Essays on the political economy of development in Nigeria

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I would like to dedicate this thesis to the Late Prof. G.D. Olowononi, who played a crucial role in shaping my intellectual journey

Declaration

I hereby declare that except where specific reference is made to the work of others, the contents of this dissertation are original and have not been submitted in whole or in part for consideration for any other degree or qualification in this, or any other university.

I can confirm that Chapter 2 is based on a paper that was written with Jean-François Maystadt. I certify that I was the main contributor in terms of data construction, implementing the analysis and drafting the paper. Chapter 3 is outcome of a collaborative work with Andrea Guariso, and I certify that I was responsible for the data construction, analysis, and writing the paper. Andrea helped with the initial climatic data and set-up for the analysis. I confirm that the idea for chapter 4 emerged from extensive discussions with Emanuele Bracco. I derived the results, while the analysis was done with assistance from Emanuele.

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Abstract

This thesis consists of an introductory chapter, which situate the central theme of the dissertation within the intellectual frontier of political economy of development, and three distinct but related essays that addresses issues affecting the economic and political development of Nigeria.

The first essay examines the political economy of intergovernmental transfers in Nigeria. Using oil windfalls as a source of exogenous variation in the political discretion an incumbent government can exert in rule-based transfers, I showed that an increase in VAT transfers induced by higher oil windfalls improves the electoral fortune of an incumbent government in the Presidential elections. This result questions the promotion of rule-based transfers as a one-fits-all institutional solution in resource-abundant countries with relatively weak institutions.

The second essay exploits climatic data to study how resource inequality between ethnic groups affects the risk of violent conflicts within Nigeria. The main results show that a one standard deviation change in between-group rainfall inequality during the growing season increase the risks of civil conflicts prevalence in Nigeria by about seven percentage points. This relationship is driven, in part, by declining social capital. Specifically, I demonstrated that an unequal distribution of rainfall between ethnic groups reinforce citizen's grievances over the government performance and creates mistrust between predominantly farming communities and those engaged in nomadic herding. The analysis highlights the need to develop conflict-sensitive mitigation and adaptation strategies to reduce the adverse effects of climatic shocks.

The third essay evaluates how different punishment mechanisms may affect the incidence of bribe requests and payments. The analysis is based on a dynamic game in which the bureaucrat moves first and decides whether to solicits for bribe or not. Conditional on agents accepting to bribe, harsher punishment for corrupt bureaucrat incentivize him to angle for a larger bribe to compensate for the higher risks. I show that the effects of a switch from a fixed punishment mechanism to a proportional one that varies with the size of the bribe depend on how much effort is needed to deliver the public service. Where the delivery of public service requires much effort, the bribe becomes too expensive that only agent with

larger opportunity cost of time would engage in bribing. The essay discuss the implications of the results on willingness to pay and inequality.

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Chapter 1

General Introduction

> When you think of all the conflicts we have – whether those conflicts are local, whether they are regional or global – these conflicts are often over the management, the distribution of resources. If these resources are very valuable, if these resources are scarce, if these resources are degraded, there is going to be competition . . .
>
> —Wangari Maathai, Nobel Peace Prize Laureate, 2004

1.1 Setting the agenda

Who gets what, when, how, why and at whose cost? This is perhaps one of the central questions in political science and economics. It also sets the scene for many of the political and economic struggles in history, as rightly pointed out by Wangari Maathai in the opening quote above. While political leaders continue to grapple with the challenges of sustaining a peaceful world order, there has also been a rise in populist movements who feel that the prevailing system is deeply flawed. More than that, they argue that economic and political policies have been *rigged* against ordinary voters in favour of the governing classes (Inglehart and Norris, 2016). But if politicians are intrinsically motivated to remain in office, to what extent can they *fiddle with* economic policy? The answer to this question might lie in the old saying: *he who pays the piper dictates the tune*. It is indeed possible to think of economic history as one that provides tacit support for policies that are useful to fortify the continued dominance of the middle and less secure strata of the society by the political class. For example, think about how the classical school accentuated the self-stabilising nature of the economy, between the 18th and early-to-mid 19th century, to suit the dominant political elites; the wealthy creditors of the time, with little interest in government intervention. Then, fast-forward to the present-day emphasis on the primacy of institutions - rules and norms of the game - and how these embolden economic growth and development (e.g., Acemoglu et al., 2002; North and Thomas, 1973; North, 1990; Williamson, 1985).

Encouragingly, the last few decades have seen an incredible advance in conceptual and methodological tools that allow a deeper analysis of how economic and political processes interact to affect growth and development. Within this context, several studies have focused on analysing the political economy of generic issues such as tactical redistributive policies (Dahlberg and Johansson, 2002; Dixit and Londregan, 1996), corruption (Jain, 2002; Lambsdorff, 2007), and politician competence (Dal Bó et al., 2017). In this dissertation, I follow the path of the recent literature on the political economy of development to analyse tactical redistributive policies in developing countries, resource inequality, and conflict. In particular, this thesis revolves around three themes: intergovernmental transfers, communal conflict, and endemic corruption, as they affect the economic and political development of Nigeria as a sovereign state. Hopefully, this will contribute in a complimentary way to our understanding of the economic and political difficulties currently facing Nigeria, and possibly pave the way for institutional and policy reforms that can move the country towards a path of economic and political development. In the following sections, I discuss these issues and outline the key questions that this thesis seeks to address.

1.2 Issues in Nigeria's political economy

Nigeria is a culturally diverse society with a long history of ethnic and religious tensions that dates to the pre-independence era. The amalgamation of Southern and Northern Nigeria in 1914, to create present-day Nigeria has often been cited as the roots to many of the rivalries that dot the political and social landscape of the country (Papaioannou and Dalrymple-Smith, 2015). After gaining independence in 1960, Nigeria was plunged into a secession crisis with the Eastern part of the country pulling out to create the state of Biafra in May 1967.[1] Perceived marginalisation in the distribution of scarce resources and political power by the ruling Northern elites underlies some of the push-factors that led to the secession, culminating into a full civil war in July 1967.

The aftermaths of the civil war saw Nigeria's political institutions evolving a more formal and proportional revenue sharing arrangement under its fiscal federalism structure. For example, revenues from oil, combined with VAT, custom and excise duties are paid into the central pool of the Federation

[1]The failed state of Biafra was championed by the Igbo – a major ethnic group that resides mostly in the South-Eastern part of Nigeria – and other minority ethnic groups (mostly in Nigeria's oil-rich south-south region).

Account and shared between the central and state governments at the middle of every month in accordance to some rules.[2] Nonetheless, the country continues to suffer from ethno-regional agitations and rising religious violence that threatens to destabilise it. Indeed, the International Crisis Group in a series of reports on Nigeria identified the country's faltering federal system; unrest in the oil-rich Niger Delta area; escalating farmers-herders' crisis due to climate change; and widespread corruption as major factors threatening Nigeria's fragile political system.[3] Three of these issues relate to the core theme of this dissertation, which will be briefly discussed below: fiscal federalism, farmers-herders conflict, and corruption.

Nigeria's revenue and power sharing system has entrenched, what Richard Joseph in his work "Democracy and Prebendal Politics in Nigeria," described as prebendal or neo-patrimonial politics. Prebendalism features extreme patterns of ethnic mobilisation that rests on the justifying principle that state power should be treated as "a congeries of offices," which can be competed for, appropriated and then administered for the benefit of the individual occupant and their support groups. In this regard, ethnic and kinship identities became elevated as the "official language" of political grievances and provided formal backings to clientelistic demands for the allocation of the country's resources (Kendhammer, 2015).

In recent years, political entrepreneurs have intensified the mobilization of ethnic networks to demand for a restructure of the federal systems to allow for an equitable access to a "share of the national cake" (Onuoha, 2011).[4] While this has led to increased ethnic tensions and violence across the country, political-cum-ethnic elites have continued to accept guaranteed access to federal resources alongside expanding federal power. Motivated by the political economy literature on tactical redistributive policies, which posits that opportunistic politicians may implement policies to maximise their chances of re-election, chapter 2 of this thesis question whether the so-called national cake is indeed a political one.

Another major source of inter-communal tensions involves land disputes between ethnic groups and neighbouring communities, especially those in oil-producing states where land ownership attracts some form of compensation payments from multinational companies (Small Arms Survey, 2005). The situation is not much different in Northern Nigeria where clashes involving herdsmen and farming communities

[2]The horizontal allocation rule specifies that 40% of total revenues paid into the Federation Account should be shared on the basis of equality, while the other are distributed as follows: population – 30%; land mass and terrain – 10%; internally generated revenue – 10%, and social development such as education enrolment, health and water – 10%.

[3]The reports on Nigeria are available at https://www.crisisgroup.org/africa/west-africa/nigeria.

[4]The term 'national cake' is used to refer to any opportunity to access national wealth, owned by none, should belong to all, but is limited to few.

in southern and north-central zones have surged in recent years. The root causes for this increase might be attributed to rising population pressures and climatic-induced changes. The expansion of human settlements together with the rapid pace of urbanisation has led to the loss of grazing lands, which have long been designated by the central government as reserved areas, thereby increasing pressure on farmlands and the likelihood of conflicts over water pollution and crop damages (Baca, 2015).

Besides, climate changes have intensified droughts and desertification in the semi-arid Northern part of Nigeria. According to a report released in 2016 by the Nigeria Meteorological Agency, the annual rainy season in the country has reduced by an average of 30 days (i.e. from 150 to 120) over the last three decades. Furthermore, it is predicted that future dry spells, especially in Northern regions, may get worse as the world continues to experience hot streaks of temperatures.[5] At the same time, reports by the Food and Agriculture Organisation indicates that 50 to 75% of land areas in the North-East and North-West regions are vulnerable to desertification, and the phenomenon is spreading towards the south at the rate of $0.6km$ per year.[6]

These developments have compelled nomadic herders, most of which are ethnic Fulani from Northern Nigeria, to move southwards in search of water and pastures for their herds (International Crisis Group, 2017).[7] As they migrate into lands that are owned by predominantly farming communities, violent conflicts over crop damages or cattle rustling, often erupts. Over the last two decades, this type of violence has increased in both intensity and geographical scope. The Assessment Capacities Projects (ACAPS) reported that there have been at least 360 clashes between farmers and herdsmen in the last five years, resulting in a casualty of approximately 2,400 people in 2016 alone, compared to just 20 battles in the fifteen years before that.[8] With the conflict expanding into southern states, the herder-farmer crisis continues to pose a major threat to Nigeria's national security. If proactive actions are not taken, this may likely aggravate the already fragile relations among the different ethnic and religious groups in the country. In relation to this issue, chapter 3 investigates whether changes in the distribution of rainfall has contributed to the increase in armed conflict prevalence in the country.

Finally, widespread corruption remains a salient feature in Nigeria's political arena and has drained an estimated USD 400 billion from the country, according to the Economic and Financial Crimes Commission, which was established in 2004 to combat the scourge (Okpanachi, 2011). While the country's political

[5] Nigeria Meteorological Agency, *Drought and Flood Monitoring Bulletin,* August 2017.

[6] *FAO Country Programming Framework (CPF) Federal Republic of Nigeria 2013 - 2017.*

[7] The Fulanis are regarded as the world's largest nomadic group and occupy a large expanse of land from West to Central Africa countries.

[8] The report can be accessed at https://www.acaps.org/country/nigeria/special-reports.

leadership in the last few decades have often made the "fight against corruption" a central theme in their policy agenda, no serious progress appears to have been made. Nigeria continues to rank high alongside other countries such as Democratic Republic of Congo, Sierra Leone, Yemen, Sudan, Venezuela and Somalia in the lists of most corrupt countries in the world. For example, Nigeria ranked 32nd most corrupt country in the world, out of 168 countries surveyed in 2016 by Transparency International. Besides the inability of the government to end the pervasive culture of embezzlement and nepotism among political elites, petty corruption in the form of bribery has increased exponentially in recent years. Indeed, data from the Global Corruption Barometer indicates that about fifty-three percent of Nigerians surveyed in 2015 report to having paid a bribe to access public service, compared to around 41 percent in 2013.

This endemic culture of corruption poses a serious challenge to Nigeria's development. Anti-corruption crusaders sometimes try to estimate the costs of corruption to Nigeria's faltering economy. In 2014, for example, the head of the central bank estimated that about USD 20 billion was stolen between 2011 and 2014 alone. A recent study by economists at PricewaterhouseCoopers (PwC) predicts that if corruption is not tackled immediately, the cost to Nigeria may amount to almost 37% of the GDP by 2030. Indeed, it is now widely accepted in the economic literature that corruption does not only decrease the relative ratio to total capital accumulation but also deters foreign direct investment, thus undermining GDP growth (Lambsdorff, 2006; Wei, 2000). In addition, corruption creates distortionary effects in the quality of public investments by inducing preferences for capital projects that can create an efficient base for kickbacks (Esty and Porter, 2002; Lambsdorff, 2007). Some of these damages are already visible in the country. Investments in health, education and public infrastructures such as electricity, water, and roads have continued to suffer while billions of dollars in oil revenues vanish into private pockets.

Not surprising, President Buhari on assumption of office in May 2015, launched an anti-corruption drive. Since then, the Economic and Financial Crimes Commission have arrested several senior civil officials, politicians and military elites accused of grand theft, and a new whistle-blowing bill has been sent to the country's parliament for passage. But, for how long can the government sustain the fight against corruption? In the past, efforts to combat embezzlement were compromised by a weak punishment and flawed legal system that allows corrupt persons to go unpunished.[9] Motivated by economic literature on the use of asymmetric punishment to control the "scourge" of bribery, chapter 4 offers a simple theoretical

[9]A striking example was the case of Mr James Ibori (a former governor of Delta State in the South-South region of Nigeria) who was acquitted of corruption charges but jailed in the United Kingdom for the same offence.

model that looks into how different enforcement mechanisms may yield different outcomes in terms of bribe levels and willingness to pay.

In the remainder of this introduction, I outline the arguments made in the ensuing chapters, focusing on the empirical questions asked, contributions to the literature and the central theme that unites the chapters.

1.3 National or political cake?

The idea that opportunistic politicians can benefit from intergovernmental transfers by strategically targeting recipient groups is formalised in tactical redistributive models (e.g. Cox and McCubbins (1986); Dixit and Londregan, 1996). In these models, political parties are theorised as two spatially organised groups that allocate resources across a group of voters with a single electoral district. The voters, in turn, are assumed to have fixed and exogenous political preferences and also receive utility from the allocations they get. Within this context, a voter is usually modelled to prefer a party that offers her a transfer, large enough to outweigh her ideological attachment to her own party (Arulampalam et al., 2009). This latter theoretical postulation has some interesting implications. First, votes can be “purchased" with transfers, as voters (irrespective of their ideological leanings) can be materially induced to a rival party if the price is right. Second, political parties interested in maximising returns to votes engage in opportunistic policies and strategies aimed at winning moderate or non-ideological voters because they can be bought more easily than voters who are clearly attached to a political party (Golden and Min, 2013).

Most empirical studies (Bracco et al., 2015; Dasgupta, 2015; De La O, 2013; Larcinese et al., 2013; Manacorda et al., 2011a; Stromberg, 2004) that have drawn on these models to investigate tactical redistributive policies generally tend to focus on the discretionary component of public spending and targeted transfers, but not rule-based intergovernmental transfers. The underlying assumptions for each of these studies are that the incumbent politicians engage in clientelism and pork-barrel politics. Moreover, tactical redistribution of transfers are more likely when politicians can exert some degree of discretion in the allocation of resources to favour recipient groups identifiable by partisan leanings, race or ethnicity. However, an important question which remains unanswered in the existing studies is whether an opportunistic incumbent politician can manipulate a centralised rule-based transfer system to win more votes. One would expect that such transfers are more likely to be subject to manipulability in countries with weak institutional settings and clientelistic framework in which incumbent party leaders decide *who gets what, when and how*.

In Nigeria, for example, anecdotal evidence suggests that the redistribution of oil revenues has been subject to abuse despite the rule-based nature of these transfers. Specifically, the Economic and Financial Crimes Commission reported that between 1960 and 1999 the country's rulers may have stolen an estimated USD 400 billion in oil revenues (Okpanachi, 2011). Yet, the literature on tactical redistribution in developing countries (with the exception of Arulampalam, et al. 2009 and Banful, 2011) have emphasised the importance of ethnic favouritism without much attention to the political motives behind the use of redistributive politics. The democratisation wave experienced in Africa over the last two decades (Rakner et al., 2008), together with the push for further decentralisation reforms (Rodriguez-Pose and Gill, 2004), call for paying more attention to the risk of manipulation in intergovernmental transfers. Understanding such manipulation is key to shed light on the mixed results found on the impact of decentralisation on economic performances and regional disparities in developing countries (Rodriguez-Pose and Ezcurra, 2010, 2011).

Chapter 2 examines how much a centralised rule-based transfer system in Nigeria can be manipulated to effectively buy political support. In this context, I use oil windfalls as a source of exogenous variation in the political discretion that the central government can exert in rule-based transfers. By doing so, the chapter contributes to the literature on tactical redistribution in developing countries and also sheds light on how large increases in natural resource rents increase political power and the ability to buy votes (Robinson et al., 2014). The main finding indicates that an increase in VAT transfers induced by higher oil windfalls improves the electoral fortune of the incumbent government. The result questions the promotion of rule-based transfers as a one-fits-all institutional solution in resource-abundant countries with relatively weak institutions.

1.4 When it rains, it's peaceful

Does a change in the distribution of rainfall between groups translate into an increase in armed conflict prevalence? In recent years, there has been an increase in quantitative research on how climate change may induce higher risks of armed conflict in societies (Hsiang et al., 2013; Maystadt et al., 2014). The most immediate insight gained from this literature is that establishing a direct causal link between climate variability and conflict is far from being conclusive. First, there is a lack of a precise theoretical model to guide systematic quantitative evaluation, thus leading to the absence of consensus about the actual channel through which variations in climatic conditions might conceivably affect conflict dynamics.

Moreover, most of the analyses are conducted in a "generalizable and comparative" analytical set-up, which are usually problematic when it comes to drawing causal inferences. Although remarkable progress with respect to statistical techniques and data quality have aided more country-specific studies in recent years (Fjelde and von Uexkull, 2012; Hsiang et al., 2013; Maystadt et al., 2014), the inability of these studies to quantitatively capture complex causal linkages have continued to question causality claims. Thus, there is a growing consensus among policy-makers and academics that more research is needed to investigate better how this broad trend translates in practice within specific contexts.

Chapter 3, will focus on the case of Nigeria to investigate the relationship between changes in the distribution of rainfall between ethnic groups and armed conflicts prevalence. As a first step, the chapter investigate whether changes in the distribution of rainfall across ethnic groups living within the same state increases the incidences of civil conflicts within that state. The location of the different ethnic groups within a state are taken from the detailed Nigeria Local Government Handbook. I then spatially merge the location of ethnic groups with a high-frequency and high-resolution rainfall data provided by the European Center for Medium-Term Weather Forecasts (ECMWF). The key measure of "rainfall inequality" between ethnic groups is then constructed following Guariso and Rogall (2017) and is based on the standard Gini coefficient. The analysis covers 37 states and 19 years, from 1997 to 2015, which is the period for which all the data sources are available.

The main result indicates that a one standard deviation increases in rainfall inequality between ethnic groups living in a state increases the risks of civil conflict prevalence by about seven percentage points. In the second part of the paper, I move to investigate the channels through which rainfall inequality may induce higher prevalence of civil conflict. In doing so, I match the ethnicity level information with micro-level data provided by the Afrobarometer. I then construct an ethnic level indicator for general trust; trust in neighbour and government; within-group and between-group trust; government satisfaction; and government corruption. The results suggest that an unequal distribution of rainfall leads to lower satisfaction with the government and creates mistrust between predominantly farming ethnic groups and those engaged in herding.

1.5 Tackling corruption: A digression

It is now widely accepted that corruption has detrimental effects on societies. Rose-Ackerman's seminal works (Rose-Ackerman, 1975, 1978), as well as Shleifer and Vishny's (1993) influential paper, demonstrates that the illegal system of bribe-price can be more distortionary than taxation. The rent-seeking behaviour of corrupt government officials may induce them to redesign public systems to encourage bribery. Such actions involve not only the illicit exploitation of individual's willingness to pay as a decision criterion but also undermine efficient provision of public services. Yet, in many developing countries, private citizens are often required to pay bribes to obtain basic public services. Indeed, data from the 2015 Global Corruption Barometer produced by Transparency International shows that twenty-two percent of respondents surveyed in Sub-Saharan Africa report having paid a bribe in the last 12 months. The situation is worst in countries such as Kenya, Liberia, Nigeria and Sierra Leone where one out of two respondents surveyed say they paid a bribe to access public services such as education, health, customs and tax revenue, licenses and land services, *etc.*

This pervasive culture of bribery has important consequences for those without money and connections. As with the incidence of regressive tax, the burden of bribery may fall disproportionately on the poor as they are more likely to pay a higher percentage of their income as bribes than the rich (Hunt and Laszlo, 2012). Moreover, the distortionary effects of corruption can compromise the quality of public goods provision, in such a manner that the population may have to rely on private providers to access vital public goods and services. This again disproportionately favours the high-income groups because the costs of these services may be so high that the poor cannot afford to pay. This non-access to basic services such as education and healthcare facilities has the potential to perpetuate inter-generational poverty and hence widens income inequality. Indeed, micro-level studies such as Hunt and Laszlo (2005) and Mocan (2008) have demonstrated that the nominal amount of bribes paid is a positive function of income, whose burden decreases as income rises.

Given these distortionary effects, an interesting question to ask is how can the incidence of bribe requests and payments be reduced? While recent theoretical contributions on the economic analysis of corruption have started to focus on measures to combat it, there has been an increased debate on the merits and limitations of the different proposals (see Basu, 2011; Dixit, 2016; Dréze, 2011; Dufwenberg and Spagnolo, 2014; Oak, 2015). Chapter 4 offers a new view on how different punishment mechanisms may affect bribery outcomes and willingness to pay. In doing so, the model extends the setting by Hunt and Laszlo (2005) and also contributes to a growing literature on measures to reduce corruption (see Dixit, 2016; Andreanova and Melisasas, 2008; Hindricks, et al., 1999). While this literature focuses on the role of explicit incentive structures, such as institutional controls and the use of efficient wages in controlling corruption, I highlight how the intrinsic characteristics of public and private agents may alter bribery outcomes.

In particular, I model the interactions between a bureaucrat and private agent as a dynamic game in which the bureaucrat moves first and decides whether to solicits for a bribe or not. This modelling choice is intended to elicit the conditions under which the bureaucrat may angle for bribes, given the punishment system in place. The analysis shows that severe punishments for corrupt bureaucrats generally leads to an increase in bribe size, making bribing more expensive (and therefore less widespread). However, the effects of a proportional punishment, which varies with the amount of bribe, depends on how much effort is required to deliver the public service. If the effort of delivery is large or the service is sufficiently valuable to the agent, the bribe level in equilibrium *overcompensates* the bureaucrat for his effort and is also increasing in the net surplus available for the client with the least scruples. I also discuss the effects of the results on willingness to pay and inequality.

Chapter 2

The political economy of intergovernmental transfers in Nigeria

2.1 Introduction

The notion that incumbent politicians may benefit electorally by strategically allocating transfers to favour recipient groups is given formal expression in tactical redistributive models (e.g. Cox and McCubbins, 1986; Dixit and Londregan, 1996; Lindbeck and Weibull, 1993). Most empirical studies (Bracco et al., 2015; Dasgupta, 2015; De La O, 2013; Larcinese et al., 2013; Manacorda et al., 2011b; Stromberg, 2004) that have drawn on these models to investigate political motivations in redistributive policies tends to focus mainly on the discretionary component of public spending and targeted transfers, but not rule-based intergovernmental transfers. The underlying assumptions for each of these studies are that incumbent politicians engage in clientelism and pork-barrel politics, and that tactical redistribution of transfers is more likely when politicians can exert some degree of discretion in the allocation of resources to favour recipient groups identifiable by partisan leanings, race or ethnicity.[1] Indeed, the general recommendation for developing countries when decentralizing is to base fiscal decentralization on a rule-based system (generally considering factors such as population, wealth, location and density) in order to avoid graft and elite capture (World Bank, 2004). In particular, countries such as Nigeria, Brazil, Ghana and India

[1]Prominent studies on ethnic favouritism can be found in Hodler and Raschky (2014), Burgess et al. (2015), and De Luca et al. (2015).

have introduced a formula-based intergovernmental system based on verifiable and objective criteria to constrain politically motivated targeting of transfers.[2]

However, an important question which remain unanswered in the extant studies is, whether an opportunistic incumbent politician can manipulate a centralized rule-based transfer system to win more votes. One would expect that such transfers are more likely to be subject to manipulability in countries with weak institutional settings and clientelistic framework in which incumbent party leaders decide *who gets what, when and how*. In Nigeria, for instance, anecdotal evidence suggest that the redistribution of oil revenues has been subject to abuse despite the rule-based nature of these transfers. Specifically, the Economic and Financial Crimes Commission which was established in 2004, reported that between 1960 and 1999 the country's rulers may have stolen an estimated USD 400 billion in oil revenues (Okpanachi, 2011).

Surprisingly, the literature on tactical redistribution in developing countries (with the exception of Arulampalam, et al. 2009 and Banful, 2011) has focused mainly on ethnic favouritism without much attention to the political motives behind the use of redistributive politics. The democratisation wave experienced in Africa over the last two decades (Rakner et al., 2008), together with the push for further decentralisation reforms (Rodriguez-Pose and Gill, 2004), call for paying more attention to the risk of manipulation in intergovernmental transfers. Understanding such manipulation is key to shed light in the mixed results found on the impact of decentralisation on economic performances and regional disparities in developing countries (Rodriguez-Pose and Ezcurra, 2010, 2011). In this chapter, we examined how much a centralised rule-based transfer system in Nigeria can be manipulated to effectively buy political support. To that purpose, we exploit oil windfalls as a source of exogenous variation in the political discretion the central government can exert in rule-based transfers. In so doing, our study contributes to the literature on tactical redistribution in developing countries, and also sheds light on how large increases in natural resource rents increase political power and the ability to buy votes (Robinson et al., 2014).

Nigeria is an interesting case to consider for several reasons. First, since the discovery of oil in commercial quantities in 1956, the Nigeria's political space has been dominated by the concept of 'sharing the national cake', a phrase used to refer to any opportunity to access national wealth, owned by none, should belong to all but is limited to few. Politically, this 'sharing of the national cake' has led to a prebendal system, in which elected government officials believe they are entitled to a share of government

[2]India's National Rural Employment Guarantee Act, as well as Nigeria's Revenue Mobilisation Allocation and Fiscal Commission Act are good examples of regulations that recommends the devolution of resources to constituent parts by means of a formulae-based system.

revenues, and to use them to reward their supporters.[3] The specific outcome of this act of sharing is further manifested in the structure of Nigeria's fiscal federalism. For instance, revenues from oil, combined with VAT, custom and excise duties are paid into the central pool of the Federation Account and shared between the central and state governments at the middle of every month in accordance to some rules.[4] Thus, it is intuitive to verify whether the rules have been sufficient to avoid politically motivated targeting of transfers.

Second, Nigeria's high dependence on oil revenues and the fact that part of these revenues is distributed in a proportional way to the oil and non-oil producing states allow us to exploit how exogenous variation in crude oil prices impact on transfers and the ability of the President to buy votes. Oil prices can indeed be considered as exogenous, since Nigeria accounts for less than 4% of world oil production (Abidoye and Cali, 2015). Third, although Nigeria has a dominant party framework, electoral outcomes vary greatly across states. This variation can be exploited to investigate how plausibly exogenous variations in intergovernmental transfers affect electoral support for the central government. Lastly, while states implement their budgets independently of the central government, they do not have control over the tax base or tax rate in their jurisdiction. This means that the states' main sources of revenue are almost entirely derived from the central government transfers. Indeed, based on the Central Bank of Nigeria 2014 Annual Economic Report, the states' own internally generated revenue typically amounts to less than twenty percent of their total revenue. It is therefore important to examine whether an incumbent government can use the centralised intergovernmental transfer system to purchase political support.

Moreover, analysing the effect of opportunistic fiscal transfers on the electoral fortune of incumbent politicians can be difficult due to problems of endogeneity in the allocation of grants (Larcinese, et al 2013). To mitigate this problem, a common empirical approach in previous studies was to implement a quasi-experimental design in which voters' behaviour in electoral districts that receive relatively higher grants are compared with those in districts that receive lower grants (see Dahlberg et al., 2008; Litschig and Morrison, 2013; Manacorda et al., 2011b). However, in the absence of a quasi-experimental setting, most studies simply assume that political competition at the sub-national level is exogenous to the use of transfers or unobserved determinants of transfers. Our study considers an instrumental variable approach to test the plausibility of this assumption. In particular, we exploit exogenous variation in oil windfalls as

[3] Joseph Richard in his work "Democracy and Prebendal Politics in Nigeria" defines prebendal to mean patterns of political behaviour in Nigeria which rests on the justifying principle that state power should be treated as "a congeries of offices" which can be competed for, appropriated and then administered for the benefit of the individual occupant and their support groups.

[4] We further discuss how revenues from the central government are redistributed to states in section 2.2.

an instrumental variable, to estimate the impact of transfers on the re-election prospects of incumbent politicians. To the best of our knowledge, this is the first study to use instrumental variables to analyse the impact of tactical redistribution on election outcomes in a sub-Saharan African country.

Exploiting within-state variation between 2007 and 2015 for the 36 states in Nigeria, we find that an increase in VAT transfers induced by higher oil windfalls improves the electoral fortune of the incumbent President. This result is robust to alternative specifications (e.g. changing the definition of oil-producing states, changes in dependent variable and the variable of interest, respectively). Our results question the role of rule-based transfers as an efficient institutional arrangement in resource-abundant countries. It complements the results by Banful (2011) who shows that formula-based transfers were targeted towards swing districts in Ghana. We show that such political manipulation of rule-based transfers helps to buy votes for the incumbent in Nigeria.

The remainder of this chapter is organised as follows. The next section provides the institutional background of the study. Section 2.3 describes the empirical model and identification strategy. Section 2.4 focuses on the results, while the last section concludes the chapter.

2.2 Institutional Background

Nigeria is a Federal Republic, with an elected President and a two-chamber National Assembly, i.e. the Senate and the House of Representatives. The President is elected for a 4-year term limits and is constitutionally allowed to seek re-election for another period of 4 years after the expiration of his first term in office. The 1999 constitution recognizes a two-round electoral system. In order to win in the first round, a candidate not only needs to have a simple majority of vote cast but at least 25 percent of the votes in two-thirds of the states.

The 1999 constitution of the Federal Republic of Nigeria also defines to a large extent, the country's system of fiscal federalism. The constitution defines three levels of government: the Federal, the 36 states and the Federal Capital Territory (FCT), and 774 local government areas. It also determines the responsibility of each level of government. The federal government is charged with the provision of public services that are of national importance, such as foreign affairs, defence, security, law and public order. The states have the responsibilities to provide for education, health and physical infrastructure, and the promotion of economic and social growth within their jurisdiction. The role of the local government varies across the country and is not clearly defined by the constitution. Furthermore, the constitution outlines the manner in which revenues are shared among the three different tiers. The country operates a highly centralised revenue system. All federally collected revenues are paid into the Federation Account, which is then shared among the different levels of governments, strictly according to formula developed by the Revenue Mobilization Allocation and Fiscal Commission (RMAFC) and approved by the National Assembly. Additionally, about 4.18 percent of revenue accruing to the Federation account is kept in Four Special Funds (Federal Capital Territory, Statutory Stabilization, Development of Natural Resources, and Ecology and Derivation).

The major source of revenue for the Federation Account is revenue from oil, VAT, corporate income tax, as well as custom and excise duties. Oil accounts for almost 80 percent of total federally-collected revenue. Although oil revenues are federally-collected, the 1999 constitution requires that 13% of the gross oil revenue should be shared among oil-producing states in proportion to their production volumes. The remaining are paid directly into the Federation Account and distributed among the three levels of government.

Distributions from the Federation Account to the different tiers of government are based on a vertical allocation formula that assigns a specific share of the account to each level of government, as well as horizontal allocation formulas that distribute both the state and local government shares of the Federation Account among the states and local governments. Under the current vertical allocation revenue formula edited by a Presidential Executive order given in 2000, gross allocations in the Federation Account is shared as follows: Federal government – 52.68%; State governments – 26.72%, and Local governments – 20.60%. The horizontal allocation formula is given as follows: equality – 40%; population – 30%; land mass and terrain – 10%; internally generated revenue – 10%, and social development such as education enrolment, health and water – 10%. In practice, a large proportion of the total 20% designated for internally generated revenue and social development are usually divided equally among the States. VAT revenues are shared as follows: 50% equally to all states, 30% proportional to population, and 20% on derivation basis (the basis of relative state contributions to VAT revenues).

It is important to note that, while substantial source of revenues accrues to the Federation Account, the state and local governments can collect for themselves a number of minor taxes such as personal income taxes, license fees, and market fees. Typically, these internally generated revenues do not account for more than twenty percent of the total consolidated revenue. A notable exception is Lagos and Rivers States, which account for 38% and 12% of the total of internally generated revenues from all states between

2010 and 2014. In addition, even though states do not generally receive transfers from the Federal budget (but from the Federation Account); they have no control over either the tax base or tax rate of the federal allocations. Hence, these revenues can be considered as intergovernmental transfers to the states and local government as opposed to their own internally generated revenue.

Moreover, the Federation Allocations are administered by a *Federation Account Allocation Committee (FAAC)* in liaison with the National Revenue Mobilization Allocation and Fiscal Commission. The committee meets on a monthly basis to allocate the previous month's revenue receipts among the three tiers. The FAAC comprises of the Federal Minister of Finance, and representatives from each of the states of the Federation, usually the states' Commissioners of Finance and their Accountants-General, and representatives from fiscal and monetary related federal agencies, such as the Central Bank, Customs and Federal Inland Revenue Services. However, members of the Revenue Mobilization Allocation and Fiscal Commission are appointed by the President, and charged primarily with the responsibility of monitoring the accruals to, and disbursement of funds from the Federation Account, and reviewing on a regular basis the data and revenue allocation formula, respectively.[5] Regarding the data revision process, the horizontal allocation formula is updated by the commission on an annual basis to ensure conformity with changing realities, while the vertical revenue allocation formula is seldom reviewed without due consultation with major state and non-state actors across the Federation.

The rule-based nature of the inter-governmental transfers does not immune the system from political agency. The dearth of data on social development factors and the lack of transparency in the data updating process could open the door for political manipulation even with a rule-based intergovernmental transfer system. As illustrated in Figure A 2.1 in the Appendix, there is a discrepancy between the hypothetical allocation of transfers (based on the horizontal allocation formula) and the reality. For instance, the South-South region from which President Goodluck is originating receives 19% of the allocations compared to the expected 16%. That represents about twenty-eight million dollars a year, in real terms. Such an amount represents on average 12% of the annual budget of the states composing that region. One channel for manipulation comes from data revision on which the transfers are based. FAAC Committee members who are politically aligned with the incumbent may strategically fiddle with the data revision process to favour the incumbent party. Indeed, given Nigeria's weak institutional setting and incentive structure in which incumbent party leaders decides *who gets what, when and how*, it is plausible to suspect

[5] The commission consists of a chairperson and one member from each state of the Federation and the Federal Capital Territory.

political interference. As an example, while the act establishing the commission empowers the President to appoint persons with "unquestionable integrity" to the commission, there is little information about the criteria for such appointments and the political affiliation of the committee members. A more subtle source of manipulation may come from the input provided by civil servants in the data revision process. Nonetheless, we should acknowledge that the discrepancy depicted in Figure A 2.1 cannot be interpreted as hard evidence for manipulation. Our analysis seeks to shed light on the issue by investigating how plausibly exogenous changes in transfers can be used to buy votes for the incumbent President.

2.3 Empirical Analysis

2.3.1 Data and Identification Strategy

Our analysis spans over nine years, i.e. 2007 to 2015 for 36 states in Nigeria.[6] Our main empirical analysis is to test whether transfers allocated to a state s leads to a larger vote share for the incumbent. A naive approach would consist in regressing the amount of transfers received in state s prior to election held at time t on electoral outcomes in the following way:

$$electoutcome_{s,t} = \gamma \ln(transfers_{s,t}) + \varepsilon_{s,t} \tag{2.1}$$

One well-known problem with this approach is that the allocation of intergovernmental transfers is not random and likely to be correlated with political characteristics or other determinants of political competition in the concerned state. Even the theory is relatively ambiguous about the expected endogeneity bias. On the one hand, the proponents of the core-support hypothesis posit that a risk averse politician allocates funds to political entities that are clearly attached to the incumbent party to maximise the return to vote and reward loyalty (e.g. Cox and McCubbins, 1986) . Such rewarding mechanism would lead to an upward bias of the OLS estimates. On the other hand, the opposite bias would result from the swing voter model, according to which grants are allocated to "battleground" or regions with high proportion of non-ideological voters (e.g. Lindbeck and Weibull, 1993; Dixit and Londregan, 1996). Similar endogeneity bias may arise due to unobserved state characteristics that would influence both the allocation of transfers and voting behaviours. In a rule-based system, controlling for the allocation criteria

[6]Federal Capital Territory (FCT-Abuja) is excluded from the analysis because funds are allocated directly to it from the Federation Account through the FCT Special Fund that is under the control of the Federal Government.

are obviously key, but as pointed in Section 2.2, there is no guarantee such control variables are accurately measured or even manipulated for political motives.

In the absence of a quasi-experimental setting, we propose a two-stage approach more likely to draw causal inference. We use exogenous variation in oil windfalls as an instrument for transfers in the first stage, with other determinants of transfers controlled for. Figure A 2.2 indeed suggests a strong link between oil prices and the proportion of transfers allocated to oil-producing states. Not surprisingly, oil price variations are more strongly correlated with variations in transfers in oil-producing states compared to other states, thereby supporting the validity of the use of oil windfalls as an exogenous variation on the amount of transfers received by state authorities.[7] We include state fixed effects α_s to control for unobserved time invariant heterogeneity that may affect the allocation of transfers and voting behaviours at the state level. We also introduce year and quarter specific dummies δ_t and γ_q, to account for unobserved time and seasonality effects. We also augment the model with state-specific time trends in alternative specifications.

The first-stage regressions take the following form:

$$ln(transfer_{s,q,t}) = \beta' Oilwin_{s,q-1,t} + \theta X_{s,t-1} + \alpha_s + \gamma_q + \delta_t + \varepsilon_{sqt} \quad (2.2)$$

Where $transfer_{s,q,t}$ are VAT transfers from the Federal government to the state s received in the quarter q of year t, calculated based on 2007 constant Naira (199.05 NGN/USD at June 2015 exchange rate). This data was sourced from Nigeria's Federal Ministry of Finance monthly publications *FAAC Report*. $Oilwin_{s,q-1,t}$ represents oil windfalls occurring in the previous quarter q of year t. Following Abidoye and Cali (2015), oil windfalls are constructed by multiplying the oil production value at the state level in 2003 with the international oil price, i.e. $Oilwin_{s,q,t} = p^{oil}_{q,t} \times oil_s$. Prices indexes have been largely used in the economic literature (e.g. Bruckner and Ciccone, 2010; Dube and Vargas, 2013). When possible, it is common practice to weight the variations in international prices by a weight defined prior to the period of investigation. The reason is to render the constructed price index more exogenous. Since our analysis starts in 2007, using weights prior to 2006 is more likely to be exogenous. Data on oil production and prices were obtained from the Nigerian National Petroleum Corporation's Annual Statistical Bulletin[8]

[7]The sharp decrease in transfers during a period of increasing oil prices observed in early 2007 for both oil-producing and non-oil producing states could be explained by the creation of a sovereign wealth funds, reducing the total amount of revenues to be reallocated to all states.

[8]These data have been kindly shared by Abidoye and Cali (2015).

and Federal Reserve Economic Data (FRED). Transfers and oil windfalls are aggregated at the quarterly level to capture the possible use of transfers by the incumbent (central) party to buy votes during the next election periods, which normally falls in April. Thus, aggregating at the quarterly level allows us to capture the variation around the pre- and post-election periods.

$X_{s,t-1}$ is a vector of socio-economic and political controls. The socio-economic variables approximate the horizontal allocation formula for transfers, i.e. state population, primary and secondary school enrolment rates (land mass being time-constant, its role is captured through the introduction of state fixed effects).[9] Given that our grant and oil windfalls variables are defined at the quarterly level, the inclusion of the socio-economic and political variables may give rise to some concerns about measurement errors, since these data are usually available on an annual basis. It is important to emphasize that while such concerns are valid, we are only exploiting exogenous variations in oil windfalls to predict the change in transfers received the quarter prior to each election years. Moreover, changes in VAT transfers to states are usually conditioned on the statistical estimates from the previous year. Thus to mitigate this concern, we lag the socio-economic variables by one year and include state fixed effects to control for unobserved and time-constant characteristics likely to affect the allocation of transfers.

Since the horizontal formula allocation takes into account the previous year's internally generated revenue and given the absence of regional data on GDP for the period of our study, we use nightlights intensity to proxy for state level GDP. Indeed, night light densities have been largely used as a substitute for local GDP in economics (Donaldson and Storeygard, 2016; Henderson et al., 2012). To calculate the nightlights intensity, satellite data from the Defence Meteorological Satellite Program (DMSP) was used. The 30 arc second data ($\sim 1km^2$ at equator), covers the period from 1992 to 2013 (Small and Elvidge, 2013).[10] Six different DMSP satellites, F10 to F18, resulting in time series of 33 datasets, exist in total during this time period. We used the "stable lights" data, which shows the lights from cities, towns, and other sites with persistent lighting, thereby removing the ephemeral lights and background noises associated with the data (Small et al., 2005).

One concern may be that oil-producing states have specific political characteristics that make them more likely to receive transfers and buy votes in the second-stage. We, therefore, control for political variables, namely alignment likely to capture the core support hypothesis, and swing variables, related to

[9]The last population census in Nigeria was conducted in 2006. The population data used are projected estimates as computed by the Nigerian National Bureau of Statistics.

[10]For the remaining time period (i.e. 2014 to 2015), we did a linear extrapolation for missing values of nightlights. Two datasets of stable lights exist, the; 1) average DN value image composites, and 2) average DN value multiplied by the percent frequency of light detection image composites. We use the average DN value image composites.

the swing voter hypothesis.[11] We construct the political variables as dummy variables. To construct these variables, we consider the fact that decisions relating to grant allocations to a state are delayed by one time-period. Thus, allocations that is due in January 31st of a financial year are made in Mid-February of that financial year. The alignment indicator is defined as one if the central government and state government belong to the same political party on the 30th of the previous month and there is no emergency rule in the state as at that date.[12] To construct the swing dummy, we first identify the last Presidential election occurring in each state s prior to financial year t. Then we define for each election year, the winning margin, which is the difference between the percentage vote share of the two political parties that secure the highest number of votes in state s. We then classify a state as swing state (equals one) if the winning margin is less than or equal to 10 percent, or non-swing state (equals zero), otherwise.[13]

An additional concern may be that oil producing states are more prone to the risk of violence due to environmental degradation and resource control agitations by armed groups such as the Movement for the Emancipation of the Niger-Delta (MEND). Interestingly, the Federal Government special amnesty programme launched in 2009 to disarm, demobilize and reintegrate the ex-agitators, as well as the elevation and subsequent election of Dr Goodluck Jonathan to the office of the President following the death of the former President in 2010, brought relative stability to the region. Nonetheless, we include the lagged number of violent events occurring in each state to control for the potential use of intergovernmental transfers for counter-insurgency purposes. Geo-referenced conflict event data have been aggregated at the quarterly and state level using the Armed Conflict Location and Event Dataset (ACLED). A conflict event is defined as a single altercation, where force is used between one or more politically organised groups at a particular time and location (Raleigh et al., 2010). Lastly, similar to Burgess et al. (2015), we assess the importance of ethnic and religion favouritism in determining intergovernmental transfers, and political support in the second-stage. The co-ethnic and religion variables are constructed as dummy variables that take the value of one for states where at least 50% of the population has the same ethnic affiliation and religion as the incumbent President.

[11] Swing states or “battleground" states are states in which no single party or candidate has overwhelming support. Interestingly, while oil-producing states are more likely to have an electorate supportive of the incumbent, mean comparisons indicates that such states are also less likely to be defined as aligned or swing.

[12] In the case of an emergency rule, the Nigeria constitution empowers the President to replace an elected Governor with a Sole Administrator who oversee the affairs of the state for a limited period of three months. While a state of emergency was declared in Borno state where “Boko Haram" crisis was rife, the elected Governor remains in office through out the period.

[13] We use this cut-off value because electoral race in Nigeria are not usually very “tight" in most states, hence by using a 10% cut-off value, we reduce the risks of having few states as swings. Additionally, we increase the cut-off value to 20% to see if this affect our results; although not reported here, the results are robust to this alternative definition. Using a winning margin of less than or equal to 20% do not substantially alter our results.

In the second stage equation, we estimate the impact of transfers on electoral outcomes. Given that elections are held every four years, we consider a bootstrap method in the second stage regression, due to the small number of clusters. Standard errors are clustered at the state level using Cameron et al. (2008)'s wild bootstrap method.[14]

$$electoutcome_{s,t} = \gamma \ln(\widehat{transfers}_{s,t}) + \theta' X_{s,t-1} + \alpha_s + \gamma'_{s,t} + \delta_t + \varepsilon_{s,t} \quad (2.3)$$

Where $electoutcome_{s,t}$ refers to the vote margin between the incumbent (central) party and the other opponent in the Presidential elections. In alternative specifications, we use the percentage of votes share of the incumbent or the log of the absolute number of votes for the ruling party in the Presidential elections. Electoral data was obtained from the Independent National Electoral Commission. The timespan of the resulting dataset includes three elections periods, i.e. 2007, 2011 and 2015. In Figure A 2.3, we summarize the political and leadership transitions in Nigeria from 1999 to 2015. $\widehat{transfers}_{s,t}$ are the VAT transfers from the Federal government to the state s received in the quarter prior to the election, predicted by the first-stage regressions. Similar control and fixed effects are used. Table A 2.1 of the Appendix also summarizes the main variables of our analysis.

2.3.2 Threats to Identification Strategy

A major identification concern is the validity of the instrumental variable. To be considered exogenous, two conditions need to be met. First of all, the sub-national variation in oil production should be orthogonal to the allocation of intergovernmental transfers or any time-varying omitted variable that affects election. To that purpose, we use the share of oil production prior to the period of investigation, i.e. in 2003 (and alternatively averaged between 2003 and 2005). Second, oil prices should be exogenous to shocks occurring within Nigeria. We, therefore, use the West Texas Intermediate price taken from FRED. Oil price is normalised to 100 for the first month of 2007. As pointed by Abidoye and Cali (2015) and Fenske and Zurimendi (2017), oil prices can be considered as exogenous since Nigeria accounts for less than 4% of world oil production. In our main results, we use the three-month lagged average price index. However, to allow for cumulative effects and changes in expectation, we check the robustness of our results to

[14] Given the small number of clusters (n = 36) and the use of predicted regressors originating from our first-stage regressions, which might lead to underestimation of within-group correlation, the wild bootstrap method produce estimators that are robust to heteroskedasticity (Cameron et al., 2008)

alternative price constructions: the use of 6, 9 and 12 months moving averages and the use of anomalies compared to the long-term mean value (January 1986 to December 2006).

The second condition relates to the exclusion restriction, i.e. oil price variations should not affect political variables through another channel than transfers. Given the importance of transfers in state budgets (on average 80%), there is little scope for other budgetary mechanisms. However, we may be concerned that variations in oil prices have direct effects on state-level oil production and therefore on state-level economic activities. While we do not have quarterly state-level data on GDP per capita for the period of our study, we nonetheless assess further that identification threat. To that purpose, we use quarterly cumulative precipitation and temperature anomalies (that is, deviations from the long-term quarterly mean defined from 1950, divided by the long-run quarterly standard deviation) to proxy for changes in economic activities. Since agriculture accounts for about 60% of Nigeria's GDP, rainfall and temperature anomalies occurring in each state can be considered as a reasonable proxy for change in economic activities. Cumulative precipitation and average temperature are constructed based on climatic data provided by University of East Anglia Climatic Research Unit (UEA-CRU 2013). The UEA-CRU time-series datasets report average temperatures and total precipitation by months at data points of a high-resolution grid (of 0.5×0.5 degree), which are based on measurements from weather stations distributed around the world (Harris et al., 2014; Mitchell and Jones, 2005).[15] As described in the next section, we also do not find any evidence of a direct link between oil windfalls and economic activities, proxied by night light densities.

Another concern is that oil windfalls would affect voting behaviour through more subtle channels like the provision of public goods. We would like first to stress that it is not necessarily the case that the impact on the provision of public goods and local economic development will be positive. Michaels (2011) finds a positive impact of oil windfalls on long-run economic development in the U.S. On the contrary, in a middle-income country like Brazil, Caselli and Michaels (2013) find no significant improvement in the provision of public goods, infrastructure and household income following an increase in oil revenues in oil-rich municipalities in Brazil. Such results are in sharp contrast with the reported increase in spending on public goods and services, which the authors claimed, might result from a combination of patronage or rent sharing and embezzlement by officials. Although Nigeria is characterised by a relatively weak governance system, the literature is too limited to claim with very high confidence if the situation in Nigeria is more likely to be similar to the US case featured by Michaels (2011) or the Brazilian case in

[15] We transform the gridded UEA-CRU temperature and precipitation data to one (centered) data point by state.

Caselli and Michaels (2013). Despite the inconclusive evidence from the literature, the short-run effects of oil windfalls on local GDP and the real income of the voters remain a concern. In this regard, we indirectly assess the importance of unobserved income shocks following large oil windfalls by investigating how oil windfalls affect socio-economic outcomes. We further discuss the issue in section 2.4.2.

Moreover, given the possible strategic use of intergovernmental transfers for political reasons, we may be concerned that the political characteristics of states may also be correlated with omitted variables at the state level. To reduce the problem of omitted variables, we take advantage of our unique dataset in several ways. First, we restrict the transfers variable to formula-based grants allocated by the central government to the 36 states of Nigeria. Controlling for the criteria used to allocate funds, such a restriction should limit the risk of omitted factors affecting both the dependent variable and the main variables of interest. It basically reduces the risk that omitted variables, including time-varying state-level changes, complicate the causal identification. Second, we further introduce state fixed effects, α_s, controlling for unobserved time-constant heterogeneity at the state level. For instance, the distance to the capital is likely to confound the investigated relationships. Stromberg (2004) shows, for instance, that the use of state fixed effects in his study of the New Deal in the US changes the previous support for the swing state hypothesis. We also introduce time specific dummies δ_t, to account for unobserved time effects. Third, we lag our political variables to mitigate the simultaneity issue between voting behaviours and inter-governmental transfers. Said differently, our political variables (i.e. alignment and swing) are defined based on the last election. The descriptive statistics of the main variables of interest can be found in Table 2.1.

2.4 Results

2.4.1 Transfers and Voting Behaviour

Panel A of Table 2.2 reports the first stage results. There is a positive relationship between oil windfalls and VAT transfers. This relationship is robust across various specifications, i.e. whether we include year, state, quarterly fixed effects, state-specific time trends, and control variables. A 10% increase in oil windfalls translates into a rise in VAT transfers by about 1.99% to 2.08% (i.e. columns (4) to (6) of Table 2.2). Table 2.2 also illustrates the strength of the oil windfalls as an instrumental variable. The

Kleibergen-Paap rk Wald F statistics ranges between 14.78 and 18.22, well above the Stock and Yogo (2005) critical values with 10 percent absolute bias.[16]

Panel B of Table 2.2 provides the second stage results. Columns (1) to (2) report the baseline regressions with only year and state fixed effects, and state-specific time trends, respectively, while columns (3) to (6) includes the political and socio-economic controls. Across these various specifications, we find a positive and statistically significant relationship between VAT transfers and the margin of vote obtained by the incumbents in the Presidential elections. Specifically, the baseline specification in column (1) and (2) indicates that a 10% increase in VAT transfers to states would increase support for the incumbents by 64.23 and 60.11 percent, respectively. However, this impact reduces to between 44.76 and 56.60 percent, respectively, when we control for the political characteristics of states in column (3), and the state majority sharing the same religion and ethnicity with the incumbent President in column (4). To increase the precision of our estimates, we further control for states socio-economic characteristics that may influence both the allocation of transfers and voting behaviours in columns (5) and (6), respectively. The results suggests that a 10% increase in VAT transfers increases the margin of vote scored by the incumbent President by 48.47 (column 5) and 49.31 (column 6) percent, respectively.

The 2SLS estimates radically differ from the OLS estimates presented in Panel C of the same Table. An explanation for such a bias towards zero would be that transfers are targeted towards swing states where electoral victory is uncertain. The coefficients of the political variables (i.e. alignment and swing) in the first-stage regressions (see Table A 2.2) back such an explanation. Interestingly, splitting our sample between states that are initially defined as swing and non-swing confirms our presupposition. Although less precisely estimated as a result of the smaller sample sizes, Panel A of Table 2.3 indicates that transfers help to buy more votes for the incumbent in swing states, compared to non-swing states (Panel B of Table 2.3). Another explanation may be related to the Local Average Treatment Effect (LATE) interpretation of the IV estimates (Angrist and Fernández-Val, 2013). The positive impact of transfers on incumbent votes may be driven by specific circumstances in oil-producing states, limiting the external validity of our analysis. We cannot definitely reject that possibility, but simple mean comparisons do not indicate that oil-producing states are more likely to be swing or non-swing states. Similarly, our first-stage results are

[16] As an identification check, we have experimented with alternative instrumental variables, including the use of 6, 9 and 12 months moving averages and the use of anomalies. The coefficient on oil windfalls remains positive but provides weaker first-stage estimates in the case of the 9 and 12 months moving averages. We also do not find any evidence that future oil windfalls affect transfers, strengthening our confidence on the exogenous nature of our instrumental variable.

similar when we split the samples between aligned and non-aligned states in Section 2.4.4 suggesting that our analysis is not likely to capture a LATE effect.

2.4.2 Local Effects of Oil Production

The existence of direct local effects of oil windfalls would invalidate the exclusion restriction in our two stage framework. To explore the plausible nature of these identification threats, we assess the impact of oil windfalls on other development indicators. First, we regress night light densities on oil windfalls occurring either the same year or the preceding year. In Panel A and B of Table 2.4, we report the regression results for the whole period for which the nightlights data are available, while in Panel C and D, we focus on the period of our study only. The results in Table 2.4 does not indicate any direct effect of the oil windfalls on night light density. Second, we indirectly explore how unobserved income shocks following large oil windfalls affects standard health outcomes. On the one hand, we can assume that such income shocks would translate into one of the most reliable development indicators, the level of malnutrition. There is indeed a large literature seeking to compare the health outcomes for cohorts differently exposed to shocks in early childhood in contexts as diverse as natural disasters, weather variations (Maccini and Yang, 2009), conflict (Bundervoet et al., 2009), famine (Currie and Vogl, 2013). We borrow from that literature in estimating how oil windfalls may directly affect children's health.

Exploiting the Demographic Health Surveys from 2008 and 2013, we assess how the outcome of individual i born in state s during the first 12 months of life is affected by oil windfalls, compared to individuals from the same cohort differently exposed to the oil windfalls. More specifically, we estimate the following state and birth cohort fixed effect regressions:

$$Y_{i,s,t} = \alpha_s + \delta_t + \beta Oilwin_{s,t} + \varepsilon_{s,t} \tag{2.4}$$

Where $Y_{i,s,t}$ refers to the health outcome of child i born in state s at time t. We focus on two of the most widely used nutrition outcomes, the height-for-age z-scores (HAZ) and the weight-for-age z-scores (WAZ). While the former is likely to capture long-term health outcomes, the later is likely to look at potential short-term responses to oil windfalls. Panels A and B of Table 2.5 show the results for the effects of oil windfalls on children's HAZ and WAZ scores, respectively. Specifically, the baseline specifications reported in column (1) indicates a null effect of oil windfalls on children's HAZ and WAZ-scores, respectively. To increase the precision of our estimates, we include climatic and violence controls, children and parent's characteristics that may potentially affect children's health outcomes (columns (2) to (4)). The results in column (4) indicates that oil windfalls occurring during the year of birth have significant but negative effects on children's HAZ and WAZ-scores. The relationship is even more negative when we include state-specific time trends to control for potential differences in health trends across Nigerian states (column 5). Lastly, at some cost of reducing much variation and potentially changing the population of interest, we follow recent trends in the literature (see Alderman et al., 2006), that seek to compare siblings by introducing mother fixed effects in column (6). Our results remain negative but becomes insignificant implying that oil windfalls do not seem to have improve children's health outcome in the period of our study. We also test the robustness of the results to a relative variation with respect to the critical period of child development. Based on the month of birth of a child, we assess the impact of oil windfalls occurring during the first 12 months of life on the child's health outcome. Panels C and D of Table 2.5 indicate that across various specifications, oil windfalls occurring during the first twelve months of life do not affect children's health or at best, have a negative impact on WAZ-scores. In any case, our results reject the risk that oil windfalls would directly translate into more votes for the incumbent because of improved local economic development.

Furthermore, we should acknowledge another concern that oil windfalls may be associated with the collection of more internal sources of revenues (e.g. taxes) to be spent on local public goods and therefore affecting the electoral outcomes through another channel (voters' satisfaction). Such channel would not be very consistent with the lack of developmental impact of oil windfalls reported above. That would also contradict the lack of impact of intergovernmental transfers on local public goods discussed in Section 2.4.4. Moreover, internal revenues are quite small as a share of total consolidated revenue. As pointed in Section 2.2, internally generated revenue account for less than 20 percent of the total consolidated revenue.[17] It is not even sure that internal revenue and VAT transfers would be positively correlated. Local authorities may even have less incentive to collect their own revenue in case of windfall and related additional VAT transfers.

Lastly, it is interesting to note that the reduced-form estimation gives not only significant coefficients of interest (Panel D of Table 2.2) but also very similar voting responses to variation in the oil windfalls (compared to the 2SLS combined effects). That is reassuring with respect to the risk of weak instruments and the exclusion restriction (Angrist and Krueger, 2001).

[17] Our results are robust to the exclusion of Lagos and Rivers States, which constitute exceptions with high shares of total internally generated revenues (see details in Section 2.4.3).

2.4.3 Robustness

The above results rely on a number of specification choices. We, therefore, examine the robustness of our results to (1) alternative specification of the dependent variable, (2) alternative definition of our main variable of interest, (3) controlling for past elections, and (4) changes in the analytical sample. Table 2.6 provides a summary of the main model specification and a selected set of alternative specifications.

Using an alternative dependent variable (i.e. the percentage of vote share and the absolute number of valid votes cast for the incumbent) does not alter our results considerably. The impact of higher VAT transfers on the percentage vote share and the absolute number of valid votes cast for the incumbent President in the national elections remains positive and marginally significant (Panels B and C of Table 2.6). The explanatory power of the two alternative variables, however, are much lower. An explanation for this may be that incumbent politicians care more about winning a simple majority rather than a high share of votes, and hence strategically target those states with high numbers of registered voters (Veiga and Veiga, 2013).

In addition, the results of the preferred model remain robust to alternative definition of our main variable of interest. In Panel D of Table 2.6, we use the log of net transfers, which is the gross statutory allocation plus 13% derivation for oil producing states less contractual obligation of states.[18] However, the first stage regression results presented in Table A 2.17 provide weaker instruments when control variables are included.[19] We also use the gross statutory transfers that exclude the 13% derivation for oil-producing states as a form of falsification test. With very weak first-stage regressions, gross statutory transfers do not affect voting behaviours as soon as auxiliary control variables are included. Given that all revenue from oil exports above the budgeted oil price are deposited in the Excess Crude Account or Sovereign Wealth Fund, we do not expect oil windfalls to have any significant effect on gross transfers. Indeed, the first stage results reported in Table A 2.18 confirm our presumption.

The estimation results are also robust to using the average oil production between 2003 and 2005 as weight in the construction of the instrumental variable (Panel E of Table 2.6), as well as controlling for past votes cast for the incumbent (Panel F of Table 2.6). Furthermore, we change the definition of oil-producing states by classifying Lagos and Ogun, which are considered as off-shore oil-producing

[18]The gross statutory allocation is the main component of the federal allocations, determined strictly in accordance with the horizontal allocation formula.

[19]The Kleibergen-Paap Wald F-Statistics is below the rule-of-thumb of 10 (Stock and Yogo 2005) when quarter fixed effects are included. However, such a just-identified equation is median-unbiased and therefore unlikely to be subject to weak instrumentalization (Angrist and Pischke, 2009).

states, as non-oil producing states. In this case, we find a slightly larger impact of transfers on electoral support for the incumbent (Panel G of Table 2.6). One possible explanation for this may be related to the political sophistication in these two states. For example, Lagos state, which is considered an economic hub of Nigeria, has a burgeoning middle class that are less likely to be constrained by ideological attachment to parties and individual leaders or engaged in a cash-for-vote exchange. We further check the robustness of our main results to the exclusion of Lagos and Rivers states, which contribute high shares of total internally generated revenues to the Federation Account, from the analysis. The results, reported in Panel H of Table 2.6, indicates a lower effect compared to the benchmark model. An explanation may be attributed to the size of these two states.[20]

Finally, we introduce a quarter-specific effect prior to elections in order to explore the electoral dynamics of transfers. While we do find a higher effect at the quarter just before the election, the magnitude of the difference remains very small. This effect echoes Veiga and Veiga (2013), who find that voters do reward increases in government spending in the period close to elections, but not over a full election cycle. Unfortunately, the lack of transfer data prior to 2007 does not allow us to explore further the role of political cycles in affecting the relationship between transfers and electoral support for the incumbent.

2.4.4 Evidence of Vote Manipulation?

Political return from the incumbent may come from the efficient use of these funds to provide local public goods. For example, voters might be rewarding the “good" use of transfers by the incumbent in providing education, health and physical infrastructure. It is important to point out that such government spendings are unlikely to be decided within the quarter prior to the elections on which our identification relies on. To back up this intuition, we further test that alternative channel in two ways.

First, if such “public good” channel would explain our results, it would not matter whether the governors are politically aligned or not. Nonetheless, Panel C and D of Table 2.3 indicates that transfers help to support the incumbent only when governors are aligned to the President’s party. That indirectly gives support to a mechanism where rule-based intergovernmental transfers are subject to manipulation for political purposes.

[20] However, in an alternative specification, we weight the states by their initial population. While our results remain qualitatively similar, they become less efficient with the inclusion of nightlights as economic controls. The reason is that it gives less weight to oil producing states, which are in general and with the exception of Lagos and Rivers, less populated.

Another way to shed light on the manipulative nature of intergovernmental transfers is to see whether such transfers translate into improved education, health and physical infrastructure. To that purpose, we test whether oil-induced variations in VAT transfers improve access to public goods. In particular, we assess the probability to have access to water, sanitation services and electricity, together with the wealth index defined at the household level based on the Demographic Health Surveys from 2008 and 2013. Across year and state fixed effects specifications shown in Table 2.7, we do not find any statistical links between transfers occurring the quarter prior to election and these indicators for access to local public goods.[21]

From a qualitative point of view, that is not really surprising since it would require transfers to materialize into public investment in a relatively short period of time. We indeed exploit variations in transfers occurring only during the quarter prior to the election. But even when we conduct the analysis using transfers occurring two quarters before the election, we do not find any statistical impact of transfers on local public good provision. However, we acknowledge that the absence of evidence is not evidence of absence and that our results are only an indirect support for manipulation. Nonetheless, we believe that the mechanism through which exogenous variation in transfers would translate to investments in public good provision is less obvious in an economy like Nigeria with weak governance system.

Another explanation for the null impact might be that oil-induced variations in VAT transfers are positively correlated with rent sharing and embezzlement by corrupt politicians (Caselli and Michaels, 2013). We indeed admit that corruption may be a salient feature in Nigeria. While we do not have data on corruption to be able to assess further that channel, we expect that if oil windfall is associated with corruption aiming at increasing personal wealth, such corruption (when known) will affect the vote for the incumbent negatively.[22] That is exactly what happens to former President Goodluck Jonathan in the 2015 Presidential elections. On the other hand, if such corruption is more salient in oil-producing states, it would mean that we are capturing a lower-bound estimate.

[21] Those results are obtained based on regressions at the household level, allowing to control for the socio-economic composition within states. Not surprisingly, similar results are obtained when the development indicators are aggregated at the state level.

[22] See Chong, et al. (2012) for a review of literature on scandals and voter behaviour.

2.5 Conclusions

Recent developments in the theoretical and empirical literature suggest that partisan or opportunistic governments use transfers to increase their chances of re-election. Thus, to constrain political manipulation of fiscal policies, many countries like Nigeria, Brazil, Ghana, Japan have introduced a formula-based intergovernmental system based on verifiable and objective criteria. However, a continuing debate exists on whether such institutional arrangements are efficient in limiting political manipulation, especially in countries with weak governance system and clientelistic framework. This study argues that such a system is not immune to political manipulation. Using data from Nigeria, we showed that centralised rule-based transfers in the form of redistributing VAT revenues from the central government to the States was used to purchase political support for the incumbent government in the Presidential election. Our main result indicates that a 10% increase in VAT transfers increases the margin of votes scored by the incumbent President by 49.31 percent. The result is remarkably robust across a large set of alternative specifications.

Although with the data at our disposal, we are unable to prove directly manipulative behaviour, our result suggests an indirect channel in which oil-induced variations in transfers do not translate to investments in public good provisions but increased support for the incumbent only when the governors are aligned to the President's party. This gives credence to a mechanism in which large increases in natural resource rents increase political power and the ability to buy votes (Robinson et al., 2014). Our study has some interesting implications. First, a rule-based transfer system in which the central government determines the distributable pool or the total amount of transfer obscurely encourages patronage politics. Indeed, the dearth of data on social development factors and the lack of transparency in the data revision process might have strengthened the process for political manipulation. Second, the use of transfers to buy electoral support diminishes the ability of the state government to provide local public goods and creates a clientelistic setting where governors who are aligned with the incumbent President can be rewarded for their support. The way the direct redistribution of oil windfalls to citizens, as proposed, e.g. by Moss et al. (2015) under a oil-to-cash scheme, may reduce such perverse effects remains largely unanswered. Lastly, our analysis underlines the need for an extensive dataset that would allow researchers interested in this subject to assess further the precise mechanism through which centralised rule-based transfers may be manipulated to buy political support.

Descriptive statistics

Table 2.1 Descriptive Statistics

Variables	Observations	Mean	Std. Dev.	Min.	Max.
Percentage of votes share	108	0.638	0.268	0.051	0.999
Num. of votes share (thousands)	108	635.49	404.519	25.526	2003.521
Vote margin	108	3.805	0.728	1.889	4.610
Alignment	1152	0.687	0.464	0	1
Swing	1152	0.156	0.363	0	1
Co-ethnic	1152	0.187	0.390	0	1
Religion	1152	0.500	0.500	0	1
Population (thousands)	1152	4503.67	2005.585	1753.946	12652.398
Primary enrolment (thousands)	1152	557.329	335.487	36.508	2040.945
Secondary enrolment (thousands)	1152	163.048	105.69	26.507	694.886
Violence	1152	2.759	6.937	0	84
Gross transfers	1152	1563.536	739.727	358.164	4806.2
Net transfers	1152	2084.564	2134.878	254.031	17341.395
VAT transfers	1152	353.576	180.534	104.435	1733.413
Temperature anomalies	1152	27.351	1.658	23.186	32.785
Rainfall anomalies	1152	107.753	88.893	0	472.133
Avg. 3 months oil price (no weights)	1152	277.899	60.788	139.51	402.969
Avg. 3 months oil price (weighted by 2003 production)	1152	5.468	13.654	0	88.608
Avg. 3 months oil price (weighted by 2003/05 production)	1152	4.553	10.583	0	63.781
Avg. 6 months oil price (weighted by 2003 production)	1152	5.476	13.606	0	83.935
Avg. 6 months oil price (weighted by 2003/05 production)	1152	4.560	10.545	0	60.418
Nightlights (thousands)	1152	61.613	81.707	1.633	360.083

Source: INEC, NBS, ACLED, FMOF, FRED, and DMSP .

Note: Vote margin is expressed in log form .

Transfers are measured in Naira per capita at 2007 prices .

Table of Results

Table 2.2 Main results

Panel A. ***First-stage Estimates***	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.	**Log VAT Transfers**					
Oil windfalls	0.189***	0.196***	0.206***	0.199***	0.208***	0.208***
	(0.018)	(0.020)	(0.019)	(0.022)	(0.023)	(0.023)
Kleibergen-Paap rk Wald F	18.22	16.25	17.75	14.78	17.18	17.20
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarterly FE	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	No	Yes	Yes	Yes	Yes	Yes
Observations	1,152	1,152	1,152	1,152	1,152	1,152
Dep. var. (Panels B, C and D)	**Vote margin**					
Panel B. ***2SLS. Estimates***						
Pred. Transfer	6.423**	6.011**	4.476**	5.660***	4.847**	4.931*
	(2.935)	(2.504)	(1.722)	(1.799)	(1.876)	(2.455)
Adj. R-squared	0.337	0.535	0.654	0.736	0.737	0.788
Panel C. ***OLS Estimates***						
VAT transfers	-0.022	0.158	0.205	0.315	0.273	0.400
	(0.463)	(0.361)	(0.527)	(0.659)	(0.972)	(0.782)
R-squared	0.552	0.552	0.717	0.764	0.781	0.783
Panel D. ***Reduced form Estimates***						
Oil windfalls	1.177**	0.922**	1.041**	1.126**	1.009*	1.027*
	(0.561)	(0.396)	(0.438)	(0.464)	(0.549)	(0.576)
R-squared	0.572	0.730	0.739	0.772	0.785	0.787
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	No	Yes	Yes	Yes	Yes	Yes
Observations	108	108	108	108	108	108
Controls (for all panels):						
Alignment and swing	No	No	Yes	Yes	Yes	Yes
Co-ethnic and Religion	No	No	No	Yes	Yes	Yes
Population	No	No	No	Yes	Yes	Yes
Primary and secondary enrolment	No	No	No	Yes	Yes	Yes
Violence	No	No	No	Yes	Yes	Yes
Temperature and rainfall anomalies	No	No	No	No	Yes	Yes
Nightlights	No	No	No	No	No	Yes

Notes: Standard errors clustered at the state level in parentheses.

All variables (except alignment, swing, co-ethnic and religion) are in log form.

The same regressions are estimated in both panels.

* significant at 10%, ** at 5%, *** at 1%.

Detailed results are provided in Tables A 2.2, A 2.3, A 2.4, and A 2.5 of the Appendix.

Table 2.3 Alternative samples definition

Panel A. ***Swing states***	(1)	(2)	(3)	(4)
Dep. var.		**Vote Margin**		
Pred. Transfer	10.836**	10.369*	8.581*	10.257
	(4.411)	(5.761)	(5.208)	(7.820)
Observations	42	42	42	42
Adj. R-squared	0.293	0.307	0.348	0.359
Panel B. ***Non-swing states***				
Pred. Transfer	3.302*	4.665**	1.794**	0.242**
	(1.718)	(2.344)	(0.866)	(0.116)
Observations	66	66	66	66
Adj. R-squared	0.511	0.636	0.682	0.704
Panel C. ***Align states***				
Pred. Transfer	3.539***	3.240**	2.284*	2.285*
	(1.221)	(1.537)	(1.356)	(1.340)
Observations	69	69	69	69
Adj. R-squared	0.692	0.712	0.713	0.717
Panel D. ***Non-align states***				
Pred. Transfer	16.891	10.953	12.217	10.871
	(15.040)	(12.327)	(9.649)	(8.298)
Observations	39	39	39	39
Adj. R-squared	0.215	0.391	0.421	0.378
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes
Controls (for all panels):				
Co-ethnic and Religion	No	Yes	Yes	Yes
Population	No	Yes	Yes	Yes
Primary and secondary enrolment	No	Yes	Yes	Yes
Temperature and rainfall anomalies	No	Yes	Yes	Yes
Violence	No	No	Yes	Yes
Nightlights	No	No	No	Yes

Notes: Standard errors in brackets are clustered at the state level, using wild-bootstrapping as proposed by Cameron et al. (2008).

* significant at 10%, ** at 5%, *** at 1%.

Detailed results are provided in Tables A 2.6 and A 2.7 of the Appendix. The related first-stage results are provided in Tables A 2.8 and A 2.9 of the Appendix.

Table 2.4 Exclusion Restriction: Oil windfalls and Nightlights

Panel A. ***Full sample***	(1)	(2)	(3)	(4)
Dep. var.	**Log Nightlights**			
Oil windfalls	-0.078	-0.070	-0.036	0.009
	(0.066)	(0.063)	(0.055)	(0.052)
R-squared	0.736	0.739	0.694	0.711
Panel B. ***Full sample***				
Oil windfalls *(t-1)*	-0.073	-0.064	-0.036	0.009
	(0.067)	(0.063)	(0.054)	(0.045)
R-squared	0.735	0.738	0.694	0.711
Observations	792	792	454	454
Panel C. ***Period of study***				
Oil windfalls	0.068	0.039	0.048	-0.003
	(0.139)	(0.167)	(0.175)	(0.048)
R-squared	0.686	0.689	0.682	0.735
Panel D. ***Period of study***				
Oil windfalls *(t-1)*	-0.112	0.031	-0.056	0.051
	(0.220)	(0.145)	(0.141)	(0.072)
R-squared	0.661	0.689	0.682	0.735
Observations	324	288	237	237
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes
Controls (for all panels):				
Temperature and rainfall anomalies	No	Yes	Yes	Yes
Violence	No	No	Yes	Yes

Notes: In panel C and D, we are also able to control for population, primary and secondary school enrolment.

Standard errors in brackets are clustered at the state level.

All variables are in log form.

The same regressions are estimated in both panels.

* significant at 10%, ** at 5%, *** at 1%.

Detailed results are provided in Tables A 2.10 and A 2.11 of the Appendix.

Table 2.5 Exclusion Restriction: Oil windfalls and Health outcomes

Panel A.	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.				**HAZ-score**		
Oil windfalls during the year of birth	-0.146	-0.071	-0.335	-0.487*	-1.060***	-0.293
	(0.206)	(0.269)	(0.272)	(0.267)	(0.353)	(0.399)
R-squared	0.146	0.146	0.151	0.192	0.203	0.708
Panel B.				**WAZ-score**		
Oil windfalls during the year of birth	-0.119	-0.133	-0.317*	-0.333*	-0.686**	-0.385
	(0.161)	(0.179)	(0.172)	(0.170)	(0.255)	(0.263)
R-squared	0.147	0.147	0.149	0.182	0.192	0.712
Observations	30,826	30,826	26,721	25,398	25,398	10,499
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Temperature and rainfall controls	No	Yes	Yes	Yes	Yes	Yes
Violence	No	No	Yes	Yes	Yes	Yes
Individual controls	No	No	No	Yes	Yes	Yes
Parent's controls	No	No	No	Yes	Yes	No
State-specific time trends	No	No	No	No	Yes	Yes
Mother FE	No	No	No	No	No	Yes
Panel C.				**HAZ-score**		
Oil windfalls during the first 12-months of birth	0.358	0.405*	0.625	-0.126	-0.182	0.990
	(0.232)	(0.218)	(0.374)	(0.258)	(0.353)	(0.968)
R-squared	0.155	0.154	0.172	0.200	0.211	0.735
Panel D.				**WAZ-score**		
Oil windfalls during the first 12-months of birth	0.107	0.084	0.073	-0.548*	-0.537*	0.553
	(0.182)	(0.218)	(0.228)	(0.272)	(0.310)	(0.681)
R-squared	0.149	0.149	0.184	0.209	0.216	0.726
Observations	30,826	26,932	9,238	8,787	8,787	1,856
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Month of birth FE	Yes	Yes	Yes	Yes	Yes	Yes
Temperature and rainfall controls	No	Yes	Yes	Yes	Yes	Yes
Violence	No	No	Yes	Yes	Yes	Yes
Individual controls	No	No	No	Yes	Yes	Yes
Parent's controls	No	No	No	Yes	Yes	No
State-specific time trends	No	No	No	No	Yes	Yes
Mother FE	No	No	No	No	No	Yes

Notes: Individual controls include child's sex, age (in months) and birth order. Parent's control include mother and father's age (in months), educational attainments, occupation and total number of children under 5.

Standard errors in brackets are clustered at the state level.

R-squared retrieved from regressions with standard errors clustered at the state level.

* significant at 10%, ** at 5%, *** at 1%.

Detailed results are provided in Tables A 2.12 and A 2.13 of the Appendix.

Table 2.6 Robustness to alternative samples and dependent variables

Dependent Variable	**Vote Margin**				
	(1)	(2)	(3)	(4)	(5)
Panel A. Main results	6.011**	4.476**	5.660***	4.847**	4.931*
	(2.504)	(1.722)	(1.799)	(1.876)	(2.455)
Panel B. Using incumbents' % vote shares	1.640*	1.470*	1.731**	1.283*	1.285*
as dep. var.	(0.822)	(0.772)	(0.802)	(0.667)	(0.672)
Panel C. Using number of valid vote	2.916	2.494*	2.020	1.497*	1.495*
as dep. var.	(4.256)	(1.371)	(1.458)	(0.817)	(0.858)
Panel D. Using net transfers	8.568**	6.498**	7.934***	6.541**	6.669*
	(3.569)	(2.499)	(2.522)	(2.531)	(3.321)
Panel E. Using 2003-2005 oil productions	6.130**	4.657***	5.844***	4.955***	4.795**
as weight	(2.466)	(1.582)	(1.857)	(1.650)	(2.323)
Panel F. Controlling for past elections	6.598	4.546**	5.120**	6.250**	5.704*
	(4.064)	(2.165)	(2.136)	(2.709)	(2.859)
Panel G. Classifying Lagos and Ogun	4.733**	3.559**	6.389**	4.468**	5.373*
as non-oil producing states	(2.062)	(1.399)	(2.372)	(2.149)	(2.699)
Panel H. Dropping Lagos and Rivers states	5.138**	4.378***	5.489**	4.110**	4.308*
	(2.201)	(1.541)	(1.969)	(1.727)	(2.279)
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes
Controls (for all panels):					
Alignment and swing	No	Yes	Yes	Yes	Yes
Co-ethnic and Religion	No	No	Yes	Yes	Yes
Population	No	No	Yes	Yes	Yes
Primary and secondary enrolment	No	No	Yes	Yes	Yes
Violence	No	No	Yes	Yes	Yes
Temperature and rainfall anomalies	No	No	No	Yes	Yes
Nightlights	No	No	No	No	Yes

Notes: Standard errors in brackets are clustered at the state level, using wild-bootstrapping as proposed by Cameron et al. (2008).

* significant at 10%, ** at 5%, *** at 1%.

Detailed results are provided in Tables A 2.14, A 2.15, A 2.16, A 2.19, A 2.20, A 2.21 and A 2.22 of the Appendix.

Table 2.7 VAT transfers and Public goods

Panel A.	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.			Access to drinking water			
Pred. Transfer	12.878*	13.993**	-1.434	-1.282	3.305	0.920
	(7.052)	(7.108)	(1.344)	(1.470)	(9.763)	(17.902)
R-squared	0.072	0.073	0.075	0.075	0.075	0.101
Panel B.			**Access to sanitation facilities**			
Pred. Transfer	3.934	4.103	1.863	1.493	9.334	5.867
	(7.417)	(6.933)	(1.389)	(1.402)	(9.194)	(8.102)
R-squared	0.140	0.141	0.141	0.142	0.144	0.213
Panel C.			**Access to electricity**			
Pred. Transfer	-3.229	-3.667	-0.029	-0.372	-1.021	-5.216
	(7.272)	(7.816)	(1.523)	(1.445)	(8.376)	(8.617)
R-squared	0.196	0.196	0.196	0.196	0.196	0.283
Panel D.			**Net attendance ratio in primary school**			
Pred. Transfer	24.606***	19.935*	-1.229	-1.622	14.171	8.197
	(8.983)	(11.648)	(3.481)	(2.733)	(15.417)	(12.096)
R-squared	0.528	0.530	0.530	0.530	0.530	0.575
Panel E.			**Wealth index**			
Pred. Transfer	-1.138	0.393	3.101	3.067	25.444	10.260
	(109.487)	(39.208)	(10.607)	(7.662)	(54.728)	(27.791)
R-squared	0.390	0.390	0.390	0.391	0.391	0.555
Year of survey FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,967	69,967	69,967	69,967	69,967	69,392
Controls (for all panels):						
Population	No	Yes	Yes	Yes	Yes	Yes
Primary and secondary enrolment	No	Yes	Yes	Yes	Yes	Yes
Temperature and rainfall anomalies	No	No	Yes	Yes	Yes	Yes
Violence	No	No	No	Yes	Yes	Yes
Nightlights	No	No	No	No	Yes	Yes
Household controls	No	No	No	No	No	Yes

Notes: Household control include household size, sex, age and education of household's head.

Standard errors in parentheses are clustered at the surveys' cluster level, using wild bootstrap method (Cameron et al. 2008).

R-squared retrieved from regressions with standard errors clustered at the state level.

* significant at 10%, ** at 5%, *** at 1%.

Detailed results are provided in Tables A 2.23, A 2.24, and A 2.25 of the Appendix.

Chapter 3

Rainfall inequality, trust and civil conflict in Nigeria

3.1 Introduction

In recent years, there has been an increasing awareness that climate change can have destabilizing effect on societies. Through its effect on crop yields, climate variability has been found to affect the risks of armed conflicts between and/or within various groups in societies (see Fjelde and von Uexkull, 2012; Hsiang et al., 2013; Maystadt et al., 2014). While these claims have sometimes been disputed (Buhaug et al., 2014; Selby, 2014), most of the empirical evidence shows that there exists a strong correlation between climate shocks and violence (for a review, see Burke et al, 2015). Specifically, Schleussner et al. (2016) demonstrates a stronger links for ethnically fractured societies, which are typically more prone to conflicts. An important implication of their analysis is that multi-ethnic countries in regions such as Africa and Asia whose climates are likely to see fundamental shifts in temperature, rainfall, and sea-levels, might be facing fresh threats of violence. Indeed, since the end of the Second World War, nearly two-thirds of intrastate civil war have been fought along ethnic or religious lines (Denny and Walter, 2014; Sambanis, 2001). This already strained relations between ethnic or tribal and religious rivals can be exacerbated by the consequences of climate change. But, what are the mechanisms through which such climatic variations might translate into changing incentives for violence?

In this study, we focus on the case of Nigeria to investigate the relationship between changes in the distribution of rainfall between ethnic groups and armed conflicts prevalence. As a first step, we investigate whether changes in the distribution of rainfall across ethnic groups living within the same state – i.e. largest administrative unit of Nigeria – increase the incidences of civil conflicts within that state. We take the location of the different ethnic groups within a state from the detailed Nigeria Local Government Handbook. We then spatially merge the location of ethnic groups with a high-frequency and high-resolution rainfall data provided by the European Center for Medium-Term Weather Forecasts (ECMWF). Our key measure of "rainfall inequality" between ethnic groups is then constructed following Guariso and Rogall (2017) and is based on the standard Gini coefficient. Our analysis cover 37 states and 19 years, from 1997 to 2015, which is the period for which all our data sources are available.

Our main result indicates that a one standard deviation increase in rainfall inequality between ethnic groups living within a state increases the risks of civil conflict prevalence by about seven percentage points. In the second part of the chapter, we move to investigate the channels through which rainfall inequality may induce higher prevalence of civil conflict. In doing so, we match our ethnicity level information with micro-level data provided by the Afrobarometer. We then construct an ethnic level indicator for general trust; trust in neighbour and government; within-group and between-group trust; government satisfaction; and government corruption. The results suggest that a more unequal distribution of rainfall leads to lower satisfaction with the government and creates mistrust between predominantly farming ethnic groups and those engaged in herding.

Nigeria is an interesting country to consider for at least two reasons. First, it is a highly heterogenous society with more than 300 ethnic groups, a long history of civil conflicts, and currently confronting poor leadership, development challenges, and deep-seated ethnic divisions. The underlying reasons for these divisions have been attributed to the distribution of scarce resources and political power across the various ethnic groups that dot the country's landscape (Papaioannou and Dalrymple-Smith, 2015). Indeed, the perceived dominance of the political and military leaders from the North, and the failure of political leaders to provide an equitable revenue sharing formula has led to the intensity of violent conflicts in recent years.

Secondly, Nigeria is one of the countries identified as a hot spot for climate change, where there is a high possibility of extreme impacts across the different vegetation zones (Müeller et al., 2014). Indeed, it is predicted that "certain parts of the country, specifically the semi-arid North could experience reductions in fresh water availability up to 25-30% due to higher temperature and decreases in rainfall. In contrast, the Niger Delta region in the South is likely subject to more frequent flooding, also due to increased irregularity in rainfall" (Müeller et al., 2014). These climatic challenges could have extreme negative impacts on health, food security, employment, and economic growth, which could, in turn, lead to more violence. Indeed, this sequence is already playing out in a few conflict-prone spots such as the Niger Delta and the arid North-east. Specifically, in recent years there has been increased incidences of violent conflict between predominantly pastoralists and predominantly farming ethnic groups. Data from Armed Conflict Location and Event Data project (ACLED) show that around 1,600 lives were lost to this type of violence in 2015 alone (Baca, 2015). One potential driver of these conflicts is climate-induced competition over water and arable land. To the best of our knowledge, this study represents the first attempt to investigate this link and its underlying mechanisms empirically.

Our paper contributes to the literature in three ways. First, despite a rapidly growing literature on the potential links between climate variability and conflict, little attention has been paid to examining the cause and effect chain. There are some exceptions to this; for example, recent papers by Schleussner, et al., (2016) and Guariso and Rogall (2017) focus on how climatic conditions can increase the risks of armed conflicts in multi-ethnic socities. Specifically, Guariso and Rogall (2017) use a dataset of 214 ethnicities across 42 African countries to demonstrate how increase in rainfall-based inequality between ethnic groups increases the risks of ethnic conflicts, especially among ethnic groups that have recently lost political power. However, their analysis focuses on a specific channel, related to the balance of political power between ethnic groups. There is a growing consensus among policy makers and academics that more research is needed to investigate better how this broad trend translates in practice within specific contexts. This is because much of the evidence that has been presented have been sensitive to the definition of samples and the variable of interest (see Burke et al., 2009; Ciccone, 2011; Miguel and Satyanath, 2011). For this, a more local level analysis is needed. Our study fills this void by focusing on the cause and effect chain through which variations in climatic conditions can affect an ethnically fractionalized society like Nigeria.

Second, our study complement the literature on the relationship between inequality and conflict (see Cederman et al., 2011; Huber and Mayoral, 2014; Kuhn and Weidmann, 2015; Østby, 2008; Stewart, 2005). While Empirical support for this link remain mixed, most of these studies have had to contend with endogeneity issues and severe data constraints, thus inhibiting an empirically robust causal interpretation. For example, study by Cederman et al. (2011) relied on digitized map of economic activity provided by Nordhaus et al. (2006), which has a limited geographical and temporal scope for Sub-Saharan African countries, to construct their horizontal income inequality measure. Moreover, the digital map does not capture informal activities such as subsistence farming, which remain an important source of livelihood to a large segment of African population, hence inducing potential bias in the inequality measurement. Other studies such as Huber and Mayoral (2014); Østby (2008) rely on household surveys, which are not frequently available and thus tend to be noisy and unreliable (Beegle et al., 2012). To that purpose, we construct a measure of inequality using a high-frequency rainfall dataset, which is available at a resolution of 0.5-degree longitude$\times$0.5-degree latitude. Given the spatial and temporal coverage of gridded weather dataset available, we believe that using rainfall data will help to overcome endogeneity concerns and the lack of disaggregated income data.

Lastly, our study also relates to the literature on the link between inequality and trust. Most studies that have examined this relationship have typically struggled to make causal inferences due mostly to endogeneity issues. While recent studies (e.g. Barone and Mocetti (2016); Bergh and Bjørnskov (2011)) tend to focus on instrumental variable approach to address endogeneity, the lack of valid instruments has continued to question causality claims. In that regards, we reappraise the relationship between inequality and trust using our unique measures of rainfall inequality, which can be considered as plausibly exogenous to the determinants of trust. In particular, our analysis explores how inequality induces decline in trust, thus heightening the risks of civil conflict prevalence. By doing so, our paper also contributes to the literature on conflict and trust, which has grown fast in recent years but remain deficient in identifying the precise causal links due to concerns about selection bias and omitted variables (see Bauer et al., 2016; De Luca and Verpoorten, 2015; Rohner et al., 2013).

The remainder of this chapter is organized as follows. Section 3.2 provides a contextual background to the study. Section 3.3 describes the data and empirical strategy, while section 3.4 presents and discusses the results. Section 3.5 concludes.

3.2 Background

Nigeria is a culturally diverse society with a long history of religious, ethnic and civil strives that dates back to the pre-independence era. The amalgamation of Southern and Northern Nigeria in 1914, which hitherto were administered as two autonomous colonies by the British colonial government, to create present-day Nigeria has often been cited as the roots to many of the rivalries that dot the political and social landscape of the country (Papaioannou and Dalrymple-Smith, 2015). After gaining independence in 1960, Nigeria was plunged into a secession crisis with the Eastern part of the country pulling out to create the state of Biafra in May 1967. Perceived marginalisation in the distribution of scarce resources and political power by the ruling Northern elites underlies the main reasons for the secession, which culminated into a full civil war in July 1967.[1]

The war, which has been described as one of Africa's bloodiest civil war with casualties ranging between 1 and 3 million (Akresh et al., 2012), was followed by several years of military rule that suppressed resentments among the different groups. However, with the return to democracy in 1999, the grievances that built up over the decades of military adventurism into governance came to the fore as several restive groups began to emerge across the country. For example, in the oil-rich South-South region, the Movement for the Emancipation of Niger-Delta (MEND) and the Niger Delta People's Volunteers Force (NDPVF) were two militia groups that led violent protests against the Nigeria government, to demand for resource controls and better environmental quality standards (International Crisis Group, 2006). The protests, which later evolved into a full-fledged insurgency in 2006, resulted in several fatalities, kidnappings of oil workers and attacks on oil installations. The insurgency was bolstered by the lack of basic infrastructural facilities (such as electricity, water and hospital) and high rate of unemployment in the region, and continued to spread until June 2009 when the Nigerian government initiated an amnesty program to disarm and reintegrate the militants.

Religious rivalry between Muslims and Christians is another major source of violence in Nigeria. While the 1999 constitution of the Federal Republic of Nigeria classifies it as a secular state, the advancement of religious teachings, especially in most part of Northern Nigeria where Islamic law were introduced, as solutions to political and socio-economic issues, further exacerbated the already tensed relationship between the two major religious groups (Sampson, 2014). Christian communities, particularly those in the affected states, perceived the introduction of Shari'ah (Islamic moral codes) as a threat of "Islamisation" and hence protested against its adoption as state laws. These protests often leads to violent clashes between Muslim and Christians, especially in Northern states such as Kaduna and Plateau where there is a growing Christian population.

In addition, the "Boko Haram" terrorist group, which has unleashed an atrocious campaign against both Christians and Muslims in the North-Eastern part of the country, has further stoked the embers of hatred between the two dominant religions.[2] In particular, the group's stated objective of establishing

[1] The failed state of Biafra was championed by the Igbo – a major ethnic group that resides mostly in the South-Eastern part of Nigeria – and other minority ethnic groups (mostly in Nigeria's oil rich south-south region).

[2] The insurgency has led to over ten thousand deaths, displaced several others from their homes and worsened the already poor economy in the North East.

an Islamic caliphate across Northern Nigeria and its assault on churches heightened religious tensions and pitted neighbours against each other (International Crisis Group, 2014). While the root cause of the insurgency is often attributed to the extra-judicial killing of its leader, the International Crisis Group (ICG) in a report published in 2014, noted that sustained economic hardship, rising inequality and social frustrations have continually helped to foster the growth of extremist groups in Nigeria. Indeed, the failure of political leaders to provide an "equitable" way to distribute limited resources across the different groups in the country; a flawed legal system that allows crimes to go unpunished; widespread poverty; and traditional breakdown in conflict resolution mechanisms underlies many of the violent conflicts Nigeria has experienced since the civil war.

Some of the worst violence involved land disputes between ethnic groups and neighbouring communities, especially those in oil-producing states where land ownership attracts some form of compensation payments from multinational companies (Small Arms Survey, 2005). The situation is not much different in Northern Nigeria where clashes involving herdsmen and farming communities in southern and north central zones have surged in recent years. The root causes for this increase might be attributed to rising population pressures and climatic-induced changes. The expansion of human settlements together with the rapid pace of urbanisation has led to the loss of grazing lands, which have long been designated by the central government as reserved areas, thereby increasing pressure on farmlands and the likelihood of conflicts over water pollution and crop damages (Baca, 2015).

Besides, climate changes have intensified droughts and desertification in the semi-arid Northern part of Nigeria. According to a report released in 2016 by the Nigeria Meteorological Agency, the annual rainy season in the country have reduced by an average of 30 days (i.e. from 150 to 120) over the last three decades. Furthermore, it is predicted that future dry spells, especially in Northern regions, may get worse as the world continues to experience hot streak of temperatures.[3] At the same time, reports by the Food and Agriculture Organisation indicates that 50 to 75% of land areas in the North-East and North-West regions are vulnerable to desertification, and the phenomenon is spreading towards the south at the rate of 0.6*km* per year.[4]

These developments have compelled nomadic herders, most of which are ethnic Fulani from Northern Nigeria, to move southwards in search of water and pastures for their herds (International Crisis Group,

[3]Nigeria Meteorological Agency, *Drought and Flood Monitoring Bulletin,* August 2017.
[4]*FAO Country Programming Framework (CPF) Federal Republic of Nigeria 2013 - 2017.*

2017).[5] As they migrate into lands that are owned by predominantly farming communities, violent conflicts over crop damages or cattle rustling, often erupts. Over the last two decades, this type of violence has increased in both intensity and geographical scope. The Assessment Capacities Projects (ACAPS) reported that there have been at least 360 clashes between farmers and herdsmen in the last five years, resulting in a casualty of approximately 2,400 people in 2016 alone, compared to just 20 battles in the fifteen years before that.[6] With the conflict expanding into southern states, the herders-farmers' crisis continues to pose a major threat to Nigeria's national security and may likely aggravate the already fragile relations among the different ethnic and religious groups in the country, if proactive actions are not taken to address the deadly conflict. In our empirical analysis, we investigate the link between climatic events and conflicts and shed light on the potential channels.

3.3 Data and Empirical Strategy

3.3.1 Data sources

Our sample covers the 37 states of Nigeria (including the Capital city Abuja) over a period of 19 years, from 1997 to 2015. In constructing the dataset, we combine information from several different sources, detailed below.

Conflict variable: Data on conflict was taken from the Armed Conflict Location and Event Data project (ACLED). The ACLED dataset summarizes conflict event by the name of the main actors, location of events, number of fatalities, and event type. Thus, we identify violent events linked to ethnic militia, religious groups, farmers, and pastoralists occurring in each Local Government Area (LGA) or state in Nigeria. We then define civil conflict events as a binary variable, indicating whether a state has experienced a violent event resulting in at least 20 casualties. ACLED provides the most detailed coverage of conflict events currently available. As a robustness check, we also use the UCDP geo-referenced conflict event dataset, which has the relative advantage of covering more time periods. Thus, in using the UCDP, we extend our analysis to cover the period 1990 to 2015, for which the data is available for Nigeria.

[5]The Fulanis are regarded as the world's largest nomadic group, and occupies a large expanse of land from West to Central Africa countries.

[6]The report can be accessed at https://www.acaps.org/country/nigeria/special-reports.

Ethnicity variable: To construct our ethnicity variable, we identify the main, second and third most popular languages in each of Nigeria's 774 Local Government Areas (LGAs) using the 1998 Nigeria Local Government Handbook. The handbook contains information about the historical location of 210 main ethnic groups, spread across the country.[7] We define the borders of each ethnic group using the administrative boundary of the area for which an ethnic group is recorded as the main group in the handbook. Data on administrative boundaries is taken from Global Administrative Areas (GADM). A major concern could be that the construction of our ethnicity variable may not reflect the historical distribution of ethnic groups in Nigeria. To that purpose, we compare our ethnic composition to those recorded in the *Geo-referencing of Ethnic Groups* (GREG) dataset provided by Weidmann, et al., (2010) in an alternative definition.

Rainfall variables: Our rainfall inequality data was constructed based on rainfall data provided by the European Centre for Medium-Term Weather Forecasts (ECMWF) ERA-interim datasets. The ECMWF dataset provides re-analysis of weather data, obtained through a climatic model that combines information from different primary sources, which include weather stations, satellite images and others (Kållberg et al., 2004).[8] The database provides precipitations values at six hourly frequency from 1979 to 2015 at a resolution of 0.5-degree longitude$\times$0.5-degree latitude (corresponding to a pixel size of about 55 square kilometers at the equator). Ethnic groups in our sample covers an average of 12 grid-cells. For the analysis, we focus on rainfall during the growing season, which is when farming and herding activities may become more sensitive to adverse conditions. We follow the same procedures of Kudamatsu et al., (2014), and rely on the Normalized Difference Vegetation Index (NDVI) to define the beginning and end of the plant-growing season at a high resolution of $8 \times 8km$. We then aggregate the information at the level of our rainfall grid cell to obtain the average start and end of the growing season within each cell.[9]

Temperature variables: Data on temperature come from ECMWF ERA-interim datasets at the same frequency and resolution as the rainfall data.

Religious fragmentation and competition variable: We combine data from the Annual Abstract of Statistics published by the Nigeria National Bureau of Statistics and 2009/2010 Nigerian Harmonized Living Standard Survey (HNLSS) to identify the share of the population of the various religious group in the LGA (or state). After that, we construct an ethnic-level (or state-wide) Herfindahl (religious)

[7]The Local Government Handbook has already been used as a good source of data for the spread of ethnic groups across Nigeria (Larreguy and Marshall, 2016).

[8]Given the sparse distribution of the 44 weather stations across the 774 LGA of Nigeria, re-analysis data appears to be the most reliable source of weather-related information for the country.

[9]Figure A 3.1 illustrates how the different data sources was combined.

fragmentation index and religious competition. We define religious competition in each LGA (state) by: $1-|\eta_1-\eta_2|$, where η_1 and η_1 indicates share of the population for the two largest religious groups in the state (or LGA).

State per capita revenue allocation: Data on states' revenue allocation was obtained from Nigeria's Federal Ministry of Finance, and is available only from 2007 onwards. The per capita allocations were estimated using the aggregate allocations to each state.

Trust-related measures: Data on trust comes from the Afrobarometer surveys, which samples the economic, social and political attitudes of citizens aged 18 and above. The surveys are based on random samples stratified by states and are therefore not representative at the level of Local Government Areas (LGAs). We pool all six available rounds, (eight survey years in total covering 1999 - 2015) to obtain a sample of 19,914 respondents from 582 of Nigeria's 774 LGAs.[10] We then construct seven main indicators, namely: general trust; trust in neighbour and government; within-group and between-group trust; government satisfaction; and government corruption. The *general trust measure* is an index that captures to what extent respondents trust the following: government officials, religious organisations, security agencies such as the Army and Police, own and other ethnic groups, own-family and relatives.[11] *Trust in neighbour and government* is an index capturing to what extent respondents trust their neighbour and each of the following: the President, the Legislature, the Local councilor, and the electoral commission, respectively. The Cronbach's alpha scale reliability coefficient for the trust in government scale is 0.72.[12]

Within-group and between-group trust measures: To construct these measures, we first average a four-point ordinal scale asking to what extent respondents trust their own and other ethnic groups, respectively. We then compute a within-group trust measure, that captures the respondents' level of trust in own ethnic group, across the different LGAs of the respondent's ethnic group in a state. Between-group trust measures capture trust between the different ethnic groups living within a state.

The *government satisfaction scale* is a summative scale combining six indicators that the government handles the economy, unemployment, health, education, inflation, and water-related issues very well as opposed to very badly. The scale has a Cronbach's alpha scale reliability coefficient of 0.77. Lastly, the *government corruption scale* combines five indicators that the respondents considers the elected officials

[10]The survey was conducted in 1999, 2001, 2003, 2005, 2007, 2009, 2013 and 2015. The response rate in 2008, for which such information is publicly available, is 72%.

[11]All responses ranges from 0 - 3 but were rescaled from 0 to 1 and then average across respondents of the same ethnicity to obtain an ethnic level index.

[12]The Cronbach's Alpha provides a measure of survey's internal consistency and assess how well a set of variables are related as a group. All responses were then standardized to indicate whether respondents trusts a lot or somewhat in each of the group above.

at the Presidency, National Assembly, and Local Government corrupt or very corrupt. Its Cronbach's alpha scale reliability coefficient is 0.79.

3.3.2 Rainfall-Based Inequality Measures

In constructing our rainfall inequality measures, we follow closely the approach by Guariso and Rogall (2017). Our key variable of interest is the *Between-Group Inequality (BGR)* measure, defined at level of each one of the states in Nigeria and for each year. The measure captures inequality in the distribution of rainfall during the growing season between the ethnic groups living within a State. The BGR is computed as the weighted average of the differences in rainfall among ethnic groups living within the same state, where the weights are given by the relative size of each ethnic group in the following way:

$$BGR_s = \frac{1}{2\tilde{r}_s} \sum_{i=1}^{N_s} \sum_{j=1}^{N_s} \theta_{i,s}\theta_{j,s} \left| r_{i,s} - r_{j,s} \right| \tag{3.1}$$

where N_s refers to the number of ethnic groups located within state s, $\theta_{i,s}$ is the relative size of the ethnic group i in state s, $r_{i,s}$ is the level of rainfall in ethnic group i's homeland, and $\tilde{r}_s$ is the yearly average amount of rainfall in the state.

We also define two additional rainfall-based measures of inequality: *Within-Group Inequality (WGR) and Within-State Inequality (WSR)*. To construct WGR, we proceed in two steps: first, we construct a measure of inequality across the different areas that cover an ethnic homeland within a state. The areas are defined by the 0.5×0.5-degree grid-cells in which the rainfall data was provided. More formally, the group specific measure of inequality is computed as:

$$WGR_{i,s} = \frac{1}{2r_{i,s}} \sum_{m=1}^{G_{i,s}} \sum_{n=1}^{G_{i,s}} \pi_{m,i,s}\pi_{n,i,s} \left| r_{m,i,s} - r_{n,i,s} \right| \tag{3.2}$$

where G_i is the amount of rainfall grids covering ethnic group i's boundary, π_m is the relative size of grid-cell m, $r_{i,m}$ refers to the amount of rainfall over the grid-cell m, and r_i is the quantity of rain that fell over ethnic group i's homeland. In the second step, we obtain the state-level measure of within-group inequality by taking the weighted average of $WGR_{i,s}$ across all ethnic groups living within the state, where the weights are defined by the relative size of the ethnic group and relative rainfall in the state. That is:

$$WGR_s = \sum_{i=1}^{N_s} \theta_{i,s} \frac{r_{i,s}}{\sum_{j=1}^{N_s} r_{j,s}} WGR_{i,s} \tag{3.3}$$

Our last measure, Within-State Inequality (WSR), captures rainfall inequality between grid cells that falls within the same state. The construction of the WSR follows a similar approach to the one used in the first step for WGR, except that here we compare areas across the state, rather than focusing on specific ethnic groups' homelands. Thus, WSR is computed as:

$$WSR_s = \frac{1}{2r_s} \sum_{m=1}^{G_s} \sum_{n=1}^{G_s} \pi_{m,s} \pi_{n,s} |r_{m,s} - r_{n,s}| \tag{3.4}$$

Where G_s refers to the total number of rainfall grids covering the state, while π_m is the relative size of grid-cell m. Table A 3.1 present the correlation coefficients of the inequality measures, while Table A 3.2 shows the summary statistics of the main variables of interest.

3.3.3 Empirical Strategy

We start by empirically investigating the relationship between rainfall-based inequality and the prevalence of civil conflicts across our sample, by running the following analysis:

$$Conflict_{s,y} = \beta_1 inequality_{s,y} + \beta_2 rainfall_{s,y} + \Theta X_{s,y} + \alpha_s + \zeta_y + \alpha_s t + \varepsilon_{s,y} \tag{3.5}$$

Where s and y denotes the state and year, respectively. The dependent variable is $Conflict$, a binary variable taking on the value of one if state s experiences civil conflict resulting in at least 20 casualties in year t. In a robustness check, we also use the number of fatalities in armed conflicts occurring within states as an alternative dependent variable. $Inequality$ is our variable of interest and indicates one of the rainfall-based inequality measures described above, constructed considering rainfall during the growing season, while $rainfall$ is the yearly average rain that fell within a state's boundaries. X is a vector of geographical and institutional covariates that may affect conflict at the state level. For instance, most analysis of armed conflict in Nigeria emphasize the role of religion as a major factor. Thus, we construct a measure of religious fragmentation and competition in a state. We compute the fragmentation measure as one minus the Herfindahl index of religious group shares and then classify a state as having a high religious fragmentation (equals one) if its index is above median. Similarly, we define religious competition in each state by: $1 - |\eta_1 - \eta_2|$, where η_1 and η_2 indicate the state share of the population for the two largest religious groups. In addition, we include a dummy for oil producing states to proxy for natural resources driven conflict in the Niger-Delta area of the country. Other additional control variables include temperature anomalies – the deviation of temperature from its long-term mean value (January 1981 - December 2015), per capital allocations to states, and population. We further include state and year fixed effects – α_s, and ζ_y – to absorb period and time-invariant effects across states. For instance, the presence of mountainous terrain or the distance from the seat of power may confound the investigated relationships (see, Harari and LaFerrara (2014); Miguel, et al., (2004)). Lastly, we augment the model with state specific time trend $\alpha_s t$ to account for differential linear trends across states.

Given a binary dependent variable, a natural choice of estimation would be to conduct a probit (or logit) estimation, but we use the standard OLS and fit a linear probability model to allow us to adopt spatial-econometrics methods as in Harari and LaFerrara (2014) and Maystadt et al., (2014), which are problematic to implement in limited dependent variable models. Indeed, given the nature of our georeferenced dataset, one concern for our empirical approach may be that observations are not independent across space. To that purpose, we apply Conley's (1999) standard errors, which is robust to spatial dependence of an unknown form in the error term, following the procedure suggested by Hsiang (2010). Also, in an alternative specification, we re-estimate the above model, controlling for spatial lags of the variables of interests. Here, we follow Harari and LaFerrara (2014) and Maystadt et al., (2014) in constructing a symmetric weighting matrix W of order 2 and thereafter obtain the spatial lags of the independent variables by multiplying the matrix W and the vector of observations.

In the second part of the chapter, we try to investigate the channels through which rainfall inequality could lead to higher prevalence of civil conflict. The corresponding empirical model is:

$$polieva_{i,s,y} = \beta inequality_{i,s,y} + \Theta X_{s,y} + \alpha_s + \zeta_y + \alpha_s t + \varepsilon_{s,y} \tag{3.6}$$

Where *i*, *s* and *y* denotes the ethnic, state, and survey year, respectively. The dependent variable *polieva* refers to one of the seven main indicators described above, and inequality refers to the between-group rainfall inequality. X are economic controls such as population and per capita allocations to state, which may confound the observed relationship. In addition, we include a measure of religious fragmentation and competition between the various ethnic groups living within a state. Also, we include state and survey-year fixed effects – α_s, and ζ_y – to absorb time-invariant effects across states. For instance, the distance from the seat of power may confound the investigated relationships. Lastly, we augment the model with state specific time trend $\alpha_s t$ to account for differential linear trends across states.

3.4 Main Results

3.4.1 Civil conflict and BGR inequality

We first present the results of our main specification described in equation (3.5) in Table 3.1. In column (1) of the Table, we report the baseline regression without any fixed effects or controls, while in column (2) we introduce year fixed effects and religion controls. These baseline specifications indicate a positive and significant relationship between BGR inequality and the prevalence of civil conflict at the state level. Specifically, the estimated coefficient in column (2) suggests that a one standard deviation increase in BGR inequality would lead to an 8.57 (0.186×0.461) percentage point increase in the prevalence of civil conflict. However, this effect disappears when we add both state fixed effects and climatic controls in column (3) and becomes significant with the inclusion of state-specific time trends in column (4). This latter specification indicates that a one standard deviation increase in rainfall inequality between-groups will heighten the risks of civil conflict prevalence by about five percentage points. In column (5), the effect increase to about seven percentage points when we control for economic characteristics of the states. Compared to the average conflict prevalence in the sample (23%), this result implies an increase of about 30 percent in civil conflict prevalence. While this effect appears smaller than the one estimated by Guariso and Rogall (2016), its magnitude is still in the upper level of the ranking made by Hsiang et al. (2013) in their meta-analysis, and within the range found for studies on Sudan (Maystadt et al., 2014), and Somalia (Maystadt and Ecker, 2014).

In addition, we do not find any evidence to suggest that this effect persists over time as the lagged coefficients of BGR inequality in column (6) and (7) are not statistically different from zero. We also do not find evidence that within-group and within-state rainfall inequality affect the prevalence of civil conflict either when they are introduced separately as in columns (2) and (3) of Table 3.2 or when they are considered together with between-group inequality as in columns (4) and (5) of the same table, respectively.[13]

[13]Surprisingly, when we include between-group temperature inequality in the same specification with BGR-inequality, we find a negative relationship between temperature inequality and conflict. However, this result does not alter our main variable of interest.

3.4.2 Robustness

We check the robustness of our results to a set of alternative specifications of the benchmark model. First, we show that the dynamics is not much different between civil and communal conflicts. Most anecdotal evidence (Baca, 2015; Sayne, 2011) on the potential impact of climate change in Nigeria has often cited competition for arable land between pastoralists and farmers as a possible trigger to violence. Indeed, climate-induced shocks that tend to result in less rainfall and higher temperature can greatly disrupt herders and farmers means of livelihood and hence induces more grievances. Maystadt, et al., (2014) provides suggestive evidence that temperature anomalies heighten intergroup violence between pastoralist and agro-pastoralist's communities in Sudan.

To that purpose, we check the sensitivity of our main results to an alternative definition of conflict – communal and non-communal conflicts. We define communal conflict as battles between pastoralists and farmers, resulting in at least 20 fatalities, while non-communal conflicts are other violent events excluding battles between farmers and pastoralists.[14] Results reported in Table 3.3 shows that the effect of BGR inequality is quantitatively similar to the benchmark results presented in Table 3.1. Indeed, the result in columns (3) and (6) indicates that a one standard deviation change in BGR inequality would translate into 7.27 and 5.60 percentage points increase in the prevalence of communal non-communal conflicts, respectively.

Second, we show that our results are robust to using number of fatalities and violent events occurring in each state as alternative dependent variables, respectively. Specifically, the results reported in column (5), Panels B and C of Table 3.4 shows that a one standard deviation change in BGR inequality would lead to 18.9 and 5.5 percentage points increase in the number of fatalities and violent events, respectively. In addition, we show in Panel D of Table 3.4 that our results are also robust to using the UCDP geo-referenced conflict event dataset, which allows us to extend our analysis to cover the period 1990 to 2015.

Next, we check whether our results hold, when we control for spatial and temporal dependence between observational units. Given the high mobility of pastoralists, one major concern might be that our results are driven by climate induced migration. To test for this, we include spatial lags of the main variable of interest. The results reported in Panel E of Table 3.4 indicates that the effect of BGR inequality on the prevalence of civil conflict remain positive and significant. As a form of falsification test, we also compute an alternative between-group inequality measure based on rainfall outside of the growing seasons.

[14] Communal conflicts involving farmers and pastoralists typically accounts for about 30% of total conflict occurring in each year in Nigeria.

Given the importance of rainfall in agricultural productions in Nigeria, we would expect the effect of BGR inequality on civil conflict to be less or even null during the non-growing season. Indeed, the results presented in Panel F of Table 3.4 shows that, while the effect is smaller and marginally significant for the baseline specification without any fixed effects or controls, the impact disappears with the inclusion of these controls.

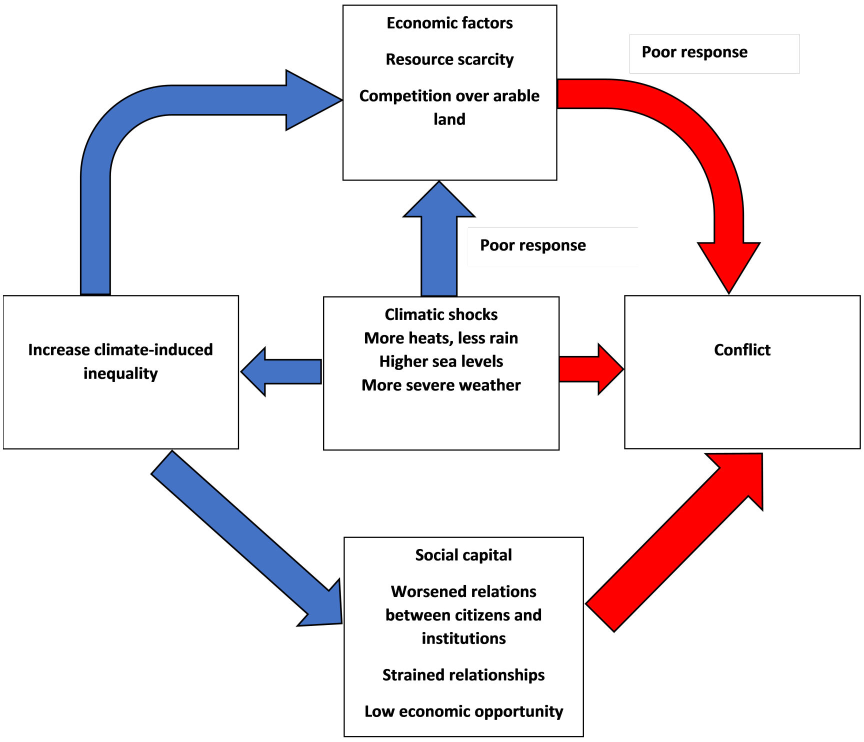
Furthermore, we assess the robustness of our results to using alternative geo-referenced ethnic dataset for the definition of BGR inequality measure. One might be worried that the construction of our ethnicity variable does not reflect the historical distribution of ethnic groups in Nigeria. In that regards, we use the GREG dataset to identify the historical locations of main ethnic groups across Nigeria and then redefine the inequality measures using the ethnic homeland as defined in the GREG data. Panel G of Table 3.4 reports the result for this alternative definition. We find that the impact of BGR inequality on civil conflict prevalence is much stronger compared to when we define the inequality measures using the local government handbook. A possible explanation for this might be related to the replacement of some minority ethnic groups with the "dominant group" they belong to in the GREG dataset thereby inducing higher variations in between-group inequality within states.

We then consider a monthly-level analysis to control for any spurious seasonal correlation that may arise due to variations in weather and conflict. Results reported in Panel H of Table 3.4 indicates that the coefficients of BGR inequality remain positive and significant, but the effect is much lower compared to the main result. Finally, we show that our results remain robust to the use of a probit model without spatial correction in the standard errors. In Panel I of Table 3.4, we report the coefficients of the average marginal effects of BGR inequality on civil conflict prevalence. The result in column (5) indicates that a one standard deviation increase in BGR inequality increases the likelihood of civil conflict prevalence by about 9.4 percentage points.

3.4.3 Transmission Mechanisms

Our previous results showed a significant relationship between rainfall inequality and conflict prevalence. When thinking about the channels, one could think of several reasons why variations in climatic conditions among organized political and ethnic groups in Nigeria could lead to violence. First, poor institutional response to a mix of weather-related shock could lead to increased resource scarcity and competition, thus heightening the risks of violence. In particular, the increased incidences of kidnapping for ransom and violent conflict between pastoralists and farmers in recent years had been attributed to lack of economic opportunities and governments' failure to provide designated areas for grazing to the pastoralists' communities (Baca, 2015).

In such circumstances, climate-induced changes that disrupt food and livestock production substantially would increase the risks of conflicts, and create distrust among ethnic groups. An illustrative example is a recent report by Sayne (2011) stating that "in the south, many farmers now plant over grazing routes long agreed upon with Fulani herders" citing climate related factors such as changes in planting techniques due to weather variability as reasons. Such breakdowns in agreement could create mistrust among the two groups and therefore increase structural conflict risks. Besides, poor responses to weather-induced shocks could reinforce citizen's grievances on government's corruption and lack of accountability thereby deepening the cycle of violence (see figure 3.1 below). Against this background, we turn to the reduced-form relationship between inequality, trust and political preferences.



Source: Adapted from *Sayne (2011) and modified by the authors*

Fig. 3.1 Channels of Transmission

Inequality, trust and Political Preferences

While the empirical debate on this relationship continues apace, the weight of the evidence suggests there is a strong negative association between inequality, trust and political participation (see Jordahl (2009), for a detailed review of empirical studies). However, establishing a causal effect is far from being an easy task due to several reasons. First, the relationship between inequality and trust is likely to be mutually reinforcing. For instance, Bergh and Bjørnskov (2011) demonstrates that countries with higher levels of trust are more likely to have larger welfare states, thus reducing inequality. Similarly, one may argue that higher trust could lead to better performing institutions and markets, which in turn would favour an equitable income distribution process (Uslaner, 2008).

Secondly, most of the empirical studies focusing on the relationship between inequality and the level of social capital are cross-country analysis, which are usually problematic when it comes to drawing causal inferences due mostly to comparability issues between countries, risks of omitting important variables and measurement errors in the inequality measures. At the same time, while robust empirical evidence focusing on within country analysis are quite limited outside of the US, findings for other countries are less conclusive (see, La Ferrara, 2002; Leigh, 2006; Gustavsson and Jordahl, 2008). In this section, we provide a reappraisal of the relationship between inequality, trust and political preferences and, in particular, attempt to address the limitations of previous studies using our unique measures of inequality.

Table 3.5 presents results of the impact of rainfall inequality on trust, and political evaluations. The results shown in column (1) of Table 3.5 indicates that an increase in BGR inequality reduces the likelihood that respondents of the same ethnicity would rate high in the general trust scale. More specifically, column (2) and (3) imply that a one standard deviation increase in BGR inequality reduces the likelihood of between and within-group trusts by 10.47 and 8.61 percentage points, respectively. Column (4) identifies a larger effect for trust towards neighbours. The point estimates indicates that higher BGR inequality reduces the likelihood that respondents from the same ethnic group would express that they trust a lot in their neighbour by 11.14 percentage points. Surprisingly, the effect is smaller for trust in government, as the result in column (5) show a 1.75 percentage point reduction.

We also find that an increase in BGR inequality reduces the likelihood that respondents of the same ethnicity would express satisfaction with the way government handles issues related to unemployment, health, education, inflation, and the general economy. Column (6) of Table 3.5 estimates that a one standard deviation increase in BGR inequality reduces the probability that respondents who share the same ethnicity, would express that they are satisfied with government by three percentage points. Also, column (7) shows that a one standard deviation change in BGR inequality increases the likelihood that respondent from the same ethnic group would consider elected government officials as very corrupt by five percentage points.

Average Control Direct Effect

To explore the potential mechanisms through which rainfall inequality may affect the prevalence of conflict, we apply sequential g-estimation as suggested by Acharya et al. (2016) to estimate the average control direct effect (ACDE) of BGR inequality net government satisfaction and trust in government on the likelihood of civil conflict. Specifically, we aim to examine whether any effect of BGR inequality persists after controlling for the intermediate confounder (or our government satisfaction and trust variables in this case). To proceed, we estimate in the first stage, the full benchmark model including the trust-related variables, and measures of government satisfaction and corruption (Table A 3.11.). Thereafter, we divide the vector of controls into pre-treatment and intermediates. We use rainfall and temperature levels as our pretreatment variables. We then treat all the other controls (i.e. religious, economic and the trust-related controls) as intermediate confounders. While it is possible that we misclassified these confounders, we check that our results are not sensitive to these classifications.

In the second stage of the g-estimation, we use only the pre-treatment variables as controls. One concern with our approach to estimating the ACDE might be that, for linear probability model, the estimates can be biased from model misspecification or if there exist unmeasured confounders between citizen's satisfaction with government, trusts and civil conflict. However, Angrist and Pischke (2009) demonstrate that such bias is likely to be low for marginal effects estimation. Nevertheless, we report bootstrapped confidence intervals for both stages. The results reported in Table 3.6 suggests that the effects of BGR inequality on civil conflict persists even after accounting for citizen's satisfaction with government handling of the economy, between-group trusts and level of trust in elected government officials. However, the effects dies out when we consider conflict between pastoralists and farmers, thus giving credence to a channel in which climate-induced shocks reinforce citizen's grievances on government handling of the economy, and create mistrust between predominantly farming ethnic groups and pastoralists thereby deepening the cycle of violence.

3.5 Conclusions

There is much discussion and debate over the role of climate-induced shocks in violent conflicts. The Intergovernmental Panel on Climate Change (IPCC) suggests that the effects of climate change can aggravate stressors such as social tensions, poverty, and environmental degradation, that allows conflict to flourish. However, understanding the exact transmission mechanisms through which variations in climatic conditions can exacerbate these conflict stressors requires a better local-level and country-specific analysis. In this chapter, we show how changes in the distribution of rainfall between ethnic groups increase the risks of armed conflicts prevalence in Nigeria, and in particular, investigate the mechanisms underlying the observed relationships. Our main results show that a 1 standard deviation change in between-group rainfall inequality during the growing season increase communal and civil conflict prevalences by about 7 percentage points. The result is robust to a set of alternative specifications. Our analysis suggests a mechanism in which climatic-induced shocks reinforce citizen's grievances over government handling of the economy and creates mistrust between predominantly farming communities and those engaged in nomadic herding.

One important limitation of our study, however, is that we are unable to adequately isolate how economic factors such as climate-induced resource scarcity may contribute to intensify conflict risks. Instead, we focus on the social capital channel potentially linking inequality to conflict. While the dearth of data on socio-economic characteristics of communities and household constrain our ability to evaluate that channel, we acknowledge that there may exist an effect of between-group rainfall inequality that does not operate exclusively through social capital. Nonetheless, our analysis underscores the importance of developing conflict-sensitive mitigation and adaptation strategies to reduce the adverse effects of climatic shocks. In particular, initiatives aimed at reducing Nigeria's frequent farmers-herders' violence should focus on strengthening traditional conflict mediation and reconciliation mechanisms and addressing environmental issues that push nomadic pastoralists to migrate towards the south for water and pastures. Indeed, recent work by Linke et al. (2017) demonstrate the mediating role of formal and informal institutions in moderating the effects of climate-induced conflicts in rural Kenya. Finally, while our results present an empirical evidence of how changes in the distribution of rainfall between ethnic group increase the risk of conflicts, the analysis is limited in predicting future risks relating to how increased frequency and intensity of weather shocks would affect inequality and ability to mitigate competition over resources. Certainly, this will be a path for further research, if there exists an extensive and quality dataset that can allow for a robust empirical analysis.

Table 3.1 Estimation of Linear Probability Model - Civil conflict and BGR inequality

Dependent Variable				**Civil conflict**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
BGR inequality	0.383***	0.461***	0.143	0.277**	0.359*	0.280*	0.287*
	(0.096)	(0.111)	(0.237)	(0.138)	(0.191)	(0.149)	(0.161)
BGR inequality (t-1)						0.911	0.842
						(1.127)	(1.115)
BGR inequality (t-2)							0.437
							(1.101)
Rainfall			0.092	0.258*	0.241**	0.251*	0.243*
			(0.063)	(0.138)	(0.103)	(0.142)	(0.137)
Temperature			0.020	0.016	-0.014	-0.014	-0.013
			(0.048)	(0.043)	(0.046)	(0.043)	(0.043)
Religion controls		Included					
Economic controls					Included		
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes	Yes	Yes	Yes
R-squared	0.020	0.093	0.151	0.379	0.430	0.406	0.425
Observations	703	703	703	703	333	703	703

Notes: Religion controls include an indicator that the state has high religious fragmentation and a measure of the state religious tension.

Economic controls include population and per capital allocations to States.

All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$

BGR indicates Between-Group Rainfall Inequality

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* denotes significant at 10%, ** at 5%, *** at 1%

Table 3.2 Alternative Estimations - Civil conflict and inequality

Dependent Variable	**Civil conflict**				
	(1)	(2)	(3)	(4)	(5)
BGR inequality	0.359*			0.361*	0.369*
	(0.191)			(0.191)	(0.191)
WGR inequality		0.005		0.058	
		(0.380)		(0.378)	
Within state inequality			0.195		0.273
			(0.512)		(0.509)
BGT inequality					
Rainfall	0.277	0.222	0.095	0.265	0.099
	(0.218)	(0.231)	(0.393)	(0.230)	(0.390)
Temperature	-0.014	-0.007	-0.008	-0.015	-0.016
	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
Economic controls	Included	Included	Included	Included	Included
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes
R-squared	0.430	0.427	0.427	0.430	0.431
Observations	333	333	333	333	333

Notes: Economic controls include population and per capital allocations to States.

All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$

BGR and WGR refers to Between-Group and Within-Group Rainfall Inequality, while BGT is Between-Group Temperature inequality

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* denotes significant at 10%, ** at 5%, *** at 1%

Table 3.3 Civil conflict and inequality - communal conflict vs non-communal

Dependent Variable	**Communal conflict**			**Non-communal conflict**		
	(1)	(2)	(3)	(4)	(5)	(6)
BGR inequality	0.309***	0.079	0.391**	0.306***	0.145	0.301*
	(0.107)	(0.231)	(0.189)	(0.219)	(0.252)	(0.172)
Rainfall	0.089	-0.017	0.116	-0.010	-0.009	0.323
	(0.229)	(0.246)	(0.230)	(0.218)	(0.109)	(0.234)
Temperature	-0.055	0.017	-0.021	-0.059	0.027	-0.024
	(0.045)	(0.048)	(0.043)	(0.045)	(0.049)	(0.043)
Religion controls	Included			Included		
Economic controls			Included			Included
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	Yes	No	Yes	Yes
State-specific time trends	No	No	Yes	No	No	Yes
R-squared	0.091	0.166	0.455	0.079	0.162	0.467
Observations	703	703	333	703	703	333

Notes: Religion controls include an indicator that the state has high religious fragmentation and a measure of the state religious tension. Economic controls include population and per capital allocations to States.

All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$

BGR indicates Between-Group Rainfall Inequality

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* denotes significant at 10%, ** at 5%, *** at 1%

Table 3.4 Robustness to alternative samples and dependent variables

Dependent Variable			**Civil conflict**		
	(1)	(2)	(3)	(4)	(5)
Panel A. Main results	0.383***	0.461***	0.143	0.277**	0.359*
	(0.096)	(0.111)	(0.237)	(0.138)	(0.191)
Panel B. Using number of fatalities as dep. var.	1.669***	1.993***	0.699	0.894	1.015*
	(0.351)	(0.405)	(0.847)	(0.632)	(0.544)
Panel C. Using number of violent events as dep. var.	1.138***	1.109***	0.514	0.601*	0.298*
	(0.204)	(0.216)	(0.351)	(0.318)	(0.170)
Panel D. Defining civil conflict based on UCDP dataset	0.337**	0.121	0.322**	0.327**	0.333**
	(0.155)	(0.074)	(0.133)	(0.139)	(0.149)
Panel E. Including spatially lagged BGR inequality	0.381***	0.439***	0.140	0.264*	0.374**
	(0.096)	(0.115)	(0.238)	(0.153)	(0.190)
Panel F. BGR inequality outside the growing season	0.283*	0.357	0.139	0.162	0.268
	(0.166)	(0.220)	(0.236)	(0.240)	(0.217)
Panel G. Defining BGR inequality based on GREG dataset	1.189***	1.431***	0.331	0.647**	0.805*
	(0.315)	(0.365)	(0.280)	(0.321)	(0.418)
Panel H. Considering monthly-level analysis	0.053*	0.055	0.180***	0.153***	0.095***
	(0.029)	(0.037)	(0.034)	(0.032)	(0.048)
Panel I. Probit model (AME) without spatial correction in SE	0.391***	0.468***	0.292	0.312*	0.504***
	(0.101)	(0.114)	(0.233)	(0.163)	(0.114)
Climatic controls		Included	Included	Included	Included
Religion controls		Included			
Economic controls					Included
Year FE	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes	Yes

Notes: Religion controls include an indicator that the state has high religious fragmentation and a measure of the state religious tension. Economic controls include population and per capital allocations to States.

All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$

BGR indicates Between-Group Rainfall Inequality

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* denotes significant at 10%, ** at 5%, *** at 1%

Detailed results are provided in Tables A 3.3., A 3.4., A 3.5., A 3.6., A 3.7., A 3.8., A 3.9. and A 3.10. of Appendix 2.

Table 3.5 BGR inequality, trust and political evaluations

Dependent Variables	Trust Variable: General	Between-group	Within-group	Neighbour	Government	Govt satisfaction	Govt corruption
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
BGR inequality	-0.575***	-0.563***	-0.463***	-0.599***	-0.094***	-0.160***	0.288***
	(0.092)	(0.118)	(0.102)	(0.119)	(0.031)	(0.027)	(0.050)
Rainfall	-0.102***	-0.070	-0.102***	-0.079*	-0.010	0.015***	-0.007
	(0.031)	(0.043)	(0.034)	(0.043)	(0.006)	(0.005)	(0.008)
Temperature	0.021	0.012	-0.005	0.019	0.070***	0.077***	-0.034***
	(0.018)	(0.025)	(0.020)	(0.025)	(0.009)	(0.008)	(0.011)
Economic controls	Included	Included	Included	Included	Included	Included	Included
Survey-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.180	0.199	0.173	0.175	0.275	0.221	0.073
Observations	812	812	812	812	812	812	812

Notes: Economic controls include population and per capital allocations to states.

General Trust is a summative scale, indicating that respondents trusts somewhat or a lot in their relatives, neighbours, own ethnic group and others.

Trust in government is a summative scale, indicating that respondents trust somewhat or a lot in the President, state Governor and Local Government Mayor.

Government satisfaction: an indicator that the government handles the economy, health, inequality, and water-related issues very well as opposed to very badly

Robust standard errors (in parentheses) are clustered at the state-level

* denotes significant at 10%, ** at 5%, *** at 1%

Table 3.6 ACDE of BGR inequality on conflict

	Civil conflict Estimate	95% Bootstrapped CI	Communal conflict Estimate	95% Bootstrapped CI
BGR inequality	0.345	[-0.077 - 0.766]	0.191	[-0.184 - 0.567]
BGR inequality (ACDE)	0.343	[0.030 - 0.755]	0.193	[-0.030 - 0.867]

Notes: For the ACDE, the mediator include government satisfaction scale: an indicator that the government handles the economy, employment, inflation, health, inequality, and water-related issues very well as opposed to very badly; general trust is a summative scale, indicating that respondents trusts somewhat or a lot in their relatives, neighbours, own ethnic group and others; between-group trust is a measure that captures the level of trust between the different ethnic groups living within a state, and trust in government scale: a summative scale, indicating that respondents trust somewhat or a lot in the President, Local Government Mayor, National Assembly, electoral commission, and ruling party. Nonparametric bootstrapped 95% CI based on 1,000 replications shown in bracket.

Chapter 4

Which punishment deters bribery? A theoretical note on the economics of corruption

4.1 Introduction

The last decades has seen an extensive attention been paid to analysing the economics of corruption. The main focus of these analyses is not on the morality or otherwise of corruption but on *monetary quid pro quo* deals where agents (either public or private) are induced to ignore the interests of their superiors in favour of their own self-interest and that of the bribers. Under this interpretation, corruption involves a hidden transaction between a public official and private individual to seek and extract illicit income for personal benefits. Early research by economists (see Bayley, 1970; Leff, 1970; Nye, 1970) were in tacit support of this "black market" mechanism of allocation, reflecting their moral commitment to the price system. In an efficient corrupt system, public services are allocated to those with the highest willingness to pay bribe, and in most cases, bribes are paid to officials to circumvent bureaucratic rules that hamper efficient function of the market system.

Although contemporary studies (see Lambsdorff, 2007; Shleifer and Vishny, 1993) have shown that this intuition is oversimplified, the price mechanism analysis remain the central theme of economic studies on the impact of corruption on resource allocations. However, it is now widely accepted that corruption does not generally lead to efficiency. Rose-Ackerman's seminal works (Rose-Ackerman, 1975, 1978) as well as Shleifer and Vishny's (1993) influential paper demonstrate that illegal systems of bribe-price can be more distortionary than taxation. The rent seeking behaviour of corrupt government officials may induce them to redesign public systems to encourage bribery. Such actions involve not only the illicit exploitation of individual's willingness to pay as a decision criterion but also undermine efficient provision of public services.

Yet, in many developing countries, private citizens are often required to pay bribes to obtain basic public services. Indeed, data from the 2015 Global Corruption Barometer produced by Transparency International show that twenty-two percent of respondents surveyed in Sub-Saharan Africa report having paid a bribe in the last 12 months. The situation is worst in countries such as Kenya, Liberia, Nigeria and Sierra Leone where one out of two respondents surveyed say they paid a bribe to access public services such as education, health, customs and tax revenue, licenses and land services, etc. This pervasiveness of bribery has important consequences for those without money and connections. As with the incidence of regressive tax, the burden of bribery may fall disproportionately on the poor as they are more likely to pay a higher percentage of their income as bribes than the rich (Hunt and Laszlo, 2012).

Moreover, the distortionary effects of corruption can compromise the quality of public goods provided, in such a manner that the population may have to rely on private providers to access vital public goods and services. This again disproportionately favours the high-income groups because the costs of these services may be so high that the poor cannot afford to pay. This non-access to basic services such as education and health care facilities has the potential to perpetuate inter-generational poverty and hence widens income inequality. Indeed, micro-level studies such as Hunt and Laszlo (2005) and Mocan (2008) have demonstrated that the nominal amount of bribe paid is a positive function of income, whose burden decreases as income rises.

Given these distortionary effects, an interesting question to ask is how can the incidence of bribe requests and payments be reduced? As Rose-Ackerman (2010) notes, bribe offering and taking "are generally criminal offence", and most countries impose some form of punishments to deter both public and private agents from engaging in corrupt transactions. According to Nigeria's Independent Corrupt Practices and Other Related Offences Act (2012), a public official found culpable of soliciting for bribes shall "forfeit the bribe and pay a fine of [at least] five times the sum of the value of the bribe or a fixed fine of ten thousand Naira (i.e. about $35), whichever is higher." In India too, the Prevention of Corruption Act (1988) stipulates that any person guilty of giving and receiving bribe shall be liable for up to five years imprisonment, in addition to paying a fine. Despite these penalties, the menace of bribery remains an everyday and commonplace occurrence in most of these countries.

This chapter offers a simple theoretical model that looks into how different enforcement mechanisms may yield different outcomes in terms of bribe levels and proportion of people engaging in bribery. In particular, we focus on a specific issue that has often been overlooked: how the monetary value of a bribe is affected by the willingness to pay and affects the equilibrium level of inequality. In doing so, the model extends the setting by Hunt and Laszlo (2005) and show the effects of a switch from a fixed punishment mechanism to a proportional one, in which the private cost to the bureaucrat of engaging in bribery is linearly related to the bribe itself. Our analysis shows that severe punishments for corrupt bureaucrats would generally cause an increase in bribe size, making bribing more expensive (and therefore less widespread). However, the effects of a proportional punishment that varies with the amount of bribe depends on how much effort is required to deliver the public service. When effort of "normal" delivery is large or the service is much valuable to the client, the bribe level in equilibrium more than compensates the bureaucrat for his effort and is also increasing in the net surplus available for the client with the least scruples. We also discuss the effects of our result on willingness to pay and inequality.

The model has some interesting policy implications: if agent's opportunity cost of time is sufficiently low, harsher punishments to the bureaucrat can be effective in reducing the spread of corruption. However, in countries where bribery is pervasive or there is a general level of dishonesty, a fixed fine to the bureaucrat can be more taxing on the poor, as a rise in the expected punishment would imply an increase in the amount of bribe for everyone on the average. When this is the case, a punishment mechanism that impose a penalty on agents might further exacerbate the burden on the poor if it is lower than the fixed fine on bureaucrats.

The rest of the paper is organized as follows. Section 4.2 provides a review of related literature. Section 4.3 presents the theoretical framework and results, and section 4.4 discuss the main findings and concludes.

4.2 Literature Review

It is now widely recognised that corruption has detrimental effects on societies. Hence, an important body of work is devoted to analysing the economic, social and political consequences of corruption. We review the most relevant studies for our paper.[1]

[1] Lambsdorff (2006) provides a comprehensive survey of the literature.

At the centre of theoretical and empirical studies on public and private sector quality and productivity is whether corruption detrimentally affects the quality of goods and services or not. Kaufmann et al. (1999) aptly describe this argument as whether: corruption “greases the wheel” by reducing inefficiencies associated with bureaucratic delays or “throws sand in the wheel” by misallocating resources or lowering the security of property rights. Commenting on these views, Lambsdorff (2007) noted that corruption may induce preferences for wrong firms and projects, and thereby reduce the quality of public investments. For example, suppose a contracting process was undermined to such an extent that corrupt government officials award the contracts to firms offering the highest bribe. Competitors with high scruples who might be more efficient would lose in the process, thus creating several distortionary effects for the economy. First, quality controls can be circumvented as corrupt contractors are incentivized to save costs in order to break even. In such circumstances, high price-quality ratio would no longer be guaranteed. Second, wrong projects may be selected by corrupt bureaucrats to maximize their chances of extracting bribes. Winston (1979) argues that corruption flourishes when the probability of detection is low, and this probability depends on the number of people involved, the number and duration of the transactions and the simplicity and standardization of the procedures. In that regards, corrupt government officials are usually incentivized to disregard inexpensive “off-the-shelf” projects in favour of projects with non-transparent negotiations and huge capital investments.

Beyond these distortionary effects, Rose-Ackerman (1999) confirms that corruption reduces productivity by inducing the efforts exerted by corrupt public official. The reason for such reduction is that lower level of efforts increases the willingness of private agents to pay bribe in exchange for quicker and quality service. Thus, several empirical studies have investigated the link between corruption, the quality of public goods and services, environmental regulations and productivity. In particular, Gupta et al. (2001) find that countries with high level of perceived corruption have low quality of public healthcare provision, which they proxy by the percentage of children with low birth weights, as well as low quality of public education proxy with student drop-out rates. Using a cross-section of more than 100 countries, Welsch (2006) show that corruption adversely impacts reported ambient pollution of air and water through reducing the effectiveness of environmental regulations, and an indirect channel that lowers income. Although the empirical investigations discussed above present some mixed results, it is now widely agreed that corruption introduces some distortions into public and private sectors.

In recent times, theoretical contributions on the economic analysis of corruption has started to focus on measures to combat it. Our work speak to at least three strands of this literature. First, the paper offers a new view on how different punishment mechanisms may affect bribery outcomes and willingness to pay. In doing so, our paper contributes to a growing literature on measures to reduce corruption (see Hindricks, et al., 1999; Andreanova and Melisasas, 2008; Dixit, 2016). While this literature focuses on the role of explicit incentive structures, such as institutional controls and the use of efficient wages, in controlling corruption, we highlight how the intrinsic characteristics of public and private agents may alter bribery outcomes. In particular, we model the interactions between bureaucrat and private agent as a dynamic game in which the bureaucrat moves first and decides whether to solicits for bribe or not. This modelling choice is intended to elicit the conditions under which the bureaucrat may angle for bribes, given the punishment system in place.

Our paper is also related to the literature on the use of asymmetric punishment to control the "scourge" of bribery.[2] Following the suggestions of Basu (2011) for India to "legalize bribe giving, double the fine for bribe taking, and make the bribe taker pay back the bribe if discovered," there has been an increased focus on the merits and limitations of asymmetric punishment (e.g. Dréze, 2011; Dufwenberg and Spagnolo, 2014; Felli and Hortala-Vallve, 2016; Oak, 2015). Although the measure propose by Basu (2011) was to incentivize private citizens to report incidence of bribe payments and requests by public officials, Dréze (2011) argues that the proposal eliminates the moral cost associated with committing an illegal act and therefore, might lead to an increase in the incidence of bribing. On their part, Dufwenberg and Spagnolo (2014); Oak (2015) shows that legalizing bribe giving in an environment with inefficient legal system would incentivize the bureaucrat towards angling for low-value *harassment* bribes.

However, an earlier study by Lambsdorff and Nell (2007) demonstrate that, while asymmetry punishment might increase the risks inherent in corrupt transactions, it is ineffective in cases of bargaining game where detection is costly. In this paper, therefore, we consider different punishment mechanisms in a dynamic game environment, where the bureaucrat enjoys a first mover advantage and therefore extract most of the rent. By doing so, our paper provides a formal model to the extensive discussion offer by Rose-Ackerman (2010) on how different punishment system may affect the negotiations between briber and bribee. The paper also complements the study by Dufwenberg and Spagnolo (2014), who show that, if institutional quality is high, asymmetric punishment may deter bribery in a repeated game,

[2]Here, asymmetric punishment refers to penalizing one agent less than the other, so as to incentivize agents to report a crime.

where the bureaucrat builds a reputation of being dishonest. While in their setting, the size of the bribe is independent of the punishment scheme, we consider an alternative setting in which the private cost to the bureaucrat of engaging in corruption varies with the amount of bribe.

Finally, our paper also contribute to the literature on the relationship between corruption and inequality. Theoretical studies have generally emphasized the relative importance of institutional quality in explaining productive differentials resulting from high rent-seeking activities (Alesina and Angeletos, 2005; Chong and Gradstein, 2007; Mandal and Marjit, 2010; Spinesi, 2009). In particular, Spinesi (2009) develops a Schumpeterian growth model in which the quality of institutions encourages inequality and growth. The author shows that public inefficiencies resulting from rent-seeking activities induce higher wage inequality by diverting a share of the labour force from productive to unproductive activities. These points are consistent with Mandal and Marjit (2010) who show that corruption diverts resources from productive sectors to non-productive ones, thereby engendering wage differentials in the different sectors. Banerjee (1997) and Alesina and Angeletos (2005) formalize the idea that that corruption creates a distortionary effect in the positive externality generated by government expenditure - thus increasing inequality.

On the empirical side, there are several pieces of literature examining the corruption-inequality nexus at both macro and micro level. At the macro level, Gupta et al. (2002) demonstrates that rising corruption induces high income inequality and poverty through lower economic growth, distortions in social programs, and biased tax systems in favour of the rich. Focusing on a number of countries, Gyimah-Brempong and de Camacho (2006) shows that countries with relatively low corruption tend to have larger distributional impact of corruptions suggesting that the link between corruption and inequality might be non-linear. On the other hand, the micro literature on the relationship between corruption and inequality are less conclusive. For example, Hunt and Laszlo (2012) show how the burden of bribe as a share of income decrease with agent's income, while Mocan (2008) and Svensson (2003) report that the nominal amount of bribe paid increases with agent's income implying that people with higher income are worst hit by corruption.

Our interpretation of these facts is that at the macro level, the positive correlation between corruption and inequality is due to the productivity effects resulting from corrupt rent-seeking activities, thus impacting negatively on growth and economic welfare. However, the mechanism leading to these effects do not incorporate the bribery channel, which the micro literature argues can generate income and productivity effects (Hunt and Laszlo, 2005; Mocan, 2008). It is commonly accepted that the poorest segment of the society are worst hit by corruption since they are likely to rely more on basic public services, and hence more likely to be exposed to bribery. In that regards, the portion of income lost to corruption is likely to be higher when the household is poor. In this chapter, therefore, we extend the setting by Hunt and Laszlo (2005) to conceptualize how different punishment mechanisms affects the monetary value of a bribe and equilibrium level of inequality.

4.3 Theoretical Framework

The model extends the setting by Hunt and Laszlo (2005) to show how different punishment mechanisms can affect bribery outcomes. In the model, a bureaucrat has discretionary power to offer public service to a continuum of agents with identical preferences, but differing valuation of time. In their interactions, the bureaucrat and agent play a two stage game. The bureaucrat move first and decides whether to ask for a bribe or not. His preferences are characterised by two parameters: an honest bureaucrat receives utility U_b per stage from having discharge his duty diligently and honestly, and experiences disutility of normal effort E in each stage. For simplicity, we assume that the bureaucrat's wage is normalized to zero. Therefore, the total utility of an honest bureaucrat across the two periods is:

$$2(U_b - E) \tag{4.1}$$

We assume that $U_b > E$ so that if the bureaucrat decides not to ask for bribe, he performs his job diligently without shirking. On the other hand, if the bureaucrat decides to angle for bribe, he shirks in the first stage by providing less than the statutory amount of services to the private agent.

The agents observes the move of the bureaucrat and decides whether to accept the lower quality of service or offer a bribe in order to obtain a better service than the initial level of service provided by the bureaucrat. We assume that agents have identical preferences except in the utility they gain from the public service R. This can be interpreted as the opportunity cost of time, as bribing may let the agent skip the queue or by-pass certain procedures, which an honest official would require compliance.[3] In this regard, we expect agents with a higher valuation of time R to be willing to pay larger bribes to obtain quicker service.[4] If she refuses to bribe, she receives utility U_a, which we define as agent's aversion to

[3]Following Banerjee (1997); Hunt and Laszlo (2005), we assume that the bureaucrat control over bureaucratic procedures is costless in that he has discretionary powers to wave certain paperwork.

[4]The idea that those who have a higher valuation of time have a higher willingness to pay has been justified in Lui (1985).

dishonesty.[5] In the event the private agent does not bribe, the bureaucrat punishes her further by shirking in the second stage. Thus, by decreasing the amount of service to an acceptable level, the bureaucrat successfully creates a black market for corrupt-transaction, in which he is a monopolist. This assumption is motivated by the findings of Guriev (2004) who demonstrates that corruption increase the equilibrium level of red tape, and Shleifer and Vishny (1993) who shows that bureaucratic delays reduce the level of services offered by public officials.

Both bureaucrat and agent engage in bribery if they find it advantageous. The bureaucrat's main gain consists in the bribe, while for the agent, it is a convenience of having a speedier service from the bureaucrat. In that regards, we assume that if bribery occurs, then the agents receive utility E from the efforts exerted by the bureaucrat. There are also costs to both parties in engaging in corruption. In this model, we include both a "moral" cost of participating in dishonest transactions (U_b and U_a), and the cost related to the possibility of being detected and punished for the corrupt deal.

In this paper, we consider three punishment mechanisms: (I) a fixed punishment (as briefly mentioned in (Hunt and Laszlo, 2005)) in which the bureaucrat receiving a bribe is caught with probability δ and fined a fixed amount F; (II) a fixed punishment system in which with a given probability both bureaucrat and agents may be caught and fined; and (III) a proportional punishment, in which the private cost to the bureaucrat of engaging in bribery is linearly related to the bribe itself. We describe below the benchmark case when the bureaucrat is faced with a fixed punishment mechanism, and thereafter, discuss how each punishment system affects equilibrium outcomes.

4.3.1 Scenario I: Fixed punishment to bureaucrat

We solve this by backward induction, starting from the second-stage utility of bureaucrat and agent. Suppose the agent decides to pay a bribe, the bureaucrat exerts efforts E in the second stage and receives a bribe B, but risks punishment (δF). His second stage utility is, therefore:

$$B - E - \delta F \tag{4.2}$$

Where δF is the expected punishment from receiving a bribe. If the agents decides not to pay the bribe, the bureaucrat exerts no efforts and therefore shirks further in the second stage, and the agents receives

[5] We assume that R, U_a and U_b are independent.

zero utility. The bureaucrat, therefore, angles for a bribe as long as (4.2) is non-negative, i.e.:

$$B > E + \delta F \tag{4.3}$$

On the other hand, agent accepts to bribe if $E+R-B > U_a$, that is:

$$B < E + R - U_a \tag{4.4}$$

From equations (4.3) and (4.4), we can see that bribery occurs if $\delta F < R - U_a$: the expected punishment to the bureaucrat must be lower than the net gain $(R - U_a)$ to the agent. The result is quite intuitive: if there is a stringent punishment or higher probability of being caught, both the bureaucrat and agents are not incentivized towards corruption. On the contrary, more bribery occurs if there are agents with a higher valuation of time or very low scruples, thus increasing the incentives to be corrupt. Indeed, Hunt (2007); Mocan (2008) and Svensson (2003) presented empirical evidence indicating that those who have higher income, have a higher valuation of time and therefore tend to demand quicker services. These findings are consistent with the claim that bribe payment increases with income. In addition, the net benefit from reduced bureaucracy to agents may be greater in society with a higher incidence of corruption in which there is a general level of low aversion to dishonesty (U_a's) compared to environments where corruption is less widespread (Miller, 2006; Mishra, 2006). In this case, all agents will further be inclined towards corruption.

In this benchmark case, we assume that the bureaucrat can observe the agent's aversion to dishonesty U_a and valuation of time R. The bureaucrat maximizes his utility (equation 4.2) by picking the largest bribe conditional on the agents choosing to bribe, taking advantage of his first-mover opportunity. In other words, the equilbrium bribe is:

$$B^* = E + R - U_a \tag{4.5}$$

The bureaucrat extracts a larger bribe if the agent has lower U_a, the more valuable to the agent is the service he's offering (R), the higher is the effort that the bureaucrat exerts (E), which also represents the agent's utility for "normal" delivery of the public service. Substituting equation (4.5) into (4.2), we obtain the bureaucrat's second-stage utility conditional on bribery occurring:

$$R - U_a - \delta F \tag{4.6}$$

This is independent of E, as the bribe fully compensates for it.

While opting to solicit for a bribe, the bureaucrat will have to compare the total utility from honest behaviour (as in 4.1) with the sum of second stage utility from angling for a bribe (equation 4.6) and zero utility from shirking in the first stage. The bureaucrat chooses honest behaviour if: $2(U_b - E) > R - U_a - \delta F$, that is:

$$U_b > E + \frac{R - U_a - \delta F}{2} \tag{4.7}$$

The bureaucrat opts for honesty if he has high U_b, and decide to seek for a bribe if the effort of normal delivery is high or the agent's opportunity cost of time is high compared to the agent's scruples (i.e. high $R - U_a$) or the punishment is weak. When $\delta F > R - U_a$, either the bureaucrat or agent do not want to accept bribery as the expected punishment from engaging in corruption is higher compared to the one under honest behaviour. He will, therefore, choose honesty if $U_b > E$.

We can summarize the results in this scenario in the following proposition:

Proposition 1. ***Equilibrium with fixed penalty for corrupt bureaucrats under complete information.*** *The bureaucrat solicits for a bribe if:* $U_b < E + \frac{R - U_a - \delta F}{2}$ *and behaves honestly otherwise.*

No agent is willing to pay a bribe if: $R < U_a + \delta F$.

In equilibrium, the optimal level of the bribe B is:

$$B^* = E + R - U_a$$

Equilibrium outcome under incomplete information

Our previous analysis relies on the assumption that the bureaucrat knows the agent's aversion to dishonesty U_a and opportunity cost of time or willingness to pay R. It is indeed possible that the bureaucrat knows R, as he may be able to judge from the agent's address or appearance. On the other hand, it is implausible that the bureaucrats can judge the agent's aversion to dishonesty U_a.

Following Hunt and Laszlo (2005), we assume that U_a is uniformly distributed along the interval $\left[\underline{U}_a, \overline{U}_a\right]$. The distribution is common knowledge, but its realization is private information to the agent.

Suppose the bureaucrat chooses to angle for a bribe, equation (4.4) implies that agent pays if $U_a < E + R - B$, from which we can calculate the probability π that the agent accepts to pay the bribe:

$$\pi = P(U_a < E + R - B) = \frac{E + R - B - \underline{U}_a}{\overline{U}_a - \underline{U}_a} \tag{4.8}$$

The bureaucrat chooses to ask for a bribe B by maximizing his expected utility $\pi(B - E - \delta F)$. Taking the first order condition (and concentrating for the time being on interior solutions), we can define the optimal level of bribe as:

$$B^* = E + \frac{R - \underline{U}_a + \delta F}{2} \tag{4.9}$$

The result is quite intuitive. A bureaucrats angles for a larger bribe the greater is the effort required to do his job diligently (E), the costlier is shirking to the agent ($R - \underline{U}_a$), and if the largest is the probability of detection (δ) and the fixed fine (F) is large, as the bribe income will have to compensate for the higher risks.[6] By substituting (4.9) into (4.8), it can easily be seen that the equilibrium probability of agents bribing is decreasing in the punishment:

$$\pi^* = \frac{1}{2} \frac{(R - \underline{U}_a - \delta F)}{(\overline{U}_a - \underline{U}_a)} \tag{4.10}$$

Thus, if the punishment technology becomes stricter, a smaller proportion of people with larger opportunity cost of time R would engage in bribing, and the bribe larger. We can also calculate the bureaucrat's expected pay-off $\pi(B - E - \delta F)$ if he chooses to ask for a bribe:

$$\frac{1}{4} \frac{(R - \underline{U}_a - \delta F)^2}{(\overline{U}_a - \underline{U}_a)} \tag{4.11}$$

Comparing (4.11) and (4.1), the bureaucrat chooses honesty over asking for bribe if

$$U_b > E + \frac{1}{8} \frac{(R - \underline{U}_a - \delta F)^2}{(\overline{U}_a - \underline{U}_a)} \tag{4.12}$$

[6]This can be more taxing on agents with low ability to pay since an increase in the expected punishment by a unit, would translate into an increase in the amount of bribe by δF for everyone on an average.

The official chooses honesty if he has high scruples U_b, and if the expected punishment δF is high. He is also likely to ask for a bribe if efforts E is high, or the net benefit for the agent with the least scruples $(R - \underline{U}_a)$ is high.

We must also consider the corner solutions. If the agents opportunity cost of time is very small $(R < \underline{U}_a + \delta F)$, bribery will not occur ($\pi^* = 0$) because either agents with low R will not find it convenient to pay a costly bribe, or the bureaucrat is not asking for a bribe as the amount agents are willing to pay does not repay for the potential risk of punishment. If R is instead very large $(R > 2\overline{U}_a - \underline{U}_a + \delta F)$, bribery will occur independently of the agent's scruple ($\pi^* = 1$), and the outcome will be identical to the full information case described in the previous section. These results can be summed up in the following Proposition:

Proposition 2. ***Equilibrium with fixed penalty for corrupt bureaucrats.*** *The bureaucrat angles for bribe if:* $U_b < E + \frac{1}{8}\frac{(R - \underline{U}_a - \delta F)^2}{(\overline{U}_a - \underline{U}_a)}$ *and behaves honestly otherwise.*

No agent is willing to pay a bribe if: $R < \underline{U}_a + \delta F$.

In equilibrium, value of the bribe B is:

$$B^* = \begin{cases} E + \dfrac{R - \underline{U}_a + \delta F}{2} & \textit{for } R \in [\underline{U}_a + \delta F, 2\overline{U}_a - \underline{U}_a + \delta F] \\ E + R - \overline{U}_a & \textit{for } R > 2\overline{U}_a - \underline{U}_a + \delta F \end{cases}$$

4.3.2 Scenario II: Fixed punishment for both bureaucrat and agent

The analysis above relies on the assumption that only corrupt bureaucrats are punished when caught soliciting for a bribe. In many countries, both offering and taking bribes are considered illegal, and both agents and bureaucrats may be prosecuted for engaging in corrupt transactions. Thus, it is plausible to consider a set-up where agent's decision to bribe can be altered by a punishment system with a common probability of detection δ, and fixed fines for both bureaucrat (F_b) and agent (F_a).[7]

As in the baseline case, the bureaucrat will choose the largest bribe possible, conditional on the agent accepting it, i.e.: $B^* = E + R - U_a - \delta F_a$. The bureaucrat internalizes the punishment for the agents, and hence the optimal level of bribe becomes cheaper for everyone. The utility of the bureaucrat in the second

[7] We assume that $F_b > F_a$, which is a reasonable assumption since the bureaucrat could also face a disciplinary action from his superiors.

stage is, therefore:

$$R - U_a - \delta F_a - \delta F_b \tag{4.13}$$

Note that the above expression does not depend on the bureaucrat's effort, as the bribe requested will fully compensate it. The decision of the bureaucrat on whether to angle for a bribe or not depends on comparing the honesty pay-off with the utility from engaging in bribery. The bureaucrat will behave honestly if $2(U_b - E) > R - U_a - \delta F_a - \delta F_b$, i.e.:

$$U_b > E + \frac{R - U_a - \delta F_a - \delta F_b}{2} \tag{4.14}$$

The bureaucrat chooses honesty if he has high moral scruples (U_b), and decide to angle for a bribe if the net benefit from having reduced bureaucracy is high (i.e. high $R - U_a$) or effort of standard delivery (E) is high. If $\delta(F_a + F_b) > R - U_a$, the agent or bureaucrat will not be incentivized towards bribery because the punishment pay-off to both is higher compared to the expected gain from corruption. In that case, the bureaucrat will prefer honesty if $U_b > E$.

These results are summarized in the following proposition:

Proposition 3. ***Equilibrium with fixed penalty for corrupt bureaucrats and agent under complete information.*** *The bureaucrat solicits for a bribe if:* $U_b < E + \frac{R - U_a - \delta F_a - \delta F_b}{2}$ *and choose honesty otherwise.*

No agent is willing to pay a bribe if: $R < U_a + \delta(F_a + F_b)$.

In equilibrium, the optimal level of the bribe B is:

$$B^* = E + R - U_a - \delta F_a$$

One consequence we can draw from this result is that bribes are negatively related not only to the honesty of agents (which may not be readily affected by policy makers) but also to the punishment imposed on agents.

Equilibrium outcome under incomplete information

We now expand on the previous section analysing the equilibrium in case agents are heterogeneous in their honesty U_a, as we did for Scenario I. In this case, the probability of bribing by the agent (π) is given by:

$$\pi = P(U_a < E + R - B - \delta F_a) = \frac{E + R - B - \underline{U}_a - \delta F_a}{\overline{U}_a - \underline{U}_a} \tag{4.15}$$

Conditional on the bureaucrat angling for bribe (and concentrating for the time being on the interior solution), the optimal bribe becomes:

$$B^* = E + \frac{R - \underline{U}_a - \delta(F_a - F_b)}{2} \tag{4.16}$$

The result is comparable to equation (4.9), with the added feature that the optimal bribe level is also decreasing in the punishment for the agents F_a: an anti-corruption policy, which seeks to punish clients for paying bribes lowers the optimal bribe level, making bribery cheaper for everyone. Combining equations (4.15) and (4.16), we can see that the probability of the agent bribing decreases even more, i.e.:

$$\pi^* = \frac{1}{2} \frac{(R - \underline{U}_a - \delta F_a - \delta F_b)}{(\overline{U}_a - \underline{U}_a)} \tag{4.17}$$

The expected pay-off $\pi(B - E - \delta F_b)$ from bribery is:

$$\frac{1}{4} \frac{(R - \underline{U}_a - \delta F_a - \delta F_b)^2}{(\overline{U}_a - \underline{U}_a)} \tag{4.18}$$

we can derive the condition under which the bureaucrat chooses honesty over asking for a bribe:

$$U_b > E + \frac{1}{8} \frac{(R - \underline{U}_a - \delta F_a - \delta F_b)^2}{(\overline{U}_a - \underline{U}_a)} \tag{4.19}$$

The bureaucrat chooses honesty over angling for a bribe if he has high U_b, and if the punishment system $\delta(F_a + F_b)$ is strict. On the other hand, he is likely to ask for a bribe if efforts of normal delivery of service E is high, or the surplus available for the agent with the least scruples, i.e. $(R - \underline{U}_a)$ is high. When the agent's opportunity cost of time is very low ($R < \underline{U}_a + \delta(F_a + F_b)$), no bribery happens, while when it is very high ($R > 2\overline{U}_a - \underline{U}_a + \delta F_a + \delta F_b$), all agents irrespective of their scruples U_a will accept to pay a bribe as in the complete information case These results can be formulated through the following Proposition:

Proposition 4. ***Equilibrium with fixed penalty for corrupt bureaucrats and agent.*** *The official angles for a bribe if:* $U_b < E + \frac{1}{8}\frac{(R - \underline{U}_a - \delta F_a - \delta F_b)^2}{(\overline{U}_a - \underline{U}_a)}$ *and behaves honestly otherwise.*

No agent is willing to pay a bribe if: $R < \underline{U}_a + \delta(F_a + F_b)$.

In equilibrium, value of the bribe B is:

$$B^* = \begin{cases} E + \dfrac{R - \underline{U}_a - \delta(F_a - F_b)}{2} & \text{for } R \in \left[\underline{U}_a + \delta(F_a + F_b), 2\overline{U}_a - \underline{U}_a + \delta F_a + \delta F_b\right] \\ E + R - \overline{U}_a - \delta F_a & \text{for } R > 2\overline{U}_a - \underline{U}_a + \delta F_a + \delta F_b \end{cases}$$

From the above proposition, notice that as long as $F_b > F_a$, $\frac{\partial B}{\partial F_b} > 0$ and $\frac{\partial B}{\partial F_a} < 0$; i.e. the bureaucrat who risks fiercer punishment will ask for more expensive bribes, thus decreasing the proportion of agents engaging in bribing.

4.3.3 Scenario III: Proportional punishment

In the above analysis, we assume that the expected punishment to the bureaucrat is fixed and independent of the bribe paid. In reality, bureaucrats who are successful in extracting bribes may need to hide their illicit wealth from the public or altering their consumption patterns to avoid detection. In so doing, a corrupt bureaucrat would typically incur some private costs, which are larger, the larger is the amount of bribe.[8] Similarly, often the punishment being inflicted on a corrupt bureaucrat is not fixed but depends on the bribe itself. To encompass these occurrences, as a first approximation, we model these costs as linearly dependent on the bribe and also encompassing the expected cost of punishment. The bureaucrat's expected utility under bribery becomes: $B - E - \alpha B$, where αB is the cost (in expectation) to the bureaucrat of concealing illicit income received from corruption plus punishment. The bureaucrat, therefore, prefers bribery if bribe yields higher returns than the disutility of effort E, or the probability of detection α is lower or the total cost of concealing illicit wealth is small, i.e.:

$$B > E + \alpha B \tag{4.20}$$

[8]Intuitively, the larger the size of bribe one gets, the more visible it is to the public or government, so more resources would be needed to conceal it.

Both bureaucrat and private agent prefer bribery when $\alpha B < R - U_a$. This means that the expected cost, to the bureaucrat, of hiding illicit wealth must be lower than the net gain to the agent from having reduced bureaucracy.

Conditional on the agent choosing to bribe, the bureaucrat will ask for a bribe in this scenario if it is similar to the amount shown in equation (4.5). By substituting equation (4.5) into the bureaucrat's expected utility under bribery, we can write his second stage as:

$$(R - U_a) - \alpha(E + R - U_a) \tag{4.21}$$

Where $\alpha(E + R - U_a)$ is the cost of concealing bribe income. Therefore, his decision on whether or not to solicit for bribe will depend on the total utility he gets from honesty (i.e. equation (4.1)) compared to the sum of second stage utility from bribery (i.e. (4.21)) and zero utility from shirking in the first stage - that is:

$$U_b > \left(1 - \frac{\alpha}{2}\right) E + \frac{(1-\alpha)}{2}(R - U_a) \tag{4.22}$$

The bureaucrat chooses honesty if he has high scuples U_b, and decide to solicit for a bribe if the normal effort of being honest is high or the agent's gain is high compared to her scruples (i.e. high $R - U_a$) or if the cost of concealing corrupt proceeds is small.

These results can be summarized in the following proposition:

Proposition 5. ***Equilibrium with proportional penalty for corrupt bureaucrats under complete information.*** *The bureaucrat solicits for a bribe if:* $U_b < (1 - \frac{\alpha}{2})E + \frac{(1-\alpha)}{2}(R - U_a)$ *and behaves honestly otherwise.*

No agent is willing to pay a bribe if: $R - U_a < \frac{\alpha E}{1-\alpha}$.

In equilibrium, value of the bribe B is:

$$B^* = E + R - U_a$$

Equilibrium outcome under incomplete information

Expanding these results to the incomplete information case, we can calculate the bureaucrat's expected utility $\pi(B-E-\alpha B)$ if asking for a bribe as:

$$\max_{B} \frac{E+R-B-\underline{U}_a}{\overline{U}_a-\underline{U}_a}\left(B-E-\alpha B\right) \tag{4.23}$$

And find the optimal level of bribe (concentrating for the time being on the interior solution) as:

$$B^{*}=E+\frac{\alpha}{2-2\alpha}E+\frac{(R-\underline{U}_a)}{2-2\alpha} \tag{4.24}$$

The optimal level of the bribe is increasing in the normal effort of delivery plus a factor $\left(\frac{2-\alpha}{2-2\alpha}\right)$ that rewards the bureaucrat proportionally to his effort, and increasing in the surplus available for agents with the least scruples $(R-\underline{U}_a)$.

Combining equations (4.8) and (4.24), one can see that the fraction of agent willing to pay bribe decreases as the cost of bribery increase, i.e.:

$$\pi=\frac{1}{2}\frac{(R-\underline{U}_a)(1-\alpha)-\alpha E}{(\overline{U}_a-\underline{U}_a)(1-\alpha)} \tag{4.25}$$

We can then calculate the expected payoff from bribery:

$$\frac{1}{4}\frac{\left((R-\underline{U}_a)(1-\alpha)-\alpha E\right)^2}{(\overline{U}_a-\underline{U}_a)(1-\alpha)} \tag{4.26}$$

and derive the condition under which the bureaucrat chooses honest behaviour over asking for a bribe:

$$U_b>E+\frac{1}{8}\frac{\left((R-\underline{U}_a)(1-\alpha)-\alpha E\right)^2}{(\overline{U}_a-\underline{U}_a)(1-\alpha)} \tag{4.27}$$

The official is likely to choose honesty over asking for a bribe if he has high U_b. On the other hand, he is likely to ask for a bribe if efforts of standard delivery (E) is high, or the net surplus for the agent with the least scruples, i.e. $(R-\underline{U}_a)$ is high.

As usual, we need to remind ourselves that agents with very low opportunity cost of time $(R<\underline{U}_a+\frac{\alpha E}{1-\alpha})$ will not want to bribe, and agents with very high opportunity cost of time $(R>2\overline{U}_a-\underline{U}_a+\frac{\alpha E}{1-\alpha})$

will always be willing to pay the bribe exactly as in the complete information case ($B^* = E + R - \overline{U}_a$). Combining these results, we define Proposition 6 below:

Proposition 6. ***Equilibrium with proportional punishment for corrupt bureaucrats.*** *The bureaucrat angles for a bribe if:* $U_b < E + \frac{1}{8}\frac{\left((R-\underline{U}_a)(1-\alpha)-\alpha E\right)^2}{(\overline{U}_a-\underline{U}_a)(1-\alpha)}$ *and behaves honestly otherwise.*

No agent is willing to pay a bribe if: $R - \underline{U}_a < \frac{\alpha E}{1-\alpha}$.

In equilibrium, value of the bribe B is:

$$B^* = \begin{cases} E + \dfrac{\alpha}{2-2\alpha}E + \dfrac{(R-\underline{U}_a)}{2-2\alpha} & \text{for } R \in \left[\underline{U}_a + \frac{\alpha E}{1-\alpha}, 2\overline{U}_a - \underline{U}_a + \frac{\alpha E}{1-\alpha}\right] \\ E + R - \overline{U}_a & \text{for } R > 2\overline{U}_a - \underline{U}_a + \frac{\alpha E}{1-\alpha} \end{cases}$$

Looking at propositions (5) and (6), we can see how in this scenario the "normal" level of effort E is over-compensated by the bribe. Thus, the agent will have to trade-off the potential benefit from having reduced bureaucracy against the expected cost of punishment. And the more valuable is the public service to the agent, the larger is the amount of bribe she will have to pay to compensate for the bureaucrat's effort. However, if E is small or close to zero, bribing is cheap relative to the potential benefit of having reduced bureaucracy (i.e. $R - \underline{U}_a$), so everyone will be incentivized towards bribing.

4.4 Discussion and Conclusion

In this chapter, we have evaluated how different punishment mechanisms may lead to different outcomes in terms of bribe levels. First, harsher punishments for corrupt bureaucrats are effective in decreasing the spread of corruption. Second, as the equilibrium level of bribe payment has to compensate for the risk of detection, bribing becomes more expensive (and therefore less widespread) as punishment become harsher. Indeed, from Proposition 2, it can be seen that, in some circumstances, if expected penalty is low to start with, a rise in the probability of detection δ or an increase in the fixed fine F will imply a larger bribe size for everyone on an average.[9]

Introducing a (fixed) punishment for the agent, bribery becomes cheaper for everyone, as this decreases the expected value of the favourable treatment under corruption. So, to reduce the incidence of bribery, the expected punishment to the agent must be large enough to offset the value of the public service. More generally, if the punishment to the agent is large relative to the potential benefit of having reduced

[9]This result echoes the analysis by Mookherjee and Png (1995) in an environment with pollution enforcements.

bureaucracy, the agent does not have the incentive to bribe, and the only possible outcome is for the bureaucrat to behave honestly. However, as long as the bureaucrat's punishment is larger than the agent's ($F_b > F_a$), bribery survives under the incomplete information case and is increasing in equilibrium. But, the proportion of agent willing to engage in bribing decreases, because the extra punishment reduces the possibility of the indifferent agent accepting to bribe.

When the expected cost of punishment is modelled as proportional to the bribe itself, the effort of delivery or usefulness of the public service plays a more significant role, affecting both the incidence and optimal level of bribery. Our analysis shows that the bureaucrat will be incentivized towards bribery if, and only if, the bribe income is sufficiently large to cover the expected costs of punishment and/or concealing illicit wealth. However, as long as the agent is willing to bribe, the optimal level of the bribe under complete information, stays constant at $E+R-U_a$. In the incomplete information case, the bribe size must incorporate an extra compensation for the effort of the bureaucrat. If delivery of the public service requires less effort, the optimal bribe level in equilibrium rises linearly in $R-\underline{U}_a$. On the other hand, if much effort is needed to deliver the public service, the bureaucrat gets a bribe that *over-compensate* him for his efforts. This decreases substantially the proportion of agents engaging in bribing.

To interpret the policy implications of our results, it is essential to analyse the conditions under which bribing may occur, and how these affect willingness to pay and inequality. For the purpose of comparisons, we look into how results change at the variation of two agent's parameters: R and U_a. The first is the agent's willingness to pay which, depending on the context, could signal her wealth or valuation of the public service or opportunity cost of time. The second is the agent's aversion to dishonesty, which possibly could depend on the extent of corruption in the society. Below, we first summarize the contexts in which bribery might occur, then we discuss how a change in the punishment mechanism affect both welfare determination and equilibrium outcomes.

First, in some circumstances, bribery occurs either when agent's net valuation of the public service is large enough to offset the expected punishment of engaging in corrupt deals (i.e. $R-U_a \geq \delta F$) or when there is a general level of low aversion to dishonesty ($U_a \leq R+\delta F$).[10] As the expected punishment to the bureaucrat increases, the proportion of agents bribing decreases, as more bribe is required to incentivize the bureaucrat towards bribery. In this case, only agents with larger opportunity cost of time would engage in bribing, so the change in bribe size is simply a reallocation of surplus between wealthy agents and bureaucrat. However, where bribery is pervasive or if there is a general level of dishonesty, a fixed penalty

[10] This condition also holds when there is a fixed penalty for both the agent and bureaucrat.

to the bureaucrat can be more taxing on agents with low R, since an increase in the expected punishment would translate into an increase in the amount of bribe for everyone on the average.

Second, although, a fixed penalty to both bureaucrat and agent reduces the equilibrium level of bribe under the complete information scenario, it might not be desirable unless it eliminates bribery. Suppose, the penalty to the agent is large enough so that $\delta F_a \geq E + R$, the extent to which the elimination of bribery improves welfare depends on the honesty (U_b) of the bureaucrat to deliver the public service in an uncorrupted transaction and the utility of the agent outside bribery U_a. Under the incomplete information case, however, if $F_b > F_a$, the impact of a fixed punishment to both players on welfare is indeterminate: while a larger proportion of agents are not incentivized towards bribery, the marginally bribing agent becomes richer.

Furthermore, the effects of a proportional punishment on the optimal level of bribe depend on how much effort is required to deliver the public service. In this setting, agents are willing to bribe if the net returns from bribing weakly exceed the expected cost of compensating the bureaucrat for his effort (i.e. $R - U_a \geq \frac{\alpha E}{1-\alpha}$). Where the delivery of the public service requires much effort or is much valuable to the agent, the bribe is so expensive that only agent with a larger opportunity cost of time or willingness to pay would engage in it.

Finally, one important caveat is that our analysis is limited to a particular type of bureaucratic corruption in which government officials responsible for delivering public services to citizens can impose red tape as a means to extract bribes. Indeed, while there are several other ways to extend the analytical framework, we believe that our main conclusions are not likely to be affected in significant ways. Nonetheless, we hope the following posers will stimulate further theoretical analysis: how would the analysis fare if we consider a more complex form of corruption, such as grand thefts, in which a senior government official or politician can use his influence to secure a construction project to unqualified private companies in order to receive kickbacks? What would happen if the agent can engage in *whistle-blowing* as suggested by Basu (2011) or if agents who are ineligible for the public service offer to pay a bribe to influence the bureaucrat's decision? What if a bureaucrat can remit part of the bribe income to bureaucratic superiors?

Chapter 5

Concluding remarks

This thesis provides an insight into the issues surrounding the political economy of development in Nigeria through the lens of an applied economist. In particular, the research presented in Chapters 2 and 3 asked two overarching questions: (1) can politicians manipulate the distribution of resources to buy political support? And (2) how much does changes in the distribution of rainfall between groups contributes to rising armed conflict prevalence in Nigeria? Chapter 4 shifts the focus away from resource distribution, inequality and conflict towards measures to address the endemic culture of corruption in developing countries. Specifically, the chapter presents a theoretical model that looks into how different punishment mechanisms may result in different outcomes in terms of bribe levels and willingness to pay. The following paragraphs briefly summarise the main findings of each chapter and also outline the policy implications, with the aim that this will help developmental efforts in Nigeria and also set a path for further research.

Chapter 2 provides a first attempt to investigate how much the centralised rule-based transfer system in Nigeria can be manipulated to effectively buy political support. Using oil windfalls as a source of exogenous variation in the political discretion the central government can exert in rule-based transfers, I show that a 10% increase in VAT transfers from the central government to the states improves the electoral fortune of the incumbent government in the Presidential election by 49.31 percent. While the study was unable to demonstrate directly manipulative behaviour, the result suggests an indirect channel in which oil-induced variations in transfers do not translate to investments in public good provisions but increased support for the incumbent only when the governors are aligned to the President's party. This gives support to a mechanism in which large increases in natural resource rents increase political power and the ability to buy votes (Robinson et al., 2014).

The study has some interesting implications. First, a rule-based transfer system in which the central government determines the distributable pool obscurely incentivizes patronage politics. Indeed, the dearth of data on social development factors and the lack of transparency in the data revision process might have strengthened the process for political manipulation of VAT transfers in Nigeria. To that purpose, institutional and political reforms, which should aim at enhancing transparency in the data updating and review process, are urgently needed to contain the adversarial element of clientelistic and ethnic networks demanding for a restructure of the federal systems. Second, the use of transfers to buy electoral support diminishes the ability of the state government to provide local public goods and creates a clientelistic setting where governors who are aligned with the incumbent President can be rewarded for their support. The way that the direct redistribution of oil windfalls to citizens, as proposed, e.g. by Moss et al. (2015) under an oil-to-cash scheme, may reduce such perverse effects remains largely unanswered. Finally, this analysis underlines the need for an extensive dataset that would allow researchers interested in this subject to assess further the precise channel(s) through which centralised rule-based transfers may be manipulated to buy political support.

Chapter 3 study the relationship between changes in the distribution of rainfall among ethnic groups living within the same state and armed conflict prevalence. The main results show that a one standard deviation change in between-group rainfall inequality during the growing season increases the risks of civil conflicts in Nigeria by about seven percentage points. In addition, I show that the dynamics are not much different between civil and communal conflicts, which involves farmers and pastoralists communities. In the second part of the chapter, I investigate the transmission channels underlying the observed relationship. The result suggests a mechanism in which climatic-induced shocks reinforce citizen's grievances over government handling of the economy and creates mistrust between predominantly farming communities and those engaged in nomadic herding. An important limitation of the analysis, however, is that the study was unable to adequately isolate how economic factors, such as climate-induced resource scarcity, may contribute to intensify conflict risks. Instead, it focus on the social capital channel potentially linking inequality to conflict.

Nonetheless, the empirical results presented in chapter 3 underscores the importance of developing conflict-sensitive mitigation and adaptation strategies to reduce the adverse effects of climatic shocks. In particular, initiatives aimed at reducing Nigeria's frequent farmer-herder violence should focus on strengthening traditional conflict mediation and reconciliation mechanisms, and addressing environmental issues that push nomadic pastoralists to migrate towards the south for water and pastures. Also, while the results do present an empirical evidence of how changes in the distribution of rainfall between ethnic group increase the risk of conflicts, the analysis is limited in predicting future risks relating to how increased frequency and intensity of weather shocks would affect inequality and ability to mitigate competition over resources. Certainly, this will be a path for further research, if there exists an extensive and quality dataset that can allow for a robust empirical analysis.

Chapter 4 evaluated how different punishment mechanisms may affect the equilibrium value of bribes and the proportion of people engaging in bribery. I show that harsher punishments for corrupt bureaucrats would generally cause an increase in bribe size, making bribing more expensive (and therefore less widespread). However, the effects of a switch from a fixed punishment mechanism to a proportional one, which varies with the amount of bribe, depends on how much effort is required to deliver the public service. When effort of "normal" delivery is large, or the service is highly valuable to the client, the bribe level in equilibrium more than compensates the bureaucrat for his effort, and is also increasing in the net surplus available for the client with the least scruples. I also discuss how the results affects willingness to pay, and hence inequality.

The model has some important policy implications: if agent's opportunity cost of time is sufficiently low, stricter punishments to the bureaucrat can be effective in reducing the spread of corruption. However, in countries where bribery is pervasive or there is a general level of dishonesty, a fixed fine to the bureaucrat can be more taxing on the poor, as a rise in the expected punishment would imply an increase in the amount of bribe for everyone on the average. When this is the case, a punishment mechanism that impose a penalty on agents might further worsen the situation, especially if the penalty is lower than the fine on bureaucrats. An important caveat to borne in mind is that the analysis is limited to a particular type of bureaucratic corruption in which government officials responsible for delivering public services to citizens can impose red tape as a means to extract bribes. Thus, it is useful to consider how the results might translate in regard to more complex forms of corruption such as grand thefts or political corruption.

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Appendix A: Supplementary Tables and Figures

Table A 2.1. Description of variables

Variables	Description	Source
Percent vote shares	This is the percentage of valid votes scored by the party of the incumbent (central) government at the Presidential elections	Independent National Electoral Commission (INEC)
Num. of votes	This is the absolute number of valid votes scored by the party of the incumbent (central) government in the presidential elections	INEC
Vote margin	This is the difference in the number of valid votes scored by the party of the incumbent (central) government and the leading opponent at the Presidential elections	INEC
Alignment	An indicator variable that takes the value of 1 if the central and state governments belong to the same political party on the 30th of the previous month, and there is no emergency rule in the state as at that date.	Constructed from INEC data and various Newspaper publications relating to party affiliations of states
Swing	An indicator variable that takes the value of one if the winning margin (i.e. the difference between the percentage votes share of the two political parties that secure the highest number of votes in a state) is less than or equal to 10 percent.	Constructed from Election data provided by INEC
Co-ethnic and religion	An indicator variable that takes the value of 1 for states where at least 50% of the population has the same ethnic affiliation and religion as the incumbent President.	Constructed from INEC data and various Newspaper publications relating to Profile of Presidential candidates
Population	The estimated total number of persons inhabiting a state at any given period	National Bureau of Statistics (NBS)
Nightlight	High resolution data on light density measured by satellites at nights	U.S. Air Force's Defense Meteorological Satellite Program/Operational Linescan System (DMSP/OLS)
Climatic anomalies	The deviation of rainfall and temperature from their long term quarterly mean (defined from 1950) divided by their long-term quarterly standard deviations.	University of East Anglia Climatic Research Unit (UEA-CRU)
Primary enrolment	The total number of pupils of official primary school age who are enrolled in primary education	NBS
Secondary enrolment	The total enrolment in secondary education, regardless of age	NBS
Violence	Altercation, where force is used between one or more politically organised groups at a particular time and location	Armed Conflict Location and Event Dataset (ACLED)
VAT transfers	VAT transfers account for 15 percent of total (net) federal allocations to states. Transfers from the VAT pool is based on equality, population, and relative state contributions to VAT revenues	Federal Ministry of Finance (FMF)
Gross statutory transfers	This is the main component of the Federal Allocations, determined strictly according to the horizontal allocation formula. Gross statutory transfers accounts for (about) 75 percent of total federal allocations to states	FMF
Net transfers	this is gross statutory allocation plus 13% derivation for oil producing states less contractual obligations of states	FMF
Oil price index	This index is constructed by multiplying the production value at the state level in 2003 with the international oil price	Federal Reserve Economic Data (FRED).

Source: INEC, NBS, DMSP/OLS, UEA-CRU, ACLED, FMF, and FRED

Table A 2.2. VAT Transfers and Oil Windfalls (First Stage Results)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable			**Log VAT Transfers**			
Oil windfalls	0.189***	0.196***	0.206***	0.199***	0.208***	0.208***
	(0.018)	(0.020)	(0.019)	(0.022)	(0.023)	(0.023)
Alignment			-0.046**	-0.047**	-0.048**	-0.048**
			(0.019)	(0.022)	(0.022)	(0.022)
Swing			0.027*	0.024	0.025	0.025
			(0.013)	(0.015)	(0.016)	(0.016)
Co-ethnic				0.022	0.033	0.034
				(0.042)	(0.042)	(0.042)
Religion				0.001	0.006	0.006
				(0.027)	(0.027)	(0.027)
Population				0.040	-0.007	-0.004
				(0.068)	(0.067)	(0.089)
Primary enrolment				0.004	0.003	0.003
				(0.018)	(0.018)	(0.018)
Secondary enrolment				0.028	0.028*	0.028*
				(0.017)	(0.017)	(0.017)
Violence				-0.008	-0.006	-0.006
				(0.006)	(0.006)	(0.006)
Temperature Anomalies					-0.019***	-0.019***
					(0.007)	(0.007)
Rainfall anomalies					0.007*	0.007*
					(0.004)	(0.004)
Nightlights						-0.002
						(0.037)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarterly FE	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	No	Yes	Yes	Yes	Yes	Yes
Observations	1,152	1,152	1,152	1,152	1,152	1,152
Kleibergen-Paap rk Wald F	18.22	16.25	17.75	14.78	17.18	17.20
Number of States	36	36	36	36	36	36

Notes: Standard errors clustered at the state level in parentheses.

All variables (except alignment, swing, co-ethnic and religion) are in log form.

* significant at 10%, ** at 5%, *** at 1%.

Table A 2.3. Election Outcome and VAT Transfers (Second Stage Results)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable				**Vote Margin**		
Pred. Transfer	6.423**	6.011**	4.476**	5.660***	4.847**	4.931*
	(2.935)	(2.504)	(1.722)	(1.799)	(1.876)	(2.455)
Alignment			0.423	0.255	0.171	0.327
			(0.644)	(0.340)	(0.336)	(0.374)
Swing			-1.106***	-1.239***	-1.216***	-1.262***
			(0.329)	(0.362)	(0.353)	(0.364)
Co-ethnic				-0.572	-0.767	-1.073**
				(0.340)	(0.495)	(0.459)
Religion				-9.945***	-9.421***	3.046
				(2.907)	(2.972)	(1.890)
Population				14.856***	15.520***	12.326***
				(0.000)	(0.000)	(4.262)
Primary enrolment				-0.239	-0.158	-0.067
				(0.245)	(0.281)	(0.275)
Secondary enrolment				-0.029	-0.049	0.120
				(0.136)	(0.149)	(0.210)
Violence				-0.023	-0.068	0.030
				(0.122)	(0.156)	(0.151)
Temperature Anomalies					0.192	0.253
					(0.165)	(0.159)
Rainfall anomalies					0.110	0.074
					(0.094)	(0.099)
Nightlights						3.372**
						(1.500)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	No	Yes	Yes	Yes	Yes	Yes
Observations	108	108	108	108	108	108
Adj. R-squared	0.337	0.535	0.654	0.736	0.737	0.788
Number of States	36	36	36	36	36	36

Notes: Standard errors clustered at state level in parentheses using wild-bootstrapping as proposed by Cameron et al. (2008).

All variables (except percentage of votes share, alignment, swing, co-ethnic and religion) are in log form.

* significant at 10%, ** at 5%, *** at 1%.

Table A 2.4. Election Outcome and VAT Transfers (OLS Results)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable				**Vote margin**			
VAT transfers	-0.191	-0.022	0.158	0.205	0.315	0.273	0.400
	(0.173)	(0.463)	(0.361)	(0.527)	(0.659)	(0.972)	(0.782)
Alignment				0.266	-0.033	-0.089	0.073
				(0.548)	(0.395)	(0.365)	(0.412)
Swing				-1.055***	-1.175***	-1.125***	-1.172***
				(0.323)	(0.299)	(0.283)	(0.318)
Co-ethnic					-0.155	-0.270	-0.582
					(0.303)	(0.470)	(0.465)
Religion					-6.065***	-5.357**	-2.773
					(2.173)	(2.308)	(2.591)
Population					14.749***	14.674***	11.589**
					(3.651)	(3.863)	(4.160)
Primary enrolment					-0.152	-0.054	0.023
					(0.342)	(0.363)	(0.301)
Secondary enrolment					-0.031	-0.024	0.143
					(0.247)	(0.242)	(0.250)
Violence					-0.026	-0.076	0.019
					(0.183)	(0.208)	(0.203)
Temperature Anomalies						0.045	0.110
						(0.178)	(0.164)
Rainfall anomalies						0.244	0.208
						(0.143)	(0.153)
Nightlights							3.371*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	No	No	Yes	Yes	Yes	Yes	Yes
Observations	108	108	108	108	108	108	108
R-squared	0.019	0.552	0.552	0.717	0.764	0.781	0.783
Number of States	36	36	36	36	36	36	36

Notes: Standard errors clustered at the state level in parentheses.

All variables (except percentage of votes share, alignment, swing, co-ethnic and religion) are in log form.

* significant at 10%, ** at 5%, *** at 1%.

Table A 2.5. Election Outcome and Oil Windfalls (Reduced Form)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable			**Vote margin**			
Oil windfalls	1.177**	0.922**	1.041**	1.126**	1.009*	1.027*
	(0.561)	(0.396)	(0.438)	(0.464)	(0.549)	(0.576)
Alignment		0.215	0.250	-0.010	-0.061	0.091
		(0.497)	(0.456)	(0.331)	(0.308)	(0.347)
Swing		-0.987***	-0.979***	-1.106***	-1.097***	-1.140***
		(0.305)	(0.307)	(0.236)	(0.244)	(0.261)
Co-ethnic			-0.208	-0.449	-0.605	-0.908*
			(0.390)	(0.340)	(0.507)	(0.480)
Religion			-2.737	-9.939***	-9.392**	-6.816*
			(2.059)	(2.631)	(3.412)	(3.644)
Population				15.084***	15.484***	12.307***
				(3.416)	(3.713)	(4.119)
Primary enrolment				-0.216	-0.145	-0.055
				(0.281)	(0.293)	(0.277)
Secondary enrolment				0.130	0.088	0.260
				(0.235)	(0.234)	(0.232)
Violence				-0.067	-0.096	0.001
				(0.165)	(0.184)	(0.179)
Temperature Anomalies					0.099	0.158
					(0.153)	(0.145)
Rainfall anomalies					0.144	0.109
					(0.136)	(0.147)
Nightlights						3.361*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	108	108	108	108	108	108
R-squared	0.572	0.730	0.739	0.772	0.785	0.787
Number of States	36	36	36	36	36	36

Notes: Standard errors clustered at the state level in parentheses.

All variables (except percentage of votes share, alignment, swing, co-ethnic and religion) are in log form.

* significant at 10%, ** at 5%, *** at 1%.

Table A 2.6. Election Outcome and VAT Transfers (Second Stage Results)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable					**Vote margin**			
		Swing States				**Non-swing States**		
Pred. Transfer	10.836**	7.549*	8.581*	10.257	3.302*	1.544**	1.794**	0.242**
	(4.411)	(4.579)	(5.208)	(7.820)	(1.718)	(0.720)	(0.866)	(0.116)
Alignment	0.583	0.362	0.192	0.356	0.212	0.268	0.222	0.208
	(0.867)	(0.380)	(0.309)	(0.304)	(0.154)	(0.258)	(0.245)	(0.226)
Swing	-0.521	-0.309	-0.433*	-0.260	-1.499***	-1.443***	-1.361***	-1.258***
	(0.346)	(0.631)	(0.233)	(0.232)	(0.020)	(0.026)	(0.029)	(0.029)
Co-ethnic		-0.175*	-0.163*	-0.165*		0.046	0.064	0.065
		(0.087)	(0.086)	(0.086)		(0.056)	(0.057)	(0.057)
Religion		0.049*	0.051*	0.050*		-0.013	-0.009	-0.009
		(0.026)	(0.025)	(0.025)		(0.040)	(0.040)	(0.040)
Population		-0.006	-0.032	-0.290		3.217	2.196	2.342
		(0.113)	(0.108)	(0.192)		(3.187)	(2.948)	(2.891)
Primary enrolment		0.015	0.014	0.019		0.013	0.007	0.007
		(0.028)	(0.028)	(0.029)		(0.041)	(0.040)	(0.039)
Secondary enrolment		0.054	0.055	0.058		0.043	0.045	0.044
		(0.037)	(0.036)	(0.037)		(0.034)	(0.032)	(0.032)
Temperature Anomalies		0.211	-0.015	-0.016*		0.219***	0.229***	0.201***
		(0.179)	(0.009)	(0.009)		(0.009)	(0.009)	(0.009)
Rainfall anomalies		0.537	0.007	0.008		-0.018	0.006	0.006
		(0.460)	(0.006)	(0.006)		(0.015)	(0.005)	(0.005)
Violence			0.011	0.011			0.000	0.000
			(0.014)	(0.014)			(0.009)	(0.009)
Nightlights				0.165*				-0.038
				(0.082)				(0.059)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	42	42	42	42	66	66	66	66
Adj. R-squared	0.293	0.307	0.348	0.359	0.511	0.636	0.682	0.704
Number of States	14	14	14	14	22	22	22	22

Notes: Standard errors clustered at state level in parentheses using wild-bootstrapping as proposed by Cameron et al. (2008).
All variables (except alignment, swing, co-ethnic and religion) are in log form.
* significant at 10%, ** at 5%, *** at 1%.

Table A 2.7. Election Outcome and VAT Transfers (Second Stage Results)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	**Vote margin**							
	Align States				**Non-align States**			
Pred. Transfer	3.539***	2.574**	2.284*	2.285*	16.891	12.328	12.217	10.871
	(1.221)	(1.237)	(1.356)	(1.340)	(15.040)	(12.327)	(9.649)	(8.298)
Co-Ethnic		0.149	0.046	0.046		-0.193	-0.226	-0.234
		(0.104)	(0.075)	(0.077)		(0.157)	(0.170)	(0.163)
Religion		-2.171***	-1.752*	-0.793		-2.074***	-0.703	-0.994
		(0.728)	(0.926)	(0.566)		(0.724)	(0.536)	(1.126)
Population		1.039	1.111	1.356		-3.971	-1.376	-1.618
		(1.106)	(1.147)	(1.471)		(2.694)	(1.501)	(1.580)
Primary enrolment		-0.357*	-0.333	-0.337		-0.171	-0.102	-0.100
		(0.194)	(0.289)	(0.289)		(0.369)	(1.019)	(0.309)
Secondary enrolment		-0.052	-0.066	-0.071		-0.036	-0.166	-0.262
		(0.146)	(0.151)	(0.147)		(0.308)	(0.206)	(0.149)
Temperature Anomalies		0.142**	0.128**	0.128***		0.406	0.392	0.367
		(0.057)	(0.053)	(0.047)		(0.341)	(0.301)	(0.319)
Rainfall anomalies		0.072	0.056*	0.055		-0.005	0.058*	0.058*
		(0.036)	(0.032)	(0.033)		(0.020)	(0.031)	(0.033)
Violence			0.000	0.002			0.010	0.027
			(0.019)	(0.051)			(0.069)	(0.704)
Nightlights				0.090				0.496
				(0.358)				((0.309))
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69	69	69	69	39	39	39	39
Adj. R-squared	0.692	0.712	0.713	0.717	0.215	0.391	0.421	0.378
Number of States	23	23	23	23	13	13	13	13

Notes: Standard errors clustered at state level in parentheses using wild-bootstrapping as proposed by Cameron et al. (2008).
All variables (except alignment, swing, co-ethnic and religion) are in log form.
* significant at 10%, ** at 5%, *** at 1%.

Table A 2.8. VAT Transfers and Oil Windfalls (First Stage Results)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	**Log VAT Transfers**							
	Swing States				**Non-swing States**			
Oil windfalls	0.181***	0.189***	0.192***	0.186***	0.201***	0.173***	0.163***	0.163***
	(0.038)	(0.043)	(0.041)	(0.041)	(0.020)	(0.023)	(0.025)	(0.025)
Co-ethnic		-0.154*	-0.153*	-0.155*		0.184***	0.181***	0.183***
		(0.083)	(0.084)	(0.085)		(0.050)	(0.048)	(0.048)
Religion		0.052*	0.053*	0.051*		-0.080*	-0.078*	-0.078*
		(0.029)	(0.029)	(0.028)		(0.039)	(0.038)	(0.038)
Population		-0.060	-0.083	-0.384		0.762	0.562	0.572
		(0.115)	(0.129)	(0.228)		(0.857)	(0.984)	(1.000)
Primary enrolment		0.012	0.012	0.018		-0.024	-0.023	-0.019
		(0.027)	(0.026)	(0.028)		(0.015)	(0.015)	(0.015)
Secondary enrolment		0.043	0.042	0.047		0.013	0.015	0.014
		(0.034)	(0.034)	(0.036)		(0.010)	(0.010)	(0.009)
Temperature Anomalies		-0.016	-0.017*	-0.017*		-0.016*	-0.017*	-0.017*
		(0.009)	(0.009)	(0.009)		(0.009	(0.009)	(0.009)
Rainfall anomalies		0.007	0.009	0.008		0.002	0.002	0.002
		(0.006)	(0.006)	(0.006)		(0.003)	(0.003)	(0.003)
Violence			0.010	0.016			0.000	0.002
			(0.013)	(0.014)			(0.008)	(0.009)
Nightlights				-0.125**				0.031
				(0.056)				(0.024)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	448	448	448	448	704	704	704	704
Kleibergen-Paap rk Wald F	5.85	4.36	4.48	4.92	11.54	8.27	8.68	8.70
Number of States	14	14	14	14	22	22	22	22

Notes: Standard errors clustered at the state level in parentheses.
All variables (except alignment, swing, co-ethnic and religion) are in log form.
* significant at 10%, ** at 5%, *** at 1%.

Table A 2.9. VAT Transfers and Oil Windfalls (First Stage Results)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	**Log VAT Transfers**							
	Align States				**Non-align States**			
Oil windfalls	0.226***	0.230***	0.231***	0.231***	0.128***	0.126***	0.122***	0.121***
	(0.021)	(0.025)	(0.024)	(0.025)	(0.029)	(0.035)	(0.034)	(0.034)
Co-ethnic		0.070	0.070	0.070		-0.010	-0.008	-0.009
		(0.054)	(0.054)	(0.054)		(0.067)	(0.069)	(0.069)
Religion		-0.009	-0.009	-0.009		0.022	0.019	0.019
		(0.040)	(0.040)	(0.040)		(0.027)	(0.027)	(0.027)
Population		1.965	1.967	2.042		-0.031	-0.010	-0.081
		(3.045)	(3.058)	(3.036)		(0.052)	(0.049)	(0.076)
Primary enrolment		0.007	0.007	0.007		0.000	0.002	0.001
		(0.040)	(0.040)	(0.040)		(0.004)	(0.004)	(0.005)
Secondary enrolment		0.040	0.040	0.040		0.009*	0.013**	0.014**
		(0.032)	(0.032)	(0.032)		(0.005)	(0.004)	(0.005)
Temperature Anomalies		-0.023**	-0.023**	-0.023**		-0.010	-0.009	-0.009
		(0.009)	(0.009)	(0.009)		(0.007)	(0.007)	(0.007)
Rainfall anomalies		0.006	0.006	0.006		0.009*	0.009*	0.009*
		(0.004)	(0.004)	(0.004)		(0.004)	(0.005)	(0.004)
Violence			0.010	0.009			-0.010	-0.011
			(0.008)	(0.009)			(0.009)	(0.009)
Nightlights				-0.029				-0.017
				(0.050)				(0.030)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	736	736	736	736	416	416	416	416
Kleibergen-Paap rk Wald F	15.33	12.77	15.99	16.00	5.25	5.79	4.36	4.45
Number of States	23	23	23	23	13	13	13	13

Notes: Standard errors clustered at the state level in parentheses.
All variables (except alignment, swing, co-ethnic and religion) are in log form.
* significant at 10%, ** at 5%, *** at 1%.

Table A 2.10. Exclusion Restriction: Oil windfalls and Nightlights (full sample)

Panel A	(1)	(2)	(3)	(6)
Dep. var.		**Log nightlights**		
Oil windfalls	-0.078	-0.070	-0.036	0.009
	(0.066)	(0.063)	(0.055)	(0.052)
Rainfall anomalies		-0.025	-0.015	-0.014
		(0.024)	(0.025)	(0.014)
Temperature anomalies		-0.076	-0.101	0.063**
		(0.058)	(0.063)	(0.027)
Violence			-0.028**	-0.010
			(0.011)	(0.006)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes
Observations	792	792	454	454
R-squared	0.736	0.739	0.694	0.711

Panel B				
Dep. var.		**Log nightlights**		
Oil windfalls *(t-1)*	-0.073	-0.064	-0.036	0.009
	(0.067)	(0.063)	(0.054)	(0.045)
Oil windfalls				0.008
				(0.046)
Rainfall anomalies		-0.024	-0.015	-0.014
		(0.024)	(0.025)	(0.014)
Temperature anomalies		-0.080	-0.102	0.062**
		(0.059)	(0.062)	(0.026)
Violence			-0.028**	-0.011
			(0.011)	(0.007)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes
Observations	792	792	454	454
R-squared	0.735	0.738	0.694	0.711

Notes: Standard errors clustered at the state level in parentheses. * significant at 10%, ** at 5%, *** at 1%. The same regressions are estimated in both panels. All variables are in log form.

Table A 2.11. Exclusion Restriction: Oil windfalls and Nightlights (period of study only)

Panel A	(1)	(2)	(3)	(6)
Dep. var.		**Log nightlights**		
Oil windfalls	0.068	0.039	0.048	-0.009
	(0.139)	(0.167)	(0.175)	(0.052)
Population	3.090***	3.083***	2.985***	1.291***
	(0.690)	(0.700)	(0.730)	(0.326)
Primary enrolment	0.038	0.038	0.062	0.035
	(0.047)	(0.046)	(0.051)	(0.043)
Secondary enrolment	0.161*	0.157*	0.152	-0.089*
	(0.081)	(0.081)	(0.094)	(0.049)
Rainfall anomalies		0.033	0.036	0.037
		(0.020)	(0.034)	(0.033)
Temperature anomalies		0.135	0.169	0.063
		(0.145)	(0.161)	(0.075)
Violence			-0.010	0.013
			(0.024)	(0.016)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes
Observations	288	288	237	288
R-squared	0.686	0.689	0.682	0.727

Panel B				
Dep. var.		**Log nightlights**		
Oil windfalls *(t-1)*	-0.112	0.031	-0.056	0.051
	(0.220)	(0.145)	(0.141)	(0.072)
Population	3.931***	3.084***	2.960***	1.306***
	(0.936)	(0.708)	(0.739)	(0.331)
Primary enrolment	0.084*	0.038	0.062	0.035
	(0.048)	(0.046)	(0.050)	(0.042)
Secondary enrolment	0.159*	0.156*	0.150	-0.090*
	(0.094)	(0.081)	(0.094)	(0.050)
Rainfall anomalies		0.035	0.033	0.040
		(0.021)	(0.036)	(0.035)
Temperature anomalies		0.151	0.159	0.074
		(0.128)	(0.148)	(0.080)
Violence			-0.013	0.012
			(0.024)	(0.015)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes
Observations	324	288	237	237
R-squared	0.661	0.689	0.682	0.735

Notes: Standard errors clustered at the state level in parentheses. * significant at 10%, ** at 5%, *** at 1%. The same regressions are estimated in both panels. All variables are in log form.

Table A 2.12. Exclusion Restriction: Oil windfalls and Health outcomes

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.			HAZ-score			
Oil windfalls	-0.146	-0.071	-0.335	-0.487*	-1.060***	-0.293
	(0.206)	(0.269)	(0.272)	(0.267)	(0.353)	(0.399)
Temperature		-0.272	-0.066	-0.078	0.467	0.647*
		(0.394)	(0.351)	(0.340)	(0.322)	(0.349)
Rainfall		-0.050	-0.077	-0.051	0.020	-0.032
		(0.092)	(0.098)	(0.094)	(0.081)	(0.125)
Violence			-0.094	-0.095	-0.132***	-0.105**
Individual controls	No	No	No	Yes	Yes	Yes
Parent's controls	No	No	No	Yes	No	No
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	No	No	No	No	Yes	Yes
Mother FE	No	No	No	No	No	Yes
Observations	30,826	30,826	26,721	25,398	25,398	10,499
R-squared	0.146	0.146	0.151	0.192	0.203	0.708
Panel B						
Dep. var.			WAZ-score			
Oil windfalls	-0.119	-0.133	-0.317*	-0.333*	-0.686**	-0.385
	(0.161)	(0.179)	(0.172)	(0.170)	(0.255)	(0.263)
Temperature anomalies		0.157	0.261	0.253	0.623***	0.694***
		(0.191)	(0.179)	(0.183)	(0.183)	(0.241)
Rainfall anomalies		0.125*	0.116	0.129*	0.143*	0.205**
		(0.065)	(0.074)	(0.069)	(0.076)	(0.086)
Violence			-0.036	-0.038	0.031	0.028
			(0.033)	(0.032)	(0.025)	(0.037)
Observations	30,826	30,826	26,721	25,398	25,398	10,499
R-squared	0.147	0.147	0.149	0.182	0.192	0.712

Notes: Individual controls include child's sex, age (in months) and birth order. Parent's control include mother and father's age (in months), educational attainments, occupation and total number of children under 5. Standard errors in parentheses are clustered at the state level. * significant at 10%, ** at 5%, *** at 1%. The same regressions are estimated in both panels. R-squared retrieved from regressions with standard errors clustered at the state level.

Table A 2.13. Exclusion Restriction: Oil windfalls and Health outcomes

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.				**HAZ-score**		
Oil windfalls (1st 12-months of birth)	0.358	0.405*	0.625	-0.126	-0.182	0.990
	(0.232)	(0.218)	(0.374)	(0.258)	(0.353)	(0.968)
Temperature anomalies		0.013	0.098	0.126**	0.144***	-0.084
		(0.029)	(0.061)	(0.062)	(0.049)	(0.162)
Rainfall anomalies		-0.030	-0.064	-0.042	-0.042	0.059
		(0.025)	(0.041)	(0.038)	(0.033)	(0.077)
Violence			0.003	-0.015	-0.029	-0.151
			(0.077)	(0.069)	(0.054)	(0.130)
Individual controls	No	No	No	Yes	Yes	Yes
Parent's controls	No	No	No	Yes	No	No
Month of birth FE	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	No	No	No	No	Yes	Yes
Mother FE	No	No	No	No	No	Yes
Observations	30,826	26,932	9,238	8,787	8,787	1,856
R-squared	0.155	0.154	0.172	0.200	0.211	0.735
Panel B						
Dep. var.				**WAZ-score**		
Oil windfalls (1st 12-months of birth)	0.107	0.084	0.073	-0.548*	-0.537*	0.553
	(0.182)	(0.218)	(0.228)	(0.272)	(0.310)	(0.681)
Temperature anomalies		0.026	0.079	0.118**	0.119**	0.172
		(0.024)	(0.056)	(0.049)	(0.049)	(0.116)
Rainfall anomalies		-0.024	-0.054**	-0.038	-0.037*	0.080
		(0.017)	(0.024)	(0.024)	(0.022)	(0.063)
Violence			0.022	0.008	0.008	-0.062
			(0.044)	(0.043)	(0.039)	(0.086)
Observations	30,826	26,932	9,238	8,787	8,787	1,856
R-squared	0.149	0.149	0.184	0.209	0.216	0.726

Notes: Individual controls include child's sex, age (in months) and birth order. Parent's control include mother and father's age (in months), educational attainments, occupation and total number of children under 5. Standard errors in parentheses are clustered at the state level. * significant at 10%, ** at 5%, *** at 1%. The same regressions are estimated in both panels. R-squared retrieved from regressions with standard errors clustered at the state level.

Table A 2.14. Alternative specifications: Using percentage votes share

	(1)	(2)	(3)	(4)
Dependent Variable	**Incumbents' Percentage Votes Share**			
Pred. Transfer	1.470*	1.731**	1.283*	1.285*
	(0.772)	(0.802)	(0.667)	(0.672)
Alignment	0.132	0.144	0.104	0.108
	(0.090)	(0.098)	(0.072)	(0.079)
Swing	-0.085*	-0.092**	-0.077	-0.078
	(0.042)	(0.042)	(0.050)	(0.055)
Co-ethnic		-0.159	-0.198	-0.205
		(0.137)	(0.161)	(0.152)
Religion		-2.096***	-1.696*	-0.738
		(0.732)	(0.896)	(0.532)
Population		0.959	1.082	0.996
		(1.070)	(1.141)	(1.332)
Primary enrolment		-0.031	0.006	0.008
		(0.092)	(0.058)	(0.050)
Secondary enrolment		-0.070**	-0.072	-0.068
		(0.034)	(0.044)	(0.051)
Violence		0.030	0.013	0.016
		(0.049)	(0.038)	(0.043)
Temperature Anomalies			0.050	0.052
			(0.040)	(0.038)
Rainfall anomalies			0.056*	0.055
			(0.032)	(0.033)
Nightlights				0.089
				(0.326)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes
Observations	108	108	108	108
Adj. R-squared	0.893	0.888	0.899	0.895
Number of States	36	36	36	36

Notes: Standard errors clustered at state level in parentheses using wild-bootstrapping as proposed by Cameron et al. (2008).
All variables (except percentage of votes share, alignment, swing, co-ethnic and religion) are in log form.
* significant at 10%, ** at 5%, *** at 1%.

Table A 2.15. Alternative specifications: Number of Valid Votes

	(1)	(2)	(3)	(4)
Dependent Variable	**Log Number of Valid Votes**			
Election Outcome and VAT Transfers (2SLS)				
Pred. Transfer	2.494*	2.020	1.497*	1.495*
	(1.371)	(1.458)	(0.817)	(0.858)
Alignment	0.425	0.334	0.293	0.290
	(0.306)	(0.387)	(0.310)	(0.304)
Swing	-0.151	-0.137	-0.119	-0.118
	(0.190)	(0.150)	(0.174)	(0.177)
Ethnicity		-0.227	-0.244	-0.238
		(0.612)	(0.826)	(0.699)
Religion		-2.716	-2.232	-2.980
		(2.412)	(2.819)	(2.158)
Population		-1.186	-1.130	-1.075
		(3.133)	(3.393)	(4.070)
Primary enrolment		0.380	0.417	0.416
		(0.448)	(0.467)	(0.475)
Secondary enrolment		-0.203	-0.201	-0.204
		(0.186)	(0.224)	(0.302)
Violence		0.273	0.256	0.254
		(0.238)	(0.221)	(0.185)
Temperature Anomalies			0.043	0.042
			(0.168)	(0.151)
Rainfall anomalies			0.054	0.055
			(0.124)	(0.137)
Nightlights				-0.060
				(1.076)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes
Observations	108	108	108	108
Adj. R-squared	0.815	0.812	0.799	0.791
Number of States	36	36	36	36

Notes: Standard errors clustered at state level in parentheses using wild-bootstrapping as proposed by Cameron et al. (2008).
All variables (except percentage of votes share, alignment, swing, co-ethnic and religion) are in log form.
* significant at 10%, ** at 5%, *** at 1%.

Table A 2.16. Alternative specifications: Net Transfers

	(1)	(2)	(3)	(4)
Dependent Variable		**Vote margin**		
Election Outcome and Net Transfers (2SLS)				
Pred. Transfer	6.498**	7.934***	6.541**	6.669*
	(2.499)	(2.522)	(2.531)	(3.321)
Alignment	0.454	0.284	0.186	0.341
	(0.684)	(0.347)	(0.336)	(0.366)
Swing	-0.846***	-0.920***	-0.946***	-0.988**
	(0.273)	(0.269)	(0.274)	(0.353)
Co-ethnic		-0.220	-0.524	-0.822**
		(0.255)	(0.434)	(0.387)
Religion		-10.049***	-9.503***	2.964
		(2.937)	(2.998)	(1.890)
Population		13.667***	14.380***	11.449**
		(0.000)	(0.000)	(4.212)
Primary enrolment		-0.137	-0.076	0.019
		(0.250)	(0.318)	(0.190)
Secondary enrolment		0.169	0.107	0.275
		(0.210)	(0.204)	(0.213)
Violence		-0.026	-0.079	0.019
		(0.134)	(0.162)	(0.159)
Temperature Anomalies			0.260	0.322*
			(0.185)	(0.182)
Rainfall anomalies			0.169*	0.134
			(0.092)	(0.108)
Nightlights				3.177**
				(1.525)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes
Observations	108	108	108	108
Adj. R-squared	0.730	0.772	0.785	0.787
Number of States	36	36	36	36

Notes: Standard errors clustered at state level in parentheses using wild-bootstrapping as proposed by Cameron et al. (2008).

All variables (except percentage of votes share, alignment, swing, co-ethnic and religion) are in log form.

* significant at 10%, ** at 5%, *** at 1%.

Table A 2.17. Alternative specifications: Net Transfers

	(1)	(2)	(3)	(4)
Dependent Variable	**Log Net Transfers**			
Net Transfers and Oil Windfalls (First Stage Results)				
Oil windfalls	0.142***	0.142***	0.154***	0.154***
	(0.046)	(0.045)	(0.046)	(0.046)
Alignment	-0.037*	-0.037	-0.038	-0.037
	(0.022)	(0.022)	(0.023)	(0.023)
Swing	-0.022	-0.023	-0.023	-0.023
	(0.030)	(0.028)	(0.029)	(0.028)
Ethnicity		-0.029	-0.012	-0.013
		(0.031)	(0.031)	(0.032)
Religion		0.014	0.017	0.017
		(0.021)	(0.021)	(0.020)
Population		0.179	0.169	0.129
		(0.113)	(0.116)	(0.206)
Primary enrolment		-0.010	-0.011	-0.011
		(0.018)	(0.018)	(0.017)
Secondary enrolment		-0.005	-0.003	-0.002
		(0.014)	(0.014)	(0.012)
Violence		-0.005	-0.003	-0.003
		(0.007)	(0.007)	(0.007)
Temperature Anomalies			-0.025***	-0.025***
			(0.007)	(0.007)
Rainfall anomalies			-0.004	-0.004
			(0.008)	(0.008)
Nightlights				0.028
				(0.117)
Year FE	Yes	Yes	Yes	Yes
Quarterly FE	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes
Observations	1,152	1,152	1,152	1,152
Kleibergen-Paap rk Wald F	4.88	4.54	5.33	5.31
Number of States	36	36	36	36

Notes: Standard errors clustered at the state level in parentheses.
All variables (except alignment, swing, ethnicity and religion) are in log form.
* significant at 10%, ** at 5%, *** at 1%.

Table A 2.18. Falsification Test: Gross Transfers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable				**Log Gross Transfers**			
Gross Transfers and Oil Windfalls (First Stage Results)							
Oil windfalls	0.182***	0.068*	0.080*	0.084*	0.082	0.098	0.097
	(0.038)	(0.041)	(0.046)	(0.047)	(0.059)	(0.069)	(0.069)
Alignment				-0.016	-0.018	-0.019	-0.019
				(0.019)	(0.019)	(0.019)	(0.019)
Swing				0.014	0.011	0.012	0.012
				(0.024)	(0.024)	(0.025)	(0.025)
Co-ethnic					-0.027	-0.007	-0.007
					(0.029)	(0.030)	(0.030)
Religion					0.010	0.015	0.015
					(0.018)	(0.018)	(0.018)
Population					0.177	0.153	0.144
					(0.238)	(0.227)	(0.255)
Primary enrolment					0.000	-0.001	-0.001
					(0.015)	(0.015)	(0.015)
Secondary enrolment					0.001	0.003	0.003
					(0.015)	(0.015)	(0.015)
Violence					-0.009	-0.006	-0.006
					(0.007)	(0.007)	(0.007)
Temperature Anomalies						-0.030***	-0.030***
						(0.006)	(0.006)
Rainfall anomalies						-0.002	-0.002
						(0.006)	(0.006)
Nightlights							0.006
							(0.067)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarterly FE	No	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,152	1,152	1,152	1,152	1,152	1,152	1,152
Kleibergen-Paap rk Wald F	22.56	2.81	2.99	3.25	2.44	2.14	2.13
Number of States	36	36	36	36	36	36	36

Notes: Standard errors clustered at the state level in parentheses.

All variables (except alignment and swing) are in log form.

* significant at 10%, ** at 5%, *** at 1%.

Table A 2.19. Alternative specifications: Using 2003-2005 as a weight

	(1)	(2)	(3)	(4)
Dependent Variable		**Vote Margin**		
Pred. Transfer	4.657***	5.844***	4.955***	4.795**
	(1.582)	(1.857)	(1.650)	(2.323)
Alignment	0.419	0.252	0.168	0.307
	(0.638)	(0.327)	(0.318)	(0.375)
Swing	-1.108***	-1.241***	-1.219***	-1.259***
	(0.329)	(0.363)	(0.353)	(0.363)
Co-ethnic		-0.570	-0.756	-1.029**
		(0.339)	(0.453)	(0.440)
Religion		-9.794***	-9.277***	3.431*
		(2.863)	(2.927)	(1.767)
Population		14.952***	15.594***	12.431***
		(0.000)	(0.000)	(4.298)
Primary enrolment		-0.259	-0.178	-0.082
		(0.237)	(0.265)	(0.247)
Secondary enrolment		-0.030	-0.049	0.118
		(0.136)	(0.153)	(0.210)
Violence		-0.030	-0.072	0.024
		(0.123)	(0.153)	(0.162)
Temperature Anomalies			0.191	0.243
			(0.153)	(0.151)
Rainfall anomalies			0.100	0.073
			(0.091)	(0.101)
Nightlights				3.283**
				(1.512)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes
Observations	108	108	108	108
Adj. R-squared	0.657	0.741	0.740	0.788
Number of States	36	36	36	36

Notes: Standard errors clustered at state level in parentheses using wild-bootstrapping as proposed by Cameron et al. (2008).

All variables (except percentage of votes share, alignment, swing, co-ethnic and religion) are in log form.

* significant at 10%, ** at 5%, *** at 1%.

Table A 2.20. Alternative specifications: controlling for past elections

	(1)	(2)	(3)	(4)
Dependent Variable		**Vote Margin**		
Pred. Transfer	4.546**	5.120**	6.250**	5.704*
	(2.165)	(2.136)	(2.709)	(2.859)
Alignment	0.426	0.232	0.184	0.328
	(0.636)	(0.395)	(0.379)	(0.412)
Swing	-1.107***	-1.230***	-1.204***	-1.253***
	(0.328)	(0.358)	(0.347)	(0.360)
Co-ethnic		-0.619	-0.391	-0.852
		(0.400)	(0.661)	(0.664)
Religion		-9.526***	-9.997***	3.049
		(2.773)	(3.140)	(1.952)
Lag vote share (opposition)	-0.006	0.053	-0.301	-0.167
	(0.252)	(0.119)	(0.283)	(0.252)
Population		14.725***	15.875***	12.650***
		(0.000)	(0.000)	(4.356)
Primary enrolment		-0.186	-0.356	-0.181
		(0.355)	(0.372)	(0.344)
Secondary enrolment		-0.025	-0.045	0.116
		(0.146)	(0.150)	(0.211)
Violence		-0.029	-0.070	0.025
		(0.120)	(0.155)	(0.173)
Temperature Anomalies			0.199	0.255
			(0.165)	(0.159)
Rainfall anomalies			0.272	0.165
			(0.169)	(0.181)
Nightlights				3.238**
				(1.454)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes
Observations	108	108	108	108
Adj. R-squared	0.643	0.723	0.736	0.782
Number of States	36	36	36	36

Notes: Standard errors clustered at state level in parentheses using wild-bootstrapping as proposed by Cameron et al. (2008).

All variables (except percentage of votes share, alignment, swing, co-ethnic and religion) are in log form.

* significant at 10%, ** at 5%, *** at 1%.

Table A 2.21. Alternative specifications: Ten Oil Producing States

	(1)	(2)	(3)	(4)
Dependent Variable		**Vote margin**		
Election Outcome and VAT Transfers (2SLS)				
Pred. Transfer	3.559**	6.389**	4.468**	5.373*
	(1.399)	(2.372)	(2.149)	(2.699)
Alignment	0.406	0.336	0.187	0.407
	(0.621)	(0.280)	(0.285)	(0.334)
Swing	-1.106***	-1.262***	-1.212***	-1.277***
	(0.329)	(0.369)	(0.351)	(0.368)
Co-ethnic		-0.787*	-0.786	-1.212**
		(0.439)	(0.578)	(0.552)
Religion		-10.537***	-9.027**	-6.995*
		(3.080)	(3.814)	(3.483)
Population		15.120***	15.355***	12.151**
		(0.000)	(0.000)	(4.584)
Primary enrolment		-0.226	-0.127	-0.051
		(0.257)	(0.291)	(0.317)
Secondary enrolment		-0.076	-0.065	0.106
		(0.165)	(0.163)	(0.219)
Violence		-0.030	-0.072	0.031
		(0.145)	(0.160)	(0.166)
Temperature Anomalies			0.142	0.227
			(0.149)	(0.146)
Rainfall anomalies			0.123	0.062
			(0.098)	(0.108)
Night lights				3.567**
				(1.546)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes
Observations	108	108	108	108
Adj. R-squared	0.639	0.732	0.726	0.784
Number of States	36	36	36	36

Notes: In this table, we change the definition of oil-producing states by classifying Lagos and Ogun States, which are considered as off-shore oil states as non-oil producing states.

Standard errors clustered at state level in parentheses using wild-bootstrapping as proposed by Cameron et al. (2008).

All variables (except percentage of votes share, alignment, swing, co-ethnic and religion) are in log form.

* significant at 10%, ** at 5%, *** at 1%.

Table A 2.22. Alternative specifications: Excluding Lagos and Rivers States

	(1)	(2)	(3)	(4)
Dependent Variable		**Vote margin**		
Election Outcome and VAT Transfers (2SLS)				
Pred. Transfer	4.378***	5.489**	4.110**	4.308*
	(1.541)	(1.969)	(1.727)	(2.279)
Alignment	0.444	0.246	0.122	0.279
	(0.692)	(0.348)	(0.287)	(0.331)
Swing	-1.041***	-1.203***	-1.147***	-1.208***
	(0.308)	(0.349)	(0.329)	(0.345)
Co-ethnic		-0.550	-0.645	-1.021*
		(0.496)	(0.588)	(0.576)
Religion		15.226***	16.680***	14.370***
		(4.413)	(0.000)	(4.471)
Population		14.953***	15.327***	12.373***
		(0.000)	(4.398)	(4.069)
Primary enrolment		-0.301	-0.198	-0.103
		(0.237)	(0.273)	(0.246)
Secondary enrolment		0.015	0.020	0.189
		(0.175)	(0.150)	(0.235)
Violence		-0.026	-0.072	0.037
		(0.131)	(0.169)	(0.139)
Temperature Anomalies			0.176	0.237
			(0.163)	(0.151)
Rainfall anomalies			0.145	0.103
			(0.095)	(0.121)
Night lights				3.377**
				(1.346)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes
Observations	102	102	102	102
Adj. R-squared	0.635	0.712	0.714	0.769
Number of States	34	34	34	34

Notes: Standard errors clustered at state level in parentheses using wild-bootstrapping as proposed by Cameron et al. (2008).

All variables (except percentage of votes share, alignment, swing, co-ethnic and religion) are in log form.

* significant at 10%, ** at 5%, *** at 1%.

Table A 2.23. Interpretation: VAT transfers and Public goods

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.	**Access to drinking water**					
Pred. Transfer	12.878*	13.993**	-1.434	-1.282	3.305	0.920
	(7.052)	(7.108)	(1.344)	(1.470)	(9.763)	(17.902)
Population		-1.977	-2.538	-2.728	-2.116	-1.844
		(2.026)	(2.178)	(2.148)	(2.097)	(1.948)
Primary enrolment		-0.190**	-0.006	-0.012	-0.066	-0.037
		(0.091)	(0.035)	(0.036)	(0.113)	(0.117)
Secondary enrolment		-0.334**	0.001	-0.007	-0.112	-0.057
		(0.148)	(0.048)	(0.063)	(0.202)	(0.209)
Temperature Anomalies			-0.008	-0.036	0.048	0.012
			(0.034)	(0.042)	(0.174)	(0.286)
Rainfall anomalies			-0.140**	-0.010	-0.043	-0.033
			(0.070)	(0.039)	(0.043)	(0.039)
Violence				0.039**	0.037*	0.044**
				(0.017)	(0.020)	(0.019)
Nightlights					0.023	0.016
					(0.214)	(0.195)
Household controls	No	No	No	No	No	Yes
Year of survey FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,967	69,967	69,967	69,967	69,967	69,392
R-squared	0.072	0.073	0.075	0.075	0.075	0.101

Panel B						
Dep. var.	**Access to sanitation facility**					
Pred. Transfer	3.934	4.103	1.863	1.493	9.334	5.867
	(7.417)	(6.933)	(1.389)	(1.402)	(9.194)	(8.102)
Population		-1.689	-0.735	-1.014	-0.946	-0.613
		(1.826)	(2.021)	(2.069)	(1.876)	(1.653)
Primary enrolment		-0.007	0.016	0.020	-0.048	0.003
		(0.155)	(0.039)	(0.038)	(0.113)	(0.064)
Secondary enrolment		-0.085	-0.037	-0.023	-0.258	-0.182
		(0.145)	(0.040)	(0.047)	(0.206)	(0.175)
Temperature Anomalies			0.025	-0.003	0.153	0.102
			(0.035)	(0.020)	(0.150)	(0.131)
Rainfall anomalies			-0.239***	-0.000	-0.014	0.000
			(0.077)	(0.004)	(0.055)	(0.005)
Violence				0.013	0.012	0.022
				(0.017)	(0.023)	(0.019)
Nightlights					0.533***	0.544***
					(0.198)	(0.183)
Observations	69,967	69,967	69,967	69,967	69,967	69,392
R-squared	0.140	0.141	0.141	0.142	0.144	0.213

Notes: Household control include household size, sex, age and education of household's head. Standard errors in parentheses are clustered at the surveys' cluster level, using wild bootstrap method (Cameron et al. 2008). * significant at 10%, ** at 5%, *** at 1%. The same regressions are estimated in both panels. R-squared retrieved from regressions with standard errors clustered at the surveys' cluster level.

Table A 2.24. Interpretation: VAT transfers and Public goods

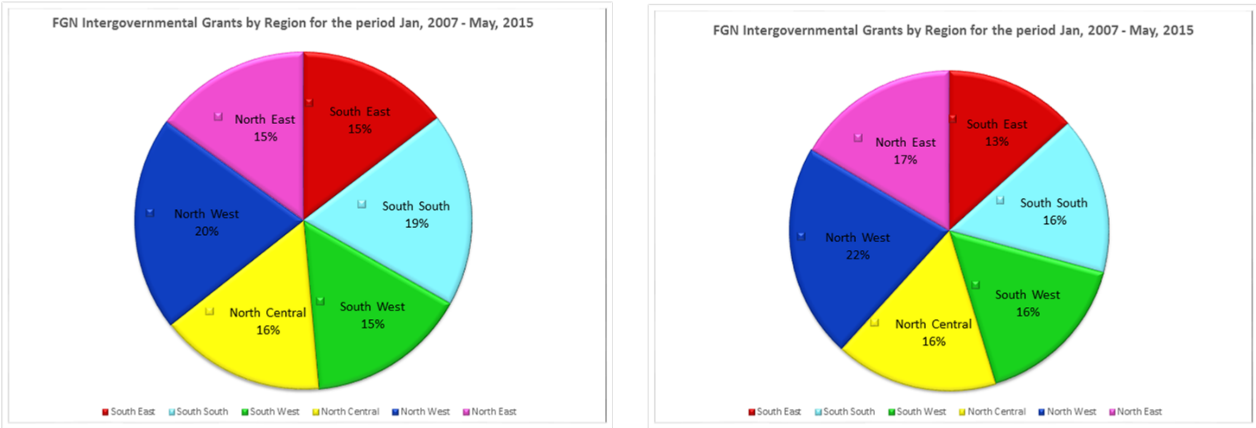
Panel A	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.			**Access to electricity**			
Pred. Transfer	-3.229	-3.667	-0.029	-0.372	-1.021	-5.216
	(7.272)	(7.816)	(1.523)	(1.445)	(8.376)	(8.617)
Population		-0.426	-0.500	-0.798	-0.600	-0.318
		(2.382)	(2.300)	(2.226)	(2.296)	(2.142)
Primary enrolment		0.030	-0.013	-0.011	-0.003	0.055
		(0.097)	(0.046)	(0.041)	(0.525)	(0.100)
Secondary enrolment		0.073	-0.006	0.007	0.014	0.107
		(0.181)	(0.046)	(0.055)	(0.151)	(0.188)
Temperature Anomalies			-0.028	-0.039	-0.044	-0.107
			(0.034)	(0.040)	(0.137)	(0.141)
Rainfall anomalies			-0.096*	0.011	0.008	0.024
			(0.058)	(0.043)	(0.044)	(0.040)
Violence				-0.018	-0.014	-0.002
				(0.021)	(0.030)	(0.029)
Nightlights					0.037	0.034
					(0.288)	(0.217)
Household controls	No	No	No	No	No	Yes
Year of survey FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,967	69,967	69,967	69,967	69,967	69,392
R-squared	0.196	0.196	0.196	0.196	0.196	0.283
Panel B						
Dep. var.			**Net attendance ratio in primary school**			
Pred. Transfer	24.606***	19.935*	-1.229	-1.622	14.171	8.197
	(8.983)	(11.648)	(3.481)	(2.733)	(15.417)	(12.096)
Population (aged 6-12)	0.767***	0.766***	0.766***	0.766***	0.766***	0.540***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population		11.154***	10.123***	9.288***	10.039***	10.606***
		(0.000)	(0.000)	(2.823)	(3.051)	(0.000)
Primary enrolment		-0.319**	-0.064	-0.068	-0.253	-0.163
		(0.130)	(0.106)	(0.092)	(0.173)	(0.139)
Secondary enrolment		-0.238	0.208***	0.201**	-0.128	-0.007
		(0.363)	(0.000)	(0.079)	(0.392)	(0.260)
Temperature Anomalies			0.157**	-0.049	0.210	0.123
			(0.072)	(0.073)	(0.256)	(0.205)
Rainfall anomalies			-0.192***	-0.045	-0.118*	-0.086
			(0.068)	(0.124)	(0.068)	(0.054)
Violence				0.003	-0.017	0.007
				(0.043)	(0.101)	(0.045)
Nightlights					-0.054	-0.065
					(0.435)	(0.323)
Observations	69,967	69,967	69,967	69,967	69,967	69,392
R-squared	0.528	0.530	0.530	0.530	0.530	0.575

Notes: Household control include household size, sex, age and education of household's head. Standard errors in parentheses are clustered at the surveys' cluster level, using wild bootstrap method (Cameron et al. 2008). * significant at 10%, ** at 5%, *** at 1%. The same regressions are estimated in both panels. R-squared retrieved from regressions with standard errors clustered at the surveys' cluster level.

Table A 2.25. Interpretation: VAT transfers and Public goods

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.	**Wealth index**					
Pred. Transfer	-1.138	0.393	3.101	3.067	25.444	10.260
	(109.487)	(39.208)	(10.607)	(7.662)	(54.728)	(27.791)
Population		-3.505	-2.467	-2.535	-3.191	-2.186
		(19.316)	(17.520)	(16.931)	(18.910)	(7.345)
Primary enrolment		-0.060	-0.095	-0.094	-0.332	-0.115
		(0.660)	(0.234)	(0.194)	(0.645)	(0.359)
Secondary enrolment		-0.095	-0.165	-0.154	-0.665	-0.329
		(1.243)	(0.195)	(0.261)	(1.044)	(0.590)
Temperature Anomalies			0.059	0.013	0.379	0.152
			(0.114)	(0.200)	(0.857)	(0.465)
Rainfall anomalies			-0.583***	0.002	-0.038	0.022
			(0.189)	(0.069)	(0.528)	(0.146)
Violence				-0.035	-0.070	-0.029
				(0.318)	(0.251)	(0.103)
Nightlights					0.398	0.396
					(0.998)	(0.505)
Household controls	No	No	No	No	No	Yes
Year of survey FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	69,967	69,967	69,967	69,967	69,967	69,392
R-squared	0.390	0.390	0.390	0.391	0.391	0.555

Notes: Household control include household size, sex, age and education of household's head. Standard errors in parentheses are clustered at the surveys' cluster level, using wild bootstrap method (Cameron et al. 2008). * significant at 10%, ** at 5%, *** at 1%. The same regressions are estimated in both panels. R-squared retrieved from regressions with standard errors clustered at the surveys' cluster level.



(a) Actual grants

(b) Hypothetical grants

Note: All grants were deflated by 2007 constant Naira (page 9). The hypothetical VAT allocation to each region were calculated applying the horizontal formula for VAT allocation to the total net VAT transfers (after deductions) available for distribution to states annually.

Fig. A 2.1 Actual and hypothetical grants based on population and landmass

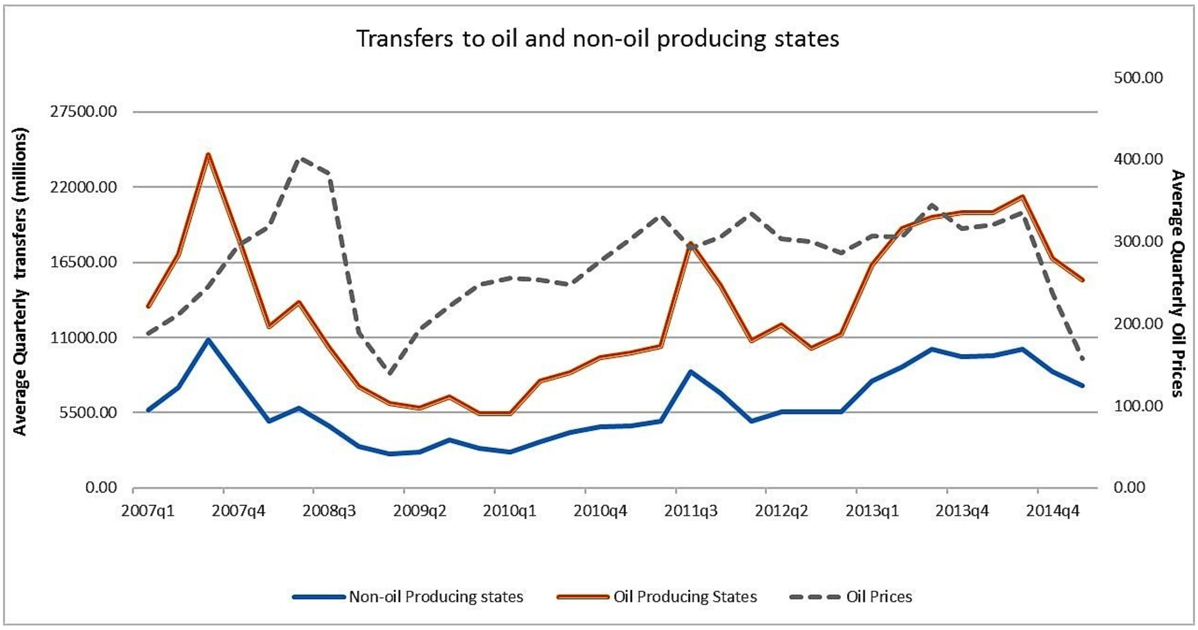


Fig. A 2.2 Real international oil prices and average VAT transfers in oil and non-oil producing States

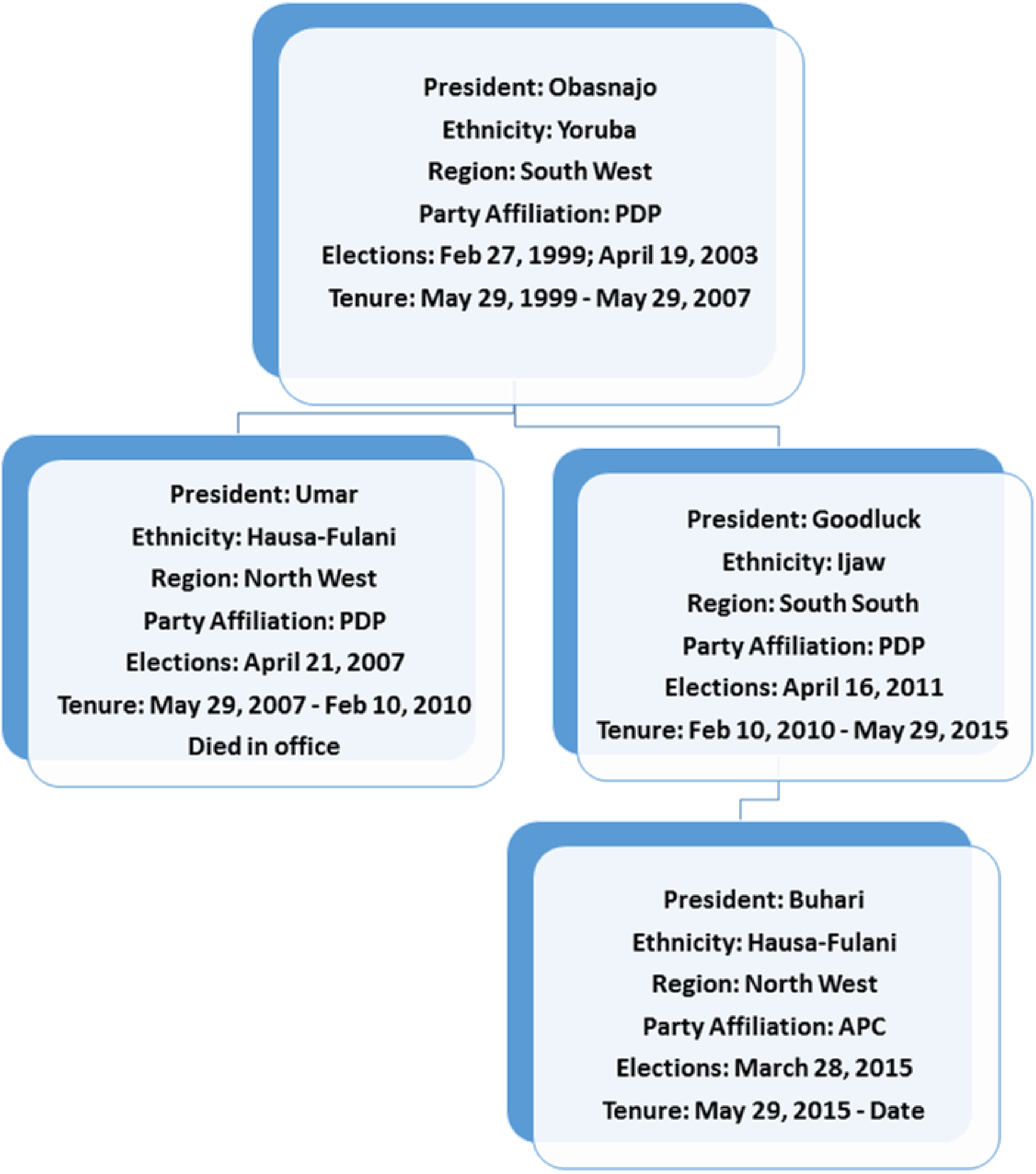


Fig. A 2.3 Political and Leadership Transitions in Nigeria, 1999 - Date

Appendix B: Supplementary Tables and Figures for Chapter 2

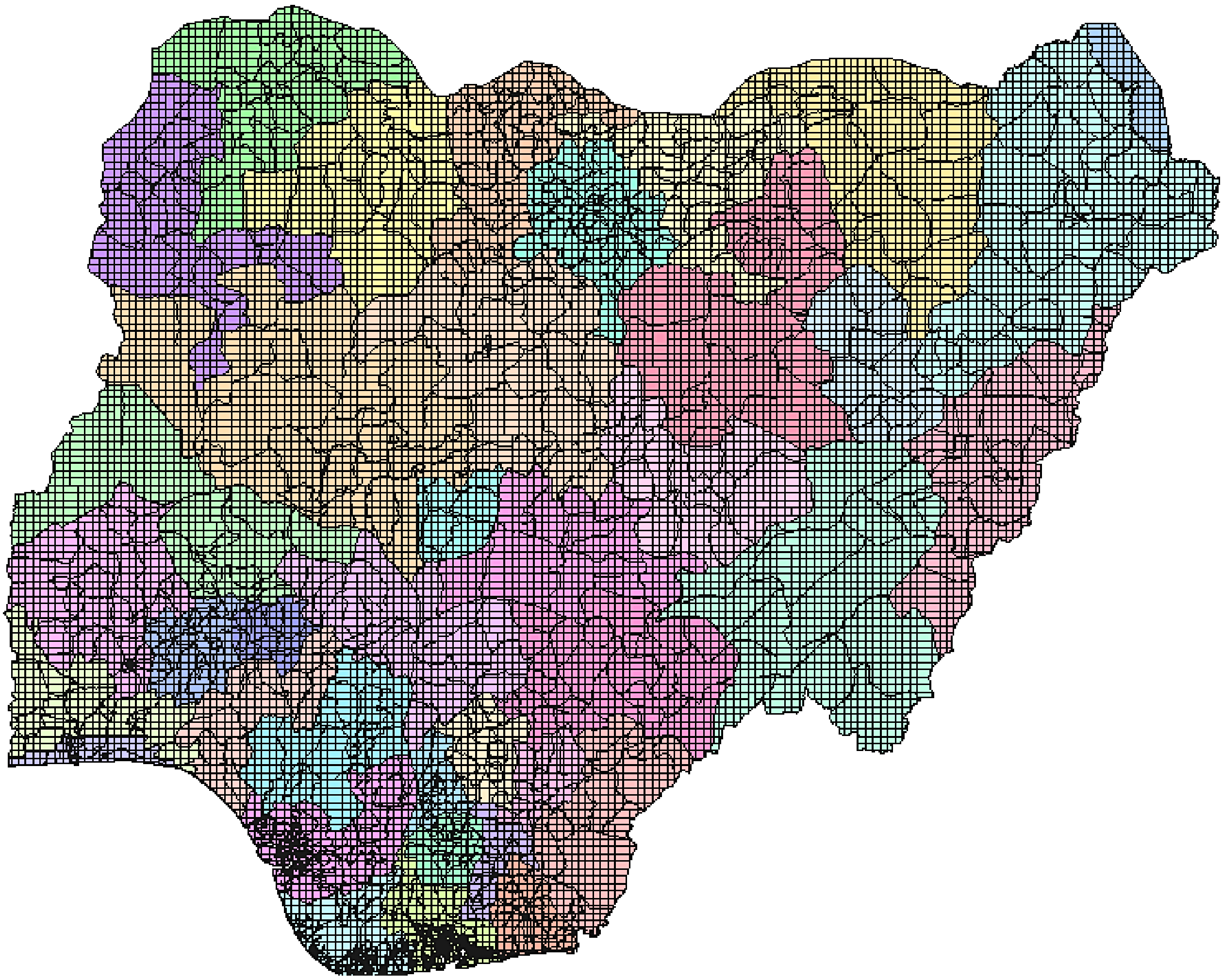


Fig. A 3.1 Map showing how the different dataset was combined to construct BGR inequality

Table A 3.1. Cross-correlation table

Variables	BGR inequality	WGR inequality	WSR inequality	BGT inequality	WGT inequality	WST inequality
BGR inequality	1.000					
WGR inequality	0.028	1.000				
WSR inequality	0.702	0.711	1.000			
BGT inequality	0.580	0.024	0.453	1.000		
WGT inequality	-0.103	0.857	0.520	0.090	1.000	
WST inequality	0.316	0.624	0.681	0.699	0.763	1.000

Table A 3.2. Summary Statistics

Variables	**Observations**	**Mean**	**Std. Dev**	**Min**	**Max**
Rainfall	703	59.501	24.471	2.185	180.90
Temperature	703	18.068	5.935	5.188	39.489
Indicator that the State has high religious fragmentation	703	0.485	0.382	0	1
Measure of State religious tension	703	0.258	0.255	0	0.720
Number of violent events	703	9.855	23.53	0	315
Fatalities	703	81.33	428.0	0	7,396
Civil conflict	703	0.232	0.422	0	1
Communal conflict	703	0.284	0.500	0	1
BGR inequality	703	0.174	0.186	0	1
WGR inequality	703	0.102	0.143	0	1
Within-state inequality	703	0.162	0.142	0	1
BGT inequality	703	0.134	0.152	0	1
WGT inequality	703	0.137	0.176	0	1
Within-state Temperature inequality	703	0.184	0.170	0	1
Oil producing state dummy	703	0.351	0.478	0	1
General Trust	1,204	0.499	0.401	0	1
Between-group Trust	1,204	0.525	0.473	0	1
Within-group Trust	1,204	0.573	0.404	0	1
Trust neighbour	1,204	0.511	0.500	0	1
Trust in government scale	1,624	0.341	0.379	0	1
Government corruption scale	1,624	0.530	0.432	0	1
Government satisfaction scale	1,624	0.362	0.329	0	1

Notes: All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$. BGR indicates Between-Group Rainfall Inequality. WGR indicates Within-Group Rainfall Inequality. BGT indicates Between-Group Temperature Inequality. WGT indicates Within-Group Temperature Inequality.

Table A 3.3. Robustness to using number of fatalities

Dependent Variable	Number of fatalities				
	(1)	(2)	(3)	(4)	(5)
BGR inequality	1.669***	1.993***	0.699	0.894	1.015*
	(0.351)	(0.405)	(0.847)	(0.632)	(0.544)
Rainfall		0.314	0.234	0.129	0.437**
		(0.821)	(0.782)	(0.112)	(0.206)
Temperature		-0.256	-0.101	-0.216*	-0.342**
		(0.188)	(0.190)	(0.131)	(0.155)
Religion controls		Included			
Economic controls					Included
Year FE	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes	Yes
R-squared	0.029	0.222	0.372	0.426	0.523
Observations	703	703	703	703	333

Notes: All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$.

BGR indicates Between-Group Rainfall Inequality.

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* significant at 10%, ** at 5%, *** at 1%

Table A 3.4. Robustness to using number of violent events

Dependent Variable		**Number of violent events**			
	(1)	(2)	(3)	(4)	(5)
BGR inequality	1.138***	1.109***	0.514	0.601*	0.298*
	(0.204)	(0.216)	(0.351)	(0.318)	(0.170)
Rainfall		0.027	0.189	0.273	0.567
		(0.458)	(0.395)	(0.205)	(0.417)
Temperature		-0.095	-0.004	-0.105	-0.158**
		(0.107)	(0.094)	(0.068)	(0.079)
Religion controls		Included			
Economic controls					Included
Year FE	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes	Yes
R-squared	0.045	0.331	0.546	0.612	0.671
Observations	703	703	703	703	333

Notes: All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$.

BGR indicates Between-Group Rainfall Inequality.

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* significant at 10%, ** at 5%, *** at 1%

Table A 3.5. Robustness to using alternative conflict dataset (UCDP)

Dependent Variable		**Civil conflict**			
	(1)	(2)	(3)	(4)	(5)
BGR inequality	0.337**	0.121	0.322**	0.327**	0.333**
	(0.155)	(0.074)	(0.133)	(0.139)	(0.149)
Rainfall		0.027	0.169**	0.349*	0.567
		(0.458)	(0.075)	(0.182)	(0.417)
Temperature		-0.195	-0.218	-0.168*	-0.183**
		(0.107)	(0.172)	(0.087)	(0.093)
Religion controls		Included			
Economic controls					Included
Year FE	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes	Yes
R-squared	0.045	0.331	0.546	0.584	0.671
Observations	703	703	703	703	333

Notes: All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$.

BGR indicates Between-Group Rainfall Inequality.

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* significant at 10%, ** at 5%, *** at 1%

Table A 3.6. Robustness to including spatial lag of BGR inequality

Dependent Variable		**Civil conflict**			
	(1)	(2)	(3)	(4)	(5)
BGR inequality	0.381***	0.439***	0.140	0.264*	0.374**
	(0.096)	(0.115)	(0.238)	(0.153)	(0.190)
Spatially lagged BGR	0.068**	0.095	0.155	0.238*	1.664*
	(0.033)	(0.139)	(0.181)	(0.134)	(0.977)
Rainfall		0.126	0.093	0.130	0.252
		(0.230)	(0.232)	(0.081)	(0.217)
Temperature		-0.010	0.020	0.014	-0.012
		(0.047)	(0.048)	(0.037)	(0.043)
Religion controls		Included			
Economic controls					Included
Year FE	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes	Yes
R-squared	0.021	0.094	0.151	0.362	0.433
Observations	703	703	703	703	333

Notes: All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$.

BGR indicates Between-Group Rainfall Inequality.

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* significant at 10%, ** at 5%, *** at 1%

Table A 3.7. Robustness to considering BGR inequality outside the growing season

Dependent Variable		**Civil conflict**			
	(1)	(2)	(3)	(4)	(5)
BGR inequality (non-growing)	0.283*	0.357	0.139	0.162	0.268
	(0.166)	(0.220)	(0.236)	(0.240)	(0.217)
Rainfall		0.023	0.016	0.039	0.068*
		(0.045)	(0.045)	(0.0261)	(0.037)
Temperature		-0.017	0.020	0.024	-0.014
		(0.046)	(0.048)	(0.040)	(0.043)
Religion controls		Included			
Economic controls					Included
Year FE	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes	Yes
R-squared	0.020	0.093	0.151	0.284	0.430
Observations	703	703	703	703	333

Notes: All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$.

BGR indicates Between-Group Rainfall Inequality.

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* significant at 10%, ** at 5%, *** at 1%

Table A 3.8. Robustness to using alternative ethnic dataset (GREG)

Dependent Variable			**Civil conflict**		
	(1)	(2)	(3)	(4)	(5)
BGR inequality	1.189***	1.431***	0.331	0.647**	0.805*
	(0.315)	(0.365)	(0.280)	(0.321)	(0.418)
BGR inequality (t-1)					
BGR inequality (t-2)					
Rainfall		0.023	0.018	0.053*	0.070*
		(0.045)	(0.046)	(0.029)	(0.037)
Temperature		-0.018	0.019	-0.016	-0.011
		(0.046)	(0.048)	(0.042)	(0.044)
Religion controls		Included			
Economic controls					Included
Year FE	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes	Yes
R-squared	0.019	0.091	0.151	0.431	0.435
Observations	703	703	703	703	333

Notes: All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$.

BGR indicates Between-Group Rainfall Inequality.

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* significant at 10%, ** at 5%, *** at 1%

Table A 3.9. Robustness to considering monthly-level analysis

Dependent Variable	**Civil conflict**				
	(1)	(2)	(3)	(4)	(5)
BGR inequality	0.053*	0.055	0.180***	0.153***	0.095***
	(0.029)	(0.037)	(0.034)	(0.048)	(0.034)
Rainfall		0.007	0.084***	0.089***	0.076***
		(0.019)	(0.022)	(0.024)	(0.021)
Temperature		-0.085***	-0.062***	-0.058***	-0.086***
		(0.014)	(0.013)	(0.016)	(0.014)
Religion controls		Included			
Economic controls				Included	Included
Month FE	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes	Yes
R-squared	0.051	0.106	0.303	0.428	0.433
Observations	5,182	5,182	5,182	3,966	3,996

Notes: All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$.

BGR indicates Between-Group Rainfall Inequality.

Robust standard errors (in parentheses) are adjusted for spatial dependence of an unknown form (Conley, 1999)

* significant at 10%, ** at 5%, *** at 1%

Table A 3.10. Robustness to using probit model

Dependent Variable		**Civil conflict**			
	(1)	(2)	(3)	(4)	(5)
BGR inequality	0.391***	0.468***	0.292	0.312*	0.504***
	(0.101)	(0.114)	(0.233)	(0.163)	(0.114)
Rainfall		0.123	-0.053	0.047	0.007
		(0.224)	(0.094)	(0.083)	(0.146)
Temperature		-0.016	-0.018	-0.027	-0.022
		(0.045)	(0.025)	(0.032)	(0.038)
Religion controls		Included			
Economic controls					Included
Year FE	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes
State-specific time trends	No	No	No	Yes	Yes
Observations	703	703	703	703	333

Notes: Robust standard errors (in parentheses) are clustered at the state-level

All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$

BGR indicates Between-Group Rainfall Inequality

* significant at 10%, ** at 5%, *** at 1%

Table A 3.11. Civil conflict, trust and inequality

Dependent Variable	**Civil conflict**						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
BGR inequality	0.301	0.298	0.307	0.373*	0.303	0.346*	0.345
	(0.196)	(0.193)	(0.191)	(0.213)	(0.194)	(0.183)	(0.214)
Rainfall	0.011	0.020	0.338	0.323	0.004	0.385	0.384
	(0.039)	(0.052)	(0.214)	(0.239)	(0.214)	(0.054)	(0.239)
Temperature	-0.022	-0.022	-0.011	-0.017	-0.022	-0.018	-0.017
	(0.044)	(0.043)	(0.042)	(0.048)	(0.043)	(0.048)	(0.048)
General Trust	-0.401*						-0.010
	(0.214)						(0.065)
Between-group Trust	-0.341**						-0.103*
	(0.163)						(0.055)
Trust in government scale		-0.403*			-0.023	-0.012	-0.019
		(0.214)			(0.052)	(0.066)	(0.094)
Government satisfaction scale			-0.038***		-0.406*		-0.048***
			(0.012)		(0.239)		(0.015)
Government corruption scale				-0.024		-0.026	
				(0.046)		(0.046)	
Economic controls	Included	Included	Included	Included	Included	Included	Included
Survey-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.448	0.446	0.442	0.470	0.447	0.475	0.475
Observations	296	296	296	296	296	296	296

Notes:All inequality measures have been normalized by taking $(X - X_{min})/(X_{max} - X_{min})$

BGR indicates Between-Group Rainfall Inequality

General Trust is a summative scale, indicating that respondents trusts somewhat or a lot in their relatives, neighbours, own ethnic group and others.

Trust in government is a summative scale, indicating that respondents trust somewhat or a lot in the Government.

Between-group trust is a measure that captures the level of trust between the different ethnic groups living within a state.

Government satisfaction: an indicator that the government handles the economy very well as opposed to very badly.

Robust standard errors (in parentheses) are clustered at the state-level

* denotes significant at 10%, ** at 5%, *** at 1%