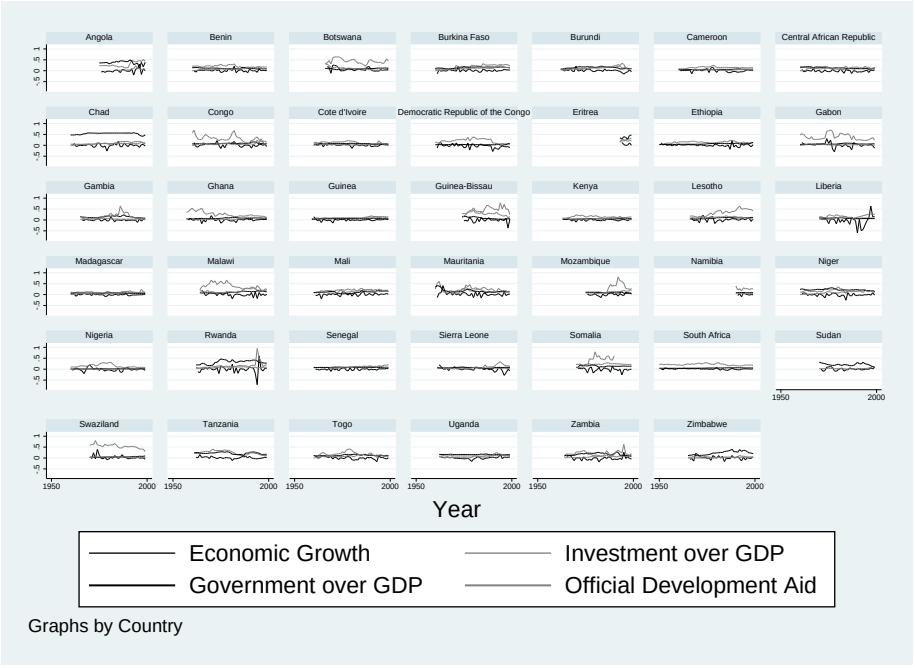

Figure 4: Main Controls by country and year.

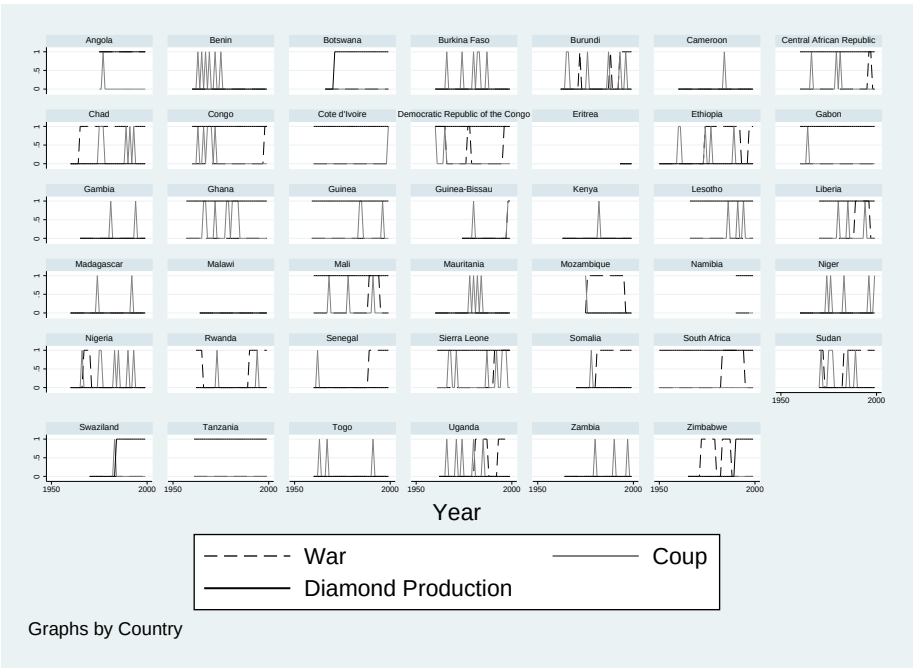

Table 1: Summary Statistics of the 1965 Cross-Section.

Variable	Mean	Std. Dev.	Min.	Max.	N
GDP per capita (in thousands of dollars)	1.199	1.304	0.297	6.778	30
log GDP per capita	-0.101	0.678	-1.214	1.914	30
Economic Growth	0.021	0.066	-0.173	0.199	28
Investment over GDP	0.16	0.111	0.032	0.544	30
Government over GDP	0.114	0.092	0.01	0.478	30
Number of EPR groups	4.9	2.644	1	13	30
Number of included groups, EPR	2.7	2.054	1	7	30
Share of Included Groups	0.605	0.33	0.077	1	30
Share of Included Groups * Autocracy	0.447	0.399	0	1	30
Polity Index	-4.103	5.672	-9	8	29
Autocracy	0.733	0.45	0	1	30
Diamond Production	0.367	0.49	0	1	30
Oil per capita	0.107	0.473	0	2.574	30
Coup	0.1	0.305	0	1	30
War	0.1	0.305	0	1	30
Life Expectancy at birth	41.956	5.861	29.502	53.304	29
Openness to trade	0.488	0.213	0.16	0.891	23
Secondary Schooling					0
Official Development Aid	0.052	0.035	0.003	0.152	20

Summary statistics of the 1965 cross-section of 30 sub-Saharan Countries.

Table 2: Summary Statistics of the 1995 Cross-Section.

Variable	Mean	Std. Dev.	Min.	Max.	N
GDP per capita (in thousands of dollars)	1.532	2.148	0.161	12.112	41
log GDP per capita	-0.025	0.852	-1.827	2.494	41
Economic Growth	0.022	0.115	-0.152	0.611	41
Investment over GDP	0.171	0.114	0.032	0.522	41
Government over GDP	0.134	0.112	0.011	0.549	41
Number of EPR groups	4.821	3.178	1	13	39
Number of included groups, EPR	2.846	1.981	1	7	39
Share of Included Groups	0.689	0.313	0.077	1	39
Share of Included Groups * Autocracy	0.397	0.415	0	1	39
Polity Index	-0.171	5.481	-9	9	41
Autocracy	0.634	0.488	0	1	41
Diamond Production	0.439	0.502	0	1	41
Oil per capita	0.6	2.653	0	16.57	41
Coup	0.024	0.156	0	1	41
War	0.268	0.449	0	1	41
Life Expectancy at birth	50.71	6.633	31.239	61.370	40
Openness to trade	0.687	0.306	0.148	1.437	36
Secondary Schooling	25.769	16.234	5.306	56.737	18
Official Development Aid	0.174	0.154	0.003	0.628	36

Summary statistics of the 1995 cross-section of 30 sub-Saharan Countries.

Table 3: Baseline Dynamic Panel Data Growth Regression Estimates. Share of Included Groups interacted with Autocracy (polity2<0) in sub-Saharan African Countries. Fixed-Effects, Difference-GMM and System-GMM estimations. Yearly panel. 1950-2000.

	Dependent variable is Log GDP per capita in t					
	(1) FE	(2) DGMM	(3) SGMM	(4) FE	(5) DGMM	(6) SGMM
Log GDP per capita$_{t-1}$	0.901***	0.788***	0.990***	0.887***	0.735***	0.985***
	(0.0271)	(0.0524)	(0.00339)	(0.0290)	(0.0609)	(0.00497)
Share of Included Groups	0.0684***	0.0807***	0.0251*	0.0578***	0.0449**	0.0211
	(0.0192)	(0.0239)	(0.0143)	(0.0192)	(0.0225)	(0.0170)
Share of Included Groups * Autocracy	-0.0434**	-0.0415	-0.0177	-0.0484***	-0.0594*	-0.0156
	(0.0162)	(0.0273)	(0.0161)	(0.0161)	(0.0304)	(0.0180)
Autocracy	0.0169	0.0184	-0.00791	0.0177	0.0295	-0.0119
	(0.0120)	(0.0205)	(0.00993)	(0.0114)	(0.0214)	(0.0112)
Investment over GDP	0.177***	0.122**	0.107***	0.186***	0.131*	0.101***
	(0.0365)	(0.0620)	(0.0201)	(0.0371)	(0.0676)	(0.0232)
Government over GDP	-0.198***	-0.407***	-0.00315	-0.207***	-0.388***	0.00654
	(0.0717)	(0.107)	(0.0232)	(0.0739)	(0.122)	(0.0238)
War				-0.0176*	-0.0299***	-0.00867
				(0.00886)	(0.00985)	(0.00646)
Coup				-0.0142	-0.00647	-0.0119
				(0.00914)	(0.00971)	(0.00972)
Oil per capita				0.00692***	0.0140***	0.00270***
				(0.00207)	(0.00333)	(0.000827)
Diamond Production				0.0432**	0.0952	0.00110
				(0.0169)	(0.0603)	(0.00623)
Observations	1,420	1,376	1,420	1,420	1,376	1,420
R^2	0.891			0.893		
Number of countries	41	41	41	41	41	41
AR(1)-p		0.000121	0.000377		0.000120	0.000361
AR(2)-p		0.343	0.222		0.315	0.213
Sargan-p		0.00243	0.0426		0.000426	0.0386
Hansen-p		1	1		1	1
Number of instruments		978	1230		978	1230

notes : Robust standard errors clustered at the country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Columns 1 and 4 display Fixed-effects estimates, columns 2 and 5 display Difference-GMM estimates and columns 3 and 6 display System-GMM estimates. The sample comprises sub-Saharan countries. The panel is unbalanced and covers the period 1950-2000. All regressions have country and year fixed effects.

Table 4: Baseline Growth Error Correction Model Estimates. Share of Included Groups interacted with Autocracy (polity2<0) in sub-Saharan African Countries. Fixed-Effects, Difference-GMM and System-GMM estimations. Yearly panel. 1950-2000.

	Dependent variable is Δ Log GDP per capita in t					
	(1) FE	(2) DGMM	(3) SGMM	(4) FE	(5) DGMM	(6) SGMM
ΔShare of Included Groups$_t$	0.0521***	0.0847***	0.0497***	0.0451**	0.0607***	0.0415**
	(0.0180)	(0.0244)	(0.0190)	(0.0193)	(0.0229)	(0.0206)
ΔShare of Included Groups * Autocracy$_t$	-0.0330	-0.0440*	-0.0397*	-0.0398*	-0.0668***	-0.0423*
	(0.0217)	(0.0229)	(0.0208)	(0.0220)	(0.0250)	(0.0221)
ΔAutocracy$_t$	-0.00959	-0.00296	-0.00978	-0.00390	0.0134	-0.00692
	(0.0195)	(0.0163)	(0.0187)	(0.0189)	(0.0175)	(0.0193)
ΔInvestment over GDP$_t$	0.329***	0.229*	0.313***	0.323***	0.223*	0.298***
	(0.105)	(0.122)	(0.102)	(0.103)	(0.122)	(0.0996)
ΔGovernment over GDP$_t$	-0.500***	-0.670***	-0.469***	-0.492***	-0.642***	-0.457***
	(0.134)	(0.187)	(0.135)	(0.132)	(0.203)	(0.132)
ΔWar$_t$				-0.0272**	-0.0217*	-0.0247**
				(0.0123)	(0.0123)	(0.0116)
ΔCoup$_t$				-0.00815	-0.00388	-0.00584
				(0.00966)	(0.0101)	(0.00962)
ΔOil per capita$_t$				0.0422***	0.0335***	0.0428***
				(0.0135)	(0.0114)	(0.0111)
ΔDiamond Productiona$_t$				0.0568***	0.0313	0.0835***
				(0.0193)	(0.0572)	(0.0306)
Log GDP per capita$_{t-1}$	-0.0793***	-0.351***	-0.00626**	-0.0860***	-0.396***	-0.0103**
	(0.0209)	(0.0588)	(0.00317)	(0.0228)	(0.0635)	(0.00400)
Share of Included Groups$_{t-1}$	0.0642***	0.140***	0.0308**	0.0561**	0.109***	0.0270
	(0.0215)	(0.0334)	(0.0147)	(0.0216)	(0.0308)	(0.0166)
Share of Included Groups * Autocracy$_{t-1}$	-0.0420**	-0.0450	-0.0222	-0.0418**	-0.0743**	-0.0171
	(0.0175)	(0.0362)	(0.0167)	(0.0173)	(0.0379)	(0.0179)
Autocracy$_{t-1}$	0.0183	0.00555	-0.00176	0.0159	0.0239	-0.00702
	(0.0123)	(0.0257)	(0.0104)	(0.0120)	(0.0249)	(0.0115)
Investment over GDP$_{t-1}$	0.121***	0.125**	0.0893***	0.135***	0.156*	0.0829***
	(0.0271)	(0.0630)	(0.0179)	(0.0284)	(0.0802)	(0.0188)
Government over GDP$_{t-1}$	-0.107*	-0.530***	0.0102	-0.120*	-0.526***	0.0163
	(0.0577)	(0.156)	(0.0190)	(0.0598)	(0.184)	(0.0202)
War$_{t-1}$				-0.0100	-0.0173	-0.00379
				(0.00885)	(0.0135)	(0.00609)
Coup$_{t-1}$				-0.0121	-0.00449	-0.00817
				(0.00803)	(0.0126)	(0.00873)
Oil per capita$_{t-1}$				0.00456**	0.0164***	0.000969
				(0.00175)	(0.00316)	(0.000674)
Diamond Production$_{t-1}$				0.0274*	0.0624	0.00271
				(0.0155)	(0.0606)	(0.00486)
Observations	1,417	1,374	1,417	1,417	1,374	1,417
R^2	0.188			0.210		
Number of countries	41	41	41	41	41	41
AR(1)-p		5.38e-05	0.000519		4.62e-05	0.000549
AR(2)-p		0.579	0.478		0.567	0.546
Sargan-p		3.98e-09	0.000666		5.83e-10	0.00320
Hansen-p		1	1		1	1
Number of instruments		850	851		850	855

notes : Robust standard errors clustered at the country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Columns 1 and 4 display Fixed-effects estimates, columns 2 and 5 display Difference-GMM estimates and columns 3 and 6 display System-GMM estimates. The sample comprises sub-Saharan countries. The panel is unbalanced and covers the period 1950-2000. All regressions have country and year fixed effects.

Table 5: Additional Controls : Life Expectancy, Openness and Official Development Aid in the Baseline Growth Error Correction Model. Share of Included Groups interacted with Autocracy (polity2<0) in sub-Saharan African Countries. Fixed-Effects, Difference-GMM and System-GMM estimations. Yearly panel. 1950-2000.

	Dependent variable is Δ Log GDP per capita in t					
	(1) FE	(2) DGMM	(3) FE	(4) DGMM	(5) FE	(6) DGMM
ΔShare of Included Groups$_t$	0.0797**	0.128***	0.0338	0.0743***	0.0440*	0.0712**
	(0.0320)	(0.0343)	(0.0212)	(0.0218)	(0.0259)	(0.0293)
ΔShare of Included Groups * Autocracy$_t$	-0.0674**	-0.110***	-0.0277	-0.0694***	-0.0439	-0.0810***
	(0.0313)	(0.0340)	(0.0233)	(0.0265)	(0.0284)	(0.0303)
ΔAutocracy$_t$	0.0306*	0.0624***	-0.00496	0.0171	0.00349	0.0212
	(0.0159)	(0.0224)	(0.0205)	(0.0189)	(0.0243)	(0.0235)
ΔInvestment over GDP$_t$	0.323**	0.376***	0.285***	0.213*	0.371***	0.336***
	(0.135)	(0.128)	(0.103)	(0.123)	(0.0802)	(0.0823)
ΔGovernment over GDP$_t$	-0.213	-0.233	-0.405**	-0.549**	-0.336***	-0.408***
	(0.198)	(0.242)	(0.169)	(0.218)	(0.0999)	(0.141)
ΔWar$_t$	-0.00865	-0.00839	-0.0292*	-0.0159	-0.0348**	-0.0254**
	(0.0168)	(0.0144)	(0.0167)	(0.0153)	(0.0167)	(0.0118)
ΔCoup$_t$	0.00997	0.00383	-0.00964	-0.00411	-0.0121	-0.00543
	(0.0118)	(0.0135)	(0.0106)	(0.0113)	(0.0101)	(0.0101)
ΔOil per capita$_t$	0.0504***	0.0408***	0.0399***	0.0361***	0.0400***	0.0376***
	(0.0150)	(0.0125)	(0.0128)	(0.0132)	(0.0125)	(0.0139)
ΔDiamond Productiona$_t$	0.108***	-0.0450	0.0553**	0.0598	0.0612	0.0767
	(0.0397)	(0.0289)	(0.0259)	(0.0582)	(0.0435)	(0.0611)
ΔOpenness$_t$			-0.0348	-0.0403		
			(0.0549)	(0.0607)		
ΔAid$_t$					-0.183	-0.213
					(0.161)	(0.160)
ΔLife Expectancy$_t$	0.000440	0.00584				
	(0.00512)	(0.00793)				
ΔSecondary Schooling$_t$	-2.66e-05	-7.37e-05				
	(0.000131)	(0.000129)				
Log GDP per capita$_{t-1}$	-0.113**	-0.367***	-0.100***	-0.336***	-0.0959***	-0.340***
	(0.0423)	(0.0458)	(0.0247)	(0.0719)	(0.0261)	(0.0856)
Observations	615	538	1,205	1,163	1,122	1,080
R^2	0.258		0.215		0.254	
Number of countries	37	37	39	39	38	38
AR(1)-p		0.00147		0.000346		0.000345
AR(2)-p		0.865		0.757		0.659
Sargan-p		0.0251		1.61e-08		7.21e-06
Hansen-p		1		1		1
Number of instruments		457		800		774

notes : Robust standard errors clustered at the country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Columns 1, 3 and 5 display Fixed-effects estimates, columns 2, 4 and 6 display Difference-GMM estimates. The sample comprises sub-Saharan countries. The panel is unbalanced and covers the period 1950-2000. All regressions have country and year fixed effects.

Table A1: Lag Structure of the GMM instrumentation. Baseline Growth Error Correction Model Estimates. Share of Included Groups interacted with Autocracy (polity2<0) in sub-Saharan African Countries. Difference-GMM and System-GMM estimations. Yearly panel. 1950-2000.

	Dependent variable is Δ Log GDP per capita in t					
	(1) DGMM	(2) SGMM	(3) DGMM	(4) SGMM	(5) DGMM	(6) SGMM
ΔShare of Included Groups$_t$	0.0677***	0.0466**	0.0519**	0.0385*	0.0565***	0.0314
	(0.0212)	(0.0192)	(0.0227)	(0.0208)	(0.0194)	(0.0203)
ΔShare of Included Groups * Autocracy$_t$	-0.0250	-0.0359*	-0.0383*	-0.0383*	-0.0424*	-0.0293
	(0.0229)	(0.0204)	(0.0232)	(0.0214)	(0.0225)	(0.0199)
ΔAutocracy$_t$	-0.0171	-0.0123	-0.00649	-0.00960	-0.00654	-0.0155
	(0.0196)	(0.0183)	(0.0182)	(0.0187)	(0.0201)	(0.0173)
ΔInvestment over GDP$_t$	0.263**	0.320***	0.256**	0.305***	0.289***	0.317***
	(0.108)	(0.101)	(0.107)	(0.0986)	(0.0985)	(0.0965)
ΔGovernment over GDP$_t$	-0.585***	-0.477***	-0.564***	-0.463***	-0.496***	-0.484***
	(0.150)	(0.130)	(0.155)	(0.128)	(0.129)	(0.129)
ΔWar$_t$			-0.0213*	-0.0267**	-0.0207*	-0.0242**
			(0.0126)	(0.0116)	(0.0119)	(0.0118)
ΔCoup$_t$			-0.00881	-0.00520	-0.00801	-0.00489
			(0.0102)	(0.00979)	(0.00968)	(0.00959)
ΔOil per capita$_t$			0.0396***	0.0430***	0.0417***	0.0428***
			(0.0145)	(0.0113)	(0.0139)	(0.0113)
ΔDiamond Productiona$_t$			0.0485	0.0831***	0.0677*	0.0824***
			(0.0422)	(0.0314)	(0.0358)	(0.0301)
Log GDP per capita$_{t-1}$	-0.232***	-0.00629**	-0.256***	-0.0106***	-0.158***	-0.0101**
	(0.0462)	(0.00316)	(0.0503)	(0.00407)	(0.0297)	(0.00398)
Share of Included Groups$_{t-1}$	0.110***	0.0301**	0.0882***	0.0238	0.0845***	0.0251
	(0.0259)	(0.0148)	(0.0278)	(0.0171)	(0.0225)	(0.0169)
Share of Included Groups * Autocracy$_{t-1}$	-0.0321	-0.0215	-0.0441	-0.0145	-0.0442**	-0.0154
	(0.0268)	(0.0168)	(0.0282)	(0.0179)	(0.0205)	(0.0181)
Autocracy$_{t-1}$	-0.00146	-0.00225	0.00571	-0.00905	0.00722	-0.00834
	(0.0185)	(0.0104)	(0.0178)	(0.0114)	(0.0165)	(0.0116)
Investment over GDP$_{t-1}$	0.106**	0.0900***	0.129***	0.0827***	0.125***	0.0856***
	(0.0434)	(0.0178)	(0.0494)	(0.0186)	(0.0379)	(0.0184)
Government over GDP$_{t-1}$	-0.341***	0.0101	-0.337***	0.0214	-0.200***	0.0141
	(0.107)	(0.0191)	(0.118)	(0.0204)	(0.0724)	(0.0202)
War$_{t-1}$			-0.0130	-0.00854	-0.0107	-0.00337
			(0.0128)	(0.00641)	(0.0104)	(0.00602)
Coup$_{t-1}$			-0.0148	-0.00671	-0.0132	-0.00630
			(0.0116)	(0.00925)	(0.00880)	(0.00874)
Oil per capita$_{t-1}$			0.0117***	0.000994	0.00724***	0.000954
			(0.00325)	(0.000688)	(0.00248)	(0.000666)
Diamond Production$_{t-1}$			0.0446	0.00323	0.0511	0.00134
			(0.0452)	(0.00545)	(0.0357)	(0.00498)
Observations	1,374	1,417	1,374	1,417	1,374	1,417
Number of countries	41	41	41	41	41	41
AR(1)-p	0.000137	0.000518	0.000116	0.000547	0.000265	0.000543
AR(2)-p	0.535	0.486	0.568	0.556	0.541	0.573
Sargan-p	3.69e-05	0.0138	2.07e-05	0.0316	0.0778	0.267
Hansen-p	1	1	1	1	1	1
Number of instruments	1072	1078	1072	1078	1262	1291

notes : Robust standard errors clustered at the country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Columns 1, 3 and 5 display Difference-GMM estimates and columns 2, 4 and 6 display System-GMM estimates. The sample comprises sub-Saharan countries. The panel is unbalanced and covers the period 1950-2000. All regressions have country and year fixed effects.

Table A2: Random-Effects estimations with the methodology of Mundlak (1978). Baseline Dynamic Panel Data Growth Regression Estimates. Share of Included Groups interacted with Autocracy (polity2<0) in sub-Saharan African Countries. Yearly panel. 1950-2000.

	Dependent variable is Log GDP per capita in t					
	(1) RE	(2) RE	(3) RE	(4) RE	(5) RE	(6) RE
Log GDP per capita$_{t-1}$	0.905***	0.891***	0.889***	0.888***	0.888***	0.888***
	(0.0246)	(0.0266)	(0.0280)	(0.0282)	(0.0285)	(0.0286)
Share of Included Groups	0.0680***	0.0579***	0.0565***	0.0554***	0.0557***	0.0559***
	(0.0190)	(0.0190)	(0.0194)	(0.0196)	(0.0196)	(0.0196)
Share of Included Groups * Autocracy	-0.0441***	-0.0493***	-0.0474***	-0.0467***	-0.0469***	-0.0472***
	(0.0160)	(0.0161)	(0.0168)	(0.0169)	(0.0169)	(0.0169)
Autocracy	0.0165	0.0175	0.0158	0.0150	0.0152	0.0156
	(0.0121)	(0.0113)	(0.0122)	(0.0122)	(0.0122)	(0.0122)
Investment over GDP	0.177***	0.187***	0.188***	0.189***	0.189***	0.189***
	(0.0357)	(0.0363)	(0.0365)	(0.0365)	(0.0365)	(0.0364)
Government over GDP	-0.199***	-0.207***	-0.206***	-0.206***	-0.206***	-0.205***
	(0.0719)	(0.0739)	(0.0747)	(0.0750)	(0.0750)	(0.0751)
War		-0.0190**	-0.0181**	-0.0180**	-0.0181**	-0.0180**
		(0.00920)	(0.00893)	(0.00889)	(0.00888)	(0.00885)
Coup		-0.0140	-0.0142	-0.0143	-0.0143	-0.0143
		(0.00919)	(0.00921)	(0.00922)	(0.00922)	(0.00923)
Oil per capita		0.00668***	0.00682***	0.00691***	0.00689***	0.00691***
		(0.00195)	(0.00203)	(0.00205)	(0.00205)	(0.00206)
Diamond Production		0.0433***	0.0445***	0.0458***	0.0454***	0.0454***
		(0.0160)	(0.0165)	(0.0168)	(0.0169)	(0.0169)
$\overline{\text{Log GDP per capita}}_i$	0.0976***	0.111***	0.120***	0.116***	0.116***	0.117***
	(0.0243)	(0.0260)	(0.0284)	(0.0283)	(0.0285)	(0.0286)
$\overline{\text{Investment over GDP}}_i$	-0.119**	-0.132***	-0.150***	-0.141***	-0.139***	-0.127***
	(0.0463)	(0.0453)	(0.0464)	(0.0429)	(0.0417)	(0.0395)
$\overline{\text{Government over GDP}}_i$	0.213***	0.225***	0.245***	0.293***	0.285***	0.282***
	(0.0781)	(0.0854)	(0.0861)	(0.0842)	(0.0860)	(0.0865)
$\overline{\text{Share of Included Groups}}_i$	-0.0421	-0.0344	-0.0367	-0.0347	-0.0387	-0.0455
	(0.0374)	(0.0390)	(0.0313)	(0.0325)	(0.0313)	(0.0323)
$\overline{\text{Share of Included Groups * Autocracy}}_i$	0.0195	0.0319	0.0460	0.0515	0.0542	0.0556
	(0.0442)	(0.0466)	(0.0364)	(0.0362)	(0.0350)	(0.0341)
$\overline{\text{Autocracy}}_i$	-0.0111	-0.0172	-0.0304	-0.0466*	-0.0485**	-0.0497**
	(0.0294)	(0.0315)	(0.0254)	(0.0255)	(0.0246)	(0.0245)
$\overline{\text{War}}_i$		0.0212	0.0298*	0.0272*	0.0275*	0.0288**
		(0.0161)	(0.0164)	(0.0148)	(0.0148)	(0.0143)
$\overline{\text{Coup}}_i$		0.0346	0.0805**	0.0972***	0.0911***	0.0995***
		(0.0324)	(0.0389)	(0.0327)	(0.0332)	(0.0350)
$\overline{\text{Oil per Capita}}_i$		-0.00705***	-0.00857***	-0.00826***	-0.00832***	-0.00712***
		(0.00214)	(0.00235)	(0.00229)	(0.00230)	(0.00222)
$\overline{\text{Diamond Production}}_i$		-0.0377**	-0.0341**	-0.0322*	-0.0315*	-0.0314*
		(0.0163)	(0.0163)	(0.0165)	(0.0167)	(0.0169)
Observations	1,420	1,420	1,420	1,420	1,420	1,420
Number of countries	41	41	41	41	41	41

notes : Robust standard errors clustered at the country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All columns display Random-effects estimates with the methodology of Mundlak (1978). Undisplayed additional controls for fixed country characteristics are used in columns 3 to 6. The sample comprises sub-Saharan countries. The panel is unbalanced and covers the period 1950-2000. All regressions have year fixed effects.

Table A3: 5-years panel. Baseline Dynamic Panel Data Growth Regression Estimates. Share of Included Groups interacted with Autocracy (polity2<0) in sub-Saharan African Countries. Fixed-Effects, Difference-GMM and System-GMM estimations. 1950-2000.

	Dependent variable is Log GDP per capita in t					
	(1) FE	(2) FE	(3) FE	(4) DGMM	(5) DGMM	(6) DGMM
Log GDP per capita$_{t-1}$	0.569***	0.563***	0.552***	0.955***	0.920***	0.917***
	(0.0776)	(0.0782)	(0.0807)	(0.0213)	(0.0310)	(0.0315)
Share of Included Groups	0.224**	0.216**	0.196*	0.207*	0.241**	0.233**
	(0.101)	(0.102)	(0.103)	(0.110)	(0.115)	(0.114)
Share of Included Groups * Autocracy	-0.154**	-0.160**	-0.147**	-0.147	-0.171	-0.166
	(0.0714)	(0.0721)	(0.0688)	(0.124)	(0.128)	(0.127)
Autocracy	0.0760	0.0731	0.0642	0.0282	0.0280	0.0310
	(0.0470)	(0.0466)	(0.0439)	(0.0796)	(0.0934)	(0.0900)
Investment over GDP	0.699***	0.714***	0.719***	0.487***	0.476***	0.484***
	(0.198)	(0.199)	(0.199)	(0.139)	(0.135)	(0.137)
Government over GDP	-0.389	-0.445	-0.416	-0.0696	-0.0593	-0.0563
	(0.301)	(0.312)	(0.306)	(0.186)	(0.188)	(0.197)
War			-0.0671		0.0471	0.0462
			(0.0442)		(0.0505)	(0.0504)
Coup						-0.135
						(0.0924)
Oil per capita			0.0151		0.00853*	0.00821*
			(0.0102)		(0.00441)	(0.00425)
Diamond Production		0.102	0.0721		0.0720	0.0719
		(0.0917)	(0.102)		(0.0460)	(0.0451)
Observations	260	260	260	260	260	260
R^2	0.544	0.546	0.554			
Number of countries	41	41	41	41	41	41
AR(1)-p				0.000474	0.000501	0.000455
AR(2)-p				0.378	0.366	0.366
Sargan-p				0.0277	0.0254	0.0160
Hansen-p				1	1	1
Number of instruments				135	135	135

notes : Robust standard errors clustered at the country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Columns 1 to 3 display Fixed-effects estimates, columns 4 to 6 display Difference-GMM estimates. The sample comprises sub-Saharan countries. The panel is unbalanced and covers the period 1950-2000. All regressions have country and period fixed effects.

Table A4: Other Institutional Measures : Constraints of the Executive and Vanhanen's Democracy index. Baseline Growth Error Correction Model Estimates. Share of Included Groups interacted with Autocracy (polity2<0) in sub-Saharan African Countries. Fixed-Effects, Difference-GMM and System-GMM estimations. Yearly panel. 1950-2000.

	Dependent variable is Δ Log GDP per capita in t					
	(1) FE	(2) DGMM	(3) SGMM	(4) FE	(5) DGMM	(6) SGMM
ΔShare of Included Groups$_t$	0.0551***	0.0416	0.0512**	0.0578**	0.0791**	0.0674**
	(0.0191)	(0.0271)	(0.0237)	(0.0259)	(0.0356)	(0.0280)
ΔShare of Included Groups * Autocracy$_t$	-0.0347	-0.00655	-0.0380	-0.0356	-0.0230	-0.0571*
	(0.0213)	(0.0292)	(0.0247)	(0.0272)	(0.0336)	(0.0309)
ΔAutocracy$_t$	0.00932	-0.00466	0.00623	0.00592	-0.0232	0.0209
	(0.0158)	(0.0154)	(0.0172)	(0.0238)	(0.0241)	(0.0268)
ΔInvestment over GDP$_t$	0.327***	0.218*	0.311***	0.327***	0.223*	0.317***
	(0.105)	(0.126)	(0.104)	(0.106)	(0.129)	(0.104)
ΔGovernment over GDP$_t$	-0.502***	-0.670***	-0.471***	-0.499***	-0.687***	-0.470***
	(0.133)	(0.177)	(0.138)	(0.136)	(0.183)	(0.134)
Log GDP per capita$_{t-1}$	-0.0800***	-0.354***	-0.00649**	-0.0823***	-0.355***	-0.00561*
	(0.0211)	(0.0611)	(0.00330)	(0.0204)	(0.0615)	(0.00325)
Share of Included Groups$_{t-1}$	0.0489***	0.0623**	0.0272	0.0440**	0.120***	0.00988
	(0.0174)	(0.0316)	(0.0169)	(0.0214)	(0.0434)	(0.0126)
Share of Included Groups * Autocracy$_{t-1}$	-0.0197	0.0332	-0.0175	-0.0144	-0.00324	0.00200
	(0.0166)	(0.0433)	(0.0189)	(0.0195)	(0.0393)	(0.0141)
Autocracy$_{t-1}$	0.0112	-0.0275	-0.00265	0.00119	-0.0418*	-0.0105
	(0.0100)	(0.0270)	(0.0122)	(0.0123)	(0.0251)	(0.0121)
Investment over GDP$_{t-1}$	0.118***	0.106	0.0895***	0.122***	0.128*	0.0924***
	(0.0269)	(0.0655)	(0.0181)	(0.0247)	(0.0720)	(0.0206)
Government over GDP$_{t-1}$	-0.106*	-0.521***	0.00866	-0.0985	-0.555***	0.00937
	(0.0570)	(0.141)	(0.0189)	(0.0587)	(0.151)	(0.0178)
Observations	1,417	1,374	1,417	1,417	1,374	1,417
R^2	0.182			0.185		
Number of countries	41	41	41	41	41	41
AR(1)-p		4.21e-05	0.000487		3.36e-05	0.000467
AR(2)-p		0.571	0.456		0.584	0.410
Sargan-p		1.07e-09	0.000422		9.51e-08	0.00269
Hansen-p		1	1		1	1
Number of instruments		841	851		875	877

notes : Robust standard errors clustered at the country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Columns 1 and 4 display Fixed-effects estimates, columns 2 and 5 display Difference-GMM estimates and columns 3 and 6 display System-GMM estimates. The sample comprises sub-Saharan countries. The panel is unbalanced and covers the period 1950-2000. All regressions have country and year fixed effects.

Table A5: Level of the Polity Index. Baseline Growth Error Correction Model Estimates. Share of Included Groups interacted with Autocracy (polity2<0) in sub-Saharan African Countries. Fixed-Effects, Difference-GMM and System-GMM estimations. Yearly panel. 1950-2000.

	Dependent variable is Δ Log GDP per capita in t					
	(1) FE	(2) DGMM	(3) SGMM	(4) FE	(5) DGMM	(6) SGMM
ΔShare of Included Groups$_t$	0.0679***	0.0789***	0.0600***	0.0549***	0.0438**	0.0480***
	(0.0173)	(0.0176)	(0.0159)	(0.0185)	(0.0209)	(0.0167)
ΔShare of Included Groups * Autocracy$_t$	-0.0547***	-0.0653***	-0.0506***	-0.0536***	-0.0704***	-0.0479***
	(0.0202)	(0.0204)	(0.0176)	(0.0192)	(0.0197)	(0.0163)
ΔPolity$_t$	-0.000920	-0.00166	-0.000426	-0.000881	-0.00174	-0.000282
	(0.00110)	(0.00124)	(0.000928)	(0.00110)	(0.00127)	(0.000875)
ΔInvestment over GDP$_t$	0.337***	0.243**	0.333***	0.329***	0.241**	0.315***
	(0.104)	(0.120)	(0.101)	(0.103)	(0.120)	(0.0990)
ΔGovernment over GDP$_t$	-0.495***	-0.638***	-0.471***	-0.486***	-0.610***	-0.458***
	(0.134)	(0.182)	(0.132)	(0.132)	(0.196)	(0.130)
ΔWar$_t$				-0.0273**	-0.0281**	-0.0240**
				(0.0123)	(0.0114)	(0.0120)
ΔCoup$_t$				-0.00895	0.000512	-0.00682
				(0.00969)	(0.00907)	(0.00975)
ΔOil per capita$_t$				0.0423***	0.0342***	0.0431***
				(0.0136)	(0.0108)	(0.0114)
ΔDiamond Productiona$_t$				0.0543**	0.0343	0.0833***
				(0.0204)	(0.0549)	(0.0305)
Log GDP per capita$_{t-1}$	-0.0814***	-0.319***	-0.00658*	-0.0879***	-0.360***	-0.0115**
	(0.0212)	(0.0565)	(0.00338)	(0.0231)	(0.0613)	(0.00454)
Share of Included Groups$_{t-1}$	0.0632***	0.140***	0.0374***	0.0539**	0.0988***	0.0334**
	(0.0228)	(0.0256)	(0.0133)	(0.0228)	(0.0256)	(0.0141)
Share of Included Groups * Autocracy$_{t-1}$	-0.0427**	-0.0726***	-0.0266**	-0.0415**	-0.0866***	-0.0221*
	(0.0162)	(0.0237)	(0.0128)	(0.0163)	(0.0235)	(0.0128)
Polity$_{t-1}$	-0.00158*	-0.00283**	-0.000113	-0.00129	-0.00342***	0.000338
	(0.000896)	(0.00141)	(0.000735)	(0.000916)	(0.00129)	(0.000772)
Investment over GDP$_{t-1}$	0.125***	0.130**	0.0867***	0.138***	0.160**	0.0807***
	(0.0264)	(0.0576)	(0.0203)	(0.0276)	(0.0715)	(0.0212)
Government over GDP$_{t-1}$	-0.122**	-0.490***	0.0156	-0.133**	-0.485***	0.0223
	(0.0569)	(0.152)	(0.0179)	(0.0600)	(0.177)	(0.0196)
War$_{t-1}$				-0.0102	-0.0244**	-0.00490
				(0.00891)	(0.0101)	(0.00602)
Coup$_{t-1}$				-0.0132	0.00211	-0.00928
				(0.00820)	(0.0108)	(0.00923)
Oil per capita$_{t-1}$				0.00482**	0.0161***	0.00127
				(0.00182)	(0.00305)	(0.000831)
Diamond Production$_{t-1}$				0.0256	0.0582	0.00222
				(0.0166)	(0.0565)	(0.00497)
Observations	1,407	1,363	1,407	1,407	1,363	1,407
R^2	0.190			0.212		
Number of countries	41	41	41	41	41	41
AR(1)-p		5.90e-05	0.000546		5.25e-05	0.000570
AR(2)-p		0.539	0.479		0.546	0.543
Sargan-p		2.53e-08	0.0703		5.64e-09	0.118
Hansen-p		1	1		1	1

notes : Robust standard errors clustered at the country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Columns 1 and 4 display Fixed-effects estimates, columns 2 and 5 display Difference-GMM estimates and columns 3 and 6 display System-GMM estimates. The sample comprises sub-Saharan countries. The panel is unbalanced and covers the period 1950-2000. All regressions have country and year fixed effects.

Appendix

Proof of Proposition 1

(i) A1. Proof of the existence : Rosen (1965) states that the necessary conditions for existence of a pure strategy Nash equilibrium for the strategic form game $< \mathcal{I}, (S_i), (u_i) >$ is that the strategy sets S_i are nonempty, convex, and compact sets. $u_i(s)$ must be continuous in s, and $u_i(s_i, s_{-i})$ must be quasiconcave in s_i. The investment game in (4), (5) and (6) is such a game and respects all these conditions. As a consequence, a pure strategy Nash equilibrium exists.

A2. Proof of the uniqueness : Following Rosen (1965), we need to show that the sufficient condition for uniqueness of a pure strategy equilibrium is met. This condition requires that the payoff functions are diagonally strictly concave. We use here the shorthand $\mathcal{W}$ for $N_{\mathcal{W}}$. The notation $\nabla u(x)$ stands for $\left[\frac{\partial u_1}{\partial x_1}, \ldots, \frac{\partial u_w}{\partial x_w}\right]^T$ and . The payoff functions $(u_1, \ldots, u_w)$ are diagonally strictly concave for $x \in S$ if for every $x^*, \bar{x} \in S$,

$$(\bar{x} - x^*)^T \nabla u(x^*) + (x^* - \bar{x})^T \nabla u(\bar{x}) > 0.$$

The investment game in (4), (5) and (6) respects this condition because when

$$\bar{x} = \begin{pmatrix} \overline{C_1} \\ \vdots \\ \overline{C_w} \end{pmatrix} \qquad x^* = \begin{pmatrix} {C_1}^* \\ \vdots \\ {C_w}^* \end{pmatrix},$$

we have that

$$\begin{pmatrix} \overline{C_1} - {C_1}^* \\ \vdots \\ \overline{C_w} - {C_w}^* \end{pmatrix}^T \begin{pmatrix} \frac{1}{{C_1}^*} - \frac{\beta}{T - \sum_{i=1}^w {C_i}^*} \\ \vdots \\ \frac{1}{{C_w}^*} - \frac{\beta}{T - \sum_{i=1}^w {C_i}^*} \end{pmatrix} + \begin{pmatrix} {C_1}^* - \overline{C_1} \\ \vdots \\ {C_w}^* - \overline{C_w} \end{pmatrix}^T \begin{pmatrix} \frac{1}{\overline{C_1}} - \frac{\beta}{T - \sum_{i=1}^w \overline{C_i}} \\ \vdots \\ \frac{1}{\overline{C_w}} - \frac{\beta}{T - \sum_{i=1}^w \overline{C_i}} \end{pmatrix}$$

$$= \sum_{i=1}^w \frac{(\overline{C_i} - {C_i}^*)^2}{{C_i}^* \overline{C_i}} + \frac{\beta}{(T - \sum_{i=1}^w {C_i}^*)(T - \sum_{i=1}^w {C_i}^*)} \sum_{i=1}^w ((\overline{C_i} - {C_i}^*)^2) > 0.$$

A3. First order conditions and solution : The first order necessary and complementary-slackness conditions of the investment game given in (4), (5) and (6) are the following. A Lagrange multiplier should be associated with the constraint $C_i \geqslant 0$ but because of the log-utility, this multiplier is 0 and $C_i > 0$, the Lagrangian becomes

$$\mathcal{L}(C_i, C_{-i}, \lambda_i) \quad = \quad \log(C_i) + \beta \log(T - \sum_{j \in \mathcal{W}} C_j) - \lambda_i (C_i - x_i(1 - D)T)$$

Differentiating $\mathcal{L}$ with respect to C_i and λ_i gives the first order conditions

$$\frac{1}{C_i} - \frac{\beta}{T - \sum_{j \in \mathcal{W}} C_j} - \lambda_i \quad = \quad 0 \tag{23}$$

for $i \in \mathcal{W}$ and the complementarity-slackness conditions

$$\begin{aligned} C_i &\leqslant x_i(1 - D)T \\ \lambda_i &\geqslant 0 \\ \lambda_i (C_i - x_i(1 - D)T) &= 0 \end{aligned} \tag{24}$$

for $i \in \mathcal{W}$. Once the subsets $\mathcal{S}$ and $\mathcal{J}$ are known, (7) is the unique solution to the system of first order conditions (23) and (24).

(ii) (8) is obtained by replacing the solution (7) in the government budget constraint (5).

Proof of Proposition 2

(i) This is because in the utility function (2), every inclusion engenders a constant loss and the inclusion of more influential groups decreases of the probability of rebellion by a greater amount.

(ii) Otherwise, the ruler receives zero utility.

(iii) a. Otherwise, the ruler would realize a utility gain by including this group z as we would have

$$(1-c(N_{\mathcal{W}}))\frac{\sum_{i\in\mathcal{W}}P_i+P_z-\theta_L}{\theta_H-\theta_L}>(1-c(N_{\mathcal{W}}-1))\frac{\sum_{i\in\mathcal{W}}P_i-\theta_L}{\theta_H-\theta_L} \tag{25}$$

Reducing this condition with respect to P_z gives (11).

b. It also possible to have an optimal coalition respecting $\sum_{i\in\mathcal{W}}P_i>\theta_H$. Then, it is the one with the smallest number of members among the coalitions respecting the condition. Adding more groups would only bring an additional cost with no benefits as the probability of rebellion cannot decrease below zero.

Proof of Proposition 3

(i) $\frac{1}{A^2}\ (Y(\mathcal{W},D)^2-Y(\mathcal{W}\cup\mathcal{K},D)^2)=a+b\ D$ where a is a constant and

$$b=\frac{\sum_{i\in\mathcal{W}}n_i\ \sum_{i\in\mathcal{J}}P_i}{\sum_{i\in\mathcal{W}}P_i}-\frac{(\sum_{i\in\mathcal{K}}n_i+\sum_{i\in\mathcal{W}}n_i)(\sum_{i\in\mathcal{J}}P_i+\sum_{i\in\mathcal{K}}P_i)}{\sum_{i\in\mathcal{W}}P_i+\sum_{i\in\mathcal{K}}P_i}<0$$

because $\mathcal{J}\subset\mathcal{W}\Rightarrow\sum_{i\in\mathcal{J}}P_i\leqslant\sum_{i\in\mathcal{W}}P_i\Rightarrow\sum_{i\in\mathcal{K}}P_i\ \sum_{i\in\mathcal{J}}P_i\leqslant\sum_{i\in\mathcal{K}}P_i\ \sum_{i\in\mathcal{W}}P_i$

Adding $\sum_{i\in\mathcal{J}}P_i\ \sum_{i\in\mathcal{W}}P_i$ on both sides of the inequality implies that

$$(\sum_{i\in\mathcal{W}}P_i+\sum_{i\in\mathcal{K}}P_i)\ \sum_{i\in\mathcal{J}}P_i\leqslant(\sum_{i\in\mathcal{J}}P_i+\sum_{i\in\mathcal{K}}P_i)\ \sum_{i\in\mathcal{W}}P_i$$

or that, after rearranging

$$\frac{\sum_{i\in\mathcal{J}}P_i}{\sum_{i\in\mathcal{W}}P_i}\leqslant\frac{\sum_{i\in\mathcal{J}}P_i+\sum_{i\in\mathcal{K}}P_i}{\sum_{i\in\mathcal{W}}P_i+\sum_{i\in\mathcal{K}}P_i} \tag{26}$$

Also, we have that

$$\sum_{i\in\mathcal{W}}n_i\leqslant\sum_{i\in\mathcal{W}}n_i+\sum_{i\in\mathcal{K}}n_i \tag{27}$$

By multiplying the corresponding sides of (26) and (27), we obtain that $b<0$.

Finally, because $Y(\mathcal{W},D)$ and $Y(\mathcal{W}\cup\mathcal{K},D)$ are both nondecreasing functions of D and that

$$(Y(\mathcal{W},D)^2-Y(\mathcal{W}\cup\mathcal{K},D)^2)=(Y(\mathcal{W},D)-Y(\mathcal{W}\cup\mathcal{K},D))\times(Y(\mathcal{W},D)+Y(\mathcal{W}\cup\mathcal{K},D)), \tag{28}$$

we arrive at Proposition 3 (i).

(ii) It is a direct consequence of Proposition 3 (i) and the reduction of the condition $Y(\mathcal{W},D)>Y(\mathcal{W}\cup\mathcal{K},D)$ with respect to D, knowing that $\sum_{i\in\mathcal{J}}P_i>0,\sum_{i\in\mathcal{W}}P_i>0,\sum_{i\in\mathcal{K}}P_i>0,\sum_{i\in\mathcal{K}}n_i>0,\sum_{i\in\mathcal{W}}n_i>0,\sum_{i\in\mathcal{J}}P_i\leqslant\sum_{i\in\mathcal{W}}P_i$ that gives the value of $\hat{D}$ in (16).

(iii) (iii) and (iv) follow straightforwardly from the conditions $\sum_{i\in\mathcal{J}}P_i>0,\sum_{i\in\mathcal{W}}P_i>0,\sum_{i\in\mathcal{K}}P_i>0,\sum_{i\in\mathcal{K}}n_i>0,\sum_{i\in\mathcal{W}}n_i>0$ and $\sum_{i\in\mathcal{J}}P_i\leqslant\sum_{i\in\mathcal{W}}P_i$.

Proof of Proposition 4

(i)

$$\frac{\partial \hat{D}}{\partial \sum_{i\in\mathcal{K}} n_i} = \frac{\sum_{i\in\mathcal{W}} n_i \sum_{i\in\mathcal{K}} P_i \left(\sum_{i\in\mathcal{J}} P_i - \sum_{i\in\mathcal{W}} P_i\right) \sum_{i\in\mathcal{W}} P_i \left(\sum_{i\in\mathcal{K}} P_i + \sum_{i\in\mathcal{W}} P_i\right)}{\left(\sum_{i\in\mathcal{W}} n_i \sum_{i\in\mathcal{K}} P_i \left(\sum_{i\in\mathcal{J}} P_i - \sum_{i\in\mathcal{W}} P_i\right) - \sum_{i\in\mathcal{K}} n_i \sum_{i\in\mathcal{W}} P_i \left(\sum_{i\in\mathcal{J}} P_i + \sum_{i\in\mathcal{K}} P_i\right)\right)^2}$$

This derivative is negative because as $\mathcal{J} \subset \mathcal{W}$, $\sum_{i\in\mathcal{J}} P_i - \sum_{i\in\mathcal{W}} P_i \leqslant 0$.

(ii)

$$\frac{\partial \hat{D}}{\partial \sum_{i\in\mathcal{K}} P_i} = -\frac{\sum_{i\in\mathcal{K}} n_i \left(\sum_{i\in\mathcal{W}} P_i\right)^2 \left(\sum_{i\in\mathcal{K}} n_i + \sum_{i\in\mathcal{W}} n_i\right) \left(\sum_{i\in\mathcal{J}} P_i - \sum_{i\in\mathcal{W}} P_i\right)}{\left(\sum_{i\in\mathcal{W}} n_i \sum_{i\in\mathcal{K}} P_i \left(\sum_{i\in\mathcal{J}} P_i - \sum_{i\in\mathcal{W}} P_i\right) - \sum_{i\in\mathcal{K}} n_i \sum_{i\in\mathcal{W}} P_i \left(\sum_{i\in\mathcal{J}} P_i + \sum_{i\in\mathcal{K}} P_i\right)\right)^2}$$

This derivative is positive because as $\mathcal{J} \subset \mathcal{W}$, $\sum_{i\in\mathcal{J}} P_i - \sum_{i\in\mathcal{W}} P_i \leqslant 0$.

(iii)

$$\frac{\partial \hat{D}}{\partial \sum_{i\in\mathcal{W}} n_i} = \frac{\sum_{i\in\mathcal{K}} n_i \sum_{i\in\mathcal{K}} P_i \left(\sum_{i\in\mathcal{W}} P_i - \sum_{i\in\mathcal{J}} P_i\right) \sum_{i\in\mathcal{W}} P_i \left(\sum_{i\in\mathcal{K}} P_i + \sum_{i\in\mathcal{W}} P_i\right)}{\left(\sum_{i\in\mathcal{W}} n_i \sum_{i\in\mathcal{K}} P_i \left(\sum_{i\in\mathcal{J}} P_i - \sum_{i\in\mathcal{W}} P_i\right) - \sum_{i\in\mathcal{K}} n_i \sum_{i\in\mathcal{W}} P_i \left(\sum_{i\in\mathcal{J}} P_i + \sum_{i\in\mathcal{K}} P_i\right)\right)^2}$$

This derivative is positive because as $\mathcal{J} \subset \mathcal{W}$, $\sum_{i\in\mathcal{J}} P_i - \sum_{i\in\mathcal{W}} P_i \leqslant 0$.

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