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Analysis of the Sub-National Distribution of Foreign Aid in Sub-Saharan Africa:

Patterns, Institutions and Effects on Regional Inequality

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Summary

Chapter 1 provides an introduction and preliminary comparisons of economic and human development indicators to present current differences in levels of development between different countries grouped by their income level. Since World War II foreign aid has proved to be one of the main instruments for the developed countries to promote and increase economic development in less developed parts of the world.

Chapter 2 will give a brief chronological overview of economic theories about economic growth and development and highlight recent approaches in development research. It will be shown that the focus of development policies has changed several times since its emergence. Given positive and negative growth experiences in developing countries, the development research literature is still inconclusive concerning the effects of development assistance and foreign aid on economic development. The gap in economic performance between developing and developed countries remains considerable, even in the face of constant flows of foreign aid and continuously changing policy prescriptions addressing pressing issues and obstacles of development.

Chapter 3 uses sub-nationally disaggregated data to assess the importance of recipient countries' governance on the allocation of aid projects within recipient countries. The results show that incumbent presidents' birth regions do not significantly attract more project aid than other regions in a country. Accounting for levels of governance in recipient countries does not change the results. On the other hand, capital city regions appear to attract more project aid. Higher levels of governance seem to have a negative effect on the allocation of aid projects in capital city regions, which might be driven by clientelistic and corrupt motives of political decision makers.

Considering the results from the research literature and from Chapter 3 one may wonder how different sub-national distributional patterns of aid projects and for-

eign aid influence regional and spatial inequalities within recipient countries. If the sub-national allocation of foreign aid follows certain ethnic, political or economic considerations, instead of addressing poverty or alleviating human misery, then foreign aid might further deepen regional inequalities in recipient countries. Thus, Chapter 4 first elaborates on different theories and highlights existing empirical evidence about regional inequality. The chapter additionally presents trends and levels of different measures of regional inequality in sub-Saharan Africa.

Chapter 5 assesses the relationship between foreign aid and regional inequality. First, different measures of regional inequality and necessary considerations for proper interpretation are discussed. Secondly, using a sub-nationally disaggregated GDP data these measures of regional inequality in sub-Saharan Africa are calculated to further discuss their patterns and levels over the years 1998 to 2015. The data shows that regional inequalities vary largely within and between countries and that the pattern is on average highly persistent in the entire sample. The empirical analysis to understand the effects of foreign aid on regional inequality first provides estimation results using a static panel estimation approach. However, due to serious endogeneity concerns, especially between foreign aid and regional inequality, these results need to be taken cautiously. The empirical analysis further uses dynamic panel estimation methods such as system GMM to account for endogeneity issues and for the high persistence of regional inequalities. The results indicate that foreign aid does not increase regional inequalities, but instead even reduced regional inequalities in some specifications. Interestingly, higher trade ratios significantly reduce regional inequalities in all specifications. Furthermore, the estimation using the decomposition of regional inequalities by within and between capital and non capital city regions could not detect any significant effects in almost all specifications. This results from the limited instrument set due to fewer countries in the sample and the higher persistence of within and between regional inequalities. As a results, the analysis provides no support for the assumption that foreign aid increases regional inequalities. The uneven distribution of aid projects sub-nationally does not appear to affect overall regional inequalities.

Zusammenfassung

Kapitel 1 enthält eine Einführung und führt erste Vergleiche von Indikatoren wirtschaftlicher und humanitärer Entwicklung, um die derzeitigen Unterschiede im Entwicklungsstand verschiedener Länder, gruppiert nach Einkommen, aufzuzeigen. Seit dem Zweiten Weltkrieg hat sich die Entwicklungszusammenarbeit als eines der wichtigsten Instrumente für die entwickelten Länder erwiesen, um die wirtschaftliche Entwicklung in weniger entwickelten Teilen der Welt zu fördern.

Kapitel 2 gibt einen kurzen chronologischen Überblick volkswirtschaftlicher Theorien über wirtschaftliches Wachstum und Entwicklung und beleuchtet neuere Ansätze in der Entwicklungsökonomik. Es wird gezeigt, dass sich der Schwerpunkt der Entwicklungsökonomik seit ihrer Entstehung mehrfach geändert hat. Angesichts positiver und negativer Wachstumserfahrungen in Entwicklungsländern ist die entwicklungsökonomische Fachliteratur immer noch unschlüssig hinsichtlich der Auswirkungen von Entwicklungszusammenarbeit auf die wirtschaftliche Entwicklung. Die Kluft zwischen Entwicklungs- und Industrieländern in wirtschaftlicher Entwicklung ist immer noch beachtlich, sogar in Anbetracht konstanter Flüsse von Hilfsgeldern und der sich ständig ändernden politischen Vorgaben zur Bewältigung dringender Probleme und Entwicklungshindernisse.

In Kapitel 3 wird anhand von subnational dissagregierten Daten der Einfluss der Regierungsführung in Empfängerländern auf die Verteilung von Hilfsprojekten innerhalb der Empfängerländer bewertet. Die Ergebnisse zeigen, dass Geburtsregionen der amtierenden Präsidenten nicht signifikant mehr Hilfsprojekte erhalten als andere Regionen eines Landes. Die Berücksichtigung der Institutionen in Empfängerländern ändert nichts an den Ergebnissen. Andererseits scheinen Hauptstadtregionen mehr Hilfsprojekte anzuziehen. Eine bessere Staatsführung scheint sich negativ auf die Vergabe von Hilfsprojekten in Hauptstadtregionen auszuwirken. Dies könnte auf klientelistische und korrupte Motive der politischen Entscheidungsträger zurückzuführen sein.

In Anbetracht der Ergebnisse aus der Literatur und aus Kapitel 3 ergibt sich die Frage, wie unterschiedliche subnationale Verteilungsmuster von Hilfsprojekten und der Entwicklungszusammenarbeit regionale und räumliche Ungleichheiten innerhalb der Empfängerländer beeinflusst. Wenn die subnationale Zuteilung der Hilfsprojekte bestimmten ethnischen, politischen oder wirtschaftlichen Erwägungen folgt, anstatt die Armut zu bekämpfen oder menschliches Elend zu lindern, dann kann ausländische Hilfe die regionalen Ungleichheiten in Empfängerländern weiter vertiefen. Daher werden in Kapitel 4 zunächst verschiedene Theorien erläutert und bestehende empirische Belege für regionale Ungleichheiten aufgezeigt. Außerdem werden Trends und Niveaus verschiedener Maßtäbe für regionale Ungleichheiten in Afrika südlich der Sahara diskutiert.

In Kapitel 5 wird der Zusammenhang zwischen ausländischer Hilfe und regionaler Ungleichheit untersucht. Zunächst werden verschiedene Maße regionaler Ungleichheit und notwendige Überlegungen zur richtigen Interpretation erörtert. Zweitens werden anhand von subnational dissagregierten BIP-Daten diese Maße regionaler Ungleichheit in Afrika südlich der Sahara berechnet, um ihre Muster und Niveaus in den Jahren 1998 bis 2015 zu diskutieren. Die Daten zeigen, dass regionale Ungleichheiten innerhalb und zwischen den Ländern stark variieren und, dass das Muster in der gesamten Stichprobe im Durchschnitt sehr beständig ist. Die empirische Analyse hinsichtlich der Auswirkungen der Auslandshilfe auf die regionale Ungleichheit liefert zunächst Ergebnisse unter Verwendung eines statischen Panelschätzungsansatzes. Jedoch aufgrund schwerwiegender Endogenitätsprobleme, insbesondere zwischen Entwicklungszusammenarbeit und regionaler Ungleichheit, sind diese Ergebnisse mit Vorsicht zu genießen. In der empirischen Analyse werden daraufhin dynamische Panelschätzmethoden wie System-GMM angewandt, um Endogenitätsproblemen und der hohen Persistenz regionaler Ungleichheiten Rechnung zu tragen. Die Ergebnisse zeigen, dass die Auslandshilfe regionale Ungleichheiten nicht vergrößert. In einigen Spezifikationen verringern sogar höhere Handelsquoten die regionalen Ungleichheiten deutlich. Darüber hinaus liefert die Schätzung unter Verwendung der Aufteilung regionaler Ungleichheiten innerhalb und zwischen Hauptstadt- und Nicht-Hauptstadtregionen in fast allen Spezifikationen keine signifikanten Ergebnisse. Dies resultiert aus der begrenzten Anzahl von Instrumenten aufgrund der geringeren Anzahl von Ländern in der Stichprobe und der hohen Persistenz der Ungleichheiten innerhalb und zwischen den Regionen. Infolgedessen liefert die Analyse keine Unterstützung für die Annahme, dass Entwicklungszusammenarbeit die regionalen Ungleichheiten erhöht. Die ungleiche Verteilung von Hilfsprojekten auf subnationaler Ebene scheint insgesamt regionale Ungleichheiten nicht zu beeinflussen.

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1. Introduction

Ever since the beginning of the post-colonial era, when former colonies of Western European countries gained their independence, foreign aid has proved to be one of the main instruments for the developed countries to promote and increase economic development in less developed parts of the world. The focus of development policies has changed several times during this era. Given positive and negative growth experiences in developing countries, the development research literature is still inconclusive concerning the effects of development assistance and foreign aid on economic development. Therefore, the focus of international donors shifted various times during the Post World War II era to address the pressing issues of aid effectiveness and the factors that prevent sustained economic growth.

There is a list of various international declarations that highlight shifts and changes in development policies to overcome past mistakes and further improve economic development in less developed countries. Some recent policy recommendations are the 'Washington Consensus', which addresses the question of trade and development, the 'Monterrey Consensus', addressing the challenges of financing for development around the world, the 'Millennium Development Goals', which are several developmental goals stated in 2000 to be achieved by the year 2015, or the 'Paris Declaration', which was concerned with successful foreign aid implementation and its further application. For instance, one of the main goals of the 'Millennium Development Goals' is to eradicate extreme poverty and hunger (UN, 2000). Also the 'Paris Declaration on aid effectiveness' (OECD, 2005) addresses several core principles which are believed to increase the impact of foreign aid on reducing poverty and inequality. The renewal of such policy recommendations can be observed in various forms since the end of the Second World War. Rist (2019) provides an overview of the evolution of mainstream development ideology to conclude that most of these declarations do not differ much from each other. The author considers the repeated changes in development ideology rather as 'old wine in a new bottle'.

Development is generally defined as economic growth, with the level of development seen in terms of the size of an economy. Thus, the higher per capita production or per capita income, the more 'developed' a country's economy is conventionally said to be. The higher the annual growth rate in GNP or GDP per capita, the more rapidly a country is said to be developing. Rapid economic growth is, in historical terms, a recent phenomenon, observable during the past three hundred years for less than one-quarter of the world's population. These gaps in economic wealth seem to be persistent.

In 2012 the World Bank divided countries into four categories, low-income, lower-middle-income, upper-middle-income, and high-income, depending on their income level. As shown in Table 1.1, the world in 2017 had slightly over 7.5 billion people, with a total income of over $ 80 trillion, thus representing an average per capita income of around $ 10,670 per year. About 1.2 billion people live in high-income countries, where the total GNI is $ 51.90 trillion and the average GNI per capita is $ 43,087.5 per year. The world's richest countries account for 16% of the world's population but more than 64% of its total income. On the other hand, the 3.7 billion people living in low- and lower-middle-income countries had only $ 6.95 trillion in

Table 1.1.: Development Indicators, 2017

	Population (millions)	GNI (const. 2010 billion US$)	GNI per capita (const. 2010 US$)	Life expectancy (years)	Education (Primary completion rate, %)
LIC	687	510.5	742.6	63.4	66.8
MIC	5,619	27,734.6	4,935.8	71.7	91.7
LMIC	2,981	6,440.6	2,160.2	68.3	90.2
UMIC	2,638	21,296.6	8,074.0	75.5	94.3
HIC	1,204	51,895.8	43,087.5	80.7	98.3
World	7,511	80,141	10,669.8	72.4	90.5
SSA	1,050	1,685.1	1,604.8	60.9	68.5

Source: Data from World Bank World Development Indicators, *https://databank.worldbank.org/source/world-development-indicators.*
LIC, low-income countries; MIC, middle-income countries; LMIC, lower-middle-income countries; UMIC, upper-middle-income countries; HIC, high-income countries; SSA, Sub-Saharan Africa

total income, thus averaging GNI per capita of just $ 1,895 per year. Nearly half of the world's population have 8.67% of the world's income. Around 1 billion people live in sub-Saharan African countries with a total income of over $ 1.7 trillion. Accordingly, about 14 % of the world population lived in sub-Saharan Africa with a share of world income of around 2 %.

Furthermore, there is also a large discrepancy between low-income or sub-Saharan African countries and the rest of the world considering life expectancy and education. People living in low-income countries on average have a life expectancy of 63.4 years with only 66.8 percent of the population having completed primary school. Life expectancy in sub-Saharan Africa is even lower with 60.9 years on average, with around 68.5 percentage of the population having completed primary school. Thus, low-income countries and sub-Saharan African countries exhibit the worst performance concerning measures of well-being.

Figure 1.1 shows the evolution of GDP from 1960 to 2018 differentiated by country income groups and additionally includes sub-Saharan Africa.[1] The high-income and middle-income countries experienced a large increase in their total GDP (measured in 2010 US $), by 484% and 1248%, respectively, during this period. The sub-Saharan African countries (excluding high-income countries) experienced an increase in total GDP by 606% during the same time period and low-income countries' total GDP increased by 214% from 1986 to 2018. While these figures seem impressive for all groups of countries, a clearer picture emerges when considering changes in GDP per capita and, correspondingly, also accounting for differences in population.

This can be seen in Figure 1.2. During the same period of time high-income countries and middle-income countries experienced an increase in GDP per capita (measured in 2010 US$) by 266% and 402% respectively. On the other side, sub-Saharan African countries experienced an increase in GDP per capita of 49% during the same period of time and low-income countries an increase of 33% during the years from 1986 till 2018. Table A1 in Appendix A provides the figures for the increases in GDP and GDP per capita between the years 1960 or 1986 and 2018 differentiated by country income groups.

In fact, few countries have experienced convergence in economic growth during the past decades. Some African countries have gone from being lower-middle-income at

[1] The data comes from the World Bank Databank *https://databank.worldbank.org/source/world-development-indicators*. Note that prior to 1986 no data for low-income countries concerning their GDP or GDP per capita was available.

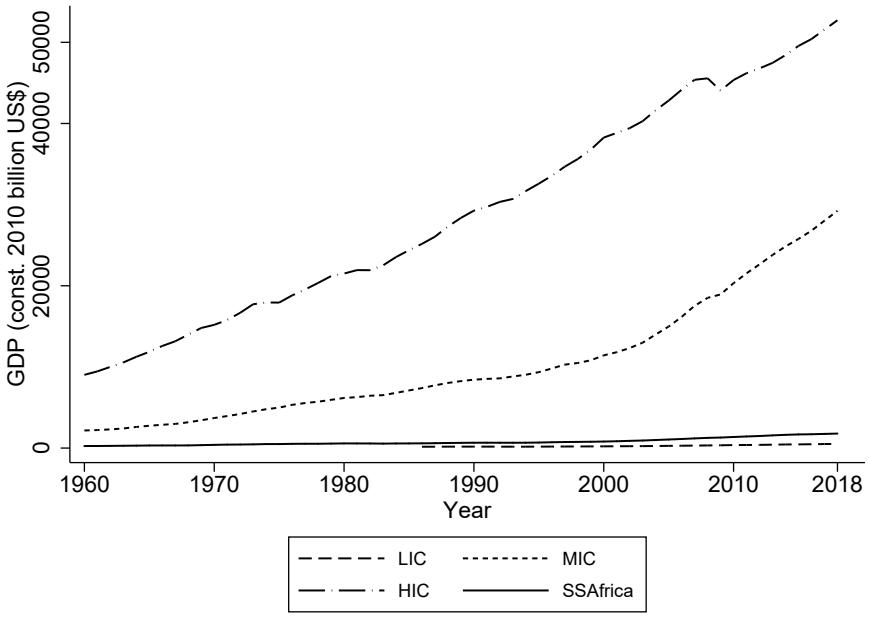

Figure 1.1.: GDP by country income level, with sub-Sahara Africa
(Source: *World Bank Data*)

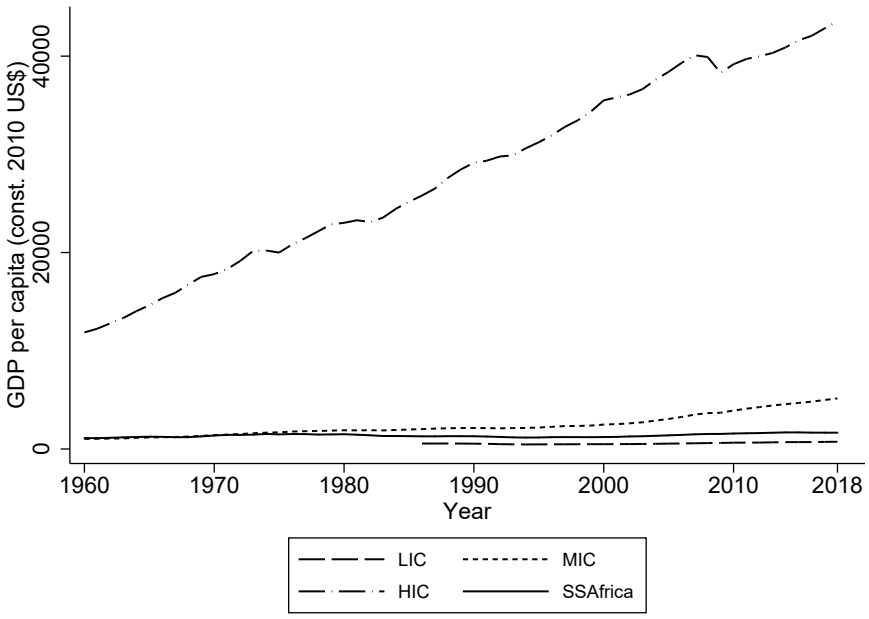

Figure 1.2.: GDP pc by country income level, with sub-Sahara Africa
(Source: *World Bank Data*)

independence to low-income countries in the 1980s. Few have regained their position as middle-income countries. The rise of some East Asian countries and a number of large middle-income countries, such as China or India, marks the beginning of a convergence towards developed countries' GDP per capita for some developing

countries. Smaller and poorer economies have also experienced important changes in their position in the global economy. For example, countries in sub-Saharan Africa averaged economic growth rates of 6.5% or more prior to the global financial crisis. In recent years prior to the financial crisis the region's aggregate GDP has grown faster than the world economy, its export share of total world exports has increased, its share of exports going to fast-growing emerging Asia destinations has increased, and FDI as a share of GDP has been higher than in most developing countries (Lin and Rosenblatt, 2012).

However, even after receiving enormous amounts of foreign aid, many countries still register low per capita income. Despite the vast theoretical and empirical literature, the effectiveness of foreign aid has still been a long debated and controversial issue. Therefore, chapter 2 will give a brief chronological overview of economic theories about economic growth and development and highlight recent approaches in development research.

As will be shown in chapter 2, in recent years the literature has increasingly highlighted recipient countries' governance as a driving factor for successful outcomes of aid funds. To face possible negative effects of recipient countries' governance, the World Bank stated that in the absence of sound economic policies aid funds should be directed through project assistance (Dollar and Pritchett, 1998, p.99). Using a newly available data set, which additionally provides the geographic coordination for aid projects from the World Bank, chapter 3 will analyze the sub-national distribution of aid projects. The analysis will incorporate recipient countries' governance to be able to understand whether project assistance and its geographical distribution is independent of recipient countries' governance. Recent studies using sub-national data have highlighted a regional bias of funds either towards birth regions of incumbent presidents or towards regions which contain capital cities. Hence, it remains unclear whether these biases in the sub-national allocation of aid projects still persist if recipient countries' governance is accounted for.

Considering the evidence in the literature concerning the uneven sub-national distribution of foreign aid, the question about the relationship between foreign aid and regional inequality imposes itself on the researcher. The research literature also provides evidence that class, ethnic, gender, and regional differences additionally contribute to extremely unequally distributed incomes within each country or group of countries. Studies employing long time series on inequality conclude that income inequality has been consistently increasing since the early 19th century. Milanovic

(2009), for example, found that global income inequality rose steadily from 1820 to 2002, with a significant increase observable since 1980. Peet and Hartwick (2015) highlight that large inequalities may further increase poverty. As a result, the recent focus in inequality shifted towards regional inequality to explain, for instance, armed conflicts in developing countries (Barro 2000; Pastor 1995; Alesina and Perotti 1996). Chapter 4 will give a brief overview of the literature on inequality with a focus on regional inequality.

Several studies have further analyzed the effects of foreign aid on income inequalities in recipient countries (Layton and Nielson, 2008; Chong et al., 2009; Pham, 2015, and Castells-Quintana and Larrú, 2015). However, given the recent focus on regional inequality, it is also of interest how foreign aid funds affect regional inequalities. If, for instance, the World Bank does consider regional needs of the population and tries to target the poor in recipient countries with aid projects, then adequately implemented aid projects should decrease regional inequalities. On the other hand, considering previous studies analyzing the sub-national allocation of foreign aid funds, it might be possible that foreign aid does increase regional inequalities within recipient countries. Especially in sub-Saharan African countries, Sahn and Stifel (2003) show that there are large differences in well-being and educational attainment between urban and rural regions. Hence, chapter 5 will first study levels and patterns of regional inequality in economic performance in sub-Saharan Africa. Further, the analysis will use static and dynamic panel estimation methods to assess the influence of foreign aid funds on regional inequalities in sub-Saharan African countries. Finally, Section 6 will summarize the obtained results and provide a conclusion at the end.

2. Literature on Economic Development and Foreign Aid

International aid, or development assistance, in its current form emerged after the Second World War and took on different forms following different policies to enhance economic development and to address the pressing issues of poverty and human misery in developing countries. One might have expected that the twentieth century would have been a period in which technology spreads across the world, allowing countries to catch up with advanced economies. This might have been achieved through trade and capital flows based upon continued progress in transportation and communication technology.

Since its emergence, international aid has raised a number of constant issues in development policy, in particular the underlying theories and the effectiveness in generating development in recipient countries. One main concern focuses on the positive effects of foreign aid transfers for donors and recipients. Another question focuses on the factors which affect the effectiveness of foreign aid transfers (Kanbur, 2006). The OECD, for instance, defines international aid to "include grants and loans to developing countries and territories which are: (i) undertaken by the official sector of the donor country, (ii) with the promotion of economic development and welfare in the recipient country as the main objective and (iii) at concessional financial terms (i.e. loans with a grant element of 25 percent)" (Hjertholm and White, 2000, p.76).

Apart from those who, based on empirical studies, have made definite arguments about the effectiveness of aid, there remains a contention between those who believe aid failure is a result of factors within recipient countries and those who argue it is attributable to external impediments such as the unfair global economic structure (Andrews. 2009). Akonor (2007) argues that "aid to Africa is a band-aid, not a long-term solution, and African leaders themselves are responsible for creating

true, systemic change" since aid does not aim at transforming Africa's structurally dependent economies.

The current chapter first provides a brief overview of the historical evolution of theories about economic growth and development. To be able to understand development it is necessary to know at least the history and basic contents of the leading conventional economic theories. Most notions about economic development and the necessary factors for successful foreign aid are based on and a mixture of historical views about economic development and current research. Thus, the implications and the impacts on real economic development policies deriving from theories of economic growth will be shown.

Peet and Hartwick (2015) divide mainstream economic theory into four historical periods such as classical and neoclassical economics, Keynesianism and neoliberal theories. Other categorizations may also be appropriate, but this classification proves to be useful to understand the evolution of development theory. Further, the current research in development economics, with its focus on different aid instruments, the relationship between foreign aid and growth and foreign aid and institutions, will be provided to highlight potential channels to enhance economic development in recipient countries. Finally, the policy implications and the development policies of the World Bank, a major international donor, will be presented. The aim of the current chapter is not to give a comprehensive review of the literature, but to highlight the main arguments in the debate on economic growth and development, which persist in the continuing debate on economic development.

2.1. Theories

Most notions and perceptions about human nature, personal freedom, social behavior and the pursuit of self-interest, which also influence temporary development approaches, are rooted in the philosophy of the Enlightenment. These new ideas and perceptions were not politically neutral as they served certain goals (Peet and Hartwick, 2015). The aim of the political economic philosophers of the 17th and 18th century such as Thomas Hobbes (1588-1679), John Locke (1632-1704) and David Hume (1711-1776) was to propound political economic ideas that might serve the new modern capitalist class in its struggle with feudalism and the landed nobility (Peet and Hartwick, 2015).

The philosophers and political economists of the Enlightenment of the 17th and 18th century Britain theorized on behalf of the new class of small proprietors. These new ideas argued for individual natural rights, equality of opportunity and civil liberties, which were thought to be essential for economic development.[2]

2.1.1. Classical Economists

Classical economics gave rise to the modern theories of growth and development. Under the historical circumstances presented by the Industrial Revolution, the classical economists thought on behalf of the new producers and manufacturers, who were mainly contributing to the increase in economic activity.

Adam Smith (1723-1790), for instance, argued that the division of labor, and the resulting specialization, markets and trade were the sources of modern economic growth. Similarly, David Ricardo (1772-1823) argued that free trade and international specialization in production, based on the principle of comparative advantage resulting from different production technologies, would benefit producers and consumers. Friedrich List (1789-1846), also agreeing with the principle of free trade, additionally proposed a national economic policy in which the state promoted the welfare of all its citizens with tariffs protecting the national economy, especially infant industries, until such industries could compete on equal terms with the dominant industrial powers, like Britain (Peet and Hartwick, 2015). This idea of government protection for infant industries became predominant for structuralist approaches during the Post World War II period.

The classical idea of economic growth and development is based on notions of self-interested, rational, and competitive producers, with specialization in production based on comparative advantage, growing markets, expanding trade, and technological innovations. Classical economics defended the market as an organizational mechanism and argued against the mercantilist state, representing the monarchy and the noble landlord class (Peet and Hartwick, 2015).

[2]Horkheimer (1936) points out that the philosophy of individual liberties was flawed and contradictory in itself, such that in essence these ideas served mainly to advocate ruling class interests. Adorno and Tiedemann (2006) provide a good philosophical overview in the lecture notes about the concept and perception of history and the concept of freedom.

2.1.2. Neoclassical Economics

During the middle of the 19th century the focus changed from the growth of national wealth to the role of margins and the efficient allocation of resources. W. S. Jevons (1835-1882) emphasized not the total utility induced by consuming all of a commodity but the final (marginal) degree of utility induced by a very small increment in consuming something. Carl Menger (1840-1921) used a subjective theory of value, stating that the value of a commodity is ultimately determined by the needs and preferences of an economic subject. Léon Walras (1954) developed marginal utility from the notion of scarcity, with the degree of utility ultimately determining the amount of value for each product. A main contribution of Walras was the concept of market equilibria. Vilfredo Pareto (1848-1923), for instance, set out the mathematical conditions under which Walras' general equilibrium might achieve an optimal economy, where supply met demand organized through markets. Further approaches in neoclassical economics extended the marginal principle to cover all aspects of production and consumption. Alfred Marshall (1842-1924) set up a model of efficient production based on minimization of the costs of production by efficient substitution among the factors of production. Marshall considered the economy as a well-balanced system always tending toward equilibrium, with prices signaling shortages or abundance of a certain good (Peet and Hartwick, 2015).

In sum, neoclassical economic theory assumed perfect competition, that price-making markets yield a long-term set of prices that lead to the equilibrium of supply and demand for all commodities in production and consumption. Market forces of supply and demand allocate resources efficiently, such that costs are minimized and maximizing consumer utilities on long term (Peet and Hartwick, 2015).

The neoclassical theory of marginal returns has several implications for international convergence in economic development and growth. For instance, a country with low endowment of capital will yield higher marginal returns for each additional capital utilized, compared to capital rich countries. This mechanism led to the convergence hypothesis in neoclassical economics, which was based on the idea that capital will flow towards those regions or countries where the marginal return is higher, hence, towards countries with low capital endowment. For instance, Barro and Sala-i Martin (1992) showed that economies tend to grow faster in per capita terms when they are further below the steady-state position. Several other studies have further provided evidence for convergence across several countries (Barro, 1991;

Mankiw et al., 1992; Sala-i Martin, 1996; Boyle and McCarthy, 1997). As a result, in the long run all economies will eventually converge in terms of per capita income, hence, the same capital to labor ratio.

2.1.3. Post-War Period

In the Post-World-War period neoclassical economic theory was criticized by John Maynard Keynes (1883-1946). Keynes believed that changes in real investment, which in turn were based on interest rates set by the government, are the crucial variable for economic growth. Accordingly, increasing investments feed into other areas of an economy, expanding the whole economy. The main idea of Keynes, which also influenced further development and foreign aid approaches, was that the state has the means to intervene in the market process by increasing the aggregate level of demand through monetary and fiscal policies (Peet and Hartwick, 2015).

Based on the Keynesian idea that economic growth results from increased investments several other growth models emerged, such as exogenous growth models. For instance, the Harrod-Domar growth model contests that the state needs to encourage savings and generate technological innovations to increase investments in fixed and human capital (Domar, 1946). Similarly, Robert Solow argued that long-run economic growth is determined by technological development (Solow, 1956).

Further models, such as the endogenous growth models, incorporated the process of technological innovation into the model, viewing the process as a result of economic considerations. According to Romer and Griliches (1993) no monetary or fiscal policy can generate sustained economic growth if it does not go hand in hand with knowledge-based innovations in the production process to create more value from a fixed set of natural resources.

However, these models focus on developed economies and seemed inapplicable for developing countries. As a consequence, during the 1950s a 'development economics' field emerged that was different from neoclassical and Keynesian economics. Development economics assumed that economic processes in developing countries were distinct from those of developed countries. Because under-development was thought to be a product of capital shortage, aid was channeled through capital transfers and investment projects to developing countries (Peet and Hartwick, 2015).

Considering the geopolitical circumstances after World War II, with former colonies gaining independence during the 1950s and 1960s, Kanbur (2006) states that a main objective of foreign aid was to prevent developing countries from approaching the communist block. Hence, Kanbur (2006) divides the history of development assistance after World War II being influenced first by the Cold War, and then by its absence after the fall of the iron curtain.

The main argument in the development literature during that period was that the main constraint to economic development was capital accumulation and supplementing domestic savings was the role of aid. At the same time, serious market failures and externalities were observed, leading the government to play a key role in managing the investment and aid process in recipient countries. It was believed that 'infant industries' needed to be protected from external competition in the early stages of economic development. (Kanbur, 2006).[3] As a consequence, the 'structuralist approach' in development economics contested previous economic approaches applied to developing countries, highlighting the specificity of Third World economics (Peet and Hartwick, 2015).

The term 'structuralism' derives itself from the notion that structural rigidities are present in most economies, especially in developing countries. Although developing countries were mainly endowed with unskilled labor and, in some cases, with an abundance of natural resources, they tried to imitate the production of capital intensive goods similar to advanced economies. As a results these countries did not produce following their comparative advantage, hence the development strategy did not turn out to be sustainable (Lin and Rosenblatt, 2012). Additionally, the financing of large capital investments for capital intensive industries forced developing countries to rely on foreign capital to maintain the import substitution industrialization model. However, these government supported industries could not compete on global markets (Lin and Rosenblatt, 2012).

Given the growth experiences resulting from the 'structuralist approach', economists started to argue against government interventionism and in favor of free markets in the 1970s. Development problems were increasingly considered to be resulting from an excess of government interference in the economy and more market based approaches were advocated. The import substitution strategies were criticized, and

[3]During that period the influential literature on economic development was from Rosenstein-Rodan (1943, 1961) who argued for a "big-push", from Rostow and Rostow (1960) and the "stages of economic growth", and from Chenery and Bruno (1962) with the "two-gap model."

the financial crisis of the late 1970's and early 1980's, causing global economic instability, provided the basis for those who could finance or refinance developing country debts. Hence, the international financial institutions such as the World Bank or the IMF advised developing countries to adjust their budgetary deficits, starting the era of structural adjustment (Kanbur, 2006). Transfers were made increasingly in the form of budgetary support, conditioned on the policy reforms that conformed to the principles of the 'Washington Consensus' (Kanbur, 2006).

2.1.4. Neoliberal Economics

Development theory changed drastically within the 1970s and 1980s and was part of a more general neoliberal movement that was opposed to Keynesianism, state intervention, and structuralism. It was criticized that previous development efforts led to unproductive industrial investments in developing countries. Capital transfers had encouraged corruption and favored import substitutions. By the mid-1980s the whole notion of development economics had been discredited. Liberal economics started to influence the theory and practice of development policy, leading to the era of neoliberalism in economic research and policy (Peet and Hartwick, 2015).

Neoliberalism originated in political-economic theories formed in the late 19th and early 20th centuries. For instance, von Mises defended the idea of a society based on laissez-faire, or the free market economy, which basically argues that harmony exists between the actors in a market (Peet and Hartwick, 2015). Another defendant of free market forces was Friedrich von Hayek, who argued that the free price system was not a conscious invention but a spontaneously derived order. He also argued that an economy emerges rather spontaneously from a complex network of interactions among agents with limited knowledge. Thus, the central role of the state should be restricted to maintaining the rule of law, with as little state intervention in the economy as possible (Peet and Hartwick, 2015).

Milton Friedman (1912-2006), leading theorist of the 'monetarist school' of economic thought, posited a close link between inflation and the money supply. Especially in developing countries, inflation was thought to be a main constraint on growth. According to Friedman, inflation can be controlled by limiting the supply of money. Hence, the government's role in guiding the economy should be limited to adjusting interest rates, which was opposed to Keynesian approaches of government fiscal policy approaches (Peet and Hartwick, 2015). Friedman (1958) states that underde-

veloped countries require the release of the energies of millions of able, active, and vigorous people who have been chained by ignorance, custom, and tradition, requiring only a favorable environment to transform the face of their countries. Similarly, Easterly (2014) states that poverty results from the absence of economic and political rights of the poor within an institutional context characterized by the 'tyranny of experts.' Easterly argues in the same way as Hayek that free individuals with individual rights in a free society solve many of their own problems.

Neoliberal ideas have become central themes in mainstream economics and also influenced approaches in development economics. In sum, the two central principles of neoliberal economics, that factors of production get rewarded at their corresponding market value and that free markets will lead to efficient factor allocation without waste, have been extraordinarily influential since 1980 (Palley, 2005).

However, Polanyi and MacIver (1944) argue that there was nothing natural or spontaneous about 'free markets'. According to the authors, the countries that grew to be most powerful experienced the greatest amount of state intervention. Equally, Chang (2002) argues that most countries prospered by state interventions, especially by protecting infant industries against foreign competition. Lin and Rosenblatt (2012) further highlight that countries that actually exhibited sustained growth did not follow the approaches proposed by the predominant development thinking. For instance, East Asian countries followed export-oriented growth strategies instead of structuralist import substitution policies (Lin and Rosenblatt, 2012). Lin and Rosenblatt (2012) and Lin (2011) advocate an approach that considers a country's economic structure as endogenous such that governments need to encourage economic development by facilitating structural change resulting in economic transition. By the second half of the 1990's the disastrous consequences of the transitions in many countries became apparent. Stiglitz et al. (2003, p.22) states that "the reforms thus both exposed the countries of the region to more shocks, and worsened its capacity for automatically coping with those shocks, the policy stances advocated by the Washington Consensus made matters still worse."

Following the failure in many developing countries to generate sustained growth, the diagnosis of problems turned to policy failures in developing countries during the 1980s. More recently, following the failure of the resulting structural adjustment programs, the international community has identified institutional failures as one of the fundamental obstacles to economic development (Paul, 2006). Furthermore, major events of the 1990's were the East Asian financial crisis, followed by

crises in Latin America and Russia, with considerable spillover effects on most poor economies. Partly as a result of the strong criticisms of the market-based approaches of the 1980's and the early 1990's, the development doctrine moved back to emphasizing poverty reduction as the ultimate objective of development, and supporting specific interventions to this end (Kanbur, 2006).

2.2. Recent Approaches in Development Economics

Kanbur (2006) states that the current state of the aid discourse, in the first years of the 21st century, reflects its evolution over the last fifty years or more. Meanwhile, the role of government is more clearly recognized, as is the importance of accountability of these governments.

As a result, bilateral donors and the international development community shifted the focus to humanitarian projects for supporting the improvement of human capital, including education and health in developing countries (Lin and Rosenblatt, 2012). Intra-household and gender issues are additionally emphasized, as are environmental degradation and its effects on the poor. The role of institutions, national and global, in affecting policy outcomes is thought to be central. One factor that is emphasized more strongly than ever before is global interdependence and the need for strong management of international spillovers (Kanbur, 2006). Furthermore, new techniques were developed, such as randomized control trials and other forms of impact evaluation, in order to understand foreign aid at the micro level (Lin and Rosenblatt, 2012).

Evaluations of aid effectiveness started in mid-1950s and continued over the next decades. In the mid 1980s a major evaluation was commissioned by the international community and was published under the title "Does Aid Work?" (Cassen, 1994). Throughout the assessments of aid carried out over the last few decades, a "micro-macro" paradox has emerged. Micro level evaluations of specific projects give a much better picture than do macro level assessments of the impact of aid on economic development, specifically on growth. Kanbur (2006) stresses that this problem could be overcome if the projects are evaluated at their 'shadow prices' that take macro level distortions into account.

2.2.1. Unconditional vs. Conditional Aid Transfers

One main debate concerned the layout of aid transfers, whether foreign aid should be given conditional on recipient countries' policies or unconditionally. The research literature analyzing the consequences of unconditional transfers is trade-theoretic in construct. The literature that considers the effects of conditional transfers uses contract-theoretic approaches (Kanbur, 2006).

The total flow of aid is small compared to global trade flows, such that terms of trade are neither affected by the transfers nor do market distortions arise. The amount of aid can be large for individual recipient countries, though. If there are distortions in the recipient country itself, then an inflow of capital could end up leading to increasing poverty. Furthermore, suggesting that aid flows to the government of the recipient country, and as such is controlled and disposed of by the elites, the distortions may further induce poverty (Kanbur, 2006; Paul, 2006). Giving aid in a non-informed manner under these circumstances may worsen the socioeconomic situation in recipient countries. These possible negative effects led to the argument of binding foreign aid to certain country specific conditions so that gains to the recipient could be better ensured. Conditionality assumes that instead of just the transfer of resources, there is a simultaneous undertaking of some other action or set of actions. The answer to successful development outcomes seems obvious, which is to simply apply the conditionality that ensures that the poor in the recipient country will be better off with the transfer (Kanbur, 2006).

However, considering the historical changes in the aid doctrine one might ask which conditionality is appropriate to ensure that the poorest benefit most from such transfers. Conditionality does not seem to work, and even if the necessary conditions for aid transfers are not met the aid funds flow anyway. For instance, Svensson (2003, p.383) finds "no link between a country's reform effort, or fulfillment of 'conditionality', and the disbursement rate" of foreign aid transfers. There are many reasons why conditionality fails. For example, the steady flow of aid is a source of income to many interest groups in the donor country. Their dominant concern is their income, not necessarily the well-being of the aid recipients (Svensson, 2000b). Further analytical modeling of the problems of conditionality focus on the problem of time inconsistency.

Additionally, several different aid instruments, such as tied aid, food aid or program aid, were also criticized throughout different development approaches. The critics

stated that either funds were given conditional on spending them on the products of donor countries, or as being harmful to recipient countries by hitting their agricultural production, or as being possibly subject to fungibility (Kanbur, 2006). Several authors highlight the fact that foreign aid transfers may be prone to fungibility, independent of the instruments implemented to transfer aid funds (Devarajan et al., 1999; Feyzioglu et al., 1998). Fungibility of aid resources seems to be a greater problem when the preferences of donors and recipients do not align (Cordella and Dell'Ariccia, 2007). Hence, aid projects may crowd out investments that recipient countries would have undertaken anyway in order that the recipient country is able to reallocate its own budget resources away from similar projects.

2.2.2. Foreign Aid and Economic Growth

As a consequence of the lasting negative experiences concerning aid effectiveness, a large amount of literature emerged addressing the issue of development aid with a broad range of topics concerning its allocation, consequences, effectiveness and necessary conditions for effective development aid.[4]

Hansen and Tarp (2000), for instance, review 131 cross-country regressions of the impact of aid on growth, from a thirty year period starting in the late 1960's to the late 1990's. They divide the studies into three generations. Corresponding to the development and aid doctrine at the time, the first generation of studies focused on the impact of foreign aid on domestic savings. The evidence from these studies is that aid leads to an increase in total savings, although not by as much as the aid flow. In the second generation of empirical work, focus turned from the aid-savings relation to estimating the link between aid and growth, with the link via investment. These studies found that the aid-investment link is positive, consistent with the result from first generation aid-saving studies. The third generation of aid effectiveness studies differed in four areas compared to both previous generations. First, they work with panel data for a number of years and a large number of countries. Second, new growth theory has inspired the analysis in distinct ways, providing a different analytical basis compared with previous work. Measures of economic policy and the institutional environment are included directly. Third, endogeneity of aid and other variables are addressed explicitly in some studies. And finally, the aid-growth relationship is explicitly seen as non-linear. Consistent with

[4]Christensen et al. (2007b) provide a broad bibliography of the aid effectiveness literature, as does Christensen et al. (2007a) for the aid allocation literature.

results from second generation models, there is a significant effect on growth, either alone or in combination with a policy variable. Non-linear effects are significant both statistically and empirically.

However, some critics point out that when measuring the effects of foreign aid on economic performance one needs to address certain timing issues of the effects. For instance, Clemens et al. (2012) show that different studies reach different conclusions because they treat the timing of causal relationships between aid and growth differently. Accordingly, any positive or negative effect of foreign aid on economic outcomes in recipient countries needs to be judged cautiously.

2.2.3. Foreign Aid and Institutions

With the appearance of one study by Burnside and Dollar (2000) the focus in the development aid literature started to shift towards analyzing the influences of recipient countries' governance on the effectiveness of foreign aid. The authors argued that the effects of foreign aid on economic growth depends on recipient countries' policy. This argument proved to be widely acknowledged and offered policy advice for aid donors. Over the past couple of decades, numerous empirical studies examined the importance of institutions and good governance for aid effectiveness in recipient countries (Svensson, 1999; Burnside and Dollar, 2000, 2004; Dollar and Svensson, 2000). Other questions investigated by the empirical literature are how and why aid is allocated across countries (Alesina and Dollar, 2000; Collier and Dollar, 2002; Dollar and Levin, 2006).

Since this shift in the literature, foreign aid programs have been criticized to encourage clientelistic policies in recipient countries in an environment of corrupt and patronage policies. Bräutigam and Knack (2004) argue that recipient governments especially in the case of development aid are less bound by their government budget restrictions and therefore face less pressure to improve their governance and institutional qualities, which in the case of Africa is assumed to be a necessary factor for economic development. Similarly, Paul (2006) argues that foreign aid changes the incentives of the recipient government, and alters the political economy equilibrium in the recipient country.

To be able to understand the institutional context in sub-Saharan African countries one needs to take into account that there may be several reasons for the lack of

governance and its persistence in recipient countries. Bräutigam and Knack (2004) point to three major factors causing poor governance in sub-Saharan Africa, such as initial poor governance, economic reasons, like balance of payments crises, political instability, and war. Additionally, a large ethnic heterogeneity leads to increasingly clientelistic politics in these countries and, hence, maintains poor institutional qualities. For instance, especially for the case of Africa clientelistic politics tend to focus on a narrow group of elites instead of being concerned with mass party patronage (Van de Walle, 2007). Due to these apparent characteristics of sub-Saharan African countries it appears to be reasonable to take institutional qualities into account when allocating foreign aid. Hence, effective governance has been suggested as key to Africa's development problem. On the other hand, Goldsmith (2003, p.205) finds that in the "long-run public bureaucratic capability is primarily endogenous and unmoved much by aid" such that foreign aid tends to undermine domestic administrative capabilities. The author finds evidence neither for aid having a positive impact on governance nor for a negative relationship.

In a model theoretic approach, for instance, Boone (1996) evaluates aid effectiveness by differentiating between different political regimes of recipient countries and finds that aid is more effective when it is non-fungible and subject to better governance. Svensson (1999) also shows that, conditional on institutional qualities in recipient countries, aid can contribute to economic growth. Collier et al. (2001) even show an effect going in either direction, from good policies to economic growth and from growth to improving governance. Furthermore, aid can affect the equilibrium outcome not only through a direct effect but also in a less direct way, by enforcing the control of rent dissipation for example, so that aid may increase rent-seeking and be detrimental to the poor (Svensson, 2000a). Similarly, Svensson (2000b) shows that if donors disburse aid partly according to the needs of the poor, potential recipients have fewer incentives to introduce policies that would reduce poverty. Further case studies show that unconditional financial aid in poor policy settings may have perverse incentive effects and deter otherwise necessary reforms (Devarajan et al., 2001).

Considering the focus on institutional qualities in the research literature, the World Bank and other multilateral donors seemed to follow the policy advice and considered recipient countries' governance when allocating foreign aid (Winters, 2010; Dollar and Levin, 2006). In the same vein, Wright and Winters (2010) showed that recipient countries with more competitive political structures rather than political inclusiveness do receive more development aid.

On the other hand, some studies show that bilateral and multilateral donors do not take governance in recipient countries into account when disbursing aid (Svensson, 1999, 2000b; Burnside and Dollar, 2000; Neumayer, 2003; Nunnenkamp and Thiele, 2006). Alesina and Weder (2002) argue that multilateral donors are possibly more concerned with alleviating human misery instead of considering different political constitutions of recipient countries and therefore do not exhibit such a sensitivity towards governance as bilateral donors do. Svensson (2003) attributes the relatively inefficient allocation of aid by donors to incentive problems arising from low opportunity costs of committed funds, which leads to a strong bias towards disbursing aid to the ex ante designated recipient, irrespective of its performance. The author proposes a simple reform to improve aid effectiveness, such that the donor commits aid to a group of countries but actually disburses a certain amount to each country depending on its relative performance.

Further studies point to several causes for the ineffectiveness of foreign aid such as increasing donor fragmentation with little or no sign of increased selectivity with respect to policies and institutions leading to inconsistencies in development policies (Easterly, 2007, 2005; Kanbur, 2006). Based on these results, further factors apart from the quality of institutions might influence the amount of foreign aid that a country receives. Alesina and Dollar (2000) highlight further factors such as political and strategic considerations rather than economic needs and policy performance of recipient countries that determine the disbursement of foreign aid. Critics have argued that the incentives in the system are all geared towards continuing the development assistance rather than building local capacities, thus keeping the need unsatisfied (Kanbur, 2006).

Furthermore, foreign aid might also negatively affect the quality of governance in recipient countries. Bräutigam and Knack (2004) highlight possible channels through which foreign aid can negatively affect local institutional qualities such as high transaction costs, different agendas followed by different donors, impediment of learning opportunities, and the impact of foreign aid on the budget process. Additionally, foreign aid may also lead to problems in solving collective action problems and moral hazard problems in recipient countries, which might prove to be large obstacles in the provision of public goods. The fact that recipient countries are not bound anymore to their budget constraint may lead to wrong incentives for recipient countries such that they even might lose the ability to calculate what they can afford to invest in and maintain (Bräutigam and Knack, 2004). Knack (2000) even shows that the institutional gap itself is increasing with aid levels.

While first perceived as a simple problem of resource scarcity and capital shortage, it has now been recognized that under-development is mainly rooted in institutional failures. Some studies also take account of constraints emanating from the nature of the aid relationship and the aid delivery system, as well as the aid agencies' own political constraints and incentive structures, to explain aid ineffectiveness (Paul, 2006).

2.3. Development Policy

Each period in the field of development economics had different policy recommendations depending on the theory of that time. In the following, different policy recommendations for economic development after the Second World War will be provided, subdivided by the according theory. At the end, development policies advocated by the World Bank will be presented.

2.3.1. Development Policy during Structuralism

The ideas of structuralist approaches extended Keynesian economic ideas to developing countries, such that government interventions are necessary for the functioning of markets. For instance, Rosenstein-Rodan (1943) argued in favor of a 'big-push' theory, implying the need for a coordinated expansion and the intervention of the state in planning economic development. The basic idea was that investment was restricted by the small size of the market in poor regions, but a number of projects beginning simultaneously in different industries might provide markets for each other. However, development economics was increasingly divided on such crucial issues as the efficacy of the market or the need for state intervention (Peet and Hartwick, 2015).

Peet and Hartwick (2015) highlight some of the main positions of structuralist development policy as follows. Firstly, due to the fact that most developing countries did not exhibit evolved market economies, policy advisers recommended maintaining the traditional subsistence sector with the agricultural sector and raw materials production and its development alongside a modern commercial sector. This was called the dualistic approach, with the intention to extend the commercial sector based on market economies and diminish the traditional subsistence sector. Given

the fact that most economists considered capital shortage in developing countries as the main restriction to economic development, it was recommended to increase the savings rate and generate domestic savings to make domestic funds available for productive investments. Furthermore, a possible savings gap and a foreign exchange gap could be filled using external sources through public financial aid, loans and private foreign investment. Industrialization should focus on the production of labor-intensive and capital-saving basic producer and consumer goods. Considering trade and the openness of the market, development economists were divided on whether free trade increases international inequalities or could contribute to the development of primary exporting countries. Increasingly, policy recommendations favored export promotion and the liberalization of trade regimes.

2.3.2. Economic Policy during Neoliberalism

The budgetary deficits in developing countries and the failures of the structuralist approaches led to the Washington Consensus (Williamson, 1990, 2009). The term 'Washington Consensus' refers to policy reforms expected whenever debtor countries in Latin America were called on to keep their economies in balance and to submit to strong conditionality (Williamson, 1997). The set of policy instruments making up the Washington Consensus and applied to, mainly Third World, borrowing countries by the World Bank and the IMF was described by Williamson (1997) as including the following ten points.

(i) Developing countries need to exhibit fiscal discipline to avoid a main source of macroeconomic dislocation in the forms of inflation, balance of payments deficits, and capital flight. (ii) Government expenditures, such as expenditures on defense, public administration, and subsidies for state enterprises, need to be reduced, and expenditures on primary education, primary healthcare, and public infrastructure investments need to be maintained or even extended. (iii) The tax base should be broadened by a tax reform, such that tax administration improves, and marginal tax rates should be cut to improve incentives. (iv) Financial deregulation should liberalize interest rates and make them market-determined rather than state-determined. Real interest rates should be positive to discourage capital flight and increase savings. (v) Exchange rates should be sufficiently competitive to enhance rapid growth in nontraditional exports but should not be overvalued, such that economies tend to be more outward-oriented. (vi) Restrictions on imports should be eliminated,

followed by tariff reductions. (vii) Foreign direct investments should be encouraged through debt-equity swaps. Exchanging debt held by foreign creditors for equity in local firms, such as privatized state enterprises. Barriers impeding the entry of foreign firms should be abolished, to attract needed capital, skills, and know-how. (viii) Following the assumption that private industry and market based competitive conditions lead to more efficient production, it was recommended that state owned enterprises should be privatized. (ix) Further, it was advised to deregulate economic activity such that state control over private enterprise is reduced to make firms subject to the market and competitive discipline. (x) Especially for the case of developing countries, it was recommended to increase and secure property rights for the informal sector. In essence, the idea of these policy recommendations was to eliminate market inefficiencies caused by governmental interference in developing countries.

However, Williamson (1990) also states that the economic positions that Washington advocated in setting growth and development policy could be summarized as prudent macroeconomic policies, outward orientation, and free market capitalism. Peet and Hartwick (2015) see this tendency in development policies leading to the Washington Consensus being greatly influenced by neoliberalism, particularly in its attitude against the state. Equally, Williamson (1997) states that the consensus was widely interpreted by critics as the essence of a neoliberal development policy package. Hence, development policy came to consist of withdrawing state direction and even government intervention in development in favor of disciplining economies by market competition and by self-interested individuals efficiently choosing between alternatives in the allocation of productive resources.

Furthermore, Lin and Rosenblatt (2012) criticize the Washington Consensus as having advised the developing countries to adopt the advanced countries' institutions without paying attention to various distortions in developing countries which might have been second-best arrangements being endogenous to the structuralist development strategy itself. Additionally, appropriate institutions may differ depending on the level of development in a particular country. As a result, earlier development policies tried to copy industries of developed countries and are now trying to copy the idealized market institutions of the high-income countries.

2.3.3. World Bank Policy

An important actor in international foreign aid as a multilateral donor is the World Bank. The World Bank has been of influential importance in international development policy since its establishment, however, also being influenced by changes and contemporaneous notions of development research. Also, because the subsequent quantitative analysis of foreign aid transactions will use aid commitments by the World Bank, it is of special interest to understand the evolution and changes in development and foreign aid policy advocated by the World Bank.

The World Bank (or International Bank for Reconstruction and Development), founded at an international conference held at Bretton Woods in 1944, guaranteed private bank loans for long-term investments in productive activities. During the 1950s, under Eugene Black (1949-1962), the World Bank mainly loaned capital for the construction of infrastructure (roads, railroads, power facilities, etc.) in the belief that development basically meant economic growth and this, in turn, depended on public investment. In the mid-1960s, under George Woods (1963-1968), emphasis shifted to education and Third World agriculture. Under Robert McNamara (1968-1981), the World Bank increased in size and changed its orientation. The immediate priority became promoting decent living conditions (food, clothing, housing, services). A basic-needs approach to development assistance was adopted in which resources were given directly rather than having to trickle down to the poor. The ultimate goal, McNamara (1981) said, was to raise the productivity of the poor, enabling them to be brought into the economic system (Peet and Hartwick, 2015).

The 1978 World Development Report (World Bank, 1978) stated that the development effort should be directed toward the objectives of rapid growth and reducing the number of people living in absolute poverty. This basic needs approach translated into a kind of Keynesianism, but with the investment funds in Third World people and infrastructure coming from international banks as well as domestic savings. The idea was to rapidly increase the productivity of developing countries by transferring foreign investment under the supervision of international financial institutions such as the World Bank or the International Monetary Fund (Peet and Hartwick, 2015). During the 1960's and 1970's assistance from multilateral organizations expanded, particularly from the World Bank (Kanbur, 2006). The 'soft loan' window of the World Bank was opened, and Regional Development Banks were

started in Asia, Africa and Latin America. These new multilateral arrangements reflected a general sense that 'consortia' of donors would overcome the coordination and other problems of a multitude of individual aid program (Rosenstein-Rodan, 1968).

Following the oil price shock and the resulting debt crisis in many non-oil-producing developing countries in the 1970's the World Bank changed its emphasis towards market based and competition enhancing policy recommendations. During the early 1980s, under the leadership of A. W. Clawson, the World Bank shifted emphasis in a more market and competition oriented direction. This was stated in a report on development in sub-Saharan Africa (Berg, 1982). The report concluded that the key problems of the region derived from both internal and external factors exacerbated by 'domestic policy inadequacies'. According to the report, several shortcomings had to be addressed and overcome if production ultimately was to be given higher priority. Existing state controls over trade were found to be ineffective. Concomitantly private sector activity should be enlarged, agricultural resources should be concentrated on small farmers and human resources should be improved under an export-oriented development strategy (Peet and Hartwick, 2015).

For instance, the 1983 World Development Report (World Bank, 1983) stated that international trade enabled developing countries to specialize in production, exploit economies of scale, and increase foreign exchange earnings. The 1984 World Development Reports (World Bank, 1984) used 'growth scenarios' to argue that developing countries could improve their economic performance by changing economic policies, specifically by avoiding overvalued exchange rates and reducing public spending commitments. Further development reports by the World Bank increasingly put the emphasis on liberalization policies in order to foster growth of national income, to alleviate poverty, and to reduce income inequalities. The World Bank suggested policy reform in three main areas, such as trade reform, macroeconomic policies to reduce government budgetary deficits, lower inflation, and ensure competitive exchange rates, and a domestic competitive market, that is, removing price controls, rationalizing investment regulations, and reforming labor market regulations (World Bank, 1989, 1990, 1997). However, as Peet and Hartwick (2015) point out, reforming labor market policies means decreasing minimum wages and ending other market regulations that supposedly distorted free labor markets. Reducing government spending meant reducing programs directed at the poor and the provision of public goods. Hence, a series of contradictions appear in the political economy of the World Bank's new policy advises.

The World Bank's strong tilt towards market based development policies began to change again in the early 2000s. Policies originating from the Washington Consensus were widely rejected as causing economic decline in Latin America. On the other hand, countries with high, sustained growth rates in the 1990s and early 2000s, like China and India, were those countries which were not applying policies according to the Washington Consensus. Hence, new approaches emerged such as the 'Millenium Development Goals' (MDGs) and 'debt relief' programs. The MDGs were enshrined as 'basic human rights - the rights of each person on the planet to health, education, shelter, and security.' They are said to be innovative in that they explicitly recognize an interdependence among growth, poverty reduction, and sustainable development (Peet and Hartwick, 2015).

2.4. Conclusion

As became apparent, the development paradigm and theories on economic growth changed considerably during the history of economic thought. These changes mostly depended and varied with the contemporaneous state of the economy and emerging problems which needed to be addressed. Thus, current approaches of development policy contain a mixture of historical views about economic development and current research. However, even with improved methods and better data availability the effects of foreign aid on recipient countries' economies remain disputed.

Even with continuously changing policy prescriptions and constant flows of foreign aid the gap in economic performance between developing and developed countries remains considerable. Recent research takes a closer look at the sub-national distribution and implementation of foreign aid projects using newly available sub-nationally disaggregated project data. Chapter 3 will also use sub-nationally disaggregated data to assess the importance of recipient countries' governance on the allocation of aid projects within the country.

3. The Influence of Institutions on the Sub-National Allocation of Aid Projects. A Panel Data Analysis

3.1. Motivation

The research literature on economic development and the effectiveness of foreign aid has led to many explanations for the unsatisfactory results of large transfers of aid dollars. Since the late 1990's and early 2000's researchers have increasingly started to highlight the effects of recipient governments' institutional constitution on the effectiveness of foreign aid. One main contribution by Burnside and Dollar (2000) shows that the effects of foreign aid on economic growth depends on recipient countries' policy. This argument proved to be widely acknowledged and offered policy advice for aid donors. A report by the World Bank in 1998 also mentions the obstacles to economic development arising from poor governance and advocates the use of different aid instruments depending on recipient countries' economic policies, as can be seen in the following citation.

> *"Program aid is not likely to promote development in the absence of sound economic policies. In such situations, donors should maintain a policy dialogue with the government, but limit aid flows and direct them to project assistance, often focusing on non-state actors. When sound economic policies have been put in place, donors should expand program aid, perhaps in the context of sectoral investment strategies negotiated with the government."*[5]

Compared to other aid instruments, such as program aid, technical assistance or

[5] Dollar and Pritchett (1998, p.99)

budget support, project aid is assumed to be the adequate instrument for donors in the presence of bad governance in recipient countries. Project aid enables donor institutions to reduce the discretion of recipient countries in terms of how to spend the money and to increase control over aid allocation and implementation (Briggs, 2014; Morrison, 2012). Collier (2006) also refers to project aid as being subject to high scrutiny such that they must go through due processes and therefore even in the presence of poor governance and fungibility can lead to more public goods and also increase sector know-how.[6]

Following these considerations the World Bank increased selectivity in the provision of foreign aid and implemented more targeted aid in countries with worse governance (Winters, 2010). However, most studies that address the issue of governance and the allocation of development aid use country level data and are not able to analyze the distribution of aid projects within a country. Even with increased selectivity by the World Bank, in the presence of low quality institutions project aid may still be used as an instrument for patronage and clientelistic policies within recipient countries. Some studies used data on sub-national economic activity or the allocation of state resources to provide evidence for ethnic favoritism and clientelistic policies by recipient governments (Dreher et al., 2019; Hodler and Raschky, 2014; Jablonski, 2014). Two country case studies analyzed the effects of governance on the sub-national allocation of state resources in Kenya (Burgess et al., 2015; Briggs, 2014). However, there has not been an overall assessment of the influence of recipient countries' governance on the sub-national distribution of aid projects across countries.

Therefore, the present study will extend the previous scope of analysis to a larger number of countries. The aim is to understand whether foreign aid in the form of project aid really underlies such high scrutiny by the World Bank such that recipient countries, even those with bad governance, have no influence on project implementation and the allocation of foreign aid funds sub-nationally. This will be done by analyzing the effects of institutional qualities on the sub-national allocation of aid projects in sub-Saharan Africa. The analysis will use a data set that provides georeferenced aid projects from the World Bank approved between the years 2000 and 2011 for 38 sub-Saharan African countries. It will be shown that ethnic favoritism is not influenced by levels of governance in recipient countries. This becomes apparent con-

[6]Several studies have highlighted that besides the advantages of project aid in the face of bad governance, it may still prove to be subject to fungibility of aid flows (Devarajan et al., 1999; Feyzioglu et al., 1998).

sidering that birth regions of incumbent presidents do not disproportionately receive more aid projects than other regions in a country. These effects do not change when levels of governance in recipient countries are additionally accounted for. However, the sub-national allocation of project aid does not prove to be completely unaffected by recipient countries' governance. First of all, capital city regions do receive more aid funds than other regions and the allocation of aid projects in capital city regions declines with better governance. The results imply that the implementation of aid projects in capital city regions not only follows economic and developmental considerations but also possibly includes corrupt and clientelistic elements.

The following sections are organized as follows. The next section will review the literature to which the present study is closely related. Section three will describe the data and explain the method used to provide the results in the subsequent section. The fifth section will provide some robustness checks to conclude in the last section.

3.2. Literature

A large amount of studies are concerned with the interrelations between foreign aid and institutional qualities in recipient countries. Some studies analyze whether donors take recipient countries' governance into account when disbursing foreign aid. Other studies analyze the effectiveness of foreign aid in different institutional environments. However, the picture that emerges is not clear cut due to the fact that most studies use country level data to determine factors and effects of foreign aid. This provides a basis either to defend existing development aid policies or argue against them. A further puzzling result in the literature is that development projects seem successful when analyzed on the micro level but lack positive effects on the macro level.

Nevertheless, due to more detailed data available, concerning the sub-national use and distribution of foreign aid and aid projects, recent studies are able to shift the focus from a macroeconomic perspective towards a micro level perspective. This possibly enables one to understand why in some cases aid projects seem to be inefficient while in other cases they result in positive outcomes. Tierney et al. (2011) introduced a new data set called AidData, which covers more bilateral and multilateral donors and more types of aid than previously existing data sets, while additionally

providing GPS coordinates for aid project locations.

Recent studies use such geo-coded data on aid projects to understand the factors that determine the actual allocation of aid projects on the sub-national level. For instance, Dionne et al. (2013) study the sub-national distribution and the effectiveness of foreign aid in Malawi. They show that the level of humanitarian need in regions does affect the decision process of aid allocation by very little. A driving factor is instead regional ethnic match with the president. The authors do not find any positive effect of aid on infant mortality with the greatest improvements being in districts that received little or no aid (Dionne et al., 2013). On the other hand, De (2013) provides evidence that sector specific aid projects in Malawi do improve regional living conditions such as decreasing disease severity, decreasing diarrhea incidence and increasing school enrollment.

Apart from regional needs the voting behavior in each region may also affect the sub-national allocation of foreign aid. Masaki (2018) shows for Zambia that fewer projects are allocated in districts where the ruling party enjoys greater popularity. Instead, the author finds strong support that projects are allocated in districts where the opposition to the ruling party is strong, thus providing evidence for the 'swing voter' strategy concerning sub-national aid allocation. On the other hand, Jablonski (2014) provides evidence for the 'core voter' strategy by showing that the sub-national allocation of aid projects in Kenya favored regions with high vote shares for the winning coalition. The study also provides evidence that regions with a larger share of the same ethnicity as the incumbent president receive a significantly larger share of foreign aid. Briggs (2014) also provides evidence that project aid and local funds in Kenya were disproportionately directed towards the president's political base.

Further studies were able to show an effect of ethnic favoritism on the sub-national allocation of state resources. Hodler and Raschky (2014), for instance, analyze night-time light intensities to capture possible economic growth effects in certain regions due to political or ethnic favoritism by incumbent presidents. Regions of incumbent political leaders' birth show increases in nighttime light intensities, however, with no long-term effects. Nighttime light intensities decrease back to initial levels at the end of the presidents' time in office. Furthermore, the sub-national allocation of Chinese foreign aid projects in sub-Saharan Africa also exhibits elements of ethnic favoritism, as Dreher et al. (2019) show. The authors find that Chinese aid is allocated to the birth regions of political leaders and regions populated by the same

ethnic group as incumbent presidents. The authors also look at WB aid projects and do not find the same results. Öhler and Nunnenkamp (2014), on the other hand, find that ethnic favoritism seems to be the main factor determining the sub-national allocation of foreign aid projects by the World Bank and the African Development Bank. Regional need factors, such as infant mortality rates, maternal health or malnutrition, do not seem to affect the sub-national distribution of project aid by multilateral donors.

Furthermore, Briggs (2017) shows that multilateral donors are not poor sensitive and do not direct their resources to regions where the poor live. The author uses sub-regional wealth data to assess the performance of the World Bank and the African Development Bank (AfDB) and shows that aid projects favor regions within countries where the richest live. Additionally, capital regions receive significantly more aid projects, which might also be explained by the fact that most rich people in sub-Saharan African countries live in capital regions. Hence, it seems that donors are not able to exercise strong control over aid projects and its allocation within recipient countries. Following Briggs (2017), these insights might also explain the differences between micro and macro level evaluations of foreign aid effectiveness.

One case study explicitly considers the effects of governance on the sub-regional allocation of state resources in Kenya (Burgess et al., 2015). The authors measure the effects of ethnic favoritism on regional road construction depending on the quality of governance. During periods of autocracy, districts coethnic to the incumbent president receive on average a larger amount of expenditures for road construction. However, during periods of democratic rule this effect almost entirely vanishes. Hence, the authors conclude that institutional qualities of a country have an effect on the sub-national distribution of state resources.

Concerning project aid, providing some level of accountability and control by donors and being more subject to scrutiny than other aid instruments, it remains unclear how far project aid is immune to political influence by recipient governments and their qualities of governance (Van de Walle, 2007). Do aid projects underlie such high scrutiny by the World Bank to prevent the misuse of aid funds, especially in the face of bad governance, in recipient countries? If aid projects are meant to alleviate poverty and human misery in recipient countries they should not be favorably allocated in regions which indicate political or ethnic favoritism. Furthermore, if multilateral donors exhibit sensitivity towards recipient countries' governance, then there should not be any effect of governance on the sub-national allocation of project

aid across countries.

The analysis considers national measures of governance instead of focusing on sub-national or regional measures of governance. This is done to analyze the extent of influence of central governments in recipient countries on the distribution of aid projects by the World Bank sub-nationally. Looking at sub-national or regional measures of governance would instead imitate the existing literature that analyzes donors' sensitivity towards recipient countries' governance when disbursing aid, only to go one level deeper by looking at measures of regional governance.

3.3. Methodology and Data

The empirical analysis covers a total of 540 sub-national regions in 38 sub-Saharan countries from 2000 till 2011. The sub-national units correspond to provinces, states and governorates at the first-level administrative unit (ADM1). The data includes all projects that could be located with a level of precision at the regional level (ADM1) or better.[7]

In order to test whether recipient countries' governance has an effect on the allocation of aid projects in incumbent presidents' birth regions or capital city regions, two equations are estimated with least square dummy variable estimation following Burgess et al. (2015). The empirical analysis will extend the approach with additional control variables used in further studies (as in Dreher et al., 2019; Briggs, 2017; Öhler and Nunnenkamp, 2014) and estimate the following equations:

$$\begin{aligned} y_{ict} = \alpha_{ct} &+ \beta_1 PrBrth_{ict} + \beta_2 PrBrth_{ict} * Inst_{ct} \\ &+ \beta_3 Cap_{ic} + \beta_4 Cap_{ic} * Inst_{ct} + \sum_{j=1}^{n} \beta_j X_{jict} + \varepsilon_{ict}, \end{aligned} \tag{3.1}$$

$$\begin{aligned} y_{ict} = \alpha_{ct} + \gamma_{ic} &+ \beta_1 PrBrth_{ict} + \beta_2 PrBrth_{ict} * Inst_{ct} \\ &+ \beta_3 Cap_{ic} * Inst_{ct} + \sum_{j=1}^{n} \beta_j X_{jict} + \varepsilon_{ict}. \end{aligned} \tag{3.2}$$

The term α_{ct} represents country-year fixed effects. The second equation additionally controls for region fixed effects with the term γ_{ic}. The subscript i stands for a region in country c in year t.

[7] The shapefiles for the ADM1 regions under study come from the GADM database (`www.gadm.org`). Observations of aid projects that were missing ADM1 information were geolocated using shapefiles from this database.

The dependent variable y_{ict} is measured in two ways following previous studies (Briggs, 2017; Dreher et al., 2019; Dreher and Lohmann, 2015). First, the dependent variable is measured as the logarithm of official financial commitment located in region i in country c and year t ($ln(Aid_{ict})$). However, detailed information about financial commitments for each single project location are not available but instead total commitments for entire projects are given. Accordingly, one needs to assume that the costs of a project are split equally across all of its project locations to be able to calculate the amount of funds that each single location receives (as in Briggs, 2017; Dreher et al., 2019 and Dreher and Lohmann, 2015). The second dependent variable is the logarithm of total project locations in each region ($ln(Proj_{ict})$)[8].

The information on aid projects comes from AidData (Strandow et al., 2011) and includes projects from the World Bank that were approved between the years 2000 and 2011. A single project can include several different project locations which can be spread over a single country or over several countries. During these years the World Bank implemented a total of 437 projects with a total of 5,651 different project locations. The total financial commitment by the World Bank adds up to 21.16 billion US $. The largest amount of financial commitments funded by the World Bank are in the sectors 'transportation', followed by the sectors 'energy and mining', and 'water, sanitation and flood protection'. The largest number of projects implemented by the World Bank are in the 'agriculture, fishing, and forestry' sector followed by 'public administration, law, and justice' and 'transportation'. Most sectors have on average 11 locations per project, whereby the sectors 'transportation' and 'health and other social services' stand out with an average of 20 and 22 locations per project, respectively. The average commitment per project across is around 48.42 million US $. Again, the 'transportation' sector stands out with an average commitment per project of 88.13 million US $.[9]

Figure 3.1 shows the number of project locations per country for the 38 countries in the sample and the total financial commitments in million US dollars. The number of project locations ranges from a high of 738 in Nigeria to a low of 10 project locations in Gabon. Nigeria receives the largest financial funds which account for 2.99 billion US $. Namibia receives the fewest financial funds of 2.86 million US $. Furthermore, the total amount of distinct projects implemented in a country ranges from a high of 29 in Kenya and Tanzania to a low of 2 projects in Gabon, Namibia

[8]The logged variables are the natural log of the total costs and total project locations in region i after 0.001 has been added to remove zeros.

[9]See Tables B1, B2 and B3 in Appendix B for detailed information on World Bank projects in the sample distinguished by projects, countries and their sectoral distribution.

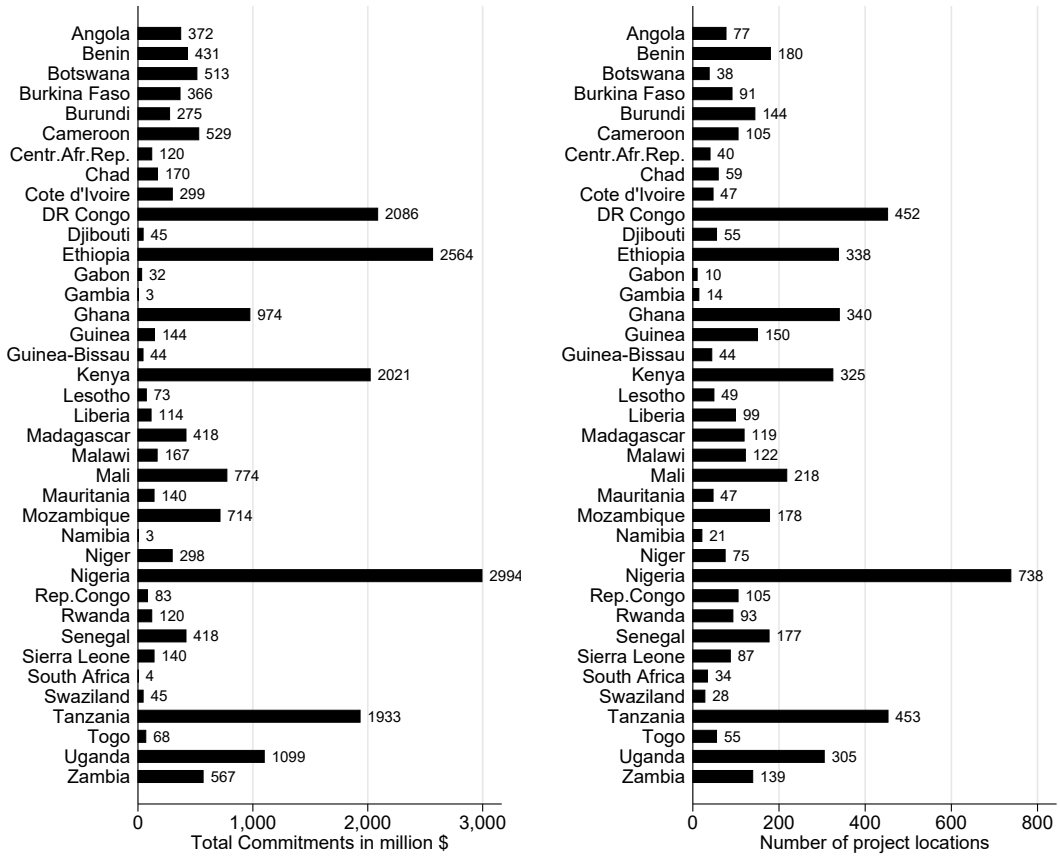

Figure 3.1.: (left) Total commitments, (right) Number of Project Locations by country

and Swaziland.[10] There are several projects which are located in several countries. There are 77 projects with 358 project locations in more than one country. For instance, one project called the ''Western Indian Ocean Marine Highway Development and Coastal and Marine Contamination Prevention Project" ranges over four countries (Mozambique, South Africa, Kenya and Tanzania) and has a total of 25 project locations in these countries. The aim of this project is to contribute to protect the region's coastal and marine environments and the biodiversity.[11] However, only a small part of projects range over more than one country compared to the total number of projects of 437 with a total of 5,651 project locations. Figures B.1 and B.2 in Appendix B.1 provide the maps of Africa with all the project locations in the data.

[10]Table B5 in Appendix B.1 provides more detailed information on WB projects in the sample distinguished by recipient countries.

[11]`https://www.thegef.org/project/western-indian-ocean-marine-highway-development-and-coastal-and-marine-contamination/`

To understand the different allocation patterns for the sub-national project locations the analysis will restrict itself to countries that received at least one project location in a given year. Due to the fact that not all countries received project aid for the entire time period between the years 2000 and 2011 the panel data is unbalanced. The aim is to understand the different allocation patterns of project locations given recipient countries' level of governance. Hence, countries that did not receive any aid project in a given year are not considered. Including years in which countries did not receive any aid projects, where all regions in a country receive the same amount of zero aid, the differences in project allocation between regions in a country would be obstructed. Birth regions of incumbent presidents or capital city regions would appear to be equally treated in the amount of aid that they receive. Thus, the analysis focuses on the effects of different allocation patterns in regions differentiated by presidents' birth regions and capital city regions, given there is any treatment (receiving aid projects) of a country in a given year. [12]

To account for incumbent presidents' birth regions a dummy variable $PresBirthpl_{ict}$ is included in each regression, which takes the value one if this region was the birth region of the incumbent president and zero otherwise.[13] Table B6 in Appendix B.1 shows the tenures of the presidents for the 38 countries in the sample with the corresponding regions of birthplaces. The regression equations also include an interaction term between levels of governance in recipient countries and the dummy variable for incumbent presidents' birth regions. The aim is to understand whether recipient governments with worse institutional qualities are better able to divert funds towards birth regions of incumbent presidents.

Table 3.1 provides preliminary descriptive statistics for both dependent variables separated by regions that were presidents' birth regions and regions that were not. On first sight, presidents' birth regions appear to receive on average more aid projects measured with both variables.

Additionally, a dummy variable is defined for capital city regions. The allocation of aid projects in capital city regions might be explained by higher economic development of these regions compared to the rest of the country, thus providing promising

[12]The section testing for robustness will also consider the whole sample, including observations where recipient countries did not receive any aid project. As can be seen in Table B9 in Appendix B.2 the results do not change.

[13]The data for presidents' birth regions is from Goemans et al. (2009) Archigos dataset. This data has further been updated by Goemans et al. (2009) and has also been used in Dreher et al. (2019). The data was cross-checked using information from the webpage `http://www.worldstatesmen.org/`.

Table 3.1.: Descriptive statistics by Pres.Birthpl. Regions

	Statistic	Aid_{ict}	$ProjLoc_{ict}$
Not Pres.Birthpl	Mean	5.31	1.42
	Std.Dev.	16.32	3.52
	Obs.	3621	3621
Pres.Birthpl.	Mean	8.08	2.14
	Std.Dev.	17.86	3.35
	Obs.	241	241
Total	Mean	5.48	1.46
	Std.Dev.	16.43	3.51
	Obs.	3862	3862

Aid_{ict} is measured in million US $.

opportunities for successful project implementation. On the other hand, if the World Bank does consider regional need aspects, capital city regions should not significantly attract more aid projects than other regions. Hence, it remains difficult to determine whether economic considerations or rather clientelistic, possibly corrupt, intentions by recipient governments drive the allocation of aid projects in capital city regions. Thus, accounting for institutional qualities in recipient countries may provide some evidence concerning the forces which influence the allocation pattern of aid projects in capital city regions. If economic considerations are the main driving forces for allocating aid projects in capital city regions, then institutional qualities in recipient countries are not expected to have any effects on the allocation of project aid in capital city regions. Therefore, the analysis will also include an interaction term between the dummy variable Cap_{ic} and the institutional variables $Inst_{ct}$. Table 3.2 provides some preliminary descriptive statistics which shows the differences in average project allocation differentiated by capital city regions and the rest of the regions within a country. The differences of aid values in Table 3.2 are more pronounced than in Table 3.1. On first sight, the bias of aid projects towards capital

Table 3.2.: Descriptive statistics by Capital City Regions

	Statistic	Aid_{ict}	$ProjLoc_{ict}$
Not Cap. Region	Mean	5.03	1.41
	Std.Dev.	15.26	3.55
	Obs.	3620	3620
Cap. Region	Mean	12.23	2.33
	Std.Dev.	27.91	2.86
	Obs.	242	242
Total	Mean	5.48	1.46
	Std.Dev.	16.43	3.51
	Obs.	3862	3862

Aid_{ict} is measured in million US $.

city regions seems more pronounced than the bias towards incumbent presidents' birth regions.

The measures for institutional qualities, captured with the term $Inst_{ct}$, come from the Worldwide Governance Indicators (WGI), which is a data bank for yearly country level indicators of governance (Kaufmann et al., 2011). For instance, Kaufmann et al. (1999) show that governance, measured with these indicators, matters for better economic development outcomes.[14] The country-level institutional variables are used in the interaction term with the regional dummy variables $PrBrth_{ict}$ and Cap_{ic} to capture the extent of influence of central governments' quality of governance on the sub-national allocation of aid projects. All institutional variables are mean centered, such that the value zero for all of these variables denotes the sample mean. However, this modification only affects levels of the coefficients for the main effects of $PrBrth_{ict}$ or Cap_{ic}, but does not affect the coefficients for the interaction terms. As a result, the coefficients for the main effects of $PrBrth_{ict}$ and Cap_{ic} depict the effects in countries with institutional qualities at the sample mean.[15]

The indicators are based on several variables obtained from different data sources capturing the perceptions of governance by respondents, such as non-governmental organizations, commercial business information providers, and public sector organizations (Kaufmann et al., 2011). The WGI measures are in standard normal units ranging from -2.5 to 2.5, with higher values depicting better governance. The first variable used to measure levels of governance in recipient countries is *control of corruption* (CC), which captures the perception concerning public officials and the extent of misuse of their positional power for private gain. *Control of corruption* also measures the extent of state capture by elites or by private interests. *Rule of law* (RL) measures the trust of economic agents and their behavior compared to the rules of society. This includes the quality of contract enforcement, property rights, the police, and the courts. *Government effectiveness* (GE) measures the quality of public and civil services and the degree of their independence from political pressures, and the credibility of governments. The last governance measure used is *regulatory quality* (RQ), which assesses the perceptions of governments and their capability to formulate and implement sound policies and regulations that permit and promote private sector development. Within the sample of all 38 countries the Democratic Republic of Congo has on average the worst qualities of governance.

[14] A number of studies have used these indicators to measure governance, such as Apodaca (2004), Clarke and Wallsten (2006), Llamazares (2005) and Neumayer (2002).

[15] For a discussion of the importance of the main term in estimations with interaction terms see Nelder (1977).

Botswana performs on average best according to the institutional measures from the WGI over the years 2000-2011. [16]

The term $\sum_{n=1}^{j} \beta_n X_{nict}$ includes further control variables, such as conflicts in a region, regional area and regional population. Violent conflicts ($ln(Battles_{ict})$) are measured as the natural logarithm of each region's total number of battles during the last two years prior to the approval year of each project. All instances of violent conflicts between two organized armed groups are considered as battles. The conflict data is drawn from the Armed Conflict Location & Event Data Project (ACLED), which is a sub-regionally disaggregated conflict data set.[17] Controlling for regional conflicts takes into account that multilateral donors might grant more aid to regions where social conflict conditions tend to be better. Donors might also consider regional security to be able to efficiently implement project aid, such that regional conflicts within a country may play a role in the sub-national allocation of projects. The area control variable accounts for the fact that the optimal number of project locations within a region may depend on the size of each region, such as infrastructure projects like road building. The area is measured as the natural logarithm of regional area ($ln(Area)$). This variable is calculated from data by the Center for International Earth Science Information Network (CIESIN), which is a population data collection with additional information on land and water areas.[18] Finally, the analysis additionally controls for regional population calculated from the CIESIN data. The data provides information on regional population on a five year basis from 2000 to 2015. Each aid project is assigned by approval year to the last observation of regional population from the CIESIN data, such that all aid projects from 2000 till 2004 are assigned the population data from 2000 and so on. Table B4 in Appendix B.1 provides the summary statistics for all variables used in the regressions.

3.4. Results

This section will discuss the results for the data and methods introduced in the previous section. First, the regression results for the allocation of project locations towards presidents' birth regions and capital city regions, without considering re-

[16] For a more detailed description of the data see Kaufmann et al. (2011).

[17] For more details see Raleigh et al. (2010).

[18] For more information see Doxsey-Whitfield et al. (2015) and Center for International Earth Science Information Network (CIESIN) (2018).

cipient countries' governance, will be discussed. Subsequently, the results for the influences of each institutional measure on the allocation pattern of aid projects in presidents' birth and capital city regions will be presented.

Table 3.3 provides the regression results for the estimation without including the interaction terms with the institutional measures. The coefficients for $Pres.Birthpl.$ are not significant in all specifications. The results by Dreher et al. (2019) for the allocation of aid projects by World Bank are confirmed, on the other hand, contradicting the findings by Öhler and Nunnenkamp (2014). It seems that project aid does not seem to be favorably distributed in regions where incumbent presidents were born. The coefficients for the capital region dummy imply that capital city regions attract a significantly larger amount of project aid than any other region. As previously discussed, this might be explained by the fact that regions with capital cities are the most economically developed regions especially in sub-Saharan African countries. It can be assumed that the possibility of implementing project aid with promising results is greater in economically developed regions with their investment opportunities. However, this would contradict the needs-based approach by the World Bank, because capital city regions are generally not the regions with the worst human living conditions in a country. As Sahn and Stifel (2003) point out, there is a large discrepancy in well-being and large inequalities between urban and rural regions in sub-Saharan Africa. Hence, allocating aid projects to capital regions does not address human-needs of the entire population in recipient countries.

Capital city regions seem to attract 487.1% more aid funds and 131.6% [19] more project locations than other regions in a country. Regional conflicts in previous years do not seem to discourage donors from allocating projects there. The coefficient for regional area provides a significant negative effect only when project aid is measured as the log of total aid dollars. Thus, the amount of aid funds in a region decreases with increasing area. Additionally, regional population proves to be a significant factor that attracts a larger amount of project aid, only, however in the specifications with country-year fixed effects. Including regional fixed effects results in negative and insignificant coefficients for regional population. Aid projects in sub-Saharan African countries funded by the WB do not seem to be favorably allocated in regions of incumbent presidents' birth. On the other hand, capital city regions do attract a significantly larger amount of aid projects.

[19] Note that for log-level regressions the technical interpretation is the following: $\%\Delta y = 100 \cdot (e^{\beta_i} - 1) \cdot \Delta x$. Thus, the coefficient for the capital city dummy in column (1) is calculated as $\%\Delta y = 100 \cdot (e^{1.77} - 1) \cdot 1 = 487.085$ and in column (3) as $\%\Delta y = 100 \cdot (e^{0.84} - 1) \cdot 1 = 131.637$.

Table 3.3.: Presidents' Birthplace and Capital City Regions and Aid

	(1) $ln(Aid_{ict})$	(2) $ln(Aid_{ict})$	(3) $ln(ProjLoc_{ict})$	(4) $ln(ProjLoc_{ict})$
Pres.Birthpl.	0.10	-0.32	0.07	0.17
	(0.70)	(1.48)	(0.24)	(0.57)
Capital	1.77**		0.84***	
	(0.67)		(0.25)	
ln(Battles)	0.06	0.04	0.01	0.01
	(0.05)	(0.04)	(0.02)	(0.01)
ln(Area)	-0.41***		-0.09	
	(0.15)		(0.06)	
ln(Population)	2.71***	-0.93	1.01***	-0.55
	(0.29)	(1.22)	(0.10)	(0.39)
Country-Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes
R-squared	0.47	0.58	0.48	0.59
Observations	3,862	3,849	3,862	3,849
Regions	540	527	540	527
Countries	38	36	38	36

Standard errors in parentheses are clustered at the country level.
***p<0.01, **p<0.05, *p<0.1

To assess the influence of governance in recipient countries on the allocation of aid projects the further analysis will provide the results of the regressions including the interaction term between institutional measures and regional dummy variables. Table 3.4 provides the estimation results for equations (1) and (2) with *control of corruption* as the institutional measure. The uneven columns provide the results obtained with country-year fixed effects and the even columns additionally consider region fixed effects.

The results in row (1) show that being the incumbent presidents' birth region does not significantly attract more aid projects throughout all specifications. However, these coefficients depend on the scaling of the institutional measure in the interaction term. Here, the coefficients depict the effects for the case when the institutional measure equals the sample mean.[20][21] Capital city regions appear to significantly attract more project aid in countries for values of *control of corruption* at the sample average. Furthermore, better *control of corruption* does not have any effect on the allocation of aid projects in incumbent presidents' birth regions. This can be seen in the insignificant coefficients for the interaction term in row (2). However,

[20] As noted earlier, the institutional quality measures are mean centered.

[21] Due to the fact that all regressions account for country-year fixed effects, the main term of the institutional measure gets dropped because it does not vary within a country in a certain year.

Table 3.4.: Presidents' Birthplace and Capital City Regions interacted with Control of Corruption (CC)

	(1) $ln(Aid_{ict})$	(2) $ln(Aid_{ict})$	(3) $ln(ProjLoc_{ict})$	(4) $ln(ProjLoc_{ict})$
Pres.Birthpl.	0.26	0.08	0.11	0.34
	(0.75)	(1.51)	(0.26)	(0.56)
Pres.Birthpl. x CC	0.50	-1.26	-0.06	-0.28
	(1.54)	(2.76)	(0.49)	(0.84)
Capital	1.88**		0.88***	
	(0.73)		(0.27)	
Capital x CC	-2.84*	0.08	-0.99*	0.16
	(1.41)	(4.13)	(0.52)	(1.25)
ln(Battles)	0.06	0.03	0.01	-0.00
	(0.06)	(0.05)	(0.02)	(0.02)
ln(Area)	-0.39***		-0.08	
	(0.13)		(0.06)	
ln(Population)	2.70***	-0.86	1.02***	-0.53
	(0.29)	(1.24)	(0.10)	(0.39)
Country-Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes
R-squared	0.48	0.58	0.49	0.60
Observations	3,646	3,633	3,646	3,633
Regions	540	527	540	527
Countries	38	36	38	36

Standard errors in parentheses are clustered at the country level.
***p<0.01, **p<0.05, *p<0.1

better *control of corruption* does seem to negatively influence the allocation of aid projects in capital city regions. The interaction term between *Capital* and *CC* does provide negative coefficients significant at the 10 percent level. An improvement in *control of corruption* by 0.1 score points will lead to 9.42% and 6.28% [22] fewer aid commitments and project locations, respectively, in capital city regions.[23] On the other hand, accounting further for region fixed effects results in insignificant coefficients for the interaction term, as can be seen in the even columns. However, this result might be driven by the fact that capital city regions do not vary across regions and over time within a country such that the variation becomes even smaller when controlling for region specific characteristics. All control variables maintain their previously discussed pattern. In sum, better *control of corruption* reduces the

[22] Again, the coefficient for the interaction term in row (4) between the capital city dummy and *control of corruption* in column (1) is calculated as $\%\Delta y = 100 \cdot (e^{-2.84} - 1) \cdot 0.1 = -9.416$ and in column (3) as $\%\Delta y = 100 \cdot (e^{-0.99} - 1) \cdot 0.1 = -6.284$.

[23] It needs to be considered that a change of the institutional variables, which originally range between -2.5 and 2.5, will not be as high as one score point. Hence, the discussion of the results will assume a change of 0.1 score points.

amount of aid funds and project locations allocated to capital cities. On the other hand, the allocation of aid projects in incumbent presidents' birth regions is not affected by improvements in corruption control.

Table 3.5 provides the estimation results with *rule of law* as the institutional measure in the interaction term. Incumbent presidents' birth regions do not significantly attract more aid projects, when accounting for recipient countries level of *rule of law*. The coefficients for the interaction term between presidents' birth regions and the *rule of law* measure are insignificant through all specifications. The results imply that the disbursement of aid projects in birth regions of incumbent presidents are not affected by levels of *rule of law* in recipient countries.

Again, capital city regions attract significantly more aid projects than other regions. Additionally, the results in the specifications with country-year fixed effects (columns (1) and (3)) imply that higher levels of *rule of law* have a significant negative effect on the allocation of aid projects in capital city regions. Hence, improving *rule of law* and the accountability of economic agents in recipient countries by 0.1 score points would reduce aid dollars and projects located in capital city regions by 9.64% and 6.99%, respectively. However, these effects do not persist when additionally accounting for region specific characteristics (columns (2) and (4)). The control variables exhibit the previously discussed pattern, with the number of previous battles in a region not affecting the number of aid projects implemented in that region. The amount of foreign aid funds in a region significantly increases with its area. And higher regional population induces more aid projects disbursed in a region, although only in the specifications with country-year fixed effects.

Hence, higher levels of *rule of law* and better accountability of economic agents and public servants seem to undermine the influence of recipient governments to allocate aid projects in capital city regions. However, the same effects are not observable for the allocation of aid projects in incumbent presidents' birth regions. There is neither a favorable treatment of these regions with aid projects nor is this affected by levels of *rule of law* in recipient countries.

Table 3.6 provides the estimation results for assessing the influence of *government effectiveness* of recipient countries on the sub-national distribution of aid projects. Incumbent presidents' birth regions do not significantly attract more aid projects in any specification in countries with values of *government effectiveness* at the sample mean. Also, the insignificant coefficient of the interaction term between

Table 3.5.: Presidents' Birthplace and Capital City Regions interacted with Rule of Law (RL)

	(1) $ln(Aid_{ict})$	(2) $ln(Aid_{ict})$	(3) $ln(ProjLoc_{ict})$	(4) $ln(ProjLoc_{ict})$
Pres.Birthpl.	0.20	0.20	0.10	0.36
	(0.76)	(1.42)	(0.26)	(0.52)
Pres.Birthpl. x RL	1.10	-1.85	0.10	-0.78
	(1.33)	(2.14)	(0.45)	(0.70)
Capital	2.03***		0.93***	
	(0.70)		(0.27)	
Capital x RL	-3.31***	-4.47	-1.20***	-0.48
	(1.16)	(6.43)	(0.39)	(2.12)
ln(Battles)	0.06	0.02	0.01	-0.00
	(0.06)	(0.05)	(0.02)	(0.01)
ln(Area)	-0.37***		-0.08	
	(0.14)		(0.06)	
ln(Population)	2.70***	-0.75	1.02***	-0.50
	(0.30)	(1.22)	(0.10)	(0.38)
Country-Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes
R-squared	0.48	0.58	0.49	0.60
Observations	3,646	3,633	3,646	3,633
Regions	540	527	540	527
Countries	38	36	38	36

Standard errors in parentheses are clustered at the country level.
***p<0.01, **p<0.05, *p<0.1

Pres.Birthpl. and *GE* implies that better *government effectiveness* has no effect on aid projects located in birth regions of incumbent presidents.

On the other hand, project aid remains significantly and positively biased towards capital city regions, even if levels of *government effectiveness* in recipients countries are accounted for. Furthermore, these effects diminish with better *government effectiveness*. This can be seen in the significantly negative coefficients for the interaction terms between *Capital* and *GE* in the specifications with country-year fixed effects (columns (1) and (3)). Albeit, the effect of the the interaction term on the log of aid funds in capital city regions is only significant at the 10 percent level. The results imply that improving *government effectiveness* by 0.1 score points significantly reduces the amount of aid dollars and project locations in capital city regions by 9.37% and 6.43%, respectively. Interestingly, the coefficients do not remain significant and are not robust for additionally accounting for region fixed effects, as can be seen in columns (2) and (4).

Table 3.6.: Presidents' Birthplace and Capital City Regions interacted with Government Effectiveness (GE)

	(1) $ln(Aid_{ict})$	(2) $ln(Aid_{ict})$	(3) $ln(ProjLoc_{ict})$	(4) $ln(ProjLoc_{ict})$
Pres.Birthpl.	0.19	0.14	0.10	0.34
	(0.78)	(1.46)	(0.27)	(0.54)
Pres.Birthpl. x GE	0.98	-1.43	-0.04	-0.70
	(1.22)	(2.17)	(0.41)	(0.68)
Capital	2.02***		0.92***	
	(0.71)		(0.26)	
Capital x GE	-2.77*	5.33	-1.03**	2.53
	(1.45)	(5.86)	(0.51)	(1.91)
ln(Battles)	0.06	0.03	0.01	0.00
	(0.06)	(0.05)	(0.02)	(0.01)
ln(Area)	-0.39***		-0.08	
	(0.14)		(0.06)	
ln(Population)	2.69***	-0.85	1.02***	-0.51
	(0.29)	(1.21)	(0.10)	(0.37)
Country-Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes
R-squared	0.48	0.58	0.49	0.60
Observations	3,646	3,633	3,646	3,633
Regions	540	527	540	527
Countries	38	36	38	36

Standard errors in parentheses are clustered at the country level.
***p<0.01, **p<0.05, *p<0.1

All in all, higher degrees of independence from political pressure and higher credibility of central governments measured with *government effectiveness* seems to reduce the amount of aid projects located in capital city regions. Incumbent presidents' birth regions remain unaffected, even if levels of *government effectiveness* are accounted for.

Lastly, Table 3.7 provides the results for the estimations using *regulatory quality* in the interaction term as the measure for governance in recipient countries. Incumbent presidents' birth regions again do not attract significantly more aid funds or project locations than other regions. Considering the interaction term between $Pres.Birthpl.$ and RQ, it is apparent that differences in *regulatory quality* in recipient countries also seem to have no effect on the allocation of aid projects in incumbent presidents' birth regions.

Capital city regions again attract significantly more aid projects than other regions. And higher levels of *regulatory quality* seem to have a reducing effect on the alloca-

tion of aid projects in capital city regions. Higher levels of *regulatory quality* by 0.1 score points reduce aid funds and project locations in capital city regions by 9.40% and 6.67%, respectively. The significant coefficients at the 10 and 5 percentage level, however, do not remain significant when controlling for region specific characteristics. As in all previous results, incumbent presidents' birth regions do not receive more aid projects than other regions within a country, even if the estimation accounts for levels of *regulatory quality*. On the other hand, recipient countries with sound policies and better regulations that promote private sector development measured with *regulatory quality* do exhibit significantly fewer aid projects in capital city regions.

These results imply that the sub-national allocation of aid projects by the World Bank from 2000 till 2011 does not exhibit a general bias towards incumbent presidents' birth regions. Ethnic favoritism, measured with the favorable treatment of incumbent presidents' birth regions with foreign aid, does not seem to be present. Furthermore, worse or better institutional qualities do not have any effect on the

Table 3.7.: Presidents' Birthplace and Capital City Regions interacted with Regulatory Quality (RQ)

	(1) $ln(Aid_{ict})$	(2) $ln(Aid_{ict})$	(3) $ln(ProjLoc_{ict})$	(4) $ln(ProjLoc_{ict})$
Pres.Birthpl.	0.21	0.27	0.10	0.40
	(0.76)	(1.45)	(0.26)	(0.54)
Pres.Birthpl. x RQ	0.31	-2.81	-0.13	-1.02
	(1.51)	(2.64)	(0.48)	(0.68)
Capital	1.92***		0.89***	
	(0.70)		(0.26)	
Capital x RQ	-2.82**	5.50	-1.10**	2.23
	(1.30)	(5.17)	(0.48)	(1.53)
ln(Battles)	0.06	0.03	0.01	-0.00
	(0.05)	(0.05)	(0.02)	(0.01)
ln(Area)	-0.39***		-0.08	
	(0.13)		(0.06)	
ln(Population)	2.70***	-0.96	1.02***	-0.56
	(0.29)	(1.24)	(0.10)	(0.40)
Country-Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes
R-squared	0.48	0.58	0.49	0.60
Observations	3,646	3,633	3,646	3,633
Regions	540	527	540	527
Countries	38	36	38	36

Standard errors in parentheses are clustered at the country level.
***p<0.01, **p<0.05, *p<0.1

allocation of aid projects in birth regions of incumbent presidents. The WB seems to have been able to exert enough control over aid projects and their implementation to prevent the misallocation of aid funds in recipient countries along ethnic lineages.

Nevertheless, capital city regions significantly attract more aid funds and project locations than other regions throughout all regressions. Referring to previous considerations about the factors driving this pattern, whether following economic or clientelistic reasoning, the interaction term with the institutional measures provide some evidence. The results imply that higher levels of governance in recipient countries, measured with *control of corruption*, *rule of law*, *government effectiveness* and *regulatory quality*, significantly reduce the amount of aid funds and project locations in capital city regions. It seems that the allocation of aid projects in capital city regions contained elements of corrupt and clientelistic purposes. The results provide evidence that the implementation of aid projects in sub-Saharan Africa was not entirely unaffected by the influence of recipient countries and their levels of governance. Further studies on regional inequalities and regional differences (Sahn and Stifel, 2003; Boone and Simson, 2019) highlight large differences especially in Africa between urban and rural regions concerning basic human needs and well-being. Hence, allocating aid projects in capital city regions does not aim the most needy regions in recipient countries, which is contradicting the self-proclaimed needs-based approach of the World Bank.

3.5. Robustness

As already mentioned, including the years in which recipient countries did not receive any project aid would bias the coefficients downwards. This is due to the fact that during years in which countries did not receive any aid, all regions in a country receive the same amount of aid projects, i.e. no aid projects at all. Therefore, the differences in the allocation patterns between presidents' birth regions or capital city regions and other regions in a country would not seem as pronounced. This is observable in Appendix B in Tables B7 and B8, which provide the descriptive statistics for the different dependent variables differentiated by presidents' birth regions and by capital city regions. Here the mean values for all dependent variables and the differences diminish compared with the statistics in Tables 3.1 and 3.2.

To check the robustness of the results, the previous analysis will be repeated for the entire sample, including observations in which a country received no aid project at all. Table B9 compares the coefficients of the interaction terms between the baseline specification, which excludes the years in which recipient countries did not receive any aid projects, and the specification with all years. Considering the whole sample does not alter the negative relationship between improving governance and the allocation of project aid in capital city regions. Previously significant coefficients remain significant, but decrease in levels. Thus, including years without aid receipts reduces the negative relationship, although, the effects remain significant.

Furthermore, to test whether the effects of presidents' birth and capital city regions on the allocation of aid projects remain the same the data is reduced by countries that have fewer than 5 regions. This excludes the countries Sierra Leone and Swaziland. Additionally, countries that received project aid for 2 years or less will be dropped in order to make sure that there is sufficient information on the yearly allocation pattern of project aid. This results in dropping the countries Gabon and Namibia. Table B10 provides the coefficients for the trimmed sample compared to the results from the baseline specification. Reducing the sample does not alter the previous results from the baseline specification. The coefficients remain mainly significant, except the coefficient for the interaction term between capital city regions and *control of corruption* measuring the effects of projects locations becomes insignificant. Furthermore, the coefficients of the interaction terms remain almost at the same level compared to the baseline specification.

Another drawback of the the data structure stems from the fact that the dependent variables are defined on regional level. Hence, if countries with large differences in the number of regions are weighted equally, then countries with more regions will exhibit a higher contribution to the results. Thus, following Briggs (2017), countries will be weighted by dividing each region with the total number of regions in a country. Table B11 provides the comparison of the baseline estimation results and the results weighted by the number of regions in each country. Here the effects of changes in *rule of law* and *regulatory quality* maintain their previous negative relationship. Albeit, the coefficients for the interaction term between $Capital$ and RL slightly decrease in significance. However, different levels in *control of corruption* do not result in significant coefficients for the sub-national allocation of project aid. And higher levels of *government effectiveness* seem to increase aid funds disbursed in birth regions of incumbent presidents. So in essence, the results do not remain robust if countries are weighted depending on their number of regions.

A further drawback of the data structure is that each year for each country provides mainly one region that is the incumbent presidents' birth region and the rest of the regions are coded zero for the $Pres.Birthpl.$ dummy variable. So in the end, one is comparing the different allocation patterns of one region to the allocation pattern to all other regions within a country. To equal the number of presidents' birth regions and the number of non-presidents' birth regions within the data, the analysis will further average all variables on the country, year and birth region level. This procedure provides two observations for each country in a year. One is the incumbent presidents' birth region and the other observation is the average for all other regions. This approach enables one to control for different numbers of regions in a country and the unequal relation between the number of presidents' birth regions and other regions in a country in one year. One disadvantage of this approach is that region specific characteristics are also averaged such that the effect of regional population or regional battles on the amount of project aid in a region cannot be precisely determined. It will also not be possible to control for region fixed effects due to the fact that the data in each year consists of incumbent presidents' birth region and the average of all other regions. Furthermore, observations are distinguished by birth regions and not by separate individual regions such that political transitions and changes in birth regions of incumbent presidents can not be traced. The same issues occur when accounting for the influence of capital city regions on the sub-national allocation of project aid.

However, the analysis will only consider changes in the interaction terms, to un-

derstand whether the previous pattern of project aid allocation towards incumbent presidents' birth regions and capital city regions does still hold.[24] Table B12 provides the results to compare the coefficients from the baseline specification with the coefficients from the collapsed sample. All coefficients for the interaction terms maintain their previous effects on the sub-national allocation foreign aid. The coefficients remain significant and the levels of the coefficients change marginally.

Further problems may arise considering that the institutional variables might be endogenously connected with the sub-national allocation pattern of aid projects by multilateral donors. It might be possible that donor institutions observe and consider current patterns of aid project allocations. So observing larger biases of sub-national allocation patterns along ethnic lineages might result in a worse assessment of the institutional qualities for a country in a given year. To overcome this endogeneity problem the institutional variables are lagged by one period to ensure that the allocation pattern of aid projects does not influence the institutional assessment of recipient governments. In general, this approach might not prove to be adequate if one wants to measure the contemporaneous effects of governance on the sub-national allocation pattern of resources. However, considering the question of how far multilateral donors take recipient countries' governance into account when deciding on and planning aid projects and exerting the necessary control over project implementation to ensure successful outcomes, lagging the institutional variables should not pose a serious problem. Being able to observe last periods performance of recipient countries concerning their governance should even lead to larger control over the implementation of project aid in the following year by donors. Hence, if multilateral donors take recipient countries' governance into account then institutional qualities should more so prove to have no effect on the sub-national allocation of project aid if lagged by one period. Table B13 provides the comparison of the coefficients between the baseline specification and the specification with lagged institutional variables by one period. Improvements in *regulatory quality* are still negatively related to the allocation of aid projects in capital city regions. Surprisingly, the coefficients for the interaction term between $Pres.Birthpl.$ and the institutional variables are significantly negative in the regressions with region fixed effects, except for *government effectiveness*. This would imply that countries with better performances in governance during the years prior to project approval will direct less aid projects towards incumbent presidents' birth regions in the current year.

[24] To obtain the coefficients for the interaction terms of birth regions and capital city regions the data was averaged separately. Once on the country, year and birth region level and the second time on the country, year and capital city region level.

Nevertheless, the sub-national allocation of aid projects by the World Bank seems not to be unaffected even by last years level of recipient countries' governance. However, previous significant effects of being capital regions do vanish and project aid does not seem to be diverted towards these regions any longer.

3.6. Summary

The analysis showed that the sub-national allocation of project aid as a foreign aid instrument is to a certain extent subject to the influences of recipient countries' governance. Aid projects in sub-Saharan Africa by the World Bank do not exhibit a bias towards incumbent presidents' birth regions but rather towards capital city regions. Recipient governments or incumbent presidents seem to be able to divert significantly larger funds of aid towards capital city regions. Introducing the interaction terms with institutional variables does provide evidence for corrupt and clientelistic channels when allocating aid projects in capital city regions. Improving levels of governance in recipient countries measured with all four institutional variables results in a decrease of aid funds and project locations in capital city regions. Although, different levels of governance in recipient countries do not have any effect on the allocation of aid projects towards regions of birth of incumbent presidents. Most studies showed a general bias of state resources towards incumbent presidents' birth regions. Contrary to previous results, the present study shows that the sub-national aid allocation by the World Bank does not follow the same pattern.

Furthermore, the results also show that the implementation of project aid does not seem to be totally unaffected by influences of recipient governments, and to some extent seems to be subject to mechanisms of patronage or clientelistic policies. As Briggs (2014) showed, even project aid does not provide the best solution to achieve effective economic development and to overcome the obstacles imposed by recipient countries' governance. According to the statement of the World Bank aid projects are expected to be the appropriate instrument in the absence of sound economic policies. However, the present analysis indicates that the methods of implementing project aid used by the World Bank during the years 2000 and 2011 were still subject to influences by recipient countries' governance.

This urban bias of aid projects towards capital city regions is, on the other side, not

surprising considering previous studies about urban biases of funds in African countries. The urban bias hypothesis was first stated by Lipton et al. (1977). Especially, in Africa it seems that urbanization and inequalities between urban and rural regions are considerably pronounced than in other regions of the world. Hence, in the following the analysis will focus on the effects of foreign aid on regional inequalities in sub-Saharan African countries.

4. Regional Inequality - Theory and Evidence

Considering the results from the previous chapter and from the research literature one may wonder how different sub-national distributional patterns of aid projects and foreign aid influence regional and spatial inequalities within recipient countries. If the sub-national allocation of foreign aid projects follows certain ethnic, political or economic considerations, instead of addressing poverty or alleviating human misery, then foreign aid might further deepen regional inequalities in recipient countries. However, if foreign aid is directed towards regions with high poverty rates, then foreign aid might have reducing effects on regional inequalities within recipient countries.

With recently available detailed information at the sub-national level concerning economic performance, health outcomes, educational attainment and further social indicators, regional and spatial inequalities received increased attention. The UNU-WIDER project on 'Spatial Inequality and Development' (Kanbur and Venables, 2005b) has collected and analyzed evidence on the extent of spatial inequalities within developing countries. The overall conclusion of the studies are that spatial inequalities are high, with disparities between rural and urban areas, and also between geographically advantaged and disadvantaged regions, which also contributes to overall inequality (Kanbur and Venables, 2005a). Boone and Simson (2019) also highlight that economic inequality across regions is associated with tensions between highly and less developed regions, problems of national integration and tensions resulting from divergent regional policy. Exclusion of regionally concentrated groups, electoral clientelism and civil conflict have been attributed to high levels of spatial inequality. The current chapter elaborates on different theories and highlights existing empirical evidence about regional inequality. The last section presents trends and levels of different measures of inequality in sub-Saharan Africa.

4.1. Theory

Larger spatial inequality with regional concentration of production does not necessarily have to be harmful for economic growth and development as it may enhance productivity resulting from regional specialization, based on comparative advantages or increasing returns to scale from production. However, if spatial inequality is caused by external forces, then regional inequality may prove to be harmful for economic growth (Kim, 2008b). Wei (2015) mentions that existing theories disagree over temporal trends and underlying forces of regional inequalities. One early type of model in regional economics is based on standard neoclassical assumptions of constant returns to scale and perfect competition, as in the Ricardian or Heckscher-Ohlin models (Kim, 2008b).

4.1.1. Neoclassical Models

Early theories on spatial inequality were stated by Kuznets (1955) and Williamson (1965). Kuznets (1955) argues that as countries develop from agriculture-based economies to industrial economies, income inequality within countries first increases, and then decreases after a certain level of development is reached. This results in the well known inverted U-shaped Kuznets curve. The reasoning is that in early stages of development, very few people benefit from increasing investments in physical capital, hence, income inequality increases. At a later stage of development, more workers shift from the agricultural sector to the industrial sector such that inequality eventually decreases. Williamson (1965) adopted the same line of argument for the case of regional inequalities within countries. He argues that regional inequalities are initially triggered by the discovery of natural resources, which are unevenly distributed within countries. However, regional inequalities decrease over time leading to convergence in economic performance between regions. Following Williamson (1965), natural resources, migration, capital mobility, and government policies are decisive for the emergence and dynamics of spatial inequalities.

Friedmann (1966) similarly argues that even if certain sectors and industrial production concentrate in few core regions, the growth effects will eventually spread over to peripheral regions generating functionally interdependent spatial systems. Barrios and Strobl (2009) and Lucas (2000), for instance, provide evidence for differences in regional growth after a technological shock takes place, which initially

increases growth in one region, and thus increases regional inequality. The authors show that other regions which adopt the new technology will grow at the rate of the leading region plus an additional growth effect, hence, leading to convergence in economic performance among regions. On the other hand, Myrdal and Sitohang (1957) argue that the process of regional development is self-reinforcing and growth rate differentials tend to persist and even widen over time.

Neoclassical convergence theories and growth pole models maintain the assumption that factor mobility and diffusion tend to equalize regional differentials in the long run, such that regional inequality is considered a transitory phenomenon. Regional growth is viewed as a process of resource reallocation, i.e. the mobility of capital and labor. However, neoclassical models of regional development and inequality have been criticized on several grounds. Especially sub-Saharan African countries do not exhibit perfect competition, perfect information and free factor mobility (Wei, 2015). In addition, these models do not sufficiently account for the open economy, and regional divergence (Armstrong and Taylor, 1985) and cultural, institutional, and geographical factors which may significantly affect trade, factor mobility, innovation and regional development (Krugman, 1991; Porter, 1990).

4.1.2. New Economic Geography

New approaches to regional development are based on arguments originating from endogenous growth theories that countries rich in capital, highly educated, and favorable to knowledge accumulation tend to grow faster (Mankiw et al., 1992). Krugman (1991), for instance, highlights the notion of agglomeration and the cumulative causation process. Such models of economic geography highlight the interrelations of knowledge creation and technological innovation resulting from spatially concentrated production (Krugman, 1991). The models assume imperfect competition and increasing returns to scale and deviate from equilibrium market assumptions. As a result, market forces will lead to inefficient levels of spatial inequality without government intervention (Kim, 2008b). Thus, infrastructural investments that increase the mobility of goods, labor and capital may prove to significantly impact spatial inequality due to the self-enforcing nature of increasing returns. For instance, Puga (1999) argues that the extent of regional inequality may be limited by the ability of manufacturing firms to recruit workers from the agricultural sector. Therefore, the potential for agglomeration also depends on the mobility of workers.

The impact of globalization and global economic forces is another important factor affecting regional economic developments and disparities (Feser, 2007). Further research on global forces and regional development considers foreign direct investments (FDI), multinational enterprises (MNEs) and transnational corporations (TNCs). Factors such as international trade, financial institutions and technological change are also included. According to Malecki (1983), the location of investments by multinational firms within host countries is much more concentrated than are those of domestic firms, which in turn directly affects regional economic structures. Kasarda and Crenshaw (1991) also argue that the globalization of production tends to lead to an increase in urban primacy and regional inequality in developing countries. The importance of spatial linkages for regional development has been reemphasized by the research on the organization of production, regional development, innovation, global cities, and human behavior (Leung, 1996; Kanbur and Venables, 2005b). Regional production networks are hierarchical and stratified, and may further contribute to and sustain existing core-periphery structures within countries (Wei and Ye, 2009). Poon et al. (2015), for instance, find that the financial human capital network is structured spatially around hubs and peripheral cities, creating wage differences between cities.

These new economic geography models suggest that regional inequality is sensitive to geographical clustering, agglomeration and congestion. Changing trajectories of leading or lagging regions have a huge impact on regional inequality (Ye and Wei, 2005; Yu and Wei, 2003). Furthermore, regional inequalities differ greatly across countries, largely shaped by country-specific geographical and institutional factors (Kim, 2008b) and across scale (Kim, 2008b; Wei, 1999; Liao and Wei, 2015; Zhang and Bao, 2015). However, the endogenous growth theory has major limitations when applied to a regional context, and new economic geography has also been criticized for not taking space and geography seriously (Martin and Sunley, 1998). Futhermore, the macro modeling approach is insensitive to geographical scale and space (Wei and Ye, 2009; Wei et al., 2011). Additionally, most of these models do not include elements of a structural shift in economic activities from agriculture to manufacturing and services, which is one of the main issues of development (Kim, 2008b). Hence, standard models of geography may prove to be inadequate for understanding regional inequalities in developing countries. Similarly, Asongu (2016) argues that foreign aid in developing countries should not orient itself towards industrialization, but instead should place more emphasis on inequality, which will lead to more sustainable development outcomes.

Further studies have shown that institutions, including states and informal institutions, are much more decisive for regional development than geography or trade. For instance, state policies in developing countries, particularly policies promoting industrialization, foreign investments and trade, tend to stimulate the development of core regions and exacerbate regional inequality (Gilbert and Gugler, 1985; Lipton et al., 1977). Political corruption and instability may additionally contribute to the rise of urban primacy and regional inequality (Kim, 2008b).

4.2. Empirical Evidence

There are several explanations of regional and spatial inequalities within African countries. One explanation differentiates between first and second nature geography. First nature geography states that some regions are favored by virtue of endowments of natural resources and proximity to rivers, coasts, ports and borders. Second nature emphasizes the interactions between economic agents, and in particular increasing returns that can be created by agglomeration and interactions (Kanbur and Venables, 2005a). Recent studies emphasize second nature geography to explain levels and trends of spatial disparities. For instance, many of the social indicators used by Sahn and Stifel (2003) show large disparities between rural and urban regions in Africa. Regional school enrollments and neonatal care directly reflect the inequality in the distribution of public schools and public health facilities. Additionally, regional inequalities appear to be an important determinant of interpersonal income inequality. Yemtsov (2005) and Elbers et al. (2005) estimate that inter-regional inequality explains about one-third of interpersonal income inequality.

Developments of Geographic Interface Systems (GIS) and spatial analysis have provided further useful approaches to understanding the impact of spatial association and spatial heterogeneity on regional inequality (Le Gallo, 2004; Liao and Wei, 2012; Rey and Montouri, 1999; Rey and Gutiérrez, 2015). For instance, Liao and Wei (2012) study regional inequality in the Guangdong province of China and find that regional inequality has risen mainly due to the widening gap between the core region of the Pearl River Delta and the rest of the province and between urban and rural areas. He et al. (2017) state that regional inequality was sensitive to geographic scales and regional heterogeneity in China from 1997 to 2010. Spatio-temporal analysis of income distribution has shown that regions neighboring richer ones tend to

have higher rates of economic growth compared to regions that are further away (Rey, 2001; Wei et al., 2011). Liao and Wei (2015) find that strengthening spatial dependence between regions accounts for the majority of the core-peripheral divide in China's Guangdong province.

4.2.1. Remoteness/Geography

Geography is a fundamental factor for agricultural development, technological diffusion, disease diffusion, and human prosperity (Diamond, 1999; Sachs, 2006). Especially in Africa, remote location and poor accessibility are decisive causes of persistent poverty and regional inequality (Christiaensen et al., 2005; Sachs, 2006; Elbers et al., 2005). Research has shown the importance of physical geography, such as climate, terrain, and coastal proximity, to regional development and inequality (Gallup et al., 1999; Glaeser and Kohlhase, 2004; Kanbur and Venables, 2005b; Collier and Gunning 1999; Ndulu et al. 2007; Nunn and Puga 2012). On the other hand, Cust and Viale (2016) state that the effects of regional endowments with natural resources on regional inequality depends on several country specific conditions such as government policies and institutions.

4.2.2. Market Openness

Geographical location also determines a country's relative position to other countries which affects its access to foreign markets. Some studies agree that market access has a positive impact on economic development (Knaap, 2006; Breinlich, 2006; Redding and Venables, 2004).[25] For instance, Bosker and Garretsen (2012) show that for sub-Saharan African countries access to other sub-Saharan markets has the largest impact on its economic development. While market openness and financial deepening may reduce inequality by increasing economic development, the effects can be impeded or even reversed by inequality increasing effects set off by globalization. Kai et al. (2009) show that globalization worsens inequality in sub-Saharan Africa, which decreases with a country's economic development. Further studies have confirmed that foreign direct investments, trade and international integration increase inequality (Alderson and Nielsen 1999; Evans and Timberlake 1980; Reuveny and Li 2003; Gustafsson and Johansson 1999; Simpson, 1990). Adams and

[25] See also Deichmann et al. (2008) for a good overview.

Klobodu (2017) also confirm the inequality increasing effects of FDI in the short and the long-run. Similarly, Kanbur and Venables (2005a, 2005b) explain high and rising spatial disparities during the years between 1980 and 2000 by increasing international trade. Lessmann (2013) uses regional data to show that foreign direct investments increase regional inequality in low and middle income countries but not in high income economies.

There are substantial differences concerning the location of foreign owned firms between urban centers and the rest of the country. Particularly in developing countries foreign investments tend to be mainly located in major cities and core regions. This urban-bias can be explained by advantages in infrastructure, labor force, and access to markets and political power (Huang and Wei, 2011). The spatial concentration of foreign capital tends to result in a process of urbanization and reinforces urban primacy and regional inequality. This effect has been shown to be present in Latin America and Asia (Armstrong and McGee, 2013) and in China (Li and Wei, 2010; Huang and Wei, 2011). For instance, in West Africa foreign owned firms tend to locate in the capital city (Te Velde and Morrissey, 2003) and in Egypt the regional bias of firms owned by returnees compared with non-migrants is in favor of the capital city (McCormick and Wahba, 2003). Thus, to the extent that market openness results in higher growth, there is nevertheless evidence that more remote areas within countries benefit less from growth in terms of poverty reduction (Christiaensen et al., 2005). Hence, investments in infrastructure can improve spatial linkages and access to markets to reduce distance and spatial obstacles for economic development (Rodríguez-Pose and Hardy, 2015).

Furthermore, there may exist another channel through which FDI might increase regional inequalities. Brazys (2018), for example, shows that local aid projects increase the probability of attracting FDI by over 10 percent. Thus, foreign aid might also have an increasing effect on regional inequality through attracting FDI. Given the research on the sub-national allocation of foreign aid (Jablonski, 2014; Briggs,2017; Burgess et al., 2015; Dreher et al., 2019; Hodler and Raschky, 2014), which shows that aid projects are more likely to be implemented in regions coethnic to incumbent presidents or urban regions, the negative effect of FDI on regional inequality might even be more pronounced.

4.2.3. Urbanization

Inequalities between urban and rural areas also affect regional inequalities, by the urban-rural wage gap, by urban specialization in different industries, and by the size distribution of cities. Since cities are associated with higher wages and productivity, urbanization is usually correlated with income growth (Kim, 2008b). For instance, Henderson (2002) finds that 70 percent of the differences in urbanization across countries is explained by differences in GDP per capita. On the other hand, Africa's GDP per capita fell by 0.66 percent per year but its urban population grew by 5.3 percent per year between 1970 and 1995 (Fay and Opal, 2000). Fay and Opal (2000) suggest that Africa was under-urbanized during the colonial period and that the recent increase in urbanization without growth may be accounted for by a catching-up hypothesis.

Kessides (2005) argues that urbanization in Africa is not excessive or imbalanced. Urbanization in sub-Saharan Africa seems weakly correlated with industrialization. Urbanization in these regions rather seems to be fueled by the growth in the informal service sector (Henderson et al., 2013). On the other hand, Barrios et al. (2006) find that rural migrants in sub-Saharan Africa were not pulled to cities and urban centers by job opportunities but rather were pushed out of their rural locations. Furthermore, Soo (2005) finds that the size distribution of cities is significantly skewed towards larger cities in developing countries and towards smaller cities in most developed countries, thus resulting in higher inequalities between urban and rural regions in developing countries.

4.2.4. Institutions

Especially in developing countries, political institutions are likely to contribute to inequalities between urban and rural regions if property rights are easier to establish and protect in cities and urban regions. On the other hand, institutions and political corruption may also contribute to urban-rural inequalities if proximity to large cities makes it easier to protect oneself against violence or if bribes are easier to conceal (Kim, 2008b). Ades and Glaeser (1995) show that the benefits of political primacy are likely to be higher in dictatorships than in democracies. Additionally, Henderson (2002) finds that developed countries are more politically decentralized than developing countries. Therefore, urban primacy is probably more pronounced

and subject to more political influence in developing countries than in developed ones.

Corruption in African countries is generally associated with high income inequality, suggesting that the poor are most affected by the economic effects of corruption in African countries. Van de Walle (2009) states that African colonialism created the conditions for the emergence of substantial spatial inequalities which still persist. For instance, the diffusion of services by the missions in the early colonial period created spatial inequalities. Missions made their way inland from the coast and were less active in remote regions. In West Africa, this often meant a significant difference in literacy levels at the time of independence between regions (Van de Walle, 2009). Institutions from the colonial era continue to exert influence on regions within developing countries. Banerjee and Iyer (2005) show that British colonial institutions in India played a major role in the divergent development of agricultural productivity between regions. Similarly, Kapur and Kim (2006) show that British land tax institutions in India have contributed to the divergence of regional economies. Additionally, regions that possessed colonial extractive industries such as mining and sugar cultivation have 18 percent lower GDP per capita today because they are more likely to possess extractive institutions (Engerman and Sokoloff, 1997; Bruhn and Gallego, 2012).

Regional differences in the quality of institutions also decisively impact regional economic developments within nations (Banerjee and Iyer, 2005; Kapur and Kim, 2006; Kim, 2009; Bruhn and Gallego, 2012). Political institutions that determine the distribution of power and fiscal resources between the federal state and local governments can play a major role in affecting spatial inequalities (Henderson, 2002; Kim, 2008a). Shimeles and Ncube (2015) find that the quality of institutions, ethnic fractionalization and education play a significant role in determining the rise of the middle class in Africa. The authors conclude that the probability of becoming asset-poor was 84 per cent, while that of of becoming middle class was 7 per cent, and being in the upper class or rich was 3 per cent. Lessmann (2009) shows that countries with a high degree of fiscal decentralization exhibit small regional disparities. His results indicate that increasing decentralization leads to decreasing disparity within countries. Rudra (2004) finds that social spending increases inequality. Yet, Huber et al. (2006) and Lee (2005) only make this conclusion in the context of non-democracies. The reason is that social spending only favors those employed in the formal sector, who in non-democracies are usually the political elite. Reuveny and Li (2003) provide evidence that democracy decreases inequality when

interacted with globalization (see also Simpson, 1990).

Additionally, ethnic diversity can affect income inequality. There are certain levels of ethnic diversity that cause large discrepancies in income distribution (Meisenberg 2007). When the political leaders come from a particular race or ethnic group, they tend to reward that race or ethnic group. Equally, Milanovic (2003) argues that inequality in Africa is politically determined. The author points out that the effect of ethnic fractionalization on income inequality is much weaker in more democratic countries. In sub-Saharan African countries politics along ethnic lineages will also increase regional inequalities because ethnic groups mainly concentrate in few areas or regions. For example, Bayart et al. (1993) list African dictators who diverted money to tribe members. This tendency to divert funds to the leader's ethnic group leads to income inequality, but also to regional inequality because ethnic groups are mainly concentrated in certain areas of a country. Furthermore, Brockerhoff and Hewett (2000) show that there were significant differences in the rate of infant mortality between ethnic groups, which is closely linked to economic inequality in many countries.

4.3. Levels and Trends

In spite of being one of the fastest growing regions in the last decade Africa exhibits persisting poverty and inequality (Bhorat et al., 2016; Boone and Simson, 2019). The studies included in Kanbur and Venables (2005b) highlight that regional and spatial inequalities in Africa are high and rising in many countries. Disparities in regional GNP per capita in African countries during the early 2000s turn out to be worse than expected (Milanovic, 2003; Okojie and Shimeles, 2006). Particularly sub-Saharan Africa is one of the most unequal regions in the world despite low levels of per capita income. Inequalities in non-income dimensions of welfare are also high, between men and women and between regions, and have remained persistent over time (Okojie and Shimeles, 2006). On the other hand, Young (2012) states that since 1990 real material consumption in sub-Saharan Africa has been rising at a rate three and half to four times higher compared to official records by international data sources.

In sum, overall income inequality is very high in African countries and spatial inequality explains a large share of inequality. Large differences concerning economic

development and human living conditions are apparent between urban and rural regions, and across rural regions in African countries (Boone and Simson, 2019).

4.3.1. Income Inequality

Low-income developing countries exhibit higher levels of interpersonal inequality and higher levels of inequality between sub-national regions (Boone and Simson, 2019; Lessmann, 2016; UNRISD, 2010). For instance, Beegle et al. (2016) state that seven of the world's ten most unequal countries are in Africa. Especially, southern Africa exhibits high inequality compared to low inequality in west Africa and the Sahel zone (Beegle et al., 2016). Anyanwu (2016) shows that average income inequality in southern Africa peaked in 1978 and constantly decreased until 2011. The author finds a dynamic and non-monotonic pattern of income inequality, such that higher levels of past inequality are positively associated with current levels. After a certain point, higher levels of past income inequality start to reduce current levels.

Canagarajah et al. (1998) show that in Ghana between 1988 and 1992 the distribution of income improved by 4%, mainly in rural areas and in cities other than the capital. The authors attribute this phenomenon to the reform program that improved the terms of trade in favor of the rural poor. Okojie and Shimeles (2006) highlight that inequalities in non-income dimensions of welfare are high, especially between men and women and between regions, and have remained persistent over time. However, income inequality seems to be more of an urban phenomenon, although asset-based and capability-based inequality suggests the opposite.

4.3.2. Spatial Inequality

Spatial inequalities account for a large share of overall inequality (Boone and Simson, 2019; Beegle et al., 2016). Lessmann (2014) highlight that spatial inequalities increase when countries shift from agricultural to industrial production. Equally, Lessmann and Seidel (2017) show significant differences in regional inequality across countries, with very poor countries such as those in the Sahel zone having low regional inequalities. Furthermore, Mveyange (2015) uses nightlight intensities to show that inequality between regions instead of within regions is the main driver of overall regional inequalities. Regional inequalities exhibit high variations across

geographical subdivision, which indicates the sensitivity of inequality to regional specificities.

Shimeles and Nabassaga (2018) provide evidence for high levels of spatial inequality within African countries with large differences between countries. Analyzing subnational DHS data provides evidence for extreme regional disparities in Ghana and Ivory Coast (UNRISD, 2010). Gennaioli et al. (2014) use regional GDP per capita to examine subnational inequality and growth. The authors provide evidence for regional convergence in growth rates with higher convergence rates in more developed countries. The authors state that the main drivers of regional growth and convergence between regions are geography, human capital, and especially better regulation.

4.3.3. Urban-Rural Inequality

Especially African countries exhibit large discrepancies between rural and urban regions concerning development, living conditions and infrastructure. For instance, Kakwani et al. (2005) state that rural poverty is larger than urban poverty. Considering 15 African countries, the authors show that the percentage of poor people in rural locations was 2 to 4 times larger than in urban locations. Equally, Sahn and Stifel (2003) examine the relative importance of rural versus urban areas in terms of living standards and find that in six out of twelve countries the percentage of people below an asset poverty line is more than 50% greater in rural areas than in urban areas. The authors conclude that policies which aim to reduce the gap in urban-rural living standards will effectively improve well-being measured at the national level, although they will not effectively reduce the overall level of inequality in health and education, and to a lesser extent asset wealth. Sahn and Stifel (2000) also report high asset-inequalities in Africa between rural and urban areas. According to their findings, the Gini coefficient for asset ownership varied from a high of 0.75 in Niger to a low of 0.43 in Tanzania in the mid and late 1990s.

Booysen et al. (2008) study trends in poverty in seven African countries towards the end of the 20th century, using an asset index constructed from DHS data. The study shows that poverty declined over this period in five of the seven countries. Rural poverty everywhere exceeds urban poverty. Poverty has declined in urban and rural areas in five out of seven countries. Ki et al. (2005) show that rural areas in Senegal are particularly affected by non-monetary poverty whereas urban areas

are affected more by monetary poverty in spite of the existence of human capital and basic infrastructure. For instance, 81.3% of urban households had access to potable water in contrast with 32.2% of rural households. The authors adopted a non-monetary approach to the analysis of poverty and inequality and state that poverty was much higher in the rural areas than in urban areas. May et al. (2002) find that in Lesotho the incidence and severity of poverty is greater among a number of social groups, such as female headed households, people living in rural areas, especially in the mountainous parts of the country, the elderly, children, and those who rely upon agricultural production and agricultural assets. The authors state that this pattern of inequality results from increased inequality within districts and not only increasing inequality between urban and rural areas.

4.3.4. Inequality in Living Conditions

Based on new approaches to overcome the focus on GDP-based indicators Lang and Lingnau (2015) advocate the use of a simple and universal index such as the multidimensional poverty index as an indicator, together with disaggregated data to broaden the development agenda. This index was developed by Alkire and Foster (2007, 2011a, 2011b) to account for multiple dimensions of inequality. The Human Development Report (HDR) also includes the Multidimensional Poverty Index (MPI) since 2010.

Bhorat and van der Westhuizen (2013) use factor analysis to construct an asset index as a measure of non-income-based welfare for South Africa during the years between 1993 and 2004. The authors find that rural and female-headed households remained particularly vulnerable, with relatively slower increases in their access to services and assets. This trend is even more evident when African female-headed households in rural areas were examined. Kimalu et al. (2004) showed that in Kenya there were rural-urban inequalities in access to potable water. Over 50% of the urban population and less than 13% of the rural population had access to piped water. Njeru and Orodho (2003) find that there has been wide and severe regional and gender disparities in Kenya in access to secondary school education. The authors find that the availability and adequacy of physical facilities of education were better in urban and medium to high agricultural areas. Gross enrollment rates in secondary education had declined and gender and regional inequalities in access to secondary education persist, with the hardest hit regions being the arid and semi-arid lands

and the medium to low agricultural potential areas (Njeru and Orodho, 2003).

Permanyer and Smits (2020) present a new data set called the Subnational Human Development Index (SHDI), which shows within-country variation in human development. The authors show that variations within countries are particularly strong in low and middle developed countries and less important in the more developed ones. Education disparities explain most inequality within low-developed countries and standards of living differences within more developed countries (Permanyer and Smits, 2020). Reinikka and Svensson (2004) further find that school grants were captured by local officials in Uganda, such that better-off communities managed to claim a higher share of grants. Such regional differences may further increase regional inequalities in educational attainment.

5. Foreign Aid and Regional Inequality in Sub-Saharan Africa

5.1. Motivation

In the year 2000 the donor community committed itself to achieving the Millennium Development Goals (MDG), which are mainly aimed at benefiting the poorest population segments in recipient countries. In spite of the fact that foreign aid failed to increase growth rates in developing countries, it could still benefit the poor by alleviating poverty and improving the income distribution in favor of the poor. The first of the United Nations' Millennium Development Goals is to reduce extreme poverty in developing countries, which is also understood as a call to more equality within and between countries (Bjørnskov, 2010). In fact, if properly directed to poorer countries and poorer regions within countries foreign aid may result in reduced inequality by alleviating poverty without affecting growth rates (Arvin and Barillas, 2002; Chong et al. 2009; Herzer and Nunnenkamp, 2012). Additionally, foreign aid could further enhance political stability and social cohesion in recipient countries by reducing inequalities within countries (OECD, 2006).

Recent research highlighted further positive impacts of foreign aid on living conditions, well-being and different inequality measures in recipient countries. Scholars also generally agree that income inequality negatively affects economic growth in developed countries (Alesina and Rodrik 1994; Persson and Tabellini 1994). Alesina and Rodrik (1994) provide evidence that democracies with less inequality grow faster and that a redistribution of income from the wealthiest in favor of the poorer quintiles would be growth enhancing. Persson and Tabellini (1994) find that income inequality is harmful to economic growth, because it leads to policies that do not protect property rights and do not sufficiently secure returns from investments. Furthermore, Barro (2000) concludes that in poor countries the growth retarding effect

of income inequality is even greater than in developed countries. Hence, inequality is assumed to have detrimental effects on economic, political and socio-political conditions (Layton and Nielson, 2008; Alesina and Perotti 1996). Additionally, high levels of inequality might negatively affect the risk perceptions of potential investors, and thus could further contribute to lower future growth (Nel, 2003).

Studies have provided evidence for the link between inequality and happiness levels (Blanchflower and Oswald 2003) or between poverty and riots (Barro, 2000; Pastor 1995; Alesina and Perotti, 1996). However, most studies are concerned with income inequality, and do not consider regional inequalities. Though, regional inequality may also prove to have negative effects on economic growth and socio-political stability. Recent research has provided evidence for a positive relationship between regional inequality and political instability and civil unrest. Inequalities between regions within a country seem to enhance political and ethnic tensions, which are prevalent especially in sub-Saharan African countries, and undermine social cohesion (Kanbur and Venables, 2005a, 2005b). Regional inequalities are even more important if they overlap with the geographic location of different ethnic groups (Kanbur and Zhang, 2005). Studies have shown that very large regional inequalities increase the risk of internal conflicts and civil wars (see e.g. Deiwiks et al., 2012; Buhaug et al., 2011; Lessmann, 2016). Conflicts are more likely in regions with low levels of education and strong relative deprivation regarding household assets (Østby et al., 2009), and in countries with strong intra-regional inequalities (Ezcurra and Palacios, 2016). Sonno (2018) shows that activities of multinational enterprises in sectors intense in scarce resources, in particular forestry, increase the probability of conflicts. On the other hand, activities of multinational enterprises which increase human capital, such as education and health, decrease the probability of civil conflict.

Additionally, inter-regional inequality often goes along with interpersonal inequality (Lessmann, 2014; Kanbur et al., 2005). For instance, Stewart (2000) and Stewart (2005) show that large horizontal inequalities between regions result in large vertical inequalities between all individuals. Therefore, regional and spatial inequalities are becoming more prominent in recent research. Studies start to advocate more differentiated measures of development and human well-being to account for the multi-dimensionality of poverty and inequality (Lang and Lingnau, 2015). So if international donors aim to reduce poverty in recipient countries, as stated by the MDG, and if aid funds are directed towards poorer population segments and poorer regions within recipient countries, then foreign aid might lead to decreasing regional

inequality. However, considering recent evidence on the sub-national allocation of foreign aid projects, one might be skeptical concerning the positive impact of foreign aid on regional inequality within recipient countries.

Newly available sub-national data and new methods provided by Geographical Interface Systems (GIS) provide possibilities to analyze regional and spatial inequalities. The following analysis will use sub-national data on GDP provided by Kummu et al. (2018) to calculate regional inequalities in sub-Saharan Africa and will further assess the impact of foreign aid on regional economic inequality in recipient countries. The next section will elaborate on the existing literature closely related to the present analysis on regional inequality and foreign aid. Different measures of regional inequality and the data will be discussed in the subsequent section. The description of the methodology and the results will be provided in section 5.4. The last two sections will first provide a discussion of the results and then summarize the insights in the conclusion.

5.2. Literature

For foreign aid funds to effectively reduce income inequality, first of all, donors would have to target the most needy and deserving population segments in recipient countries. Secondly, governments in recipient countries would have to makes sure that aid actually reaches the poor (Herzer and Nunnenkamp, 2012). However, actual foreign aid funds seem to be dictated as much by political and strategic considerations as by the economic needs and policy performance of recipient countries (Alesina and Dollar, 2000). Alesina and Weder (2002) even find that ODA is distributed indiscriminately between countries with good and corrupt governments.

There are various channels through which foreign aid can affect interpersonal and regional inequalities. First of all, aid funds support programs, which are known to increase inequality in recipient countries, such as public expenditures in non-democracies, liberalizing trade or attracting FDI. Another possible channel exists through politics. Research has provided evidence concerning fungibility and misappropriation of foreign aid funds by political elites (Devarajan et al., 1999; Feyzioglu et al., 1998). Boone (1996), for instance, shows that all political systems favor a 'high-income political elite' when it comes to aid distribution. Hence, it can be assumed that the money will be distributed in a manner that favors those high-income

individuals who support the politicians in office. Further studies provide evidence for the adverse effects of aid on rent seeking and corruption in recipient countries (Hodler, 2007; Economides et al., 2008). Angeles and Neanidis (2009) note that local elites tend to maintain considerable control in the rent-seeking competition induced by foreign aid funds.

This argument is further enhanced by recent literature on the sub-national allocation of foreign aid in sub-Saharan countries following ethnic and political considerations (Hodler and Raschky, 2014; Jablonski, 2014). Thus, ethnic favoritism may be another channel explaining why foreign aid may lead to higher regional inequalities in recipient countries. If the political leaders of recipient countries belong to a particular ethnic group, they will tend to prefer their own ethnic group when distributing foreign aid. Recent literature has shown that ethnic diversity leads to a bias of larger amounts of foreign aid and state funds in developing countries towards regions which are inhabited by the same ethnicity as the incumbent president (Burgess et al., 2015; Dreher et al., 2019; Hodler and Raschky, 2014). Considering that ethnic groups in developing countries mainly reside in certain areas or regions of a country, this uneven sub-national allocation of aid projects might increase regional inequalities in recipient countries. Kanbur and Venables (2005b) further highlight that especially for the case of sub-Saharan Africa regional inequalities can be a breeding ground for separatist tendencies and internal conflicts.

The institutional concept of foreign aid by itself creates a disincentive for politicians in recipient countries, which results from the fact that aid goes to governments whose policies retard growth and create poverty (Bauer, 1993). Recipient countries have an incentive not to improve their institutions to make sure that they keep receiving aid funds (Azam and Laffont, 2003). Donor organizations are also subject to the interests of their member states, such that the aid recipients are more likely to use the funds to improve its standing with the donor countries instead of helping the poor (Nielson and Tierney, 2003). For instance, foreign aid was used to buy votes of developing countries in the Security Council of the United Nations (Dreher et al., 2008; Kuziemko and Werker, 2006).

On the other hand, there are several channels through which foreign aid may reduce inequality within recipient countries. For instance, by improving governance, by facilitating structural reforms for macroeconomic stability or through debt relief programs (Castells-Quintana and Larrú, 2015). Lustig et al. (2012) show that aid channeled through direct budget support reduces income inequality. Furthermore,

inflowing cash could still improve inequality if the funds are invested domestically to increase economic growth and further benefit the poor by creating jobs, which is commonly referred to as the 'trickle-down' effect (Azam and Laffont 2003). However, some studies contest the trickle down effect, especially for sub-Saharan African countries, because the funds are not invested domestically and investors in poor countries generally favor foreign markets (Easterly, 1999; Boone, 1996). Furthermore, if invested domestically aid funds will still most likely be directed at competitive sectors within recipient countries (Layton and Nielson, 2008). But competitive sectors and core industries in recipient countries are spatially concentrated, either in urban regions or close to larger cities and capital cities. Hence, such investments will further increase regional inequalities.

The research literature has thus far addressed the relationship either between FDI and regional inequality or between foreign aid and interpersonal inequality. For instance, Layton and Nielson (2008) show that the effect of foreign aid on interpersonal inequality is most likely positive or non-existent. Bourguignon et al. (2009) find that the distributional impact of aid is equality enhancing but has a small impact on aggregate inequality indices. The authors argue that some of the favorable impacts of aid are decimated by the negative impact of trade restrictions imposed on the developing world. Herzer and Nunnenkamp (2012) analyze a sample of 21 countries over the period 1970-1995 and find that aid exerts an inequality increasing effect on income distribution. On the other hand, Castells-Quintana and Larrú (2015) find that aid has contributed significantly to the reduction in income inequality in Latin America. Shafiullah (2011) also provides evidence that aid reduces inequality, although by very little. The author even finds evidence that corruption in South Asia may actually help reduce inequality.

Chong et al. (2009) examine the effect of foreign aid on income inequality and poverty reduction for the years between 1971 and 2002. The authors provide weak evidence that foreign aid improves the distribution of income, when institutional qualities are taken into account. Pham (2015) provides evidence for a weak positive effect of foreign aid on income inequality. The positive impact of foreign aid, however, reverses when it is interacted with the level of corruption in recipient countries. Thus, the author concludes that corruption and rent seeking may represent major factors for increasing inequality in sub-Saharan Africa. Arvin and Barillas (2002) examine the relationship between aid and poverty given certain levels of democracy in recipient countries and find no positive relationship between foreign aid and poverty reduction.

Additionally, Chong (2004) shows that in poor and relatively unequal societies, democratization tends to be accompanied by a more skewed income distribution while the opposite is the case for rich and initially equal societies. Dreher and Gaston (2008) show that democratization in general leads to a more skewed distribution of income. Bjørnskov (2010) provides evidence that foreign aid is positively associated with the share of total income held by the elite in democratic developing countries, but not to the same extent in autocracies. Foreign aid in conjunction with democracy seems to be associated with a distribution of the national income skewed in favor of the richest part of the population.

Moreover, these results may only represent the visible part of the whole picture of misappropriation of funds by the elites in recipient countries. Andersen et al. (2020) show that aid disbursements to highly aid-dependent countries result in increases in bank deposits in offshore financial centers, which are known for bank secrecy and private wealth management, but not in other financial centers. Hence, misappropriated foreign aid funds might not directly affect inequalities within recipient countries as would be observed if the funds were kept in recipient countries and invested domestically. Thus, the relation between foreign aid and interpersonal income inequality remains controversial, as well as the relationship between democracy and inequality (Gradstein and Milanovic, 2004).

Furthermore, studies have shown that interpersonal income inequality is also to a large extent driven by regional inequality. Yemtsov (2005) and Elbers et al. (2005) estimate that inter-regional inequality explains about one-third of interpersonal income inequality. Most of the studies analyzing regional inequality, however, study the effects of FDI inflows on regional inequality. For instance, Bailey and Driffield (2002) find that inward investments increased regional inequality in the UK between 1984 and 1992. Lessmann (2013) assesses regional inequalities first within China and subsequently conducts a panel data analysis covering 55 countries. The results show that FDI increased regional inequalities in China after the economic reforms in the 1980s, but the effect vanished at the end of the 1990s. The results further showed that net FDI inflows increase regional inequality in low and middle income economies.

However, there has not been an assessment of the effects of foreign aid on regional inequality so far. Especially considering the results from Chapter 3 and the literature on the sub-national distribution of aid projects, the relationship between foreign aid and regional inequality can not be neglected. If the sub-national allocation

of foreign aid is unevenly distributed among the regions of a country, one might expect that foreign aid will increase regional inequalities in recipient countries. On the other hand, if the donors manage to direct aid funds towards poorer population segments and poorer regions in recipient countries then foreign aid may result in less regional inequality. Additionally, better factor mobility and an effective government reallocation policy might reduce the negative distributional consequences of ODA (Lessmann, 2013).

5.3. Data

The current section provides an analysis of the data and trends of the two variables of interest, which are regional inequality and foreign aid. First, necessary considerations for adequate measures of regional inequality will be discussed to provide the data and trends of different regional inequality measures for sub-Saharan Africa over the period between 1998 and 2015. Subsequently, the data for foreign aid will be presented.

To calculate regional inequalities the literature mainly depends on regional GDP per capita data (Lessmann, 2009, 2013). However, using regional GDP per capita for calculating disparity measures can be problematic because of possible biases resulting from commuters and unequal employment (Lessmann, 2013). Still, regional GDP per capita seems best suited to analyze a cross-section of countries, mainly because of missing data for other disparity measures such as regional income per capita or GDP per worker for developing countries (Lessmann, 2013). A further advantage of GDP measures is that they capture aggregate levels of economic activity and productivity, reflecting regional endowments, economic structure, and levels of development (Boone and Simson, 2019).

The current analysis will take advantage of a newly available gridded global data set for GDP provided by Kummu et al. (2018) to calculate regional GDP per capita. The data is successively aggregated along levels of regional subdivisions in each country.[26] The data set contains annual gridded data for GDP per capita, total GDP, and Human Development Index (HDI) for the whole world at 5 arc-minute resolution

[26]The shapefiles for the sub-national regions, divisions or districts under study come from the GADM database (www.gadm.org). The data on regional GDP per capita was aggregated along different levels of regional sub-divisions using these shapefiles.

for the years between 1990 and 2015.[27] Kummu et al. (2018) provide a measure for sub-national gridded GDP over time and space, which is also representative of official statistics. Table C1 in Appendix C.1 provides the correlations between the national GDP from the World Bank databank and the national GDP calculated from the gridded sub-national GDP data provided by Kummu et al. (2018) for the years between 1998 and 2015. The table additionally provides the correlations between the population data from the World Bank databank and the national population calculated from the gridded population data by CIESIN for the years between 1998 and 2015.

As can be seen in Table C1, 30 countries exhibit correlations of GDP between both data sets above 0.99 and only 4 countries have correlations of GDP below 0.95.[28][29] Thus, GDP data calculated by Kummu et al. (2018) appears to be a good approximation of official GDP data provided by the World Bank. The correlations between population data from the gridded CIESIN data and from the World Bank also provide high coefficients. Almost all correlation coefficients for the comparison of both data sets are above 0.99, except for Rwanda and Swaziland, with correlations of 0.94 and 0.98, respectively. Therefore, the population data provided by the CIESIN project, used to calculate sub-national population, does depict actual population data from the World Bank very well. Hence, using the sub-nationally gridded GDP data provided by Kummu et al. (2018) and the gridded population data from CIESIN to calculate regional GDP per capita appears to be a good approximation of official data.

5.3.1. Measures of Regional Inequality

There are several measures to study regional inequalities. To appropriately capture regional inequalities the measures must fulfill several conditions. The measures must be mean-independent, such that shifts in average GDP levels due to growth or inflation have no effect on regional inequality. Furthermore, to be applicable for a cross-country analysis regional inequality measures must be independent of the size

[27] At the equator a pixel with a length and width of 5 arc-minutes corresponds to approximately 57.6 square kilometers. At the southernmost point of Africa a pixel of 5 arc-minutes corresponds to an area of approximately 85.75 square kilometers.

[28] The correlations for Guinea and Central African Republic are below 0.95 and for Gabon and Gambia below 0.90.

[29] Note that the correlation of GDP data in Table C1 is missing for Eritrea due to missing data in the WB data set.

and the number of spatial units and robust against single extreme observations. Most importantly, the measures must satisfy the Pigou-Dalton transfer principle (Dalton, 1920; Pigou, 1912), which states that a transfer from poor to rich regions should unambiguously increase the inequality measure. These requirements are satisfied by the Gini coefficient, the coefficient of variation (CV) and the population-weighted coefficient of variation (WCV). One further advantage of the population-weighted coefficient of variation is that it incorporates different population sizes of spatial units within a country.[30] These coefficients are widely used in the literature on spatial inequality (see e.g. Williamson, 1965; Rodríguez-Pose and Ezcurra, 2009; Ezcurra and Rapún, 2006; Lessmann, 2013).[31] The mathematical formulas for these three inequality measures can be seen below:

$$\text{Gini} \quad = \frac{2}{n}\frac{\sum_{i=1}^{n} i y_i}{\sum_{i=1}^{n} y_i} - \frac{n+1}{n} \qquad \in \left[0, \frac{n-1}{n}\right], \tag{5.1}$$

$$\text{CV} \quad = \frac{1}{\bar{y}}\left[\frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2\right]^{1/2} \qquad \in \left[0, \sqrt{n-1}\right], \tag{5.2}$$

$$\text{WCV} \quad = \frac{1}{\bar{y}}\left[\sum_{i=1}^{n} p_i (y_i - \bar{y})^2\right]^{1/2} \qquad \in \left[0, n-1\right]. \tag{5.3}$$

Here $\bar{y}$ is the country's average GDP per capita, y_i is the GDP per capita of region i, p_i is the share of the country's total population in region i, and n is the number of sub-national units. The equations also provide the ranges of the inequality measure at the end, which depend on n the number of regions in each country.[32] These three measures of regional inequality will be used in the first step of the analysis to understand the influence of foreign aid on overall regional inequalities at the first administrative level (ADM1) within recipient countries.

Another measure for regional inequality also widely used in the literature is the Theil entropy index (Sahn and Stifel, 2003; Novotnỳ, 2007). In general, the Theil index is not applicable for a cross-section analysis with large differences in the number of sub-national units across countries, since its value ranges from 0 to $ln(n)$, with n being the number of regions. However, the Theil entropy index can be used to measure

[30] These measures can be calculated using the `ineqdeco` package, a Stata module for calculating inequality indices with decomposition by subgroup. See Jenkins (1999) for more details.

[31] Also see Bendel et al. (1989) for a comparison of standard inequality measures or for a more detailed discussion of inequality measures see Cowell (2011).

[32] Note that, to calculate the Gini coefficient, the values for y_i must be sorted from lowest to highest. Here the ranking i of each y_i does matter, in contrast to the coefficient of variation or the weighted coefficient of variation, because each y_i is multiplied by its rank i.

inequalities for a fixed set of regions across countries, such as between urban and rural regions, as in Sahn and Stifel (2003), or between capital city regions and the rest of the country. In such cases, the number of sub-national spatial units remains the same for all countries, being two regions (urban and rural or one capital city region and all other regions). Especially for Africa, several studies have provided evidence for large discrepancies in living conditions between urban and rural regions and for a bias of resources towards urban and capital city regions. Hence, it is also of interest to understand how foreign aid affects regional inequality between capital and non capital city regions and within both groups of regions. Therefore, apart of assessing the influence of foreign aid on overall regional inequality the analysis will further study the effects of foreign aid on within and between regional inequality when regions are grouped together by being in capital ADM1 regions or non capital ADM1 regions.

The Theil entropy index also satisfies the conditions of mean independence and the Pigou-Dalton transfer principle. Another advantage of the Theil entropy index is that it is additively decomposable, such that one can further decompose regional inequalities by within and between regional inequalities. Hence, it is possible to extend the analysis and study the differences of regional inequalities between capital city regions and the rest of the country and within these regions. [33] [34] The mathematical equation for the Theil index is given as

$$\text{Theil} = \frac{1}{n}\sum_{i=1}^{n}\frac{y_i}{\bar{y}}ln\left(\frac{y_i}{\bar{y}}\right) \quad \in \left[0, ln(n)\right], \tag{5.4}$$

where n is the number distinct regions in a country, y_i is GDP per capita in region i, and $\bar{y}$ is the country mean of GDP per capita. The Theil entropy measure can further be decomposed into the sum of within and between regional contributions. The within regional contribution is defined as

$$T_{wthn} = \sum^{i} s_i T_i, \tag{5.5}$$

where s_i is the share of the sum of y_i in a region relative to the national sum (subgroup income share), and T_i is the Theil inequality index of region i. The

[33] Throughout the discussion and analysis the population-weighted Theil index will be used. Regional population of capital and non capital regions needs to be taken into account because of obvious large differences in population size.

[34] For a detailed discussion of the Theil entropy index and its decomposability see Shorrocks (1980), Subramanian (2011) and Cowell (1980, 2003, 2006).

between regional contribution is defined as

$$T_{btw} = \sum^{i} s_i ln\Big(\frac{\bar{y}_i}{\bar{y}}\Big), \tag{5.6}$$

where $\bar{y}_i$ is the average GDP per capita in region i and $\bar{y}$ the mean GDP per capita in a country. Hence, the Theil index in Equation 5.4 can also be written as

$$\text{Theil} = T_{wthn} + T_{btw}. \tag{5.7}$$

The discussion of the data decomposes regional inequalities measured with the Theil index into the shares of between and within regional inequality relative to the total Theil index and the sub-components distinguished by capital and non capital city regions.[35] Another advantage of using the shares of each component is that it enhances the comparison of regional inequalities across countries. Considering the sub-components enables one to further understand whether levels and changes of between and within regional inequality are driven by levels and changes in capital regions or in all other regions. The sub-component shares of between and within regional inequality will be discussed descriptively in Section 5.3.3 but will not be used in the quantitative analysis. The quantitative analysis will only use the within and between shares of the Theil index due to some difficulties, which will be discussed in detail in Section 5.4.

Equation 5.7 can be rewritten so that between and within regional inequality can be expressed as shares of the Theil index:

$$1 = \frac{T_{wthn}}{T} + \frac{T_{btw}}{T} = \%T_{wthn} + \%T_{btw}. \tag{5.8}$$

These two measures will be discussed in further detail in Section 5.3.3 and will also be used as the dependent variables in the empirical analysis in Section 5.4 to analyze changes in regional inequalities, distinguished by capital and non capital city regions, induced by foreign aid.

Both measures can further be divided into their two sub-components, which denote the contribution of each sub-group. Within regional inequality in Equation 5.5 can

[35] Sahn and Stifel (2003) also refer to each component as shares of the Theil index to account for their contribution to regional inequalities.

be rewritten as

$$T_{wthn} = s_{cap}T_{cap} + s_{no.cap}T_{no.cap}. \tag{5.9}$$

Equation 5.9 can be rearranged to obtain the percentage contribution of each sub-group to within regional inequality and the Theil index:

$$\%T_{wthn} = \frac{s_{cap}T_{cap}}{T} + \frac{s_{no.cap}T_{no.cap}}{T} = \%Wthn_{cap} + \%Wthn_{no.cap}. \tag{5.10}$$

Between regional inequality between capital city regions and non capital regions in Equation 5.6 can also be decomposed into its two sub-components as

$$T_{btw} = s_{cap}ln\Big(\frac{\bar{y}_{cap}}{\bar{y}}\Big) + s_{no.cap}ln\Big(\frac{\bar{y}_{no.cap}}{\bar{y}}\Big). \tag{5.11}$$

Again, the subsequent discussion of the data will refer to each sub-component as the share of the Theil index, such that Equation 5.11 becomes

$$\%T_{btw} = \frac{s_{cap}ln\Big(\frac{\bar{y}_{cap}}{\bar{y}}\Big)}{T} + \frac{s_{no.cap}ln\Big(\frac{\bar{y}_{no.cap}}{\bar{y}}\Big)}{T} = \%Btw_{cap} + \%Btw_{no.cap}. \tag{5.12}$$

The discussion of the data includes the sub-group components of regional inequality since increases (decreases) in inequalities between regions can arise due to increases (decreases) in GDP per capita in the richer region or due to decreases (increases) in GDP per capita in poorer regions. Hence, the decomposition of between regional inequality enables one to assign changes to either group of regions. The same argument applies to within regional inequalities. The decomposition of within regional inequalities into its sub-groups enables one to assign changes in within regional inequalities to either sub-group. Interestingly, one component of the sum in Equation 5.11 will be positive while the other will be negative. This is due to the fact that the fraction within the logarithm of both terms will be larger than one in one case and lower than one in the other. Since average GDP per capita $\bar{y}$ in the denominator is the national average of GDP per capita, one numerator of regional average GDP per capita $\bar{y}_i$ will be above the country average and the other numerator will be below. Note that to be able to calculate within and between regional inequalities of the Theil index in recipient countries the analysis will use disaggregated data at the second-order administrative level (ADM2). Here, using ADM1 GDP per capita data becomes obsolete because within regional inequality in capital ADM1 level regions

using ADM1 level GDP per capita can not be calculated.[36]

Before discussing these measures of regional inequality and their patterns in the subsequent section several concerns need to be addressed. For instance, there is a difference between using population-weighted inequality measures or treating each region as if they were analogous to a single person. Thus, different sizes of regions within countries might bias the measures of regional inequality. Economic disparities within countries with large differences in regional economic activities and an unevenly distributed population might be difficult to interpret. Boone and Simson (2019) highlight that large, sparsely populated countries tend to exhibit higher spatial inequality on unweighted measures. For instance, large regions with low GDP per capita will bias the inequality measure such that it might indicate large differences in economic activity within the country. These measures of economic disparity will be misleading in countries with uninhabitable large regions with a small share of population, such as deserts, tropical forests or national parks. For such cases the unweighted measures will indicate high regional inequalities, although few people will be affected by relative poverty. Similarly, countries with regions that inhabit a large share of the population and exhibit higher GDP per capita than the country average will tend to have higher unweighted regional inequality measures than population-weighted ones (Boone and Simson, 2019; Lessmann, 2013). So, in essence, the unweighted regional inequality measure places a greater emphasis on areal territory, and the population-weighted regional inequality measure emphasizes population in the context of regional inequality. Boone and Simson (2019) further point out that large sub-national differences in the weighted regional inequality measure contradict standard economic theory's expectation about labor mobility within countries, which might be caused by possible obstacles for internal migration.[37]

Another issue concerns the areal units defined at different scales, which affects the number of sub-national units within and across countries. Novotnỳ (2007) points out that inequality measures are sensitive to the number of subnational units in a given country. Most studies examine spatial inequality across first-level administrative units (ADM1), mostly because detailed statistics are available at this level. To overcome this problem, Nordhaus (2006) uses politically neutral borders to measure spatial inequality, such as grid cells which divide the world into pixels of equal

[36]Since the Theil index in Equation 5.5 of within regional inequality in capital ADM1 regions becomes 1, the within regional inequality using ADM1 level GDP per capita will equal the income share of capital city regions.

[37]As the authors highlight, economic theory would predict migration from poor to richer regions that would result in convergence in the weighted regional inequality measure.

size. Lessmann (2013) also proposes the use of territorial classifications that create relatively homogenous regions within countries. This method generates consistent geographic units across countries, although it will, by construction, lead to higher inequality measures in larger countries (Boone and Simson, 2019). Nevertheless, Boone and Simson (2019) state that the number of regional units has a marginal effect on the country rankings of regional inequality and the effect even decreases using population-weighted measures.

A further issue arises considering the sub-national borders which are drawn to define sub-national regional units. Boundary divisions that, for instance, separate urban and rural regions will result in higher inequalities than including large cities with the surrounding area. This is especially the case for countries where capital cities or major urban centers by themselves constitute a single region, such as in Botswana, Mali or South Africa. These country specific regional borders, also historically determined, are difficult to correct for (Boone and Simson, 2019).

As a result, measures of regional inequality need to be interpreted with caution. For the case of sub-Saharan African countries it will be difficult to classify regions homogeneously because of differences in country size, location within the continent, population size, and regional sub-divisions within countries. Hence, the present study will provide overall regional inequalities at the first-order administrative division (ADM1) and at the second-order administrative divisions (ADM2). However, the number of countries in the sample reduces with decreasing levels of administrative divisions because of missing data. For instance, the CIESIN population data provides ADM1 level information for all 38 countries, but only 35 countries have data at the ADM2 level.[38] The quantitative analysis and the discussion of overall regional inequalities measured with the Gini index, the coefficient of variation and the weighted coefficient of variation, will depend on regional inequalities calculated using ADM1 regional GDP per capita. However, in the discussion of the data ADM2 regional inequalities will also be shortly elaborated on.

Furthermore, to be able to obtain within and between regional inequalities between capital city regions and the rest of the country using the Theil index, it will be necessary to use GDP per capita data at the second-order administrative level (ADM2). As noted above, using GDP per capita calculated at the ADM1 level will not account for within ADM1 regional inequalities. So, in addition to the countries with missing ADM2 level data, countries whose capital city by themselves constitute an

[38] Eritrea, Lesotho and the Republic of Congo are missing.

ADM1 and ADM2 level region are dropped from the sample, when calculating the Theil index.[39] Therefore, the total sample of countries reduces to 21 countries when analyzing within and between regional inequalities using the Theil index. Using the decomposition of regional inequality by capital and non capital city regions enables one to understand the effects of foreign aid on regional inequality particularly between and within theses two groups of regions. The decomposition by capital and non capital city regions may provide some evidence whether capital city regions benefit more from foreign aid than other regions within a country.

5.3.2. Regional Inequality: Data and Trends

This section provides the discussion of the measures of overall regional inequality, such as the Gini index, the coefficient of variation and the weighted coefficient of variation. Table 5.1 provides the mean regional inequality measures between ADM1 regions for all 38 countries in the sample distinguished by the World Bank income classification between the years 1998 and 2015. On first sight, mean regional inequality measures for low-income countries are higher than for lower-middle-income and upper-middle-income countries.

Considering the three measures for regional inequality between ADM1 regions, the ranking between countries does not shift or change considerably. The highest average regional inequality measured with the Gini index is in Mali, followed by Tanzania and the Republic of Congo, with a Gini index of 0.79, 0.56 and 0.53, respectively. Madagascar exhibits the lowest average Gini index with 0.03 followed by Ethiopia and Ghana, with regional inequalities measured with the Gini index of 0.04 and 0.07, respectively. The same pattern can be observed considering regional inequalities measured with the coefficient of variation. Mali, Tanzania and the Republic of Congo again exhibit highest regional inequalities with values of 2.64, 1.38 and 1.17, respectively. And the lowest regional inequalities measured with the coefficient of variation are in Madagascar, Ethiopia and Ghana, with values of 0.06, 0.08 and 0.13, respectively. The population-weighted coefficient of variation exhibits mainly the same pattern. Madagascar, Ethiopia and Ghana exhibit the lowest regional inequality measured with the population-weighted coefficient of variation, with values of 0.07, 0.07 and 0.15, respectively. The highest weighted coefficient of variation can

[39] This is the case for Botswana, Burkina Faso, Central African Republic, Chad, Democratic Republic of the Congo, Ethiopia, Gambia, Guinea, Guinea-Bissau, Kenya, Mali, Mauritania, Niger and Uganda.

Table 5.1.: Regional ADM1 inequalities classified by income group (World Bank country classification)

Country	Gini	CV	WCV	Country	Gini	CV	WCV
Low Income Countries				Lower Middle Income Countries			
Benin	0.24	0.45	0.44	Angola	0.30	0.57	0.56
Burkina Faso	0.08	0.15	0.15	Cameroon	0.14	0.27	0.32
Burundi	0.09	0.18	0.18	Cote d'Ivoire	0.12	0.21	0.21
Centr. Afr. Rep.	0.12	0.30	0.42	Ghana	0.07	0.13	0.15
Chad	0.14	0.30	0.16	Kenya	0.43	1.00	0.96
DR Congo	0.11	0.21	0.22	Lesotho	0.12	0.25	0.29
Eritrea	0.24	0.49	0.43	Mauritania	0.26	0.49	0.54
Ethiopia	0.04	0.08	0.07	Nigeria	0.19	0.34	0.33
Gambia	0.28	0.57	0.70	Rep. of Congo	0.53	1.17	1.85
Guinea	0.26	0.54	0.60	Swaziland	0.08	0.18	0.19
Guinea-Bissau	0.37	0.76	0.83	Zambia	0.17	0.35	0.40
Liberia	0.19	0.40	0.55	Avg.	0.21	0.44	0.50
Madagascar	0.03	0.06	0.07				
Malawi	0.19	0.36	0.26				
Mali	0.79	2.64	3.70				
Mozambique	0.35	0.84	0.67				
Niger	0.26	0.52	0.49				
Rwanda	0.14	0.28	0.26				
Senegal	0.14	0.27	0.41	Upper Middle Income Countries			
Sierra Leone	0.23	0.57	0.49	Botswana	0.45	0.82	0.55
Tanzania	0.56	1.38	1.18	Gabon	0.18	0.37	0.65
Togo	0.14	0.29	0.39	Namibia	0.13	0.27	0.35
Uganda	0.17	0.31	0.34	South Africa	0.10	0.18	0.20
Avg.	0.22	0.52	0.57	Avg.	0.22	0.41	0.44

be observed in Mali, the Republic of Congo and Tanzania with values of 3.70, 1.85 and 1.18, respectively.

Figure 5.1 provides the graphs for the largest changes in regional inequality measured with the Gini index for four countries over the period of 1998 and 2015. Figures C.1 and C.2 in Appendix C.1 provide the graphs for the largest changes of the coefficient of variation and the weighted coefficient of variation for four countries over the same period of time.

Angola exhibits the largest improvements in regional inequality measured with all three regional inequality measures over the years between 1998 and 2015. On the opposite side, the Democratic Republic of Congo exhibits the largest percentage increase in regional inequality measured with all three regional inequality measures,

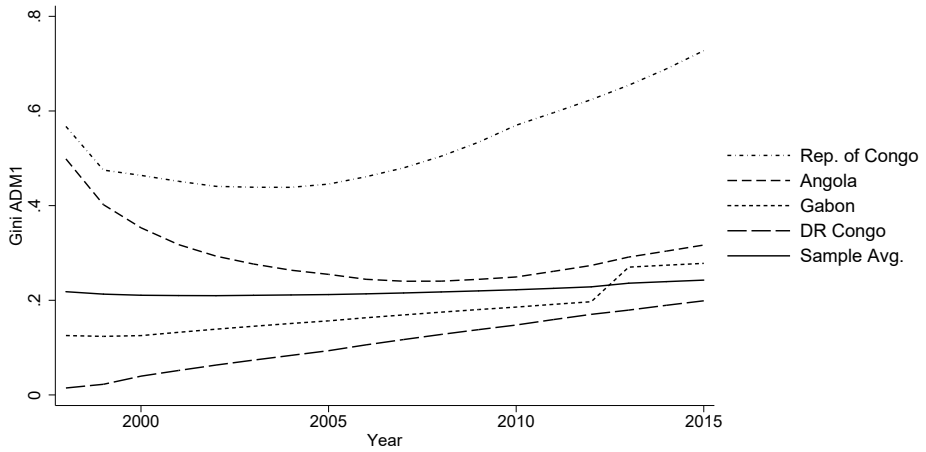

Figure 5.1.: Largest Changes in Regional ADM1 Gini Inequality

followed by the Republic of Congo and Gabon. Furthermore, Mozambique experienced a decline in regional inequality measured with the coefficient of variation and Mali's large initial regional inequality measured with the weighted coefficient of variation also decreases over the years. However, it is apparent in all three Figures that the sample average for all three measures of regional inequality did not change considerably over the years (solid line).

Table C2 in Appendix C.1 provides the changes in regional inequality measures for all countries in the sample between the years 1998 and 2015. Here, it becomes apparent that only 9 countries in the sample improved regional inequality measured with the Gini index, 12 countries improved their regional coefficient of variation inequality and only 8 countries showed improved regional inequality measured with the weighted coefficient of variation. Accordingly, less than a third of the countries showed improvements in regional inequality measured with all three measures from 1998 till 2015. Average regional inequality increased marginally for the whole sample between the years 1998 and 2015. Thus, in general regional inequality either remained persistent or increased in most sub-Saharan African countries between the years 1998 and 2015.

Additionally, regional inequalities seem to be higher for almost all countries when calculating regional inequalities using GDP per capita data at the second-order administrative level. Most countries exhibit larger regional inequalities between ADM2 regions than between ADM1 regions. For instance, only Sierra Leone and Kenya exhibit better regional inequalities between ADM2 regions for all three measures of regional inequality. Table C3 in the Appendix C.1 provides regional inequality mea-

sures using GDP per capita aggregated at the ADM2 regional level. Higher regional inequalities between ADM2 regions indicate that a large share of inequality between ADM2 regions within ADM1 regions does not get accounted for when calculating regional inequalities using GDP per capita data at the ADM1 level.

Figures C.3 till C.5 in Appendix C.1 provide the maps for regional inequalities measured with the Gini index in sub-Saharan Africa in 2015. Figure C.3 shows the map for the Gini index at the national level calculated using ADM1 level GDP per capita. Figure C.4 illustrates regional Gini inequalities at the national level, using ADM2 regional GDP per capita. Going one level further into detail, Figure C.5 provides the Gini index for regional inequalities within ADM1 regions using ADM2 GDP per capita. The black points in all maps show the location of capital cities in each country. Figures C.6 and C.7 provide the maps for the unweighted and weighted coefficient of variation in 2015 at the country level using ADM1 level GDP per capita. Here it can be seen that the country rankings mainly remain the same, with Mali, the Republic of Congo and Tanzania having the highest levels of regional inequality measured with both inequality measures. However, looking at the ranges of the weighted and unweighted coefficient of variation it is apparent that the maximum regional inequality increases using the population-weighted coefficient of variation.

5.3.3. Regional Inequality between Capital Regions and all other Regions: Data and Trends

Next, patterns and levels of the Theil index and its decomposition by between and within regional inequality and their sub-group components will be provided. Table 5.2 provides the average regional Theil index for the years between 1998 and 2015 calculated using GDP per capita data at the ADM2 regional level. The table further provides the shares of between and within group inequalities, when regions are grouped together by being either in capital ADM1 regions or in all other regions. Additionally, the contributions of either group of region to within and between regional inequalities are presented as shares of the Theil index. Due to the fact that the variables are all in percentages, the shares of between and within Theil regional inequalities (columns (2) and (5)), and the shares of all four sub-groups of between and within regional inequalities (columns (3), (4), (6) and (7)),

Table 5.2.: Mean Theil inequality index (decomposed by Capital and Non Capital ADM1 Regions)

	Theil	Between Regional Inequality			Within Regional Inequality		
	Index	% of Theil	% Cap.	% Non Cap.	% of Theil	% Cap.	% Non Cap.
LIC							
Benin	0.281	5.190	24.342	-19.151	94.810	46.812	47.997
Burundi	0.122	0.616	5.130	-4.514	99.384	64.012	35.372
Liberia	0.297	30.416	-37.776	68.192	69.584	38.975	30.609
Madagascar	0.012	11.896	-215.670	227.566	88.104	41.460	46.644
Malawi	0.145	0.198	-3.827	4.026	99.802	11.059	88.743
Mozambique	0.210	9.515	38.065	-28.550	90.485	19.372	71.113
Rwanda	0.055	14.252	-52.156	66.408	85.748	5.766	79.981
Senegal	0.132	64.498	-63.808	128.307	35.502	15.752	19.750
Sierra Leone	0.139	93.821	-39.393	133.213	6.179	3.308	2.872
Tanzania	0.453	0.239	-1.858	2.097	99.761	0.020	99.741
Togo	0.145	40.046	-87.438	127.485	59.954	50.442	9.511
LIC Avg.	0.181	24.608	-39.490	64.098	75.392	26.998	48.394
LMIC							
Angola	0.337	11.085	6.287	4.797	88.915	4.243	84.672
Cameroon	0.092	12.841	-51.261	64.102	87.159	23.404	63.755
Cote d'Ivoire	0.025	8.084	68.577	-60.493	91.916	0.822	91.094
Ghana	0.067	11.623	-56.418	68.040	88.378	11.143	77.235
Nigeria	0.187	1.181	-1.907	3.088	98.819	0.046	98.774
Swaziland	0.256	4.856	-23.135	27.991	95.144	17.483	77.661
Zambia	0.122	27.677	96.765	-69.088	72.323	12.263	60.060
LMIC Avg.	0.155	11.049	5.558	5.491	88.951	9.915	79.036
UMIC							
Gabon	0.423	35.548	-36.919	72.468	64.452	20.431	44.020
Namibia	0.208	25.593	-26.708	52.301	74.407	13.750	60.657
South Africa	0.022	2.702	-2.607	5.309	97.298	2.583	94.715
UMIC Avg.	0.218	21.281	-22.078	43.359	78.719	12.255	66.464

add up to one hundred percent in a given year.[40] As mentioned earlier, the between shares of capital and non capital regions in columns (3) and (4) are positive and negative. This pattern results from the fact that one group of regions exhibit GDP per capita above the country mean and the other below, such that the logarithm of both fractions results in one positive and one negative value.[41] Furthermore, each sub-group component of between regional inequality add up to the share of between regional inequality relative to the Theil index, which is also the case for the sub-group components of within regional inequality and the share of within regional inequality.

[40]However, Table 5.2 provides the average inequality measures for all countries during the years between 1998 and 2015. Correspondingly, mean percentages of regional inequalities in some cases might not necessarily add up to exactly one hundred percent.

[41]However, Angola is a special case because during the years between 1998 and 2015 in Angola non capital city regions converged toward and overtook capital city regions in GDP per capita. Hence, both groups of regions had above and below country average GDP per capita during the time period. This pattern will be discussed and illustrated in further detail below.

Comparing the shares of between and within regional inequality by each country it is apparent that Malawi has the largest share of within regional inequality and, thus, the lowest share of between regional inequality, followed by Tanzania, Burundi and Nigeria. These countries have more than 98.5% of regional Theil inequality attributable to within and less than 1.5% attributable to between capital and non capital regional inequalities. However, considering the percentage contribution of each sub-group on between and within regional inequalities different patterns emerge between these countries. In Burundi, for instance, capital regions exhibit higher GDP per capita than the country average. Additionally, the large share of within regional inequality in Burundi is mainly driven by inequalities within capital regions. Malawi, Tanzania and Nigeria, on the other hand, exhibit GDP per capita in capital regions below the country average. These countries also exhibit very low shares of regional inequalities within capital regions. So in sum, regional inequalities in all these four countries can mainly be explained by within regional inequalities, which in the case of Malawi, Tanzania and Nigeria is mainly driven by inequalities within non capital and in Burundi by inequalities within capital regions.

On the other hand, Sierra Leone by far has the largest share of between regional inequality, and simultaneously the lowest share of within regional inequality. Similarly, Togo, Senegal and Gabon show relatively high shares of between regional inequality and low shares of within regional inequality. In these four countries average GDP per capita in capital regions is below the country mean. This pattern is more pronounced for Senegal and Togo. Furthermore, in Togo the share of within regional inequality is mainly driven by within capital region inequality. Hence, for the case of Togo the pattern of regional inequalities decomposed by capital and non capital regions can be explained by large inequalities between these regions, with capital regions having below average GDP per capita. To make things worse, regional inequality within capital regions is higher than in the rest of the country.

The largest changes in regional inequalities measured with the Theil index between the years 1998 and 2015 can be observed in Angola, Liberia, Sierra Leone and Malawi. While Angola experiences the largest change in the Theil index, Liberia exhibits the largest change in the shares of between and within regional inequality. Sierra Leone shows the largest changes in the sub-group components of within and Malawi of between regional inequality, when regions are grouped together by being in capital or non capital regions.

Figure 5.2 shows the changes in regional inequalities in Angola measured with the

Theil entropy index. Additionally, the graph also includes the changes in between and within regional inequalities. The figure shows that most of the changes in the Theil index can be attributed to changes in regional inequalities between capital and non capital regions. The within regional inequality in Angola changed to a small extent over the years. However, within regional inequalities constitute the larger share of regional inequalities in Angola. This can be seen by comparing the areas below both graphs. For instance, the intersection of the two graphs of the Theil index and the within regional inequality around 2007 indicates that at some point regional inequalities in Angola measured with the Theil index could be explained solely by within regional inequalities. At the same time, between regional inequality between capital and non capital regions in 2007 was almost zero.

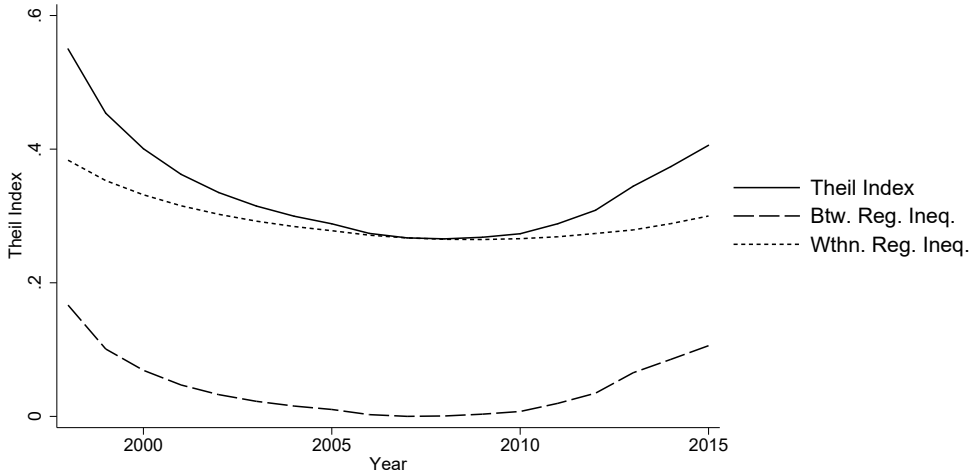

Figure 5.2.: Theil, Within and Between Regional Inequality in Angola grouped by Capital and Non Capital Regions

Figure 5.3 shows the changes in within regional inequality on the left and changes of between regional inequality on the right panel. Both variables are graphed with a solid line. Additionally, the contribution of each sub-group to the changes in within and between regional inequality are included in both figures. In Angola within regional inequality in non capital regions constitutes the larger share of within regional inequalities. Also, changes of within regional inequality can be attributed to changes within non capital regions. The contribution of capital city regions to within regional inequality is very low and does not change much over the years. Considering the right panel of Figure 5.3, which shows the graphs of between regional inequality and the contribution of each sub-group, it becomes apparent that the initial decline and the subsequent increase in between regional inequality was driven by a convergence followed by a divergence of GDP per capita. Initially, capital

regions exhibited above country average GDP per capita. After 2007, at the point where between regional inequality was at its minimum, between regional inequality increased again. However, this time due to increases of GDP per capita in non capital regions. This pattern also results in the two positive mean values for the sub-group contributions of between regional inequality for Angola in Table 5.2.

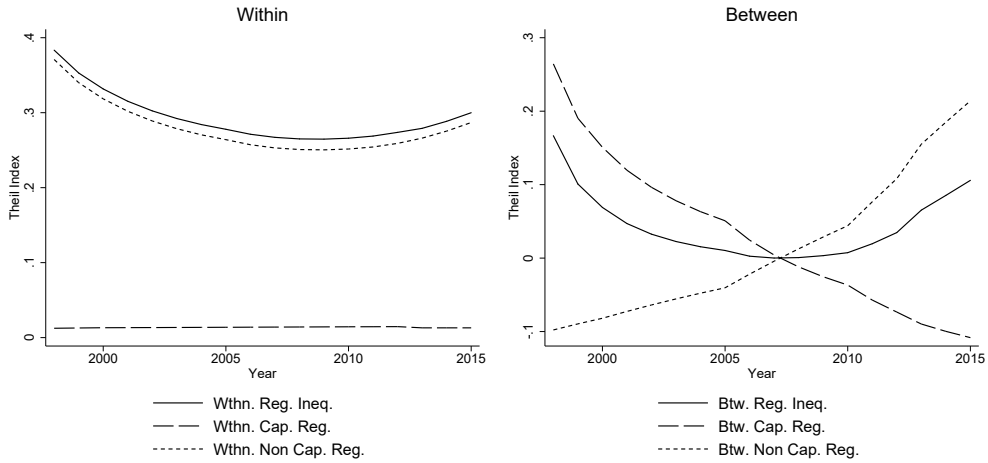

Figure 5.3.: Within and Between Regional Inequality in Angola decomposed by Capital and Non Capital Regions

Liberia experienced the largest percentage changes in between and within regional inequalities during the years 1998 and 2015. The changes in the Theil index and the within and between components of regional inequality can be seen in Figure 5.4. The overall regional inequality increased over the years. While prior to 2012 between

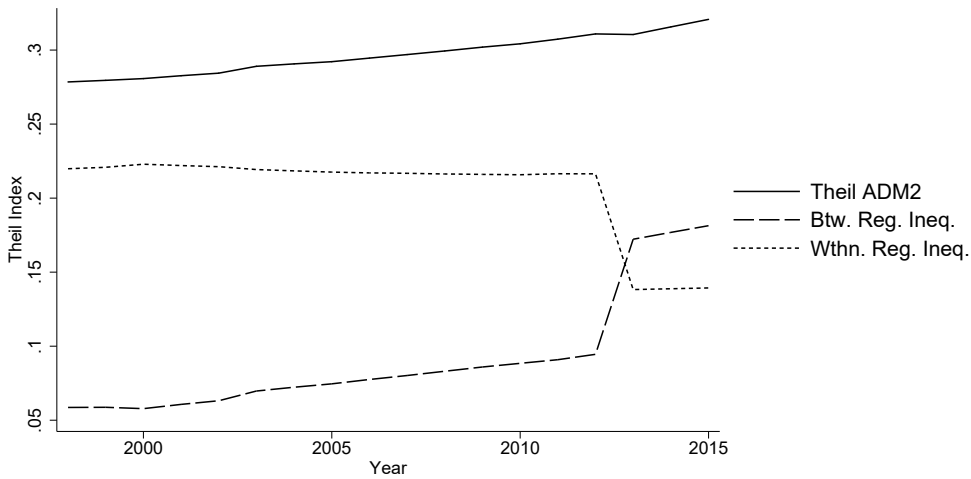

Figure 5.4.: Theil, Within and Between Regional Inequality in Liberia grouped by Capital and Non Capital Regions

regional inequality steadily increased the within component of regional inequality stayed fairly constant. However, after 2012 between regional inequality increases drastically and within regional inequality decreases. Hence, the constant increase in the Theil regional inequality index in Liberia during the years 1998 and 2012 can be attributed to increases in between regional inequalities. The drastic increase of between regional inequality after 2012 was partly compensated by a drastic decrease in within regional inequality such that the graph for the Theil index maintained its constant increasing pattern.

As can be seen in the left panel of Figure 5.5, the decrease in within regional inequality after 2012 is driven by decreases of within regional inequality in both capital and non capital regions. Moreover, the decline of within regional inequality in capital regions is more pronounced than in non capital regions such that after 2012 capital and non capital regions exhibited almost the same within regional inequality. The right panel of Figure 5.5 shows that the drastic increase in between regional inequality after 2012 is driven by increases in the contribution of non capital regions. It seems that the contribution of non capital regions to between regional inequality increased steadily with a sudden increase after 2012 while the contribution of capital regions constantly decreased.

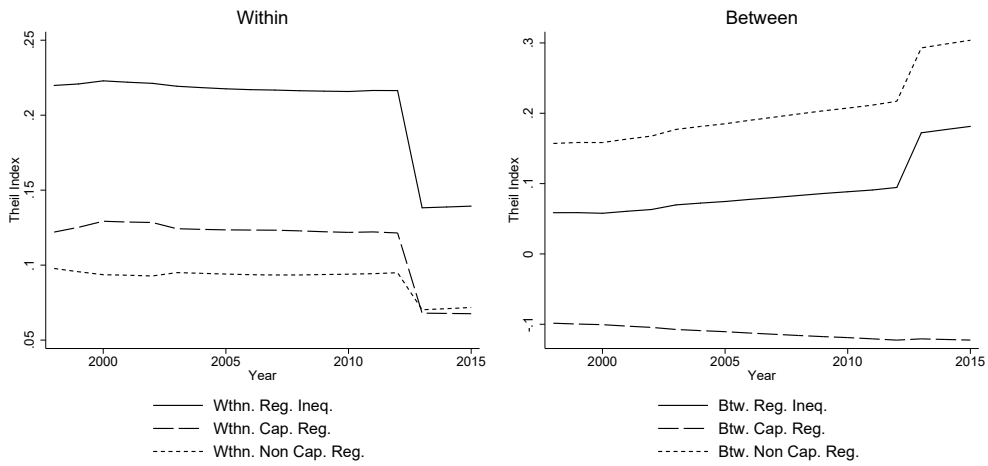

Figure 5.5.: Within and Between Regional Inequality in Liberia decomposed by Capital and Non Capital Regions

Sierra Leone, on the other hand, exhibits the largest changes in the contribution of both capital and non capital city regions to changes in within regional inequality. The pattern of the Theil regional inequality index and both within and between parts of regional inequality can be seen in Figure 5.6. It can be seen that most

changes in the Theil index in Sierra Leone can be attributed to changes in between regional inequality. Especially the sudden increase of the Theil index after 2012 can mainly be explained by increases in regional inequality between capital and non capital city regions. Within regional inequality remained very small. However, the linear pattern of within regional inequality in Figure 5.6 is misleading and due to the scales of the graph, because within regional inequality remained very small during the whole time period.

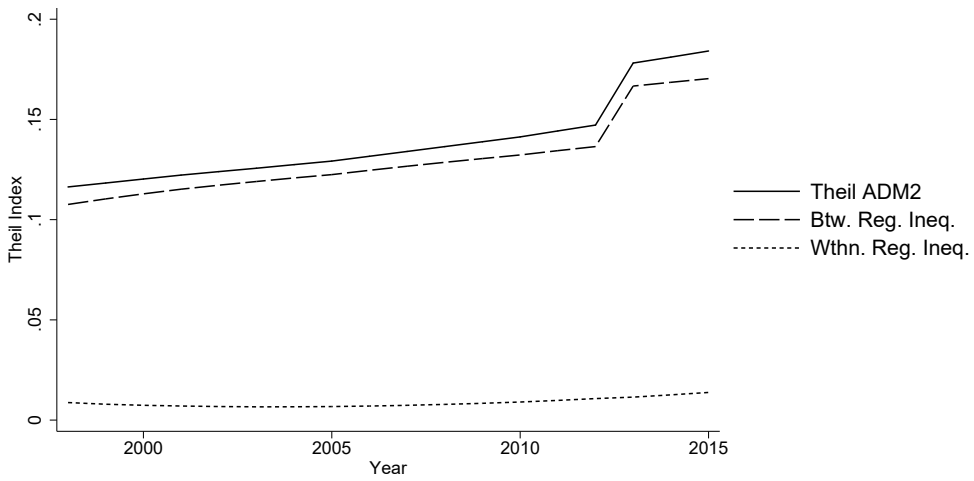

Figure 5.6.: Theil, Within and Between Regional Inequality in Sierra Leone grouped by Capital and Non Capital Regions

The left graph of Figure 5.7 enables one to look closer at within regional inequality in Sierra Leone. While within regional inequality remained at low levels within a range of 0.007 and 0.015 for the entire time period, it did experience considerable percentage changes which did not become apparent in Figure 5.6. Within regional inequality decreases until 2003 and increases afterward. The contribution of capital city regions to within regional inequalities decreases constantly over the years. On the other side, the contribution of non capital regions initially decreased and started to increase drastically after 2003. Hence, the initial decrease in within regional inequality can be attributed to decreases of within regional inequality in both regions. However, the increase of within regional inequality after 2003 is driven by increases in the contribution of non capital city regions, while the contribution of capital regions maintained its decreasing pattern. Still, these changes in within regional inequality contributed very little to changes in regional inequality measured with the Theil index. Furthermore, the right panel in Figure 5.7 depicts the patterns of between regional inequality and both of its sub-group components over the years 1998 till 2015. Average income in capital city regions was below the country mean during the whole time period. The constant increase in between regional inequality is attributable to increases in non capital regions. The contribution of the capital city region to between regional inequality remained at the same level until 2012. The increase in between regional inequality after 2012 can be explained by increases in both components. However, the percentage increase in the contribution of capital city regions to between regional inequality is larger than the percentage increase in the contribution of non capital regions.

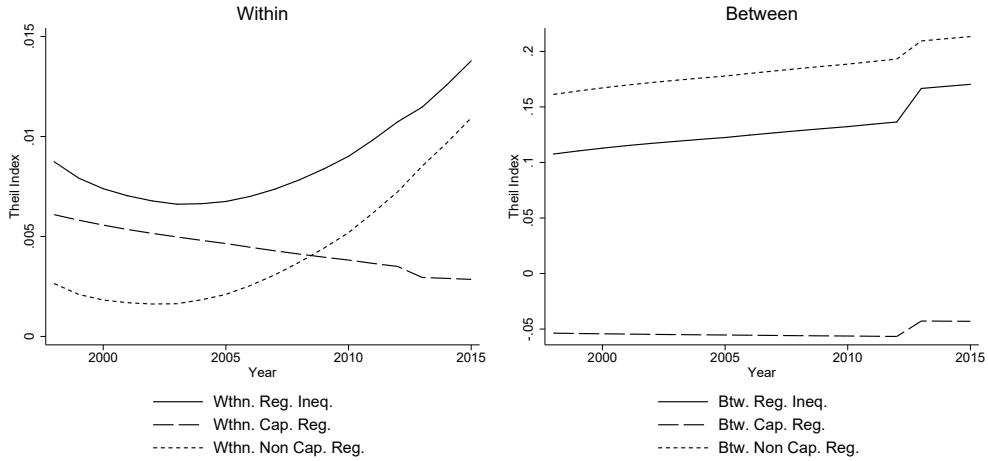

Figure 5.7.: Within and Between Regional Inequality in Sierra Leone decomposed by Capital and Non Capital Regions

Malawi also constitutes an interesting case, because during the years 1998 and 2015 Malawi experienced the largest changes of both sub-group components of between regional inequality. However, the pattern and decomposition of the Theil regional inequality index, shown in Figure 5.8, is also interesting because during all the years regional inequalities in Malawi measured with the Theil index can mainly be explained by within regional inequalities. The two graphs for the Theil index and within regional inequality are almost equal and align during all these year. Hence, between regional inequality remained very close to zero during the same time period.

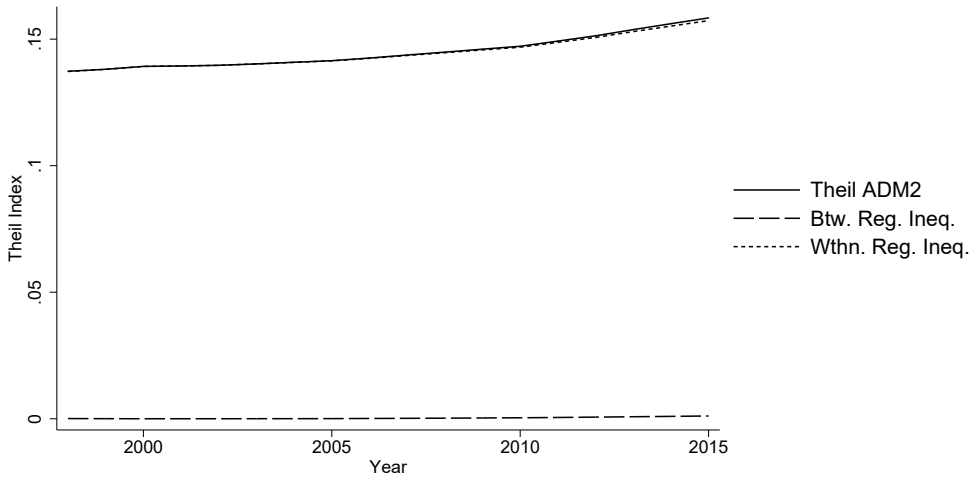

Figure 5.8.: Theil, Within and Between Regional Inequality in Malawi grouped by Capital and Non Capital Regions

Further looking at the left panel in Figure 5.9 it becomes apparent that within regional inequalities can mainly be explained by inequalities within non capital regions. Within regional inequalities in capital city regions constitute only a small share of the total within regional inequality. However, both components of within regional inequality show constant increases between the year 1998 and 2015, with larger increases in non capital regions. The right graph in Figure 5.9 shows the large changes in both components of between regional inequality. The pattern is similar to Angola, although more linear. The contribution of non capital city regions increases steadily over the years and the contribution of capital city regions decreases. Initially, GDP per capita in non capital regions is below the country mean and converges until 2001 towards the country mean. After 2001, non capital city regions exhibit GDP per capita above the country mean which increases linearly until 2015. The opposite pattern is observable for the contribution of capital city regions. However, the contributions of both groups to between regional inequality

nullify each other such that between regional inequality remains close to zero during the whole time period.

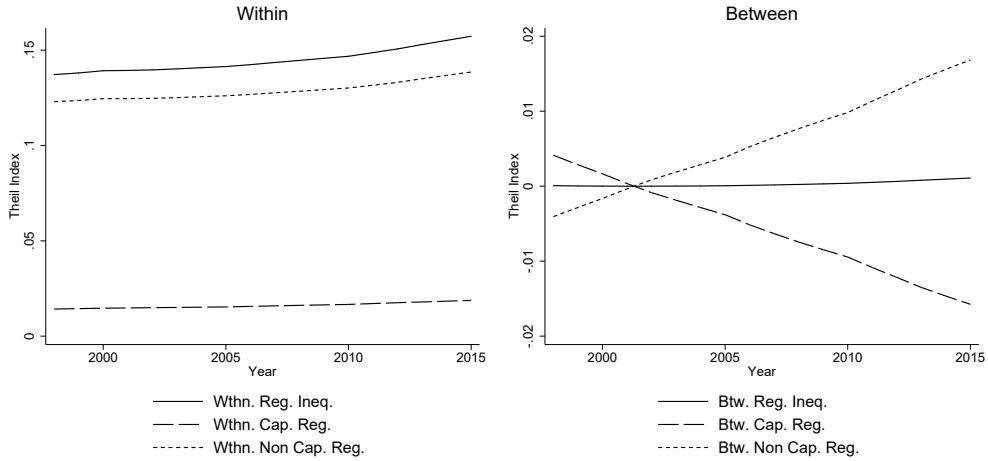

Figure 5.9.: Within and Between Regional Inequality in Malawi decomposed by Capital and Non Capital Regions

Furthermore, Figures C.8 and C.9 in Appendix C.1 show the maps of Africa with their regional inequalities. Figure C.8 shows the country-wide regional Theil inequality index calculated using ADM2 level GDP per capita. Figure C.9 provides the map for regional inequalities within ADM1 regions using ADM2 level GDP per capita. Going further into detail, by considering regional inequalities using ADM2 regional GDP per capita data, provides a more differentiated picture with large differences within countries. Additionally, Figure C.10 shows the map for the Theil inequality measure differentiated by the sub-groups of capital and non capital ADM1 regions.

5.3.4. Foreign Aid: Data and Trends

The data for official development assistance (ODA) comes from the World Bank database. The original source of the data is the Development Assistance Committee (DAC) of the OECD. These net ODA transfers consist of disbursements of loans made on concessional terms and grants by official agencies of the members of the DAC, by multilateral institutions, and by non-DAC countries. To account for recipient countries' dependency on aid flows the analysis will use the ratio of aid funds to Gross National Income (GNI). Regarding the much stated concern of aid donors about recipient governments' institutional quality, a simple scatter plot of average

aid flows and corruption (provided by the Worldwide Governance Indicators, WGI) appears to show little relationship between these variables, as is shown in Figure 5.10. This pattern is consistent with the evidence provided by Alesina and Weder (2002), who show that there is no evidence that less corrupt governments receive more foreign aid.

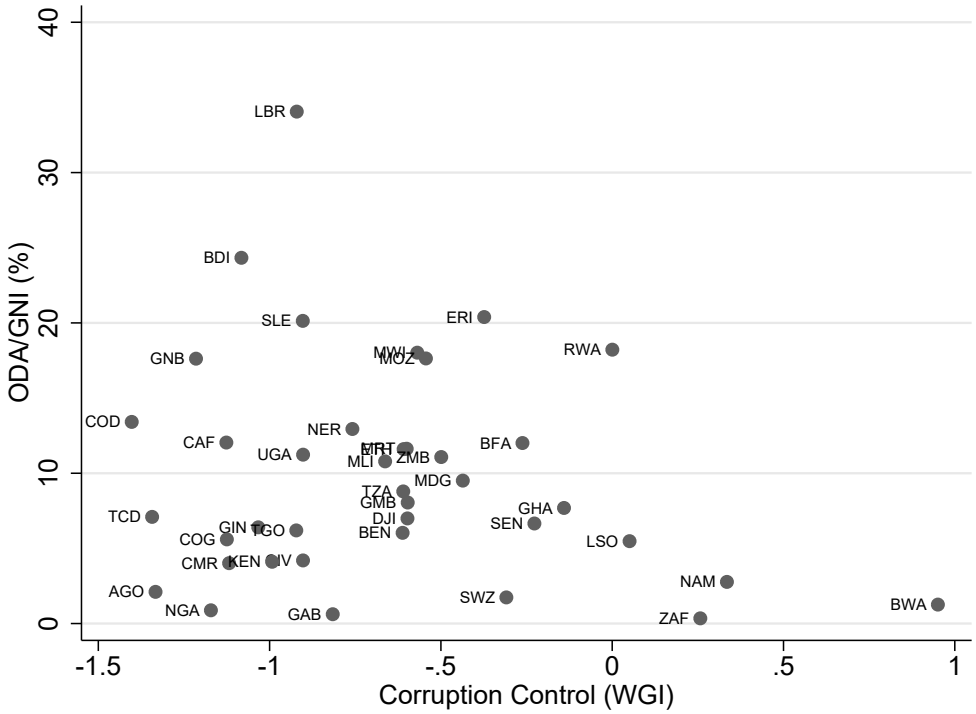

Figure 5.10.: (Mean) ODA/GNI (%) and (mean) Control of Corruption

Figure 5.11 provides graph bars of average ODA in percentages of GNI and total ODA for all countries over the years 1998 to 2015. Liberia received on average by far the largest ratio of ODA per GNI with more than 30%, followed by Burundi and Eritrea. Nigeria, Gabon and South Africa received on average the least amount of ODA relative to GNI. This might also be a result of higher GNI compared to other sub-Saharan countries, which is apparent considering that Gabon and South Africa are classified as upper middle income countries, and Nigeria as a lower middle income country. Only four countries received on average more than 20% of ODA per GNI (Liberia, Burundi, Eritrea and Sierra Leone). Furthermore, the largest amount of total ODA between the years 1998 and 2015 went to Ethiopia, with around 2.4 billion US $. Additionally, the Democratic Republic of Congo, Nigeria and Tanzania received more than 2 billion US $ over the same time period. The lowest amount of total ODA went to Gabon, Gambia and Swaziland with less than 100 million US $.

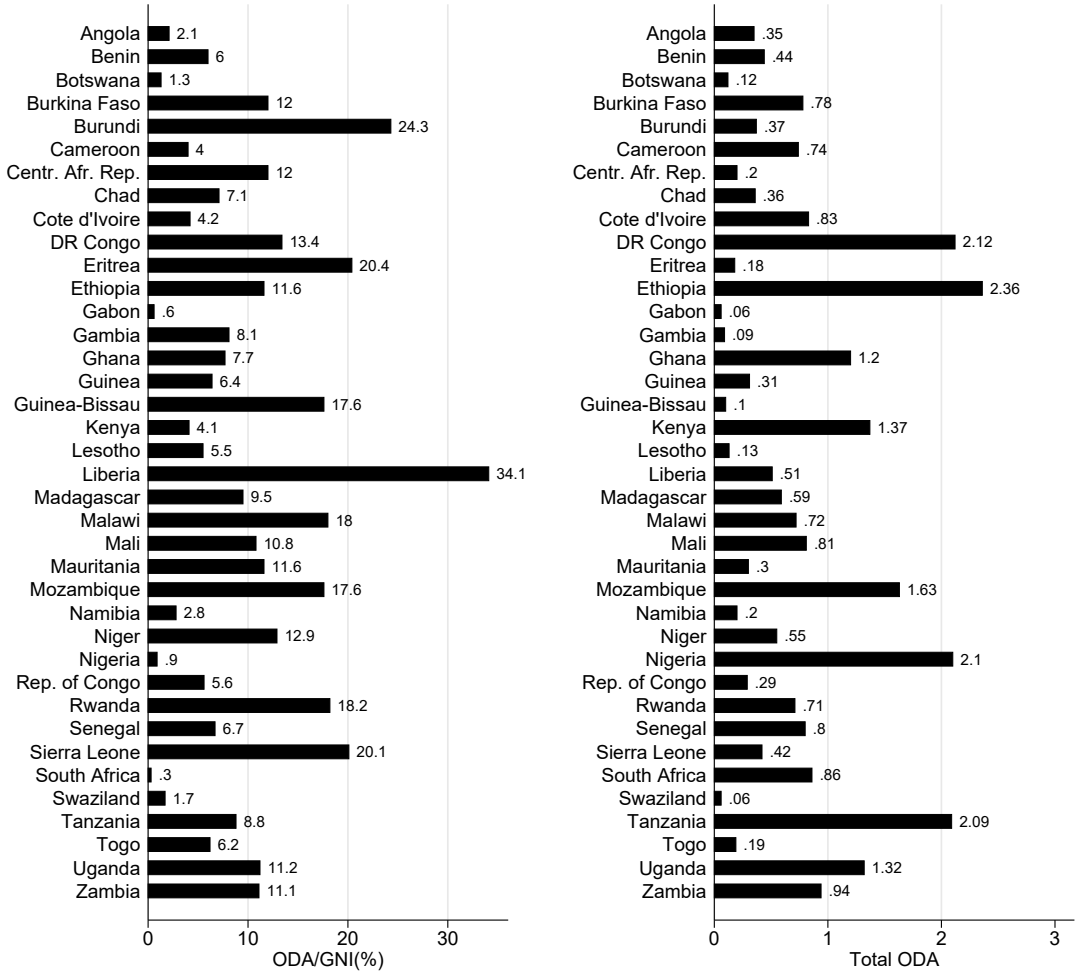

Figure 5.11.: (left) Average ODA/GNI (%), (right) Total ODA from 1998 till 2015 in billion US $

5.4. Empirical analysis

The previous section presented in detail different measures of regional inequality, which are the dependent variables, and foreign aid, which will be the main independent variable of interest. A simple scatter plot of the data in Figure 5.12 provides a first impression of the relationship between regional inequality and aid flows. The values for ODA per GNI (abscissa) and regional inequality measured with the Gini coefficient (ordinate) are mean values for each country over the period 1998 and 2015. It seems that in sub-Saharan Africa upper and lower middle income countries received on average less ODA per GNI than low income countries. However, this might also be driven by the larger GNI ratio in these more developed countries. On first sight, the scatter plot does not provide any consistent pattern for the re-

lationship between foreign aid and regional inequality. However, the scatter plot focuses on between country variations based on average cross-country data and does not take yearly changes into account. For an adequate empirical analysis of the theoretical predictions yearly variations must be taken into account.

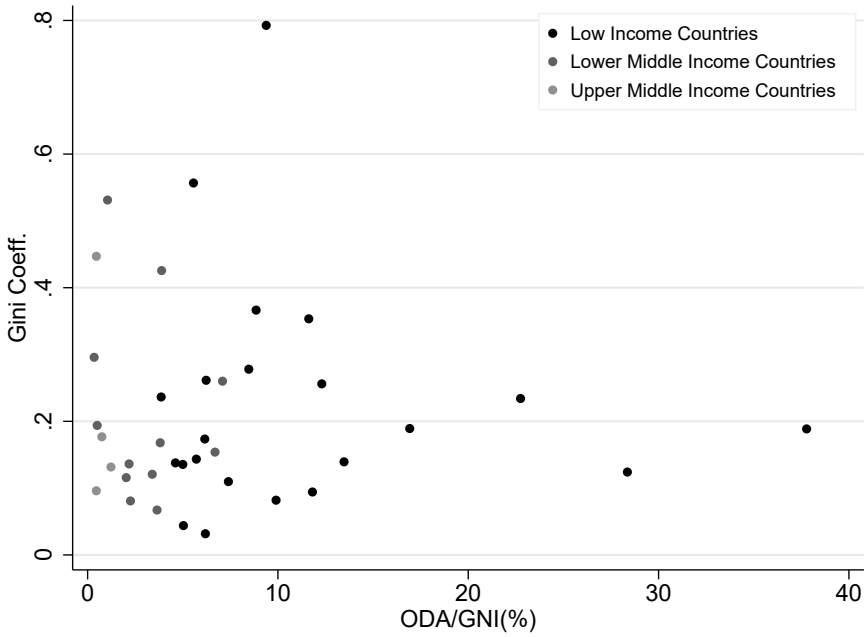

Figure 5.12.: Average Gini regional inequality and aid flows (1998-2015)

The empirical analysis of the relationship between regional inequalities and ODA is divided into two parts. First, to analyze the effects of ODA on regional inequalities in a static setup the study will use panel data estimation methods with country and year fixed effects following Lessmann (2013). Subsequently, following the literature on income inequality and foreign aid (Chong et al., 2009; Castells-Quintana and Larrú, 2015; Pham, 2015) the estimation procedure will rely on dynamic panel estimation methods (system GMM). Dynamic methods are especially useful to account for small changes in regional inequalities, to account for the effects of past regional inequalities on current regional inequalities and additionally take possible endogeneity of explanatory variables into account. Especially for the case of regional inequality which changes slowly over time, this procedure might yield more consistent estimates. The two following sections provide the methodology and estimation results of the static and dynamic panel estimation approaches.

5.4.1. Static Panel Estimation

Methodology

The static panel estimation procedure will estimate the following basic regression model for N countries and T time periods with least squares dummy variable estimation (LSDV), where countries are indexed by i and years by t.

$$RegIneq_{it} = \beta_1 ODA_{it} + \sum_{j=1}^{k} \gamma_j X_{jit} + \alpha_i + \mu_t + \varepsilon_{it} \tag{5.13}$$

$RegIneq_{it}$ is one of the alternative measures of regional inequality, α_i are country fixed effects, μ_t denotes year fixed effects, X_{jit} are k exogenous control variables affecting regional inequality, and ε_{it} is a random error term.

Using LSDV estimation with country fixed effects has several advantages which are important for the current analysis. First of all, such regressions focus on within country variations in the data, which is the more appropriate approach to testing the theoretical predictions in contrast to the between country variations in a standard cross-section analysis (Lessmann, 2013). Country fixed effects are able to eliminate unobserved heterogeneity between countries (Baltagi, 2008). Especially in the current analysis this is very important, since there are large differences between the countries under study, concerning geographic factors, like deserts, coasts, or concerning the (dis-)aggregation of the regions within a country, which also determines regional inequalities.

The set of control variables is the same for all specifications. Following Lessmann (2009), unemployment may be unequally distributed among the regions of a country, affecting measures of regional inequality. Correspondingly, the unemployment ratio defined as the share of the labor force is included. The work of Rodríguez-Pose and Ezcurra (2009) and other studies suggest that international trade has an impact on regional disparities, so trade openness measured as the share of imports and exports of GDP is controlled for. To capture possible agglomeration effects the share of urban living population is also controlled for (Krugman and Elizondo, 1996). Further, the logarithm of total population is included to control for country size, instead of using land area, which is time-invariant. FDI are also expected to influence regional disparities in economic activity within countries (Lessmann, 2013). Hence, to account for the effects of FDI on regional inequality, the analysis controls for net

FDI inflows measured as the share of GDP. To account for different levels of regional inequality for the case of different levels of economic development, GDP per capita is included. Furthermore, to capture the importance of agricultural production in less developed economies, which might affect regional inequalities, the share of employment in the agricultural sector is controlled for.

Sources and definitions of all variables considered are provided in Table C4 in the Appendix C.1. The summary statistics of the variables are provided in Table C5 in the Appendix C.1. Additionally, Table C7 provides the pairwise correlations of the main variables with significance levels at the 1 % level denoted with an asterisk.

Results - Regional Inequality

Table 5.3 provides the regression results for equation 5.13 using the first three regional inequality measures. Results for the Gini index are depicted in columns (1) and (2), for the coefficient of variation in columns (3) and (4) and for the population-weighted coefficient of variation in columns (5) and (6). Each uneven column provides the simple regression and each even column additionally includes an interaction term between ODA and GDP per capita. This is done to account for the effects of foreign aid on regional inequality, depending on the level of economic development in recipient countries. All variables are transformed using the natural logarithm except the variables for the unemployment rate and agricultural employment. Furthermore, all regressions take country and year fixed effects into account.

It can be seen that foreign aid increases regional inequality measured with the Gini index, though significant only at the 10% level. Furthermore, regional inequality measured with the Gini index decreases with increasing GDP per capita. Contrary to theoretical predictions, the coefficient for log GDPpc is negative and highly significant at the 1% level. Theory would predict that regional inequalities increase at early stages of economic development and decrease after a certain level. Furthermore, trade and foreign direct investments (FDI) do not have any significant effect on regional Gini inequalities. Larger countries measured with the log of population and countries with higher unemployment rates do not exhibit higher regional Gini inequalities. However, higher urbanization rates and higher agricultural employment decrease the Gini regional inequality index, both coefficients being significant at the 5% level.

Furthermore, introducing the interaction term between foreign aid and GDP per capita in column (2) does not alter the coefficients of the explanatory variables considerably. Foreign aid still has increasing effects on regional inequality measured with the Gini index, being significant at the 10% level. On the other other hand, the coefficient for log GDP per capita is not significant anymore. However, the coefficient for the interaction term between foreign aid and GDP per capita exhibits a significant negative coefficient. The results imply that with increasing GDP per capita the positive impact of ODA on regional inequality decreases.

The same patterns can be observed when regional inequality is measured with the coefficient of variation, as shown in columns (3) and (4). Foreign aid again has an increasing effect on regional inequality measured with the coefficient of variation. The results further imply that more developed economies in sub-Saharan Africa exhibit lower regional inequalities, as is evident by the negative and significant coefficient of log GDP per capita in column (3). The effects of trade, FDI and unemployment rate on regional inequality are insignificant. Furthermore, urbanization rate does not exert any significant effect and agricultural employment significantly decreases the coefficient of variation. Introducing the interaction term between ODA and GDP per capita in column (4) does not change these patterns. The coefficient of the interaction term is negative and significant at the 5% level. Thus, the regional inequality increasing effects of ODA decrease in more economically developed countries.

The results change substantially considering the regression results using the weighted coefficient of variation as the measure of regional inequality. First, in column (5) the results imply that foreign aid does not have any significant effect on regional inequality measured with the weighted coefficient of variation, as does the level of economic development measured with GDP per capita. Additionally, the coefficient for the rate of urbanization is negative and highly significant, which implies that higher urbanization rates decrease regional inequalities measured with the weighted coefficient of variation. This pattern might be explained by the fact that the weighted coefficient of variation takes the share of population in each region into account. Thus, high GDP per capita in certain regions will attract a larger share of the population, which will result in the fact that the high GDP per capita in that region is ascribed to a larger share of population. Hence, higher urbanization rates indicate that more people live in urban regions which are generally more developed than the rest of the country, especially in sub-Saharan Africa, resulting in lower population-weighted regional inequalities. Furthermore, larger countries measured by the size of their population seem to exhibit higher regional inequalities measured with the

Table 5.3.: Regional Inequality static Panel data estimation with LSDV

	(1) log Gini	(2) log Gini	(3) log CV	(4) log CV	(5) log WCV	(6) log WCV
log ODA	0.047*	0.334*	0.047*	0.453**	0.036	0.411**
	(0.026)	(0.196)	(0.028)	(0.199)	(0.028)	(0.204)
log GDP pc	-0.167***	-0.077	-0.252***	-0.125*	0.030	0.147**
	(0.064)	(0.067)	(0.071)	(0.070)	(0.065)	(0.068)
log ODA x		-0.041*		-0.058**		-0.053**
log GDP pc		(0.025)		(0.025)		(0.026)
log Trade	0.014	0.002	0.021	0.003	0.033	0.018
	(0.040)	(0.042)	(0.043)	(0.044)	(0.043)	(0.045)
log FDI	0.007	0.008	0.006	0.009	0.008	0.010*
	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)
log Pop.	0.051	0.135	-0.014	0.105	0.553*	0.662**
	(0.264)	(0.294)	(0.277)	(0.304)	(0.295)	(0.323)
log Urbaniz.	-0.244**	-0.294**	-0.061	-0.132	-0.521***	-0.586***
	(0.115)	(0.125)	(0.130)	(0.140)	(0.129)	(0.135)
Unempl. Rate	0.004	0.004	-0.006	-0.005	-0.006	-0.005
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)
Agric. Empl.	-0.004**	-0.005***	-0.004***	-0.006***	-0.002	-0.003**
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Countries	38	38	38	38	38	38
Observations	615	615	615	615	615	615
R-squared	0.961	0.962	0.963	0.964	0.966	0.967

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

weighted coefficient of variation, though only significant at the 10% level. All other control variables do not exert any significant effect on regional inequality measured with the population-weighted coefficient of variation.

Introducing the interaction term between foreign aid and the level of economic development into the estimation, however, changes the coefficients considerably. The results imply that foreign aid increases regional inequalities measured with the weighted coefficient of variation. This effect is significant at the 5% level. Furthermore, more developed countries in sub-Saharan Africa exhibit higher weighted coefficients of variation, which contradicts the results when regional inequality is measured with the Gini coefficient or the coefficient of variation. On the other hand, this result is in line with theoretical predictions. Additionally, the interaction term between foreign aid and GDP per capita is negative and significant at the 5% level. Therefore, foreign aid increases regional inequalities measured with the weighted coefficient of variation and reverses its effects after a certain level of

GDP per capita. Moreover, the significant negative coefficient for the rate of urbanization implies that increases in the rate of urbanization have a decreasing effect on the weighted coefficient of variation. Also, the effect of population on regional inequality is positive and significant at the 5% level. Hence, larger countries exhibit higher weighted coefficients of variations. The results further imply that increasing agricultural employment decreases regional inequalities measured with the weighted coefficient of variation. The effect is small but significant at the 5% level. In addition, increasing FDI increases the weighted coefficient of variation to a small extent, however, the effect being significant only at the 10% level.

In sum, in the static panel estimation setup foreign aid appears to significantly increase regional inequalities measured with all three regional inequality measures, except in column (4). Increases in GDP per capita exhibit decreasing effects on the unweighted measures of regional inequality and increasing effects on the population-weighted coefficient of variation. On the other side, the coefficients for the interaction terms imply that the increasing effects of foreign aid on regional inequality decrease with higher GDP per capita. This effect is the same for the weighted and unweighted measures of regional inequality. Furthermore, higher levels of urbanization and agricultural employment decrease regional inequality almost in all specifications except in columns (4) and (5), respectively. Contrary to theoretical predictions, market openness, measured with trade and FDI, does not significantly affect regional inequalities. The coefficient for FDI only appears significant at the 10% level in column (6), when regional inequality is measured with the weighted coefficient of variation.

Results - Within and Between Regional Inequality

As mentioned earlier, it is possible to further decompose regional inequalities into between capital and non capital city regions and within these regions with the Theil entropy index. Hence, the subsequent analysis will look at regional inequalities by decomposing the Theil index to understand changes of regional inequalities within and between capital and non capital city regions induced by foreign aid. Table 5.4 provides the estimation results for using the between and within regional inequality shares of the Theil inequality index as the dependent variables. Again, each even column provides the regression results with an additional interaction term between foreign aid and GDP per capita.

The results in the first column imply that foreign aid measured with log ODA significantly increases regional inequalities between capital regions and all other regions. The coefficient is positive and statistically significant at the 1% level. Thus, increasing foreign aid results in increasing shares of between regional inequality. Levels of economic development measured with GDP per capita do not significantly affect the share of between regional inequality. Furthermore, countries with increasing rates of unemployment and higher agricultural employment exhibit higher shares of between regional inequality. Both coefficients are positive and significant at the 1% level.

Introducing the interaction term between foreign aid and GDP per capital into the regression (column (2)) reduces the significance of the coefficient for log ODA. However, the coefficient remains positive and is significant at the 5% level. Additionally, the coefficient for levels of economic development measured with GDP per capita is significant at the 5% level. Hence, countries with higher levels of economic development exhibit significantly higher shares of between regional inequalities. The coefficient of the interaction term of both variables is negative and significant at the 10% level, although very low in levels compared to the coefficients of both main effects. As a result, foreign aid and higher levels of economic development increase the share of between regional inequalities, even though both variables in conjunction have a small decreasing effect on the share of between regional inequality. The effects of unemployment and agricultural employment remain significantly positive as in column (1). In addition, increasing foreign direct investments increase the share of between regional inequalities. Albeit, the coefficient is only significant at the 10% level.

The coefficients for the estimation with within regional inequality share as the dependent variable in columns (3) and (4) are equal in absolute terms to the coefficients in columns (1) and (2), although, with opposite signs. This results from the construction of the between and within regional inequality variables as shares and the fact that both variables in every year add up to one hundred percent. While the share of between regional inequality measures one part of regional inequality, the share of within region inequality measures the other. Hence, if one share increases, the other share will necessarily decrease by the same amount. Thus, the effects which increase the share of between regional inequality will also decrease the share of within regional inequality.

The results in column (3) imply that foreign aid significantly decreases the share of within regional inequality of the Theil index. Countries with higher or lower levels

Table 5.4.: Between and within share of Regional Inequality between Capital and Non Capital City Regions (Panel data estimation with LSDV)

	(1) Btw. Share	(2) Btw. Share	(3) Wthn. Share	(4) Wthn. Share
log ODA	1.584***	7.694**	-1.584***	-7.694**
	(0.494)	(3.468)	(0.494)	(3.468)
log GDP pc	3.945	5.519**	-3.945	-5.519**
	(2.406)	(2.486)	(2.406)	(2.486)
log ODA x log GDP pc		-0.859*		0.859*
		(0.490)		(0.490)
log Trade	-1.539	-1.689	1.539	1.689
	(1.183)	(1.151)	(1.183)	(1.151)
log FDI	0.384	0.453*	-0.384	-0.453*
	(0.253)	(0.259)	(0.253)	(0.259)
log Pop.	0.421	1.846	-0.421	-1.846
	(8.746)	(8.859)	(8.746)	(8.859)
log Urbaniz.	-0.019	-2.317	0.019	2.317
	(6.638)	(6.780)	(6.638)	(6.780)
Unempl. Rate	0.337***	0.337***	-0.337***	-0.337***
	(0.119)	(0.119)	(0.119)	(0.119)
Agric. Empl	0.330***	0.276***	-0.330***	-0.276***
	(0.104)	(0.095)	(0.104)	(0.095)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Countries	38	38	38	38
Observations	350	350	350	350
R-squared	0.979	0.979	0.979	0.979

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

of economic development do not exhibit higher shares of within regional inequalities. Additionally, unemployment rate and agricultural employment significantly decrease within regional inequalities. Introducing the interaction term between foreign aid and GDP per capita again results in the same coefficients as in column (2), albeit with opposite signs. Higher levels of foreign aid and GDP per capita decrease the share of within regional inequality and the interaction term of both increases the share of within regional inequality. The coefficient of the interaction term is small relative to the coefficients of both main effects and is significant only at the 10% level. Even if both variables in conjunction increase the share of within regional inequalities, the effects of both variables by themselves are larger, and thus, decrease the share of within regional inequality. FDI decreases the share of within regional inequality, being only significant at the 10% level. Unemployment rate and agricultural employment remain statistically significant and reduce the share of within regional inequality.

In sum, foreign aid appears to significantly increase regional inequalities between capital and non capital city regions and decreases regional inequalities within these regions. Higher unemployment ratios and higher levels of agricultural employment significantly increase inequalities between capital and non capital city regions and decrease inequalities within these regions. Higher levels of economic development appear to significantly increase between regional inequalities and decrease inequalities within regions, however, only in those specifications which include an interaction term between foreign aid and GDP per capita. The coefficients for the interaction term further imply that foreign aid given to countries with higher GDP per capita reduces regional inequalities between capital and non capital city regions and increases within regional inequalities. However, the effect is marginal compared to the coefficients of both main variables.

However, these results from the static estimation with fixed effects (LSDV) may suffer from several drawbacks. First of all, the estimates may suffer from several endogeneity issues. Especially considering the relationship between foreign aid and regional inequality, it might be possible that donors take regional inequalities into account when deciding on disbursements of foreign aid. Endogeneity may also exist between the explanatory variables urbanization, FDI or agricultural employment and regional inequality. Another issue posses the fact that regional inequalities are highly persistent over time. Thus, dynamic panel estimation methods will be used to also account for small changes in regional inequalities over time. The subsequent section provides the methodology and estimation results for the dynamic panel estimation.

5.4.2. Dynamic Panel Estimation

To account for possible endogeneity problems explicitly, the further analysis will extend the previous estimation approach using dynamic panel estimation methods (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998). As already mentioned, the results based on LSDV estimation may suffer from simultaneity issues and reverse causation. On the one hand, regional inequality may be affected by foreign aid. On the other hand, the decision on aid disbursement may be driven by regional inequality in recipient countries. Disentangling the causality relationship between foreign aid and regional inequality may be difficult, as aid is expected to be higher in countries with high levels of poverty, but is also aimed

at reducing inequalities in recipient countries (Chong et al., 2009). Furthermore, personal and spatial inequalities are persistent phenomena over time (Boone and Simson, 2019). Hence, for the present analysis past levels of regional inequality may prove to be an important predictor of current levels of regional inequality. To account for these issues the estimation will use a dynamic panel specification. Roodman (2009b) points out that the difference and system Generalized Method of Moments (GMM) estimators address important modeling concerns, such as fixed effects and endogeneity of regressors, and additionally avoid the dynamic panel bias. The framework is applicable to unbalanced panels and multiple endogenous variables. [42] [43]

Methodology

The dynamic panel estimation procedure will estimate the following regression model for N countries and T time periods, where countries are indexed by i and years by t. Following the literature the analysis will use triennial data to account for small changes in regional inequality.

$$RegIneq_{it} = \beta_1 RegIneq_{i,t-1} + \beta_2 ODA_{it} + \sum_{j=1}^{k} \gamma_j X_{jit} + \alpha_i + \mu_t + \varepsilon_{it} \tag{5.14}$$

$RegIneq_{it}$ is one of the alternative measures of regional inequality, α_i are country fixed effects, μ_t denotes year fixed effects, X_{jit} are further explanatory variables affecting regional inequality, and ε_{it} is a random error term. Following the literature, the dynamic panel estimation will use triennial data to account for the persistence of regional inequalities over time. Table C6 in Appendix C.1 provides the summary statistics for the triennial data.

Incorporating a lagged dependent variable into the regression equation may result in several econometric problems. Time-invariant individual characteristics can be correlated with the explanatory variables, especially with the lagged dependent variable. This correlation will cause the Nickell (1981) bias, which disappears only if T tends to infinity for standard within-group estimators. Furthermore, explanatory variables may be endogenous and causality may run in both directions such that the regressors may be correlated with the error term. Dynamic panel data techniques

[42] In addition to the original papers, see Arellano (2003) and Bond (2002).

[43] This method is also widely used in the literature on income inequality and foreign aid (Chong et al., 2009; Castells-Quintana and Larrú, 2015; Pham, 2015).

can help resolve the causal effect of aid on inequality, in contrast to cross-country comparisons (Castells-Quintana and Larrú, 2015). Additionally, dynamic panel estimation methods are more appropriate to address difficulties that arise from highly persistent phenomena such as regional inequality. Lastly, heteroskedasticity is expected to be present because heterogeneous errors might exist with different panel members. In the face of such data and difficulties, the GMM method developed by Arellano and Bond (1991), and further developed by Arellano and Bover (1995) and Blundell and Bond (1998), produces more efficient and consistent estimators compared with other procedures.[44] For a more detailed discussion of the GMM-IV technique and necessary considerations for proper instrumentation see Appendix C.2.

System GMM estimation methods (Blundell and Bond, 1998) appear to be the most suitable for the present specific panel data with a relatively small number of yearly observations, heteroskedasticity and autocorrelation between observations from the same country. System GMM estimates rely on two equations. The first one uses instruments in levels for the first differenced equation and the other one uses instruments in first differences for the levels equation. The consistency of the GMM estimator depends on whether lagged values of the explanatory variables are valid instruments in the regression. This concern can be addressed by considering two specification tests suggested by Arellano and Bond (1991) and Arellano and Bover (1995). The first is a Sargan test or Hansen test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process.[45] Failure to reject the null hypothesis gives support to the instrument set and the model. The second test examines the hypothesis that the error terms are not serially correlated. The differenced error term is tested to determine whether a first- and second-order autocorrelation exist. First-order serial correlation of the differenced error term is expected to be observed even if the original error term in levels is uncorrelated, unless the latter follows a random walk. This results from the fact that difference GMM takes Equation 5.14 in first differences. Second-order serial correlation of the differenced residual, however, indicates that the original error term is serially correlated and follows a moving average process of at least order one. If the test fails to reject the null hypothesis of absence of second-order serial correlation, one can con-

[44]This approach has been used by Hansen and Tarp (2001) and Rajan and Subramanian (2008) in the context of the link between foreign aid and economic growth.

[45]The Sargan test is valid under the assumption of homoskedasticity and the Hansen test is applied in the case of heteroskedastic error terms.

clude that the original error term is serially uncorrelated and use the corresponding moment conditions (Chong et al., 2009). Both tests together protect against weak specification, because if the series are persistent and lagged levels are weak instruments for first differences, it may still be the case that lagged first differences have some explanatory power for levels (Durlauf et al., 2005).[46][47]

Results - Regional Inequality

The results for Equation 5.14 using system GMM estimation methods are presented in Table 5.5. The table provides the necessary test statistics, such as the Hansen-J test and the test for first- and second-order autocorrelation, at the bottom. The p-values for the Hansen-J tests provide evidence for the validity of the instruments used in all models. Given the high p-values of the Hansen-J tests it is not possible to reject the null hypothesis, which lends support to the models in all columns. Additionally, the test statistics for first- and second-order autocorrelation provide evidence that almost all models exhibit first-order autocorrelation with a significance below 5% (except in column (2) with a significance of 5.7%) and no second-order autocorrelation. These tests also give support for the model specifications in all six columns. The table additionally provides the number of instruments for each model at the bottom of the table.

Considering the coefficients for ODA in all specifications in Table 5.6 it appears that foreign aid does not significantly affect regional inequalities measured with either one of the three measures of regional inequality. Economically more developed countries with higher GDP per capita exhibit lower regional inequalities measured with the Gini coefficient. Higher GDP per capita also significantly reduces the coefficient of variations, although the effect does not remain robust in column (4) when the interaction term between foreign aid and GDP per capita is included. The coefficients for the interaction term are insignificant in all three models. In addition, higher trade ratios appear to significantly reduce regional inequality in all specifications. The coefficients for trade are significant at the 5% level for the Gini index

[46] Serial correlation tests, along with tests for over-identifying restrictions, are standard to check the validity of instruments. For instruments to be valid, first-order serial correlation, but not second-order, is expected.

[47] For specific model specification issues and guidance see Kiviet et al. (2017) and Kiviet (2020). Furthermore, Roodman (2009a) provides good instructions on implementing system GMM with the Stata module `xtabond2` and Kripfganz (2019) for the Stata module `xtdpdgmm`. For a detailed discussion of the instrument set of system GMM and necessary conditions for their validity see Roodman (2009b).

and at the 10% level for the coefficient of variation and the weighted coefficient of variation. More populated countries significantly exhibit higher regional inequalities measured with the Gini index. However, countries with higher population do not exhibit higher regional inequalities measured with the coefficient of variation or the weighted coefficient of variation. Furthermore, higher ratios of agricultural employment significantly reduce the weighted coefficient of variation in columns (5) and (6) and the Gini index in column (1). All other control variables, such as FDI, urbanization rate, unemployment rate, do not exhibit any significant effect on regional inequalities in all models. Hence, accounting for possible endogeneity issues between the independent variables and the dependent variable in a dynamic estimation setup provides different results compared to the static panel estimation results in Table 5.3.

The results show that foreign aid does not significantly affect regional inequalities measured with either one of the three measures. On the other hand, higher trade ratios appear to significantly reduce regional inequalities robustly throughout all specifications. Furthermore, the results contradict theoretical predictions that less developed economies will exhibit higher regional inequalities with increasing economic development. The coefficients for GDP per capita are negative in all specifications in Table 5.5 and only significant for regional inequalities measured with the Gini coefficient and for the coefficient of variation in column (3).

Next, to further extend the scope of the analysis levels of corruption and public expenditure will be included into the estimation. First, Table 5.6 provides the estimation results when control of corruption is included. Again, the Hansen-J tests at the bottom of the table give support for the instrument sets used in all models. Additionally, the autocorrelation tests indicate that there is no second-order autocorrelation but significant first-order autocorrelation. Although, the first-order autocorrelation for the coefficient of variation in columns (3) and (4) is only significant at the 5.18% and 5.4% level, respectively, and for all other specifications below 5% of significance. Hence, both tests give support for all model specifications in Table 5.6.

Foreign aid appears to significantly reduce regional inequalities measured with the coefficient of variation, being significant at the 10% level. However, foreign aid does not affect regional inequalities measured with the Gini index and the weighted coefficient of variation given the insignificant coefficients for ODA in all other specifications. It appears that accounting for levels of corruption control in recipient

Table 5.5.: Regional Inequality dynamic Panel data estimation with system GMM

	(1) log Gini	(2) log Gini	(3) log CV	(4) log CV	(5) log WCV	(6) log WCV
lagged log Gini	0.898***	0.821***				
	(0.105)	(0.085)				
lagged loc CV			0.887***	0.872***		
			(0.142)	(0.116)		
lagged log WCV					0.727***	0.727***
					(0.104)	(0.124)
log ODA	-0.014	-0.088	-0.030	0.035	0.006	-0.001
	(0.017)	(0.087)	(0.051)	(0.178)	(0.015)	(0.102)
log GDP pc	-0.126*	-0.158**	-0.117*	-0.094	-0.030	-0.028
	(0.065)	(0.071)	(0.066)	(0.095)	(0.086)	(0.089)
log ODA x		0.009		-0.006		0.000
log GDP pc		(0.010)		(0.023)		(0.015)
log FDI	0.002	0.002	-0.003	-0.001	0.002	0.002
	(0.004)	(0.006)	(0.009)	(0.010)	(0.008)	(0.008)
log Trade	-0.087**	-0.092**	-0.094*	-0.080*	-0.112*	-0.103*
	(0.033)	(0.043)	(0.049)	(0.047)	(0.064)	(0.058)
log Pop.	0.089**	0.071*	0.142	0.104	0.044	0.073
	(0.035)	(0.039)	(0.086)	(0.094)	(0.061)	(0.064)
log Urbaniz.	-0.002	0.100	-0.224	-0.137	0.033	-0.147
	(0.142)	(0.181)	(0.315)	(0.437)	(0.260)	(0.277)
Unempl. Rate	-0.004	-0.004	-0.007	-0.006	-0.004	-0.004
	(0.003)	(0.003)	(0.007)	(0.006)	(0.006)	(0.004)
Agric. Empl.	-0.005*	-0.004	-0.004	-0.004	-0.006*	-0.005**
	(0.003)	(0.004)	(0.007)	(0.005)	(0.003)	(0.002)
Observations	178	178	178	178	178	178
Countries	38	38	38	38	38	38
Instruments	30	32	30	32	30	32
Hansen-P	0.998	0.992	0.878	0.953	0.961	0.990
AR1	0.046	0.057	0.015	0.017	0.028	0.045
AR2	0.563	0.472	0.823	0.435	0.448	0.418

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

countries does result in significant negative effects of ODA on the coefficient of variation. The results further imply that higher control of corruption only significantly reduces the weighted coefficient of variation in column (5). However, higher control of corruption does not exhibit significant effects on regional inequality in any other specification in Table 5.6. Additionally, the coefficients for the interaction term between foreign aid and levels of corruption control do not exhibit any significance in all three specifications. Hence, more corruption control possibly resulting in lower corruption in recipient countries does not robustly result in lower overall regional inequalities. These results contradict theoretical predictions that more corruption will result in higher regional inequalities. On the other hand, higher corruption

Table 5.6.: Regional Inequality dynamic Panel data estimation with system GMM (controlling for Control of Corruption)

	(1) log Gini	(2) log Gini	(3) log CV	(4) log CV	(5) log WCV	(6) log WCV
lagged log Gini	0.883***	0.892***				
	(0.069)	(0.061)				
lagged log CV			0.858***	0.868***		
			(0.078)	(0.106)		
lagged log WCV					0.854***	0.769***
					(0.124)	(0.104)
log ODA	-0.030	-0.027	-0.054*	-0.057*	-0.003	0.005
	(0.022)	(0.018)	(0.032)	(0.028)	(0.015)	(0.014)
Corr. Contr.	-0.007	-0.003	0.015	0.006	-0.076*	-0.040
	(0.021)	(0.028)	(0.029)	(0.050)	(0.038)	(0.036)
log ODA x		-0.006		0.001		0.005
Corr. Contr.		(0.016)		(0.024)		(0.014)
log GDP pc	-0.210**	-0.202**	-0.311**	-0.329***	0.015	0.033
	(0.087)	(0.089)	(0.120)	(0.103)	(0.102)	(0.083)
log FDI	-0.003	-0.001	-0.008	-0.010	0.001	-0.001
	(0.008)	(0.006)	(0.012)	(0.009)	(0.006)	(0.005)
log Trade	-0.146***	-0.134**	-0.140**	-0.149***	-0.040	-0.059*
	(0.053)	(0.065)	(0.064)	(0.049)	(0.047)	(0.033)
log Pop.	0.080**	0.077	0.104*	0.131**	0.035	0.038
	(0.033)	(0.046)	(0.054)	(0.050)	(0.060)	(0.055)
log Urbaniz.	0.304*	0.309	0.403*	0.321	-0.175	-0.195
	(0.158)	(0.192)	(0.229)	(0.304)	(0.245)	(0.152)
Unempl. Rate	-0.005	-0.006	-0.009*	-0.009	-0.001	-0.001
	(0.004)	(0.005)	(0.005)	(0.007)	(0.004)	(0.004)
Agric. Empl.	-0.007*	-0.008*	-0.005	-0.004	-0.001	-0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	178	178	178	178	178	178
Countries	38	38	38	38	38	38
Instruments	32	34	32	34	32	34
Hansen-P	0.999	0.997	0.986	0.973	0.982	0.957
AR1	0.039	0.026	0.052	0.054	0.009	0.030
AR2	0.483	0.507	0.774	0.877	0.233	0.285

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

may possibly not affect overall regional inequalities but might still affect regional inequalities between certain regions or between urban and rural regions. However, this effect cannot be addressed with the current approach and with these three measures of overall regional inequality.

Furthermore, more economically developed countries exhibit significantly lower regional inequalities measured with the Gini index and the coefficient of variation. The coefficients are significant at the 5% level. Higher trade ratios again significantly reduce regional inequalities in almost all specifications except in column (5)

for the weighted coefficient of variation. More populated countries exhibit significantly higher regional inequalities measured with the coefficient of variation. Also, more populated countries have higher regional inequalities measured with the Gini index, although the effect does not remain robust when including the interaction term between control of corruption and foreign aid in column (2). Furthermore, countries with higher urbanization ratios exhibit higher regional inequalities measured with the Gini index and the coefficient of variation being significant at the 10% level. However, these effects disappear in the specifications with the interaction term between foreign aid and control of corruption in columns (2) and (4). Finally, higher agricultural employment reduces regional Gini inequalities, albeit significant only at the 10% level.

As a result, foreign aid appears to significantly reduce regional inequalities measured with the coefficient of variation, while both other measures of regional inequality remain unaffected by foreign aid. Countries with better corruption control exhibit lower regional inequality only in column (5) when the weighted coefficient of variation is considered as the measure of regional inequality. As before, the weighted coefficient of variation does not seem to be significantly affected by the explanatory variable as both other measures of regional inequality. This might be explained by potential internal migration such that regional differences tend to diminish when taking regional population into account. Higher trade ratios maintain their robust significant negative effect on regional inequality, except in column (5) for the weighted coefficient of variation.

Next, Table 5.7 provides the estimation results when additionally accounting for government expenditure. The p-values for the Hansen-J test at the bottom of the table again give support for the instruments used in all specifications. Furthermore, almost all models exhibit first-order autocorrelation well below the 5% level of significance except in column (2) with a significance of 7.2%. The statistics do not provide further evidence for second-order autocorrelation in any specification.

The coefficients in Table 5.7 imply that foreign aid decreases regional inequalities measured with the Gini index and the coefficient of variation in columns (1) and (3), being significant at the 5% and the 10% level, respectively. However, the significant negative effect disappears in the specifications with the interaction term between foreign aid and government expenditure in columns (2) and (4). Higher government expenditure, on the other hand, significantly increases regional inequalities measured with the coefficient of variation. Regional inequalities measured with the Gini

Table 5.7.: Regional Inequality dynamic Panel data estimation with system GMM (controlling for Gov't Expenditure)

	(1) log Gini	(2) log Gini	(3) log CV	(4) log CV	(5) log WCV	(6) log WCV
lagged log Gini	0.865***	0.925***				
	(0.083)	(0.104)				
lagged log CV			0.821***	0.843***		
			(0.104)	(0.124)		
lagged log WCV					0.764***	0.818***
					(0.097)	(0.091)
log ODA	-0.028**	0.004	-0.049*	0.036	-0.002	0.049
	(0.013)	(0.053)	(0.027)	(0.051)	(0.017)	(0.033)
log Gov't Exp.	0.034*	-0.007	0.051*	0.067***	-0.002	-0.010
	(0.019)	(0.018)	(0.029)	(0.024)	(0.055)	(0.018)
log ODA x		-0.011		-0.026		-0.022*
log Gov't Exp.		(0.019)		(0.016)		(0.012)
log GDP pc	-0.150**	-0.165**	-0.216**	-0.256**	-0.087	-0.110
	(0.060)	(0.064)	(0.106)	(0.116)	(0.069)	(0.080)
log FDI	0.002	-0.001	0.000	0.004	0.002	-0.000
	(0.006)	(0.006)	(0.007)	(0.008)	(0.006)	(0.007)
log Trade	-0.096**	-0.090**	-0.126*	-0.127**	-0.095*	-0.085**
	(0.040)	(0.044)	(0.064)	(0.050)	(0.051)	(0.039)
log Pop.	0.089*	0.104**	0.068	0.076	0.065	0.081*
	(0.048)	(0.040)	(0.061)	(0.062)	(0.051)	(0.045)
log Urbaniz.	0.070	0.046	0.331	0.430*	0.042	-0.004
	(0.153)	(0.109)	(0.316)	(0.232)	(0.221)	(0.247)
Unempl. Rate	-0.008***	-0.006**	-0.009*	-0.011***	-0.005	-0.003
	(0.003)	(0.003)	(0.005)	(0.004)	(0.005)	(0.003)
Agric. Empl.	-0.007**	-0.005*	-0.007	-0.011*	-0.007**	-0.005*
	(0.003)	(0.003)	(0.007)	(0.006)	(0.003)	(0.003)
Observations	173	173	173	173	173	173
Countries	38	38	38	38	38	38
Instruments	32	34	32	34	32	34
Hansen-P	0.998	0.997	0.979	0.998	0.985	0.985
AR1	0.039	0.072	0.0121	0.001	0.001	0.006
AR2	0.546	0.413	0.522	0.705	0.568	0.897

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

coefficient also increase with increasing government expenditure, though only significant at the 10% level. The effect does not remain when including the interaction term between foreign aid and government expenditure in column (2). Furthermore, the coefficient for the interaction term between foreign aid and government expenditure is significant at the 10% level only in column (6) for the weighted coefficient of variation. However, the weighted coefficient of variation seems unaffected by either foreign aid or government expenditure separately.

The results further imply that increases in GDP per capita significantly reduce re-

gional inequalities measured with the Gini index and the coefficient of variation. Higher trade ratios again significantly decrease regional inequalities in all speci- fications. Larger population appears to significantly increase the Gini index and the weighted coefficient of variation in column (6). Furthermore, contrary to previous results higher unemployment rates appear to significantly decrease regional inequalities measured with the Gini index and the coefficient of variation but the weighted coefficient of variation seems unaffected by unemployment rates. The fact that controlling for government expenditure results in significant negative coefficients for unemployment rate might be hint for a connection between government expenditure and employment. As Huber et al. (2006) and Lee (2005) have pointed out social spending mainly favors those employed in the formal sector, which is more pronounced in less democratic countries. However, the current analysis will not look further into this relationship. Additionally, higher rates of agricultural employment significantly decrease regional inequalities in almost all columns except in column (3).

In sum, including government expenditure in the estimation results in significant negative effects of foreign aid on the Gini coefficient and the coefficient of variation. Though, the effects do not remain in those specifications with the interaction term. Government spending significantly increases the coefficient of variation and the Gini coefficient in the specification without the interaction term in column (1). The effects of trade on regional inequality remain robust and are significantly negative in all specifications. Finally, controlling for government expenditure results in significant negative coefficients for the unemployment rate when regional inequality is measured with the Gini coefficient and the coefficient of variation.

Results - Within and Between Regional Inequality

Next, the analysis will consider the between and within regional inequality shares of the Theil index to understand the impact of foreign aid on regional inequality when regions are grouped together by capital and non capital ADM1 regions. Table 5.8 provides the results for the dynamic panel estimation using system GMM with between and within regional inequality as the dependent variables. The bottom of the table again provides the results of the necessary test statistics such as the Hansen-J test and the tests for first- and second-order autocorrelation. The statistics provide support for the specifications in all models. The overidentification tests cannot be rejected in all models due to the large p-values of the Hansen-J test, thus,

the used instrument set is valid. Furthermore, given the low p-values of the AR(1) tests and the high p-values of the AR(2) tests in all models, the null hypothesis of no first-order autocorrelation can be rejected, and the null hypothesis of no second-order autocorrelation cannot be rejected. Hence, the models in all columns pass the specification tests of first and second order autocorrelation.

The results in Table 5.8 provide no evidence for any effects of foreign aid on regional inequality between capital regions and non capital regions and within either of both groups of regions. Additionally, no other control variable appears to significantly affect within and between regional inequalities between capital and non capital regions. This might result from the fact that the number of instruments, given at the bottom of the table, had to be reduced compared to previous dynamic estimation procedures because of fewer countries in the panel. Thus, the lack of evidence may result from the limited instrument set due to fewer countries in the panel. This is especially problematic considering that between and within regional inequalities are even more persistent than overall regional inequalities. The discussion of the data of within and between regional inequality in Section 5.3.3 only discusses patterns in countries with the largest changes in the sample. However, between and within regional inequalities in the entire sample are even more persistent than overall regional inequalities.

Table 5.8.: Regional Inequality between and within Capital and Non Capital Regions dynamic panel estimation with system GMM

	(1) Btw. Share	(2) Btw. Share	(3) Wthn. Share	(4) Wthn. Share
lagged Btw. Share	0.827***	0.725***		
	(0.288)	(0.235)		
lagged Wthn. Share			0.813**	0.674**
			(0.341)	(0.302)
log ODA	-0.385	-1.172	0.347	6.992
	(1.306)	(24.723)	(1.416)	(25.766)
log GDP pc	1.582	2.679	-1.517	-2.723
	(4.599)	(8.346)	(4.641)	(5.844)
log ODA x		0.052		-0.790
log GDP pc		(3.214)		(3.598)
log FDI	-0.654	-0.463	0.633	0.694
	(0.392)	(1.700)	(0.428)	(1.497)
log Trade	-0.596	0.201	0.585	-0.169
	(0.794)	(2.320)	(0.842)	(2.395)
log Pop.	-2.834	-6.997	3.725	9.972
	(5.899)	(9.642)	(6.981)	(11.802)
log Urbaniz.	9.102	22.862	-8.958	-25.722
	(12.911)	(29.634)	(12.986)	(39.754)
Unempl. Rate	1.003	1.052	-0.966	-0.930
	(1.209)	(1.093)	(1.294)	(0.900)
Agric. Empl.	0.185	0.300	-0.181	-0.452
	(0.198)	(0.326)	(0.202)	(0.285)
Observations	101	101	101	101
Countries	21	21	21	21
Instruments	20	22	20	22
Hansen-P	0.897	0.927	0.899	0.952
AR1	0.007	0.050	0.004	0.007
AR2	0.850	0.296	0.919	0.188

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Given the limited instrument set and the higher persistence of between and within regional inequalities, the estimation could not detect any significant effects of foreign aid on regional inequalities between capital and non capital city regions and within both groups of regions.

Table 5.9 provides the estimation results when introducing control of corruption and additionally the interaction term between foreign aid and control of corruption into the regressions. The specification tests at the bottom again give support for the model specification and instrument sets in all columns. The results imply that foreign aid does not affect between and within regional inequalities in those specifications excluding the interaction term. Columns (1) and (3) do no provide any

Table 5.9.: Regional Inequality between and within Capital and Non Capital Regions dynamic panel estimation with system GMM (controlling for Control of Corruption)

	(1) Btw. Share	(2) Btw. Share	(3) Wthn. Share	(4) Wthn. Share
lagged Btw. Share	0.837***	0.780**		
	(0.275)	(0.316)		
lagged Wthn. Share			0.873**	0.762**
			(0.379)	(0.339)
log ODA	-0.148	6.310*	0.100	-6.151*
	(1.156)	(3.150)	(1.390)	(3.382)
Corr. Contr.	0.620	-11.151*	-0.586	10.891*
	(2.021)	(5.362)	(2.486)	(5.788)
log ODA x Corr. Contr.		6.100**		-6.008*
		(2.920)		(3.160)
log GDP pc	-1.076	5.001	1.725	-4.740
	(4.400)	(7.380)	(5.843)	(7.427)
log FDI	-0.380	-0.408	0.538	0.388
	(0.496)	(0.632)	(0.934)	(0.662)
log Trade	0.261	-3.175*	-0.559	3.022
	(1.183)	(1.707)	(1.090)	(1.997)
log Pop.	-3.985	-4.336	3.573	5.381
	(8.056)	(5.454)	(13.473)	(5.446)
log Urbaniz.	17.871	10.652	-15.052	-10.063
	(32.609)	(14.553)	(47.112)	(16.226)
Unempl. Rate	0.029	0.026	0.184	-0.059
	(0.775)	(0.413)	(0.703)	(0.448)
Agric. Empl.	0.151	0.040	-0.175	-0.057
	(0.142)	(0.242)	(0.177)	(0.258)
Observations	101	101	101	101
Countries	21	21	21	21
Instruments	22	23	22	23
Hansen-P	0.970	0.944	0.976	0.928
AR1	0.083	0.063	0.070	0.069
AR2	0.287	0.173	0.382	0.163

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

significant effects of the explanatory variables on the dependent variable. Including the interaction term between foreign aid and control of corruption in columns (2) and (4), however, results in significant coefficients for log ODA, for control of corruption and for the interaction term of both. Albeit, the coefficients are significant at the 10% level and for the interaction term in column (2) at the 5 % level. The results imply that foreign aid significantly increases the between regional inequality share of the Theil index and significantly decreases the within regional inequality share.

The reducing effect of foreign aid on within regional inequality provides some evidence for proper implementation of aid projects within capital and non capital city regions in recipient countries. On the other hand, the increasing effect of foreign aid on between regional inequality may indicate two possible patterns. It might be that foreign aid increases GDP per capita in already richer capital city regions, thus further increasing differences in economic performance. The other channel might be that non capital city regions, which are already performing better than capital city regions, exhibit increasing GDP per capita with more aid flows. Moreover, considering average regional inequalities in recipient countries and their decomposition, as shown in Table 5.2, it becomes apparent that, on average, non capital city regions exhibit higher GDP per capita than capital city regions. Capital city regions exhibit on average higher GDP per capita only in six out of 21 countries. Hence, the data and the results provide evidence for the latter channel such that between regional inequality increases because non capital city regions experience increases in GDP per capita with increasing foreign aid. Still, the current approach does not enable one to precisely determine whether foreign aid increases GDP per capita in capital city or in non capital city regions. However, the results indicate that foreign aid does increase already existing economic differences between capital and non capital city regions, resulting in increases in between regional inequality. Although as mentioned earlier, the effects are not robust in all specifications and only significant at the 10 % level.

Furthermore, better control of corruption significantly decreases the between share of regional inequalities between capital and non capital city regions, and accordingly decreases the within share of regional inequality. This implies that lower corruption in recipient countries enhances convergence in economic performance between capital and non capital city regions. On the other side, improvements in corruption control increase the share of within regional inequality, which are generally high across countries in the sample. Furthermore, the coefficients for the interaction terms indicate that aid flows into recipient countries with higher corruption control increase the share of between and decrease the share of within regional inequalities. As a result, foreign aid in conjunction with control of corruption worsens between regional inequalities and improves within regional inequalities. These patterns can better be understood by considering the margins plots in Figures C.11 and C.12 in Appendix C.1. The left panel in Figure C.11 shows that higher control of corruption given a constant amount of foreign aid results in higher between regional inequality. The right panel in Figure C.11 shows the graph for the effects of foreign aid on between regional inequality for a given level of corruption control in recipient countries. Given

certain levels of corruption control, larger amounts of foreign aid appear to increase between regional inequalities. Obviously, the slopes of the graphs in both figures are positive due to the positive coefficient of the interaction term between foreign aid and control of corruption. The opposite effects can be observed for within regional inequalities in Figure C.12. Additionally, out of the remaining independent variables only the coefficient for trade in column (2) appears significantly negative at the 10% level.

Table 5.10 provides the estimation results for including government expenditures in recipient countries into the regressions. The test statistics at the bottom of the table provide support for the model specifications in all columns. The models do not appear to be overidentified due to the large p-values of the Hansen-J test. Furthermore, the models in columns (1) and (3) exhibit first-order autocorrelation below 10% and in column (2) and (4) below 5% of significance and no second-order autocorrelation in any models.

Again, the results in Table 5.10 provide no significant effects of any independent variable on between and within regional inequalities. Hence, no effects of foreign aid and government expenditure or any other variable on the between and within share of regional inequality could be detected. Again, this might result from the limited instrument set due to fewer countries in the sample and the highly persistent dependent variables.

In sum, it appears that the number of distinct countries in the sample is too small to be able to properly instrument the independent variables. Additionally, the measures of between and within regional inequalities of capital and non capital regions are even more persistent than overall regional inequality measures. The high persistence, on the other hand, requires a sufficiently large instrument set to adequately model the dynamic behavior of each variable. Therefore, with the relative small number of countries it is not possible to properly estimate the effects of foreign aid and the other explanatory variables on between and within regional inequalities of capital and non capital city regions. Furthermore, the dependent variables of between and within regional shares of the Theil index use population weighted measures of regional inequalities to account for differences in population within both groups of regions. Previous results analyzing overall regional inequality showed that the effects of the explanatory variables on the population-weighted measure of regional inequality are not as pronounced compared to the unweighted measures. As mentioned earlier, regional differences in economic performance do not seem as

Table 5.10.: Regional Inequality between and within Capital and Non Capital Regions dynamic panel estimation with system GMM (controlling for Gov't Expenditure)

	(1) Btw. Share	(2) Btw. Share	(3) Wthn. Share	(4) Wthn. Share
lagged Btw. Share	0.939**	0.959**		
	(0.374)	(0.371)		
lagged Wthn. Share			0.954**	0.985**
			(0.400)	(0.406)
log ODA	-0.128	-0.797	-0.026	0.490
	(3.379)	(4.333)	(2.966)	(4.124)
log Gov't Exp.	0.333	-0.019	-0.066	0.079
	(2.918)	(2.072)	(2.900)	(2.110)
log ODA x		0.111		-0.085
log Gov't Exp.		(1.366)		(1.389)
log GDP pc	-0.747	1.329	-0.280	-1.654
	(9.074)	(7.898)	(8.681)	(8.151)
log FDI	-0.711	-0.620	0.618	0.599
	(1.614)	(0.618)	(1.549)	(0.614)
log Trade	1.231	3.074	-1.164	-3.029
	(1.199)	(3.058)	(1.166)	(3.010)
log Pop.	-8.072	-8.895	9.542	9.504
	(15.727)	(26.341)	(16.655)	(28.824)
log Urbaniz.	33.983	39.820	-38.808	-43.484
	(52.746)	(56.440)	(57.908)	(58.937)
Unempl. Rate	-0.307	0.124	0.382	-0.013
	(1.231)	(0.657)	(1.151)	(0.692)
Agric. Empl.	0.209	0.331	-0.206	-0.329
	(0.402)	(0.283)	(0.395)	(0.295)
Observations	96	96	96	96
Countries	21	21	21	21
Instruments	22	23	22	23
Hansen-P	0.953	0.970	0.950	0.966
AR1	0.059	0.030	0.069	0.020
AR2	0.150	0.278	0.168	0.234

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

pronounced when taking regional population into account. This further increases the persistence of population weighted measures possibly caused by internal migration. Given these difficulties and the data on hand it was not possible to further include the sub-group component of between and within regional inequality as the dependent variable into the empirical analysis. The estimation with difference and system GMM resulted in invalid test statistics. Thus, the patterns and levels of the sub-group components of between and within regional inequality distinguished by capital and non capital city regions could only be discussed descriptively in Section

5.3.3. However, the discussion of the regional inequality data distinguished by capital and non capital city regions delivered some interesting insights on differences in economic development in both regions and their patterns over the years.

As a result, the analysis of foreign aid on between and within regional inequalities could not generate robust and significant results. Only in the models including corruption control and the interaction term between corruption control and foreign aid did it appear that foreign aid increases the between share and decreases the within share of regional inequality, although only significant at the 10% level.

5.5. Discussion

As already noted in Section 5.3.1, the measures of regional inequality and the empirical results need to be taken cautiously. For instance, differences between countries concerning large uninhabitable regions, such as deserts or tropical forests, will bias the inequality measures and may lead to false interpretations. Furthermore, differences in the definition of areal units at different scales affecting the number of sub-national units and regional borders will also have an effect on regional inequality measures. Hence, Boone and Simson (2019) conclude that statistical analysis and inference of factors affecting regional inequality at the national or cross national level still exhibit several challenges. Also considering that ADM1 regions are possibly too large and the number of ADM1 regions vary across countries such that inequality measures do not capture the entire picture and range too widely across countries. However, these measures of regional inequality pose considerable possibilities for descriptive inference to understand levels and dynamics of regional inequalities in African countries (Boone and Simson, 2019). This was shown in the description of the regional inequality data in Sections 5.3.2 and 5.3.3.

Additionally, another important factor affecting regional inequalities is internal migration. Internal migration has not been accounted for in the current analysis due to lack of data for all countries in the sample. Moreover, regional economic differences within countries may affect internal migration such that richer regions attract more people from poorer regions. Thus, accounting for regional population with population-weighted inequality measures may result in less pronounced differences in economic performance between regions. The differences in the estimation results considering unweighted and population-weighted measures of regional inequality in-

dicate that it does make a difference whether the emphasis is put on areal territory or on population in the context of regional inequality. The weighted coefficient of variation does not appear to be affected by the explanatory variables as much as the Gini index or the coefficient of variation.

Another concern is the relatively small sample size compared to yearly observations. This poses limitations to the instrument sets used in the dynamic panel estimation with system GMM. The system GMM estimation procedure improves in efficiency when the number of observations N tends to infinity for a fixed number of years T. This limitation does not seem to be as problematic for the dynamic estimation of overall regional inequality as for the dynamic estimation of between and within regional inequality with the reduced sample size. Thus, the empirical estimation of the effects of foreign aid on within and between capital and non capital city regional inequality could not detect any significant effects.

5.6. Summary

The current chapter aimed to measure the effects of foreign aid on overall regional inequality and on regional inequality between and within capital and non capital city regions. First, different measures of regional inequality and their limitations were discussed. Afterward, these measures of regional inequality were calculated for sub-Saharan African countries over the years 1998 till 2015 using sub-nationally disaggregated GDP data provided by Kummu et al. (2018). The discussion of regional inequalities in sub-Saharan Africa showed large differences within and between countries and that regional inequality are highly persistent in the entire sample.

To measure the effects of foreign aid on regional inequalities the empirical analysis first relied on static panel estimation methods. The results indicate a significant positive effect of foreign aid on regional inequality and on between regional inequality between capital and non capital city regions. However, these results need to be taken cautiously because they may suffer from several endogeneity issues considering that foreign aid and regional inequality are not entirely independent of each other.

Thus, the estimation procedure was extended by dynamic panel estimation methods using system GMM. Additionally, given the fact that regional inequalities are highly persistent, dynamic panel estimation with system GMM enables one to in-

clude past observations of regional inequality to explain current inequalities. The results from the dynamic panel estimation indicate the opposite compared to the results in the static panel estimation concerning the effects of foreign aid on regional inequality. Foreign aid appeared to not increase regional inequalities, but instead to significantly reduce regional inequalities in some specifications including control of corruption and government expenditure. However, these effects are not robust throughout all specifications.Still, no result indicated that foreign aid does have a significant increasing effect on regional inequality. The effects are either negative or non existent.

Interestingly, increasing GDP per capita significantly reduces the unweighted measures of regional inequality, the Gini index and the coefficient of variation, and does not have any effect on the weighted coefficient of variation. Thus, the results contradict theoretical predictions that less developed countries will exhibit increasing regional inequalities with increasing economic development. The results either imply that the dynamic of regional inequality in sub-Saharan Africa does not follow the same pattern as theory would suggest. Or, another explanation could be that sub-Saharan countries are no longer less developed in absolute terms, even though they remain relatively poor compared to more developed countries. As a result, levels of economic development might be high enough such that regional inequalities have already passed their maximum peak and are on the declining path of the U-shaped Kuznets curve. This would result in the fact that further increases in GDP per capita lead to decreases in regional inequality. Furthermore, higher trade ratios significantly reduce regional inequalities. This relationship remains robust in all specifications.

Additionally, the estimation using the decomposition of regional inequalities by within and between capital and non capital city regions could not detect any significant effects in almost all model specifications. As already noted, this results from the limited instrument set due to fewer countries in the sample and the high persistence of within and between regional inequality. Only in those models including control of corruption and the interaction term between foreign aid and control of corruption some effects could be detected. The results indicate that foreign aid decreases the within share and increases the between share of regional inequality between capital and non capital city regions. However, these effects could not be further entangled to understand whether foreign aid affects GDP per capita in capital city regions or in all other regions.

In sum, the results do not support the assumption that foreign aid increases regional inequalities. The uneven distribution of aid projects sub-nationally, shown in several studies, does not appear to significantly affect overall regional inequalities.

6. Conclusion

Even after gaining independence from Western colonial rule most African countries did not experience considerable economic growth. According to World Bank data, sub-Saharan African countries accounted for around 2% of total world income with a population share of almost 14% in 2017. Additionally, indicators measuring human well-being, such as life expectancy or education, show that sub-Saharan African countries lag far behind the worldwide average. There have been several attempts to help poor and developing countries to overcome certain obstacles for economic development and improve living conditions, mainly with foreign aid funds.

Over the years there have been several different declarations by international organizations and multilateral donors which served as a basic guideline for development and economic policy in developing countries. As shown in Chapter 2, fundamental ideas stated in these policy advisory documents were driven by the current theory on economic growth and development and by contemporary problems, which less developed economies faced. Hence, Chapter 2 first provides a broad overview of the theory on economic growth and development and the literature on foreign aid. Furthermore, different developmental policy prescriptions and the role of the World Bank, as an important multilateral donor, are discussed. However, given the lack of evidence of foreign aid promoting sustained economic growth in sub-Saharan African countries, these regularly changing declarations and policy recommendations indeed appear like 'old wine in new bottles', as Rist (2019) already noted.

To obtain a more precise look at foreign aid and its distribution sub-nationally, Chapter 3 uses newly available data for sub-nationally disaggregated aid projects. The results show that incumbent presidents' birth regions do not significantly attract more project aid than other regions. On the other hand, capital city regions attract significantly more project aid, which decreases with improving governance in recipient countries. Especially aid projects are assumed to be subject to high scrutiny by donors, and thus provide an alternative to other lending instruments.

However, the results provide evidence that the sub-national distribution of project aid is also affected by recipient countries' governance. These results are in line with the results in the literature providing evidence for the fact that project aid not being entirely unaffected by recipient countries governance. Thus, using newly available data the research is able to analyze in more detail the implementation and allocation of foreign aid within recipient countries and its effectiveness on improving human living conditions or increasing economic development.

With increasing availability of sub-nationally disaggregated economic data, regional inequality gained increased attention. Also considering the uneven sub-national distribution of aid projects, as shown in Chapter 3 and in recent literature, the effects of foreign aid on regional inequality poses an important question. To be able to correctly address the effects of foreign aid on regional inequality, Chapter 4 first provides a review of different theories about regional development and regional inequality. Additionally, the chapter also elaborates on the empirical evidence of factors affecting regional inequality and discusses recent levels and trends of inequality in sub-Saharan Africa.

Chapter 5 assesses the effects of foreign aid on regional inequality in sub-Saharan Africa. First, different measures of regional inequalities and possible challenges for a proper interpretation of such measures are discussed. Using newly available disaggregated data on sub-national GDP, different measures of regional inequality were calculated for sub-Saharan African countries over the years from 1998 till 2015. The discussion of the data on regional inequality in sub-Saharan Africa showed large differences within and between countries and that regional inequality is highly persistent. These measures of regional inequality were further used in a static and dynamic panel estimation set up to measure the effects of foreign aid on regional inequality. The results from the static panel estimation are not trustworthy due to serious endogeneity concerns, however, the results from the dynamic panel estimation did provide some insights. Some reducing effects of foreign aid on regional inequality could be observed in the specifications including control of corruption and government expenditure. However, these effects do not remain robust in all specifications. Furthermore, increasing GDP per capita significantly reduces unweighted measures of regional inequality and does not affect the population weighted measure. Interestingly, higher trade ratios significantly reduce regional inequalities in all specifications.

Decomposing regional inequality by capital and non capital city regions did not

deliver robust significant results. This is mainly driven by the limited instrument sets in all models due to the reduced sample of countries. However, only in those models including control of corruption and the interaction term between foreign aid and control of corruption could some significant effect be detected. The results indicate that foreign aid decreases the within share and increases the between share of regional inequality between capital and non capital city regions. As a result, the analysis could not find any evidence for the assumption that foreign aid increases regional inequalities.

In sum, discussions in the literature on foreign aid, necessary conditions for its successful implementation, and its effects on recipient countries remains inconclusive. The economic theory and policy addressing development strategies in less developed countries are still highly disputed. However, given the availability of more detailed data on foreign aid and aid projects recent analysis are able to take a deeper look at the sub-national or regional level of project implementation, in contrast to country level data. Thus, the previous chapter used such newly available data to analyze the sub-national distribution of foreign aid and its effects on regional inequality in sub-Saharan African countries.

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A. Appendix to Chapter 1 – Introduction

Table A1.: GDP and GDP per capita by country income group between 1960/1986 and 2018

Country Income Group	GDP (const. 2010 billion US$)		Perc. Increase	GDP pc 2010 US$)		Perc. Increase
Year	1960	2018		1960	2018	
High income	9025.1	52719.6	484.1	11872.1	43558.7	266.9
Middle income	2168.8	29236.6	1248.1	1026.4	5148.6	401.6
sub-Saharan Africa (excluding high income)	253.3	1788.5	606.1	1115.0	1658.8	48.8
Year	1986	2018		1986	2018	
Low Income	166.0	521.8	214.3	556.1	739.8	33.0

B. Appendix to Chapter 3 – The Influence of Institutions on the Sub-National Allocation of Aid Projects. A Panel Data Analysis

B.1. Tables and Figures

Table B1.: Descriptive Statistics of AidData by Projects

Number of Aid Projects	437
Number of Project Locations	5,651
Avg. Project Locations (per Project)	12.93
Total Dollar Commitments (in Mio.$)	21,158.1
Avg. Commitments (per Project in Mio.$)	48.42

Table B2.: Descriptive Statistics AidData by Countries

	Obs.	Mean	Std.Dev.	Min.	Max.
Projects per Country	38	12.82	8.01	2	29
Project Locations per Country	38	148.71	153.23	10	738
Avg. Project Locations (per Country)	38	10.23	4.78	3.50	28.38
Total Dollar Commitments (per Country in Mio. $)	38	556.79	758.74	2.86	2993.65
Avg. Dollar Commitments (per Country in Mio. $)	38	32.88	28.79	0.60	115.14

Table B3.: Sectoral distribution of WB projects

Sector	Projects Locations	Projects	Commitments (million US $)
Public Administration, Law, and Justice	651	76	2,461.07
Agriculture, Fishing, and Forestry	1100	79	2,099.44
Industry and Trade	109	12	583.49
Energy and Mining	732	71	4,063.29
Finance	8	8	78.10
Informations and communications	55	5	97.76
Transportation	1391	70	6,169.36
Education	143	16	508.05
Health and other social services	974	45	2,374.96
Water, sanitation and flood protection	488	55	2,722.53
Total	5,651	437	21,158.06

Table B4.: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min.	Max.
ln(Aid $)	3,862	2.36	11.08	-6.91	19.38
ln(Proj.Loc.)	3,862	-3.51	3.84	-6.91	4.39
Pres.Birthpl.	6,480	0.07	0.26	0.00	1.00
Capital	6,480	0.07	0.26	0.00	1.00
Control of Corruption (WGI)	5,940	-0.72	0.52	-1.55	1.22
Rule of Law (WGI)	5,940	-0.71	0.56	-2.01	0.73
Gov't Effectiveness (WGI)	5,940	-0.72	0.50	-1.88	0.73
Regulatroy Quality (WGI)	5,940	-0.58	0.51	-2.03	0.80
% Batlles	6,480	5.60	16.29	0.00	100.00
ln(Battles)	6,480	-4.29	3.93	-6.91	5.83
% Area	6,480	7.04	7.60	0.00	52.82
ln(Area)	6,480	9.29	1.84	3.01	13.35
% Population	6,480	7.04	7.15	0.08	62.23
ln(Population)	6,480	13.20	1.35	7.99	17.29

Table B5.: Descriptive Statistics on Project Aid by recipient countries

#	Country	Projects	Project locations	Commitments (million US $)
1	Angola	5	77	372.00
2	Benin	18	180	431.18
3	Botswana	6	38	512.97
4	Burkina Faso	13	91	365.53
5	Burundi	11	144	275.16
6	Cameroon	14	105	529.09
7	Centr. Afr. Rep.	8	40	120.47
8	Chad	8	59	169.86
9	Cote d'Ivoire	6	47	299.18
10	DR Congo	26	452	2085.57
11	Djibouti	7	55	44.94
12	Ethiopia	26	338	2563.84
13	Gabon	2	10	31.67
14	Gambia	4	14	3.25
15	Ghana	22	340	973.67
16	Guinea	12	150	144.01
17	Guinea-Bissau	8	44	43.64
18	Kenya	29	325	2021.15
19	Lesotho	6	49	72.77
20	Liberia	12	99	114.08
21	Madagascar	11	119	417.76
22	Malawi	10	122	167.23
23	Mali	22	218	774.38
24	Mauritania	12	47	139.80
25	Mozambique	21	178	714.42
26	Namibia	2	21	2.86
27	Niger	7	75	297.59
28	Nigeria	26	738	2993.65
29	Rep. of Congo	6	105	83.11
30	Rwanda	13	93	119.54
31	Senegal	18	177	417.66
32	Sierra Leone	10	87	140.43
33	South Africa	7	34	4.18
34	Swaziland	2	28	44.68
35	Tanzania	29	453	1933.49
36	Togo	7	55	67.68
37	Uganda	23	305	1098.64
38	Zambia	18	139	566.93
	Total	487	5651	21158.06

Note: The sum of the number of projects given in this table exceeds the total number of projects used in the analysis because some projects are located in more than one country.

Figure B.1.: Project Locations

Figure B.2.: Project Locations (weighted by US $ commitments)

Table B6.: African Leaders in the sample and their Birthplaces

Country	Leader Name	Entered Office	Left Office	Birthregion ADM1	Ethnicity
Angola	Jose Eduardo dos Santos	10.09.1979	ongoing	Luanda	Kimbundu
Benin	Mathieu Kerekou	04.04.1996	06.04.2006	Atakora	Somba
Benin	Thomas Yayi Boni	06.04.2006	ongoing	Bourgou	Yoruba
Botswana	Festus Mogae	31.03.1998	01.04.2008	Central	Kalanga
Burkina Faso	Blaise Compaore	15.10.1987	31.10.2014	Plateau Central	Mossi
Burundi	Pierre Buyoya	25.07.1996	30.03.2005	Bururi	Tutsi
Burundi	Domitien Ndayizeye	30.04.2005	26.08.2005	Kayanza	Hutu
Burundi	Pierre Nkurunziza	26.08.2005	ongoing	Bujumbura Mairie	Hutu
Cameroon	Paul Biya	11.06.1982	ongoing	Sud	Beti
Centr. Afr. Rep.	Ange-Felix Patasse	22.10.1993	15.03.2003	Ouham-Pende	Sara-Kaba
Chad	Idriss Deby	02.12.1990	ongoing	Ennedi	Zaghawa
Cote d'Ivoire	Robert Guei	24.12.1999	26.10.2000	Dix-Huit Montagnes	Yakouba
Cote d'Ivoire	Laurent Gbagbo	26.10.2000	11.04.2011	Fromager	Krou (Bete)
Cote d'Ivoire	Alassane Ouattara	11.04.2011	ongoing	N'Zi-Comoe	Dioula
DR Congo	Laurent-Desire Kabila	16.05.1997	16.01.2001	Katanga	Luba
DR Congo	Joseph Kabila	17.01.2001	ongoing	Sud-Kivu	Luba
Ethiopia	Meles Zenawi	23.08.1995	20.08.2012	Tigray	Tigray-Tigrinya
Gabon	Omar Bongo Ondimba	28.11.1967	08.06.2009	Haut-Ogoouè	Teke
Gambia	Yahya Jammeh	22.07.1994	ongoing	Western	Jola
Ghana	Jerry Rawlings	07.12.1981	07.01.2001	Greater Accra	Ewe
Ghana	John Agyekum Kufuor	07.01.2001	07.01.2009	Ashanti	Asante
Ghana	John Evans Atta-Mills	01.07.2009	24.07.2012	Western	Fanti
Guinea	Lansana Contè	04.03.1984	22.12.2008	Kindia	Susu
Guinea	Moussa Dadis Camara	24.12.2008	03.12.2009	Nzèrèkorè	Kpelle

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Table B6 – African Leaders in the sample and their Birthplaces - *continued*

Country	Leader Name	Entered Office	Left Office	Birthregion ADM1	Ethnicity
Guinea	Sekouba Konatè	03.12.2009	21.12.2010	Conakry	Mandinka
Guinea	Alpha Condè	21.12.2010	ongoing	Bokè	Mandinka
Guinea-Bissau	Malam Bacai Sanha	14.05.1999	17.02.2000	Quinara	Mandinka
Guinea-Bissau	Kumba Iala	18.02.2000	14.09.2003	Cacheu	Balante
Guinea-Bissau	Henrique Pereira Rosa	28.09.2003	01.10.2005	Bafata	Balante
Guinea-Bissau	Joao Bernardo Vieira	01.10.2005	02.03.2009	Bissau	Papel
Guinea-Bissau	Raimundo Pereira	02.03.2009	08.09.2009	Quinara	
Guinea-Bissau	Malam Bacai Sanha	08.09.2009	09.01.2012	Quinara	Mandinka
Kenya	Daniel arap Moi	22.08.1978	30.12.2002	Rift Valley	Kalenjin
Kenya	Mwai Kibaki	31.12.2002	ongoing	Central	Kikuyu
Lesotho	Pakalitha Mosisili	29.05.1998	ongoing	Qacha's Nek	Basotho
Liberia	Charles Taylor	02.08.1997	11.08.2003	Montserrado	Gola
Liberia	Gyude Bryant	14.10.2003	16.01.2006	Montserrado	Grebo
Liberia	Ellen Johnson Sirleaf	16.01.2006	22.01.2018	Montserrado	Gola
Madagascar	Didier Ratsiraka	09.02.1997	06.07.2002	Toamasina	Malagasy
Madagascar	Marc Ravalomanana	06.07.2002	17.03.2009	Antananarivo	Merina
Madagascar	Andry Rajoelina	17.03.2009	ongoing	Antananarivo	Merina
Malawi	Bakili Muluzi	21.05.1994	24.05.2004	Machinga	Yao
Malawi	Bingu wa Mutharika	24.05.2004	ongoing	Thyolo	Lhomwe
Mali	Alpha Oumar Konare	08.06.1992	08.06.2002	Kayes	Bambara/Fula
Mali	Amadou Toumani Toure	08.06.2002	ongoing	Mopti	Fula
Mauritania	Maaouya Ould Sid'Ahmed Taza	12.12.1984	03.08.2005	Adrar	Bidan
Mauritania	Ely Ould Mohamed Vall	03.08.2005	19.04.2007	Nouakchott	Bidan
Mauritania	Sidi Ould Cheikh Abdallahi	19.04.2007	06.08.2008	Brakna	Bidan
Mauritania	Mohamed Ould Abdel Aziz	06.08.2008	15.04.2009	Inchiri	Bidan

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Table B6 – African Leaders in the sample and their Birthplaces - *continued*

Country	Leader Name	Entered Office	Left Office	Birthregion ADM1	Ethnicity
Mauritania	Ba Mamadou Mbare	15.04.2009	05.08.2009	Gorgol	Fula
Mauritania	Mohamed Ould Abdel Aziz	05.08.2009	ongoing	Inchiri	Bidan
Mozambique	Joaquim Alberto Chissano	6.11.1986	02.02.2005	Gaza	Tsonga
Mozambique	Armando Emilio Guebuza	02.02.2005	ongoing	Nampula	Makua
Namibia	Samuel Daniel Nujoma	21.03.1990	21.03.2005	Omusati	Ovambo
Namibia	Hifikepunye Pohamba	21.03.2005	ongoing	Ohangwena	Ovambo
Niger	Mamadou Tandja	22.12.1999	08.02.2010	Diffa	Fula/Kanuri
Niger	Salou Djibo	08.02.2010	07.04.2011	Tillabery	Djerma
Niger	Mahamadou Issoufou	07.04.2011	ongoing	Tahoua	Hausa
Nigeria	Olusegun Obasanjo	29.05.1999	29.05.2007	Ogun	Yoruba
Nigeria	Umaru Musa Yar'Adua	29.05.2007	09.02.2010	Katsina	Fulani
Nigeria	Goodluck Jonathan	09.02.2010	ongoing	Bayelsa	Ijaw
Rep. of Congo	Denis Sassou Nguesso	15.10.1997	ongoing	Cuvette	Mbochi
Rwanda	Paul Kagame	19.07.1994	ongoing	Southern (Gitarama)	Tutsi
Senegal	Abdou Diouf	01.01.1981	02.04.2000	Louga	Serer
Senegal	Abdoulaye Wade	02.04.2000	ongoing	Louga	Wolof
Sierra Leone	Ahmad Tejan Kabbah	13.02.1998	17.09.2007	Eastern	Mende
Sierra Leone	Ernest Bai Koroma	17.09.2007	ongoing	Northern	Temne
South Africa	Thabo Mbeki	16.06.1999	25.09.2008	Eastern Cape	Xhosa
South Africa	Kgalema Motlanthe	25.09.2008	09.05.2009	Gauteng	
South Africa	Jacob Zuma	09.05.2009	14.02.2018	KwaZulu-Natal	Zulu
Swaziland	Mswati III of Swaziland	25.06.1986	ongoing	Manzini	Swazi
Tanzania	Benjamin Mkapa	23.11.1995	21.12.2005	Mtwara	Ngoni
Tanzania	Jakaza Kikwete	21.12.2005	ongoing	Pwani	Kwere
Togo	Gnassingbe Eyadema	14.04.1967	05.02.2005	Kara	Kabre/Kabiye

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Table B6 – African Leaders in the sample and their Birthplaces - *continued*

Country	**Leader Name**	**Entered Office**	**Left Office**	**Birthregion ADM1**	**Ethnicity**
Togo	Faure Gnassingbe	05.02.2005	ongoing	Maritime	Kabre
Uganda	Yoweri Museveni	26.01.1986	ongoing	Ntungamo	Banyankole
Zambia	Frederick Chiluba	02.11.1991	02.01.2002	Copperbelt	Bemba
Zambia	Levy Mwanawasa	03.01.2002	19.08.2008	Copperbelt	Lenje
Zambia	Michael Sata	23.09.2011	ongoing	Northern	Bemba

Table B7.: Descriptive statistics by Pres.Birthpl. (with years of no aid receipts)

	Statistic	Aid_{ict}	$ProjLoc_{ict}$
Not Pres.Birthpl.	Mean	3.19	0.85
	Std.Dev.	12.91	2.82
	Obs.	6025	6025
Pres.Birthpl.	Mean	4.28	1.13
	Std.Dev.	13.60	2.66
	Obs.	455	455
Total	Mean	3.27	0.87
	Std.Dev.	12.96	2.81
	Obs.	6480	6480

Aid_{ict} is measured in million US$.

Table B8.: Descriptive statistics by Capital City (with years of no aid receipts)

	Statistic	Aid_{ict}	$ProjLoc_{ict}$
Not Capital	Mean	3.02	0.84
	Std.Dev.	12.08	2.83
	Obs.	6024	6024
Capital	Mean	6.49	1.23
	Std.Dev.	21.21	2.39
	Obs.	456	456
Total	Mean	3.27	0.87
	Std.Dev.	12.96	2.81
	Obs.	6480	6480

Aid_{ict} is measured in million US$.

B.2. Robustness

Table B9.: Presidents' Birthplace and Capital Cities interacted with Institutional Variables (with years of no aid receipts)

	(1) $ln(Aid_{ict})$	(2) $ln(Aid_{ict})$	(3) $ln(ProjLoc_{ict})$	(4) $ln(ProjLoc_{ict})$
Baseline specification				
Pres.Birthpl. x CC	0.50	-1.26	-0.06	-0.28
	(1.54)	(2.76)	(0.49)	(0.84)
Capital x CC	-2.84*	0.08	-0.99*	0.16
	(1.41)	(4.13)	(0.52)	(1.25)
With years of no aid receipts				
Pres.Birthpl. x CC	0.03	0.58	-0.10	0.12
	(0.63)	(0.76)	(0.22)	(0.27)
Capital x CC	-1.59**	-0.00	-0.57**	0.33
	(0.68)	(1.86)	(0.26)	(0.63)
Baseline specification				
Pres.Birthpl. x RL	1.10	-1.85	0.10	-0.78
	(1.33)	(2.14)	(0.45)	(0.70)
Capital x RL	-3.31***	-4.47	-1.20***	-0.48
	(1.16)	(6.43)	(0.39)	(2.12)
With years of no aid receipts				
Pres.Birthpl. x RL	0.57	0.38	0.06	0.04
	(0.62)	(0.77)	(0.22)	(0.28)
Capital x RL	-1.71***	-1.29	-0.62***	0.29
	(0.63)	(2.86)	(0.22)	(0.97)
Baseline specification				
Pres.Birthpl. x GE	0.98	-1.43	-0.04	-0.70
	(1.22)	(2.17)	(0.41)	(0.68)
Capital x GE	-2.77*	5.33	-1.03**	2.53
	(1.45)	(5.86)	(0.51)	(1.91)
With years of no aid receipts				
Pres.Birthpl. x GE	0.30	0.29	-0.07	-0.05
	(0.55)	(0.63)	(0.19)	(0.23)
Capital x GE	-1.43*	3.05	-0.54*	1.55
	(0.78)	(3.56)	(0.28)	(1.19)
Baseline specification				
Pres.Birthpl. x RQ	0.31	-2.81	-0.13	-1.02
	(1.51)	(2.64)	(0.48)	(0.68)
Capital x RQ	-2.82**	5.50	-1.10**	2.23
	(1.30)	(5.17)	(0.48)	(1.53)
With years of no aid receipts				
Pres.Birthpl. x RQ	0.10	0.26	-0.08	-0.01
	(0.71)	(0.79)	(0.24)	(0.25)
Capital x RQ	-1.61**	2.32	-0.62**	0.99
	(0.74)	(2.50)	(0.27)	(0.78)
Country-Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes

Standard errors in parentheses are clustered on country level.
***p<0.01, **p<0.05, *p<0.1

Table B10.: Presidents' Birthplace and Aid interacted with Institutional Variables with Trimmed Sample (ADM1s>4 and Years>2)

	(1) $ln(Aid_{ict})$	(2) $ln(Aid_{ict})$	(3) $ln(ProjLoc_{ict})$	(4) $ln(ProjLoc_{ict})$
Baseline specification				
Pres.Birthpl. x CC	0.50	-1.26	-0.06	-0.28
	(1.54)	(2.76)	(0.49)	(0.84)
Capital x CC	-2.84*	0.08	-0.99*	0.16
	(1.41)	(4.13)	(0.52)	(1.25)
Trimmed Sample				
Pres.Birthpl. x CC	0.90	-1.47	0.10	-0.37
	(1.56)	(2.72)	(0.49)	(0.82)
Capital x CC	-2.58*	-0.32	-0.89	-0.09
	(1.44)	(4.14)	(0.53)	(1.26)
Baseline specification				
Pres.Birthpl. x RL	1.10	-1.85	0.10	-0.78
	(1.33)	(2.14)	(0.45)	(0.70)
Capital x RL	-3.31***	-4.47	-1.20***	-0.48
	(1.16)	(6.43)	(0.39)	(2.12)
Trimmed Sample				
Pres.Birthpl. x RL	1.39	-1.95	0.22	-0.82
	(1.32)	(2.12)	(0.44)	(0.70)
Capital x RL	-3.09**	-4.67	-1.12***	-0.57
	(1.16)	(6.51)	(0.38)	(2.14)
Baseline specification				
Pres.Birthpl. x GE	0.98	-1.43	-0.04	-0.70
	(1.22)	(2.17)	(0.41)	(0.68)
Capital x GE	-2.77*	5.33	-1.03**	2.53
	(1.45)	(5.86)	(0.51)	(1.91)
Trimmed Sample				
Pres.Birthpl. x GE	1.28	-1.75	0.08	-0.84
	(1.20)	(2.19)	(0.40)	(0.68)
Capital x GE	-2.61*	5.32	-0.97*	2.45
	(1.47)	(5.87)	(0.51)	(1.92)
Baseline specification				
Pres.Birthpl. x RQ	0.31	-2.81	-0.13	-1.02
	(1.51)	(2.64)	(0.48)	(0.68)
Capital x RQ	-2.82**	5.50	-1.10**	2.23
	(1.30)	(5.17)	(0.48)	(1.53)
Trimmed Sample				
Pres.Birthpl. x RQ	0.45	-3.13	-0.05	-1.15*
	(1.53)	(2.61)	(0.48)	(0.66)
Capital x RQ	-2.65*	5.00	-1.05**	1.93
	(1.31)	(5.24)	(0.48)	(1.55)
Country-Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes

Standard errors in parentheses are clustered on country level.
***p<0.01, **p<0.05, *p<0.1

Table B11.: Presidents' Birthplace and Aid interacted with Institutional Variables (weighting countries equally)

	(1) $ln(Aid_{ict})$	(2) $ln(Aid_{ict})$	(3) $ln(ProjLoc_{ict})$	(4) $ln(ProjLoc_{ict})$
Baseline specification				
Pres.Birthpl. x CC	0.50	-1.26	-0.06	-0.28
	(1.54)	(2.76)	(0.49)	(0.84)
Capital x CC	-2.84*	0.08	-0.99*	0.16
	(1.41)	(4.13)	(0.52)	(1.25)
Weighted regression				
Pres.Birthpl. x CC	0.59	2.29	-0.12	0.64
	(1.47)	(3.41)	(0.50)	(1.01)
Capital x CC	-1.73	2.48	-0.61	1.18
	(1.55)	(4.48)	(0.68)	(1.41)
Baseline specification				
Pres.Birthpl. x RL	1.10	-1.85	0.10	-0.78
	(1.33)	(2.14)	(0.45)	(0.70)
Capital x RL	-3.31***	-4.47	-1.20***	-0.48
	(1.16)	(6.43)	(0.39)	(2.12)
Weighted regression				
Pres.Birthpl. x RL	1.58	-0.45	0.25	-0.36
	(1.34)	(2.39)	(0.46)	(0.71)
Capital x RL	-2.78**	-3.54	-1.14**	-0.25
	(1.25)	(5.20)	(0.44)	(1.87)
Baseline specification				
Pres.Birthpl. x GE	0.98	-1.43	-0.04	-0.70
	(1.22)	(2.17)	(0.41)	(0.68)
Capital x GE	-2.77*	5.33	-1.03**	2.53
	(1.45)	(5.86)	(0.51)	(1.91)
Weighted regression				
Pres.Birthpl. x GE	3.01**	1.76	-0.09	0.14
	(1.27)	(2.43)	(0.40)	(0.72)
Capital x GE	-1.63	4.19	-0.88	2.36
	(1.02)	(5.59)	(0.62)	(1.75)
Baseline specification				
Pres.Birthpl. x RQ	0.31	-2.81	-0.13	-1.02
	(1.51)	(2.64)	(0.48)	(0.68)
Capital x RQ	-2.82**	5.50	-1.10**	2.23
	(1.30)	(5.17)	(0.48)	(1.53)
Weighted regression				
Pres.Birthpl. x RQ	1.05	0.39	0.07	-0.14
	(1.46)	(3.15)	(0.47)	(0.88)
Capital x RQ	-2.78**	5.66	-1.13**	2.57
	(1.36)	(5.21)	(0.52)	(1.75)
Country-Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes

Standard errors in parentheses are clustered on country level.
***p<0.01, **p<0.05, *p<0.1

Table B12.: Presidents' Birthplace and Aid interacted with Institutional Variables (on collapsed sample)

	(1) $ln(Aid_{ict})$	(2) $ln(ProjLoc_{ict})$
Baseline specification		
Pres.Birthpl. x CC	0.50	-0.06
	(1.54)	(0.49)
Capital x CC	-2.84*	-0.99*
	(1.41)	(0.52)
Collapsed Sample		
Pres.Birthpl. x CC	-0.20	-0.32
	(1.56)	(0.52)
Capital x CC	-2.79*	-1.04*
	(1.41)	(0.54)
Baseline specification		
Pres.Birthpl. x RL	1.10	0.10
	(1.33)	(0.45)
Capital x RL	-3.31***	-1.20***
	(1.16)	(0.39)
Collapsed Sample		
Pres.Birthpl. x RL	0.17	-0.25
	(1.45)	(0.49)
Capital x RL	-3.22***	-1.27***
	(1.17)	(0.40)
Baseline specification		
Pres.Birthpl. x GE	0.98	-0.04
	(1.22)	(0.41)
Capital x GE	-2.77*	-1.03**
	(1.45)	(0.51)
Collapsed Sample		
Pres.Birthpl. x GE	0.33	-0.31
	(1.25)	(0.44)
Capital x GE	-2.76*	-1.10**
	(1.43)	(0.50)
Baseline specification		
Pres.Birthpl. x RQ	0.31	-0.13
	(1.51)	(0.48)
Capital x RQ	-2.82**	-1.10**
	(1.30)	(0.48)
Collapsed Sample		
Pres.Birthpl. x RQ	-0.46	-0.43
	(1.49)	(0.50)
Capital x RQ	-2.92**	-1.21**
	(1.28)	(0.46)
Country-Year FE	Yes	Yes
Region FE	No	No

Standard errors in parentheses are clustered on country level.
***p<0.01, **p<0.05, *p<0.1

Table B13.: Presidents' Birthplace and Aid interacted with Institutional Variables Lagged by (t-1)

	(1) $ln(Aid_{ict})$	(2) $ln(Aid_{ict})$	(3) $ln(ProjLoc_{ict})$	(4) $ln(ProjLoc_{ict})$
Baseline specification				
Pres.Birthpl. x CC	0.50	-1.26	-0.06	-0.28
	(1.54)	(2.76)	(0.49)	(0.84)
Capital x CC	-2.84*	0.08	-0.99*	0.16
	(1.41)	(4.13)	(0.52)	(1.25)
Lagged Regressions				
Pres.Birthpl. x CC	-0.32	-6.37**	-0.29	-1.73*
	(1.72)	(3.03)	(0.53)	(0.92)
Capital x CC	-2.43*	-0.11	-0.84	0.11
	(1.34)	(5.60)	(0.52)	(1.91)
Baseline specification				
Pres.Birthpl. x RL	1.10	-1.85	0.10	-0.78
	(1.33)	(2.14)	(0.45)	(0.70)
Capital x RL	-3.31***	-4.47	-1.20***	-0.48
	(1.16)	(6.43)	(0.39)	(2.12)
Lagged Regressions				
Pres.Birthpl. x RL	-0.05	-8.15***	-0.23	-2.69***
	(1.43)	(2.23)	(0.46)	(0.75)
Capital x RL	-2.11	0.77	-0.73	2.00
	(1.44)	(6.42)	(0.47)	(2.03)
Baseline specification				
Pres.Birthpl. x GE	0.98	-1.43	-0.04	-0.70
	(1.22)	(2.17)	(0.41)	(0.68)
Capital x GE	-2.77*	5.33	-1.03**	2.53
	(1.45)	(5.86)	(0.51)	(1.91)
Lagged Regressions				
Pres.Birthpl. x GE	0.17	-4.57	-0.28	-1.60
	(1.33)	(2.72)	(0.44)	(1.00)
Capital x GE	-2.31	2.88	-0.88*	1.56
	(1.44)	(4.89)	(0.50)	(1.88)
Baseline specification				
Pres.Birthpl. x RQ	0.31	-2.81	-0.13	-1.02
	(1.51)	(2.64)	(0.48)	(0.68)
Capital x RQ	-2.82**	5.50	-1.10**	2.23
	(1.30)	(5.17)	(0.48)	(1.53)
Lagged Regressions				
Pres.Birthpl. x RQ	0.30	-6.08**	-0.12	-2.02**
	(1.40)	(2.83)	(0.45)	(0.98)
Capital x RQ	-3.71***	-1.84	-1.38***	-0.94
	(1.13)	(5.98)	(0.39)	(2.11)
Country-Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes

Standard errors in parentheses are clustered on country level.
***p<0.01, **p<0.05, *p<0.1

C. Appendix to Chapter 5 – Foreign Aid and Regional Inequality in Sub-Saharan Africa

C.1. Tables and Figures

Table C1.: Countrywise Correlations between data from Kummu et al. (2018), CIESIN population data and WB data

Country	GDP	Population	Country	GDP	Population
Angola	0.9915	0.9994	Liberia	0.9841	0.9963
Benin	0.9992	0.9996	Madagascar	0.9975	0.9999
Botswana	0.9965	0.9951	Malawi	0.9997	0.9999
Burkina Faso	0.9988	0.9999	Mali	0.9699	0.9998
Burundi	0.9987	0.997	Mauritania	0.9995	0.9998
Cameroon	0.9989	1	Mozambique	0.9986	0.9997
Centr. Afr. Rep.	0.9402	0.9999	Namibia	0.9968	0.9966
Chad	0.9989	0.9994	Niger	0.9984	0.9999
Cote d'Ivoire	0.9991	0.9993	Nigeria	0.9926	0.9999
DR Congo	0.9997	0.9994	Rep. of Congo	0.9994	0.9997
Eirtrea	-	0.9971	Rwanda	0.9997	0.9841
Ethiopia	1	0.9998	Senegal	0.9927	0.9998
Gabon	0.872	0.9993	Sierra Leone	0.9988	0.9965
Gambia	0.7487	0.9998	South Africa	0.9927	0.9938
Ghana	0.9998	0.9999	Swaziland	0.9938	0.9402
Guinea	0.9128	0.9996	Tanzania	0.9992	0.9998
Guinea-Bissau	0.9945	0.9999	Togo	0.9784	0.9985
Kenya	0.9994	0.9999	Uganda	0.9997	0.9998
Lesotho	0.9971	0.9941	Zambia	0.9997	0.9996
Total	0.9819	0.9969			

All coefficients are significant below the 1% level.

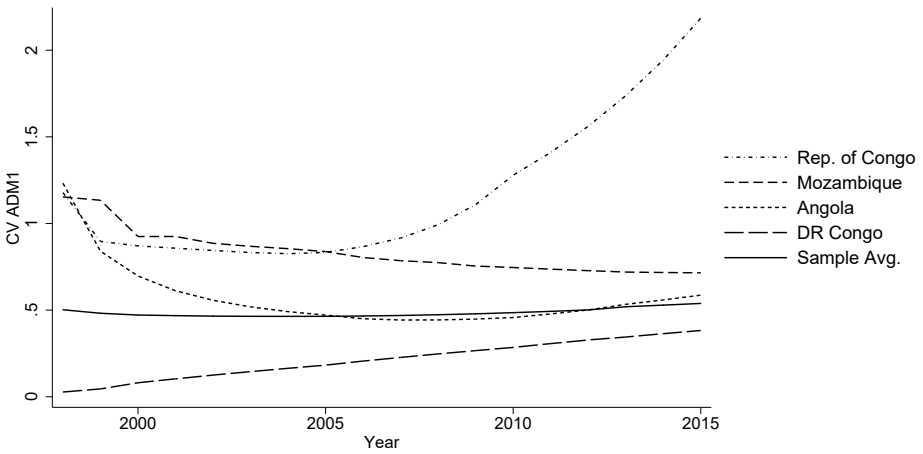

Figure C.1.: Largest Changes in Regional ADM1 CV Inequality

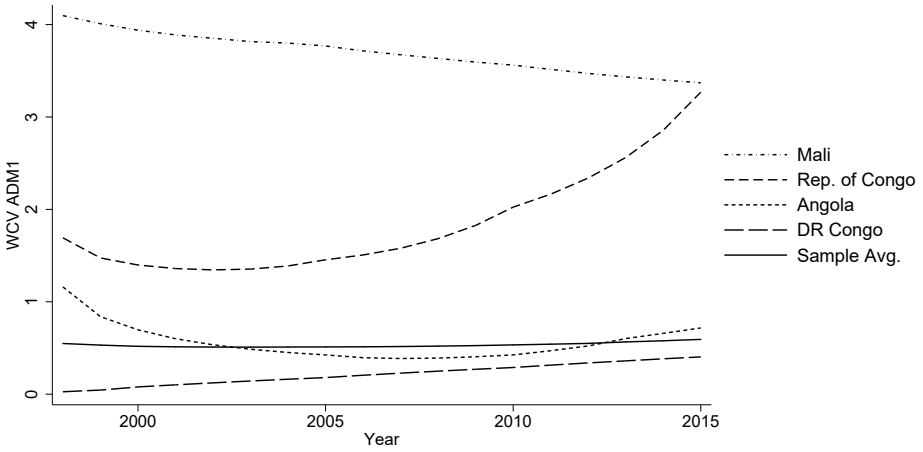

Figure C.2.: Largest Changes in Regional ADM1 WCV Inequality

Table C2.: Changes of regional ADM1 inequality for all countries between the years 1998 and 2015

Country	Gini	CV	WCV	Country	Gini	CV	WCV
Angola	-0.182	-0.646	-0.444	Liberia	0.008	0.000	0.140
Benin	0.031	0.016	-0.072	Madagascar	0.014	0.030	0.032
Botswana	-0.001	-0.008	-0.033	Malawi	0.015	0.034	0.031
Burkina Faso	0.020	0.026	0.007	Mali	-0.031	-0.115	-0.728
Burundi	0.010	0.015	0.012	Mauritania	0.051	0.067	0.101
Cameroon	0.067	0.105	0.137	Mozambique	-0.093	-0.438	-0.290
Central African	0.065	0.230	0.088	Namibia	0.021	0.061	0.116
Chad	0.044	-0.085	0.124	Niger	0.053	0.106	0.115
Cote d'Ivoire	0.020	0.037	0.033	Nigeria	0.053	0.095	0.085
DR Congo	0.184	0.355	0.377	Republic of Cong	0.160	1.007	1.577
Eritrea	0.073	0.153	0.072	Rwanda	0.072	0.144	0.141
Ethiopia	-0.014	-0.028	0.039	Senegal	0.001	0.004	0.008
Gabon	0.153	0.234	0.140	Sierra Leone	0.046	0.073	0.105
Gambia	-0.034	-0.094	-0.242	South Africa	0.009	0.014	0.006
Ghana	0.018	0.036	0.040	Swaziland	0.046	0.066	0.061
Guinea	0.007	-0.041	-0.019	Tanzania	0.016	0.167	0.039
Guinea-Bissau	-0.009	-0.069	0.039	Togo	0.040	0.066	0.079
Kenya	-0.040	-0.246	-0.221	Uganda	0.092	0.152	0.116
Lesotho	0.007	0.007	0.021	Zambia	-0.025	-0.088	-0.070
Total	0.024	0.036	0.044				

Table C3.: Regional ADM2 inequalities classified by income goup (World Bank country classification)

Country	Gini	CV	WCV	Country	Gini	CV	WCV
Low Income Countries				Lower Middle Income Countries			
Benin	0.36	1.36	1.05	Angola	0.48	1.57	1.06
Burkina Faso	0.15	0.28	0.24	Cameroon	0.12	0.26	0.40
Burundi	0.26	0.90	0.69	Cote d'Ivoire	0.14	0.24	0.23
Centr. Afr. Rep.	0.22	0.47	0.47	Ghana	0.17	0.31	0.36
Chad	0.16	0.38	0.29	Kenya	0.30	0.74	0.95
DR Congo	0.39	1.66	0.66	Lesotho	.	.	.
Eritrea	.	.	.	Mauritania	0.41	1.65	0.87
Ethiopia	0.08	0.18	0.14	Nigeria	0.31	0.66	0.65
Gambia	0.25	0.48	0.70	Rep. of Congo	.	.	.
Guinea	0.36	1.44	1.43	Swaziland	0.34	0.72	0.78
Guinea-Bissau	0.31	0.75	0.97	Zambia	0.21	0.54	0.53
Liberia	0.29	0.65	0.85	Total	0.28	0.74	0.65
Madagascar	0.08	0.14	0.15				
Malawi	0.44	1.23	0.62				
Mali	0.80	2.95	3.57				
Mozambique	0.40	1.30	0.92				
Niger	0.25	0.47	0.49				
Rwanda	0.18	0.33	0.34				
Senegal	0.19	0.40	0.48	Upper Middle Income Countries			
Sierra Leone	0.16	0.36	0.45	Botswana	0.89	4.04	1.94
Tanzania	0.54	1.43	1.21	Gabon	0.36	0.90	1.17
Togo	0.16	0.31	0.51	Namibia	0.28	0.57	0.60
Uganda	0.23	0.42	0.42	South Africa	0.11	0.20	0.21
Total	0.28	0.81	0.76	Total	0.41	1.43	0.98

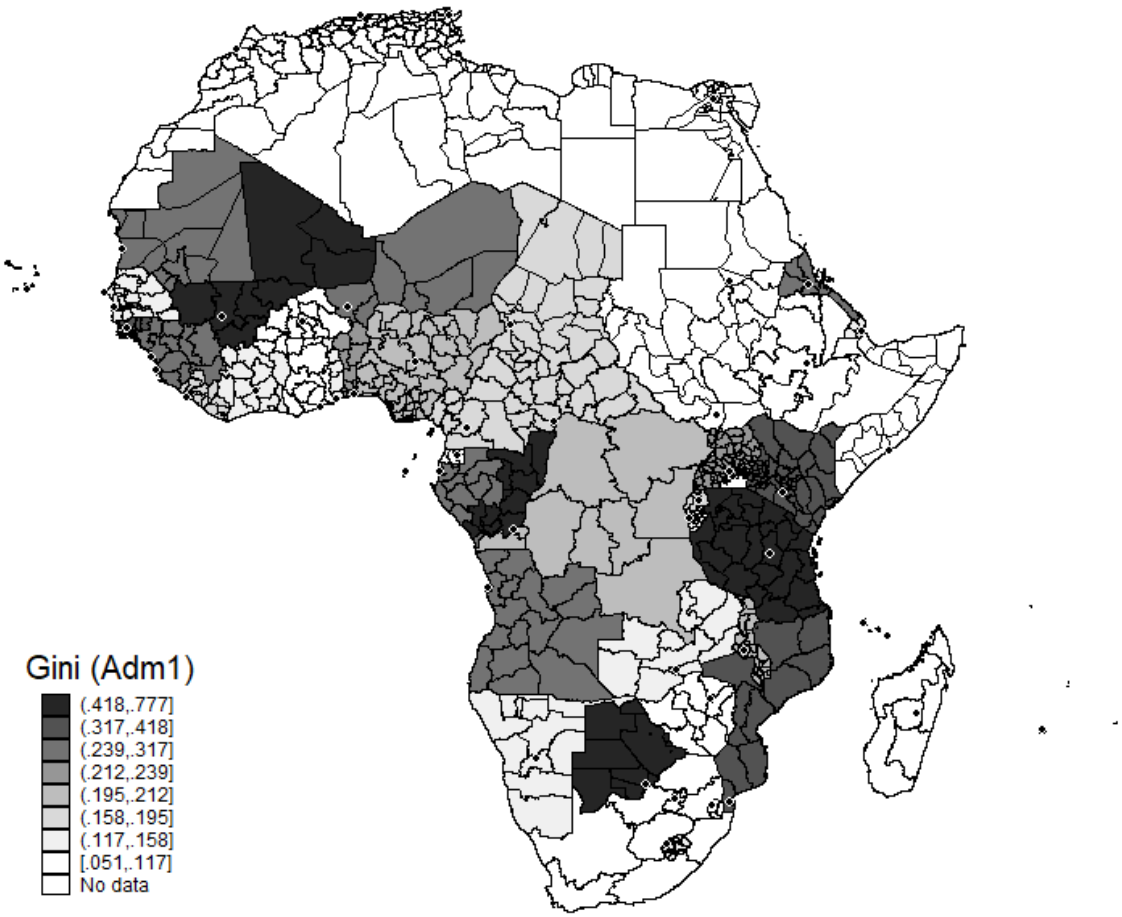

Figure C.3.: Regional Gini Inequaliy by Country (using ADM1 GDP pc data)

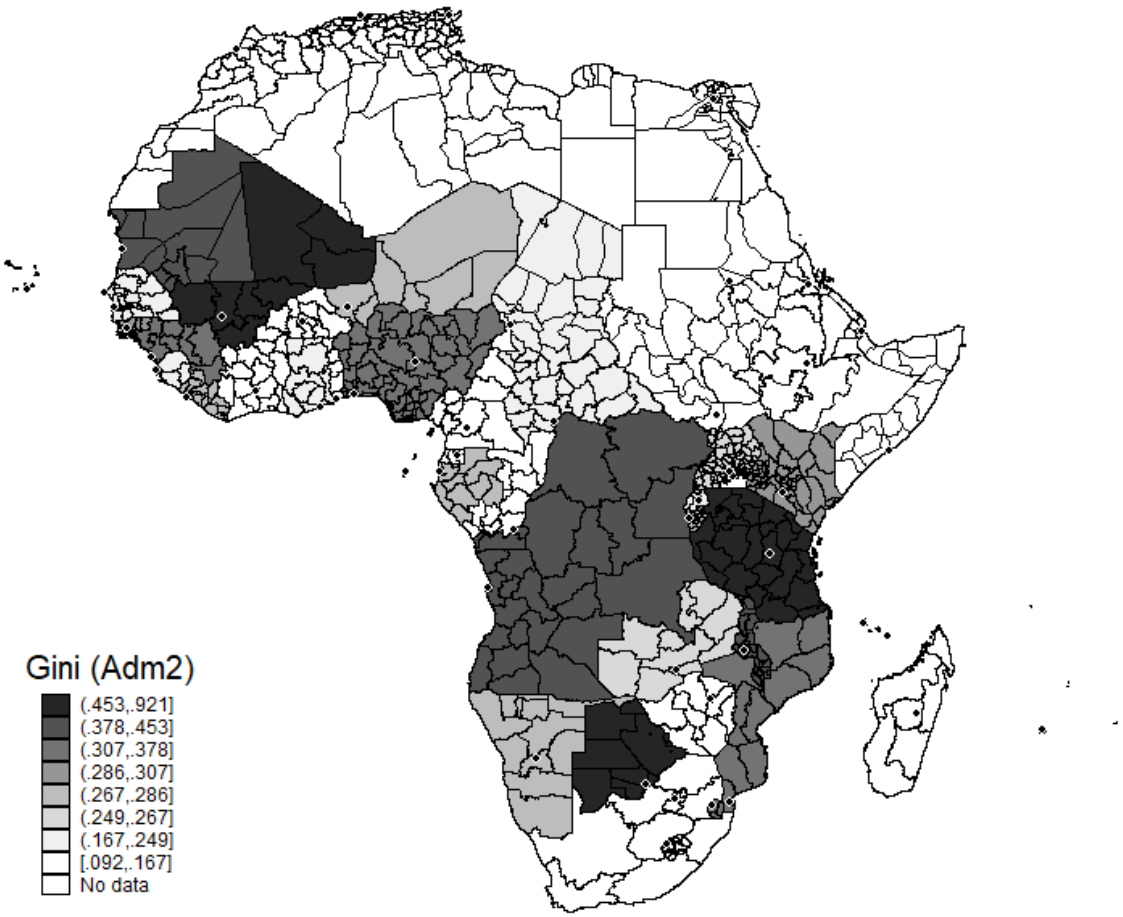

Figure C.4.: Regional Gini Inequaliy by Country (using ADM2 GDP pc data)

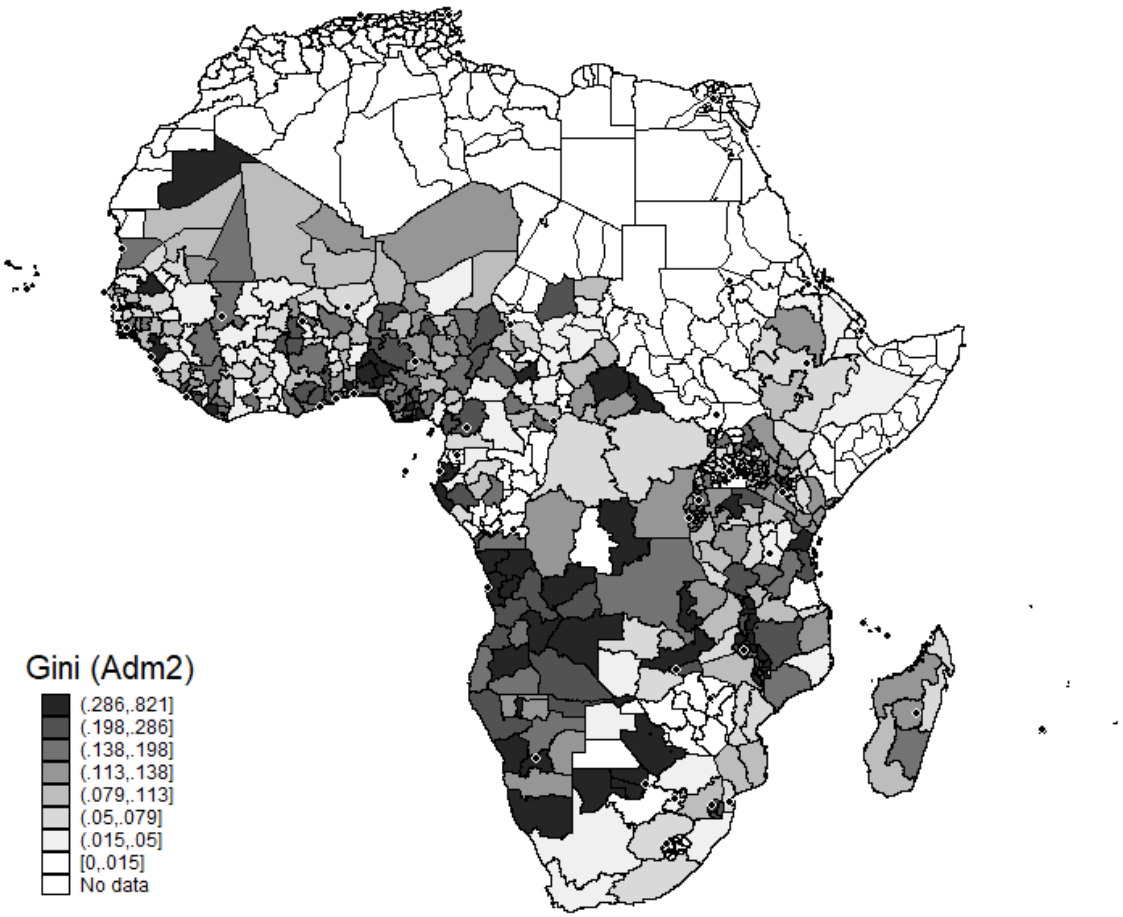

Figure C.5.: Regional Gini Inequaliy by ADM1 Regions (using ADM2 GDP pc data)

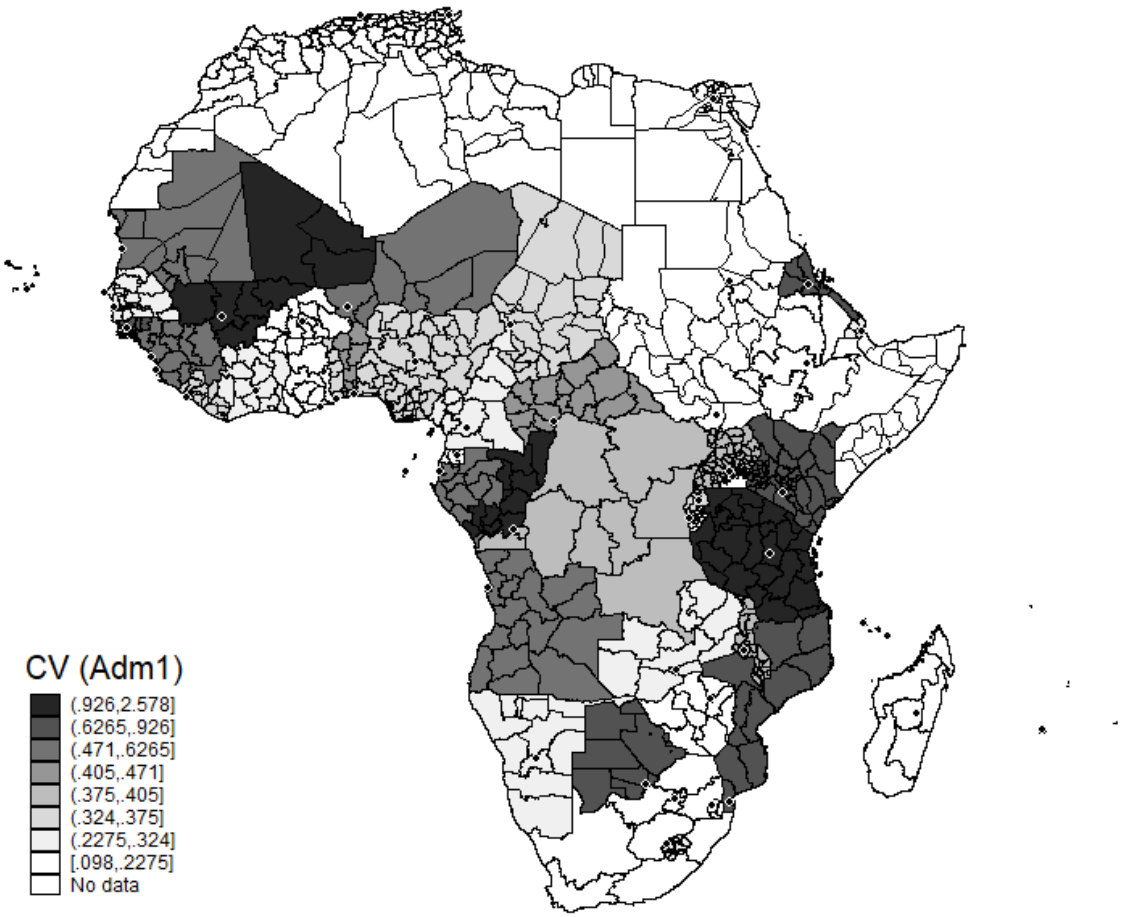

Figure C.6.: Regional Coefficient of Variation Inequality by Country

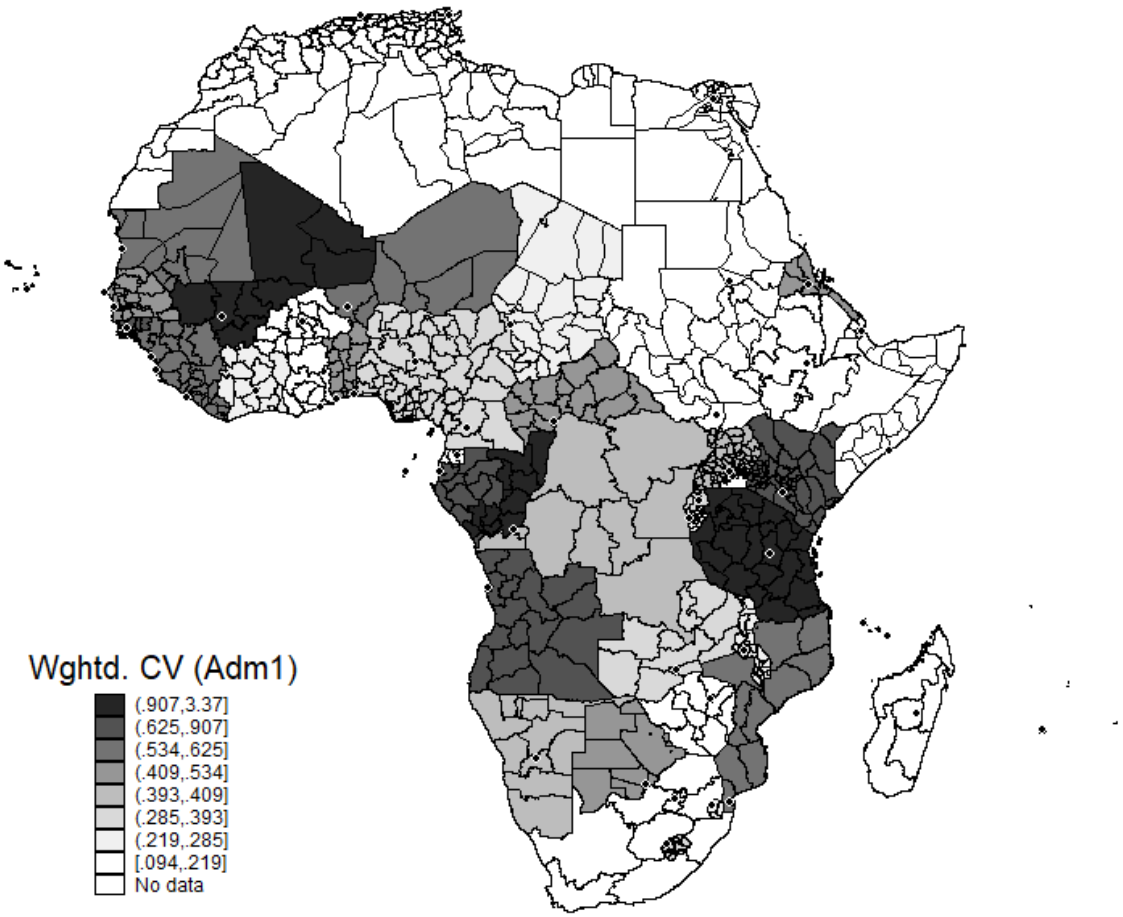

Figure C.7.: Regional weighted Coefficient of Variation Inequality by Country

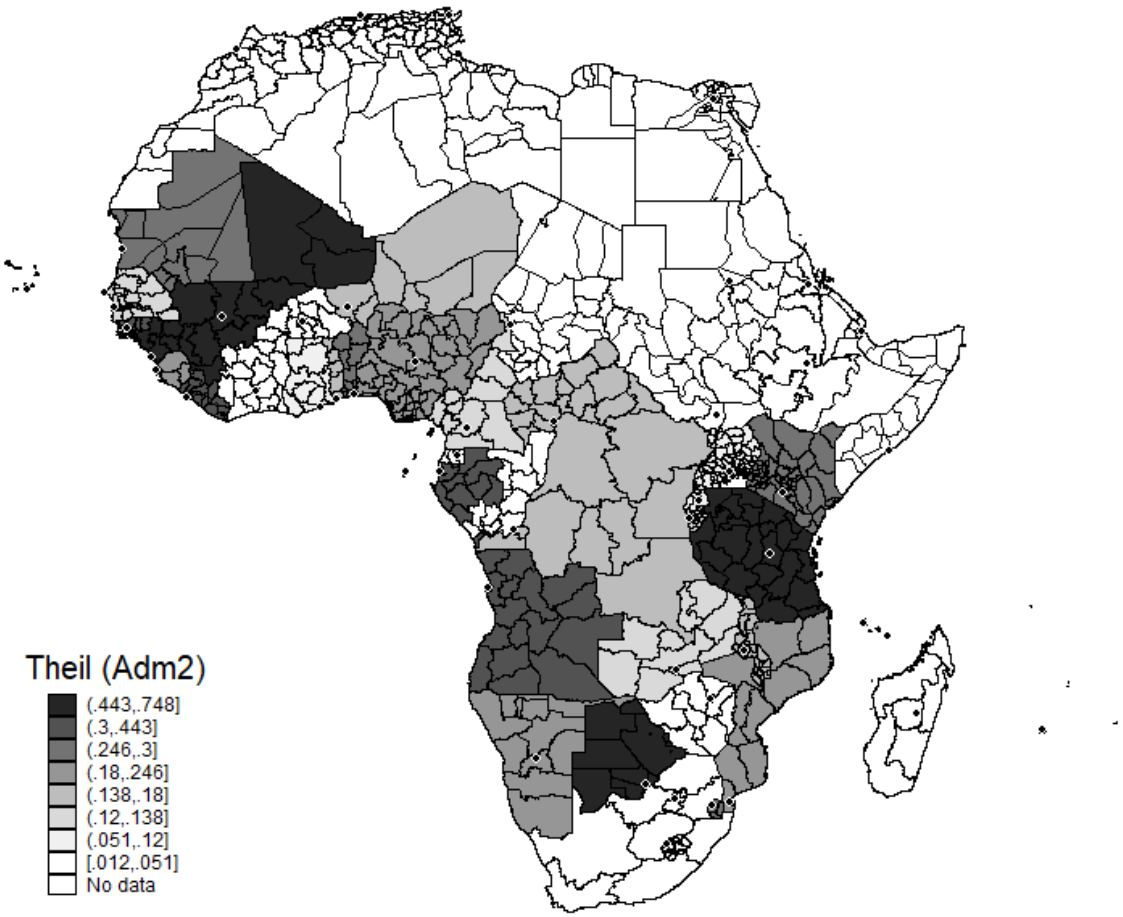

Figure C.8.: Regional Theil Inequality by Country

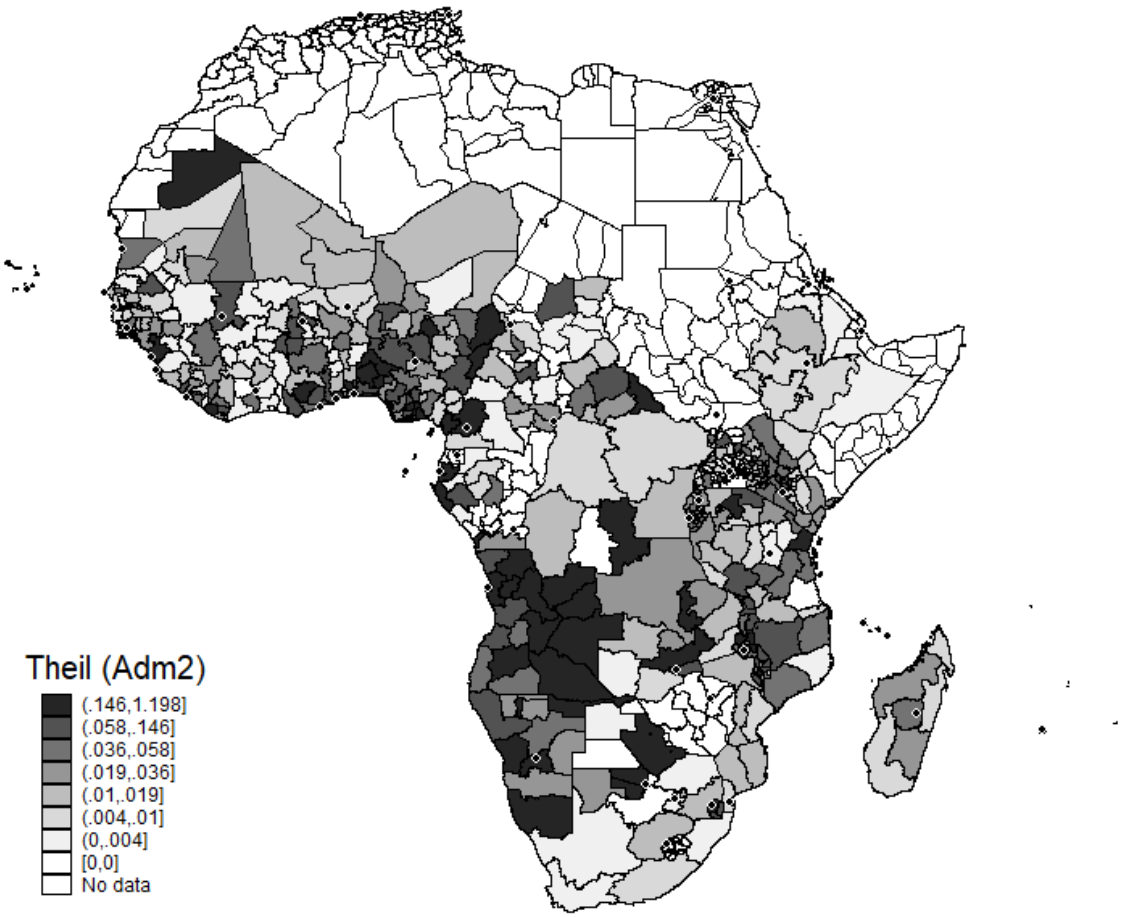

Figure C.9.: Regional Theil Inequality by ADM1 Regions

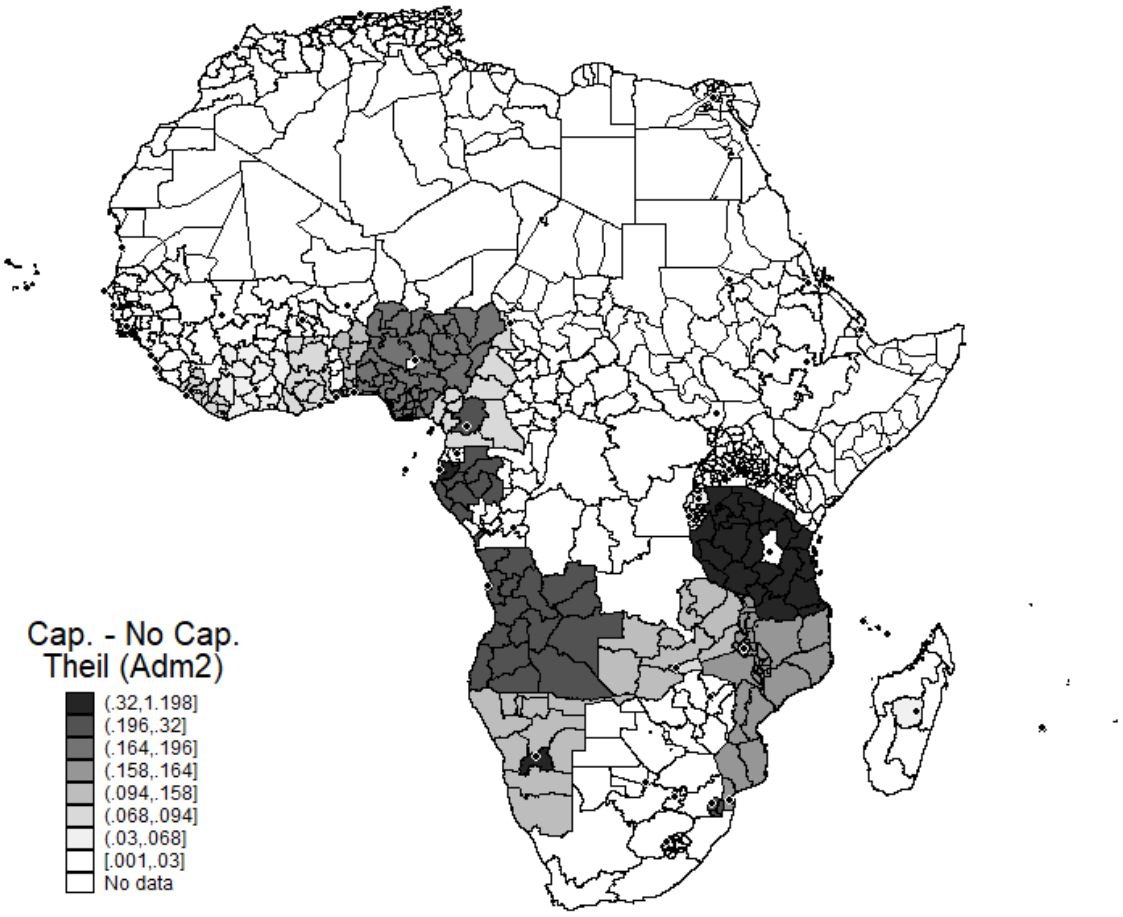

Figure C.10.: Regional Theil Inequality by sub-groups (Capital vs. Non Capital ADM1 Regions)

Table C4.: Data Source & Definitions

Variable	Definition	Source
Gini Coeff.	Gini Coefficient of regional ADM1 GDP per capita calculated from gridded GDP data	Kummu et al. (2018)
Coeff. of Variation	Coefficient of Variation of regional ADM1 GDP per capita calculated from gridded GDP data	Kummu et al. (2018)
Wgthtd. Coeff. of Variation	Population Weighted Coefficient of Variation of regional ADM1 GDP per capita calculated from gridded GDP data	Kummu et al. (2018)
Btw. Inequality Share	Population Weighted share of between capital and non capital regional inequality of ADM2 GDP per capita calculated from gridded GDP data	Kummu et al. (2018)
Wthn. Inequality Share	Population Weighted share of within capital and non capital regional inequality of ADM2 GDP per capita calculated from gridded GDP data	Kummu et al. (2018)
ODA	Net official development assistance (ODA) as a percentage of GNI	World Bank (2019)
GDP pc	GDP per capita in 2010 US $ prices	World Bank (2019)
Population	Total population	Doxsey-Whitfield et al. (2015)
Urbanization	Share of urban population as a share of total population	World Bank (2019)
Agric. empl.	Employment in agriculture in % of total employment	World Bank (2019)
Unemployment	Unemployment ratio (% of total labor force)	World Bank (2019)
FDI net inflow	Foreign direct investments net inflows in % of GDP	World Bank (2019)
Trade	Sum of imports and exports as a share of GDP	World Bank (2019)
Control of Corruption	Control of Corruption provided by Worldwide Governance Indicators	Kaufmann et al. (2011)
Gov't Expenditure	Government final consumption expenditure in % of GDP	World Bank (2019)

Table C5.: Summary statistics - annual panel data

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Gini Coeff.	702	0.22	0.16	0.01	0.81
Coeff. Of Var.	702	0.49	0.46	0.03	2.69
Wghtd. Coeff. Of Var.	702	0.53	0.62	0.03	4.10
Btw. Reg. Ineq. Share	378	19.61	23.35	0.00	94.79
Wthn. Reg. Ineq. Share	378	80.39	23.35	5.21	100.00
ODA (% of GNI)	681	9.77	9.55	0.00	92.14
FDI (% of GDP)	696	4.52	8.66	-8.70	103.34
Trade (% of GDP)	657	70.81	38.50	20.96	376.22
GDP per capita	679	1594.23	2078.21	187.52	11937.64
Population (in Mio.)	702	18.91	27.35	0.70	182.20
Urbanization	698	37.52	16.88	7.83	88.12
Agric. Employment	702	55.17	20.93	4.60	92.30
Unemployment Rate	702	7.81	7.76	0.32	37.00
Control of Corruption	624	-0.64	0.54	-1.72	1.22
Public Expenditure	637	14.77	6.97	0.95	69.54

Table C6.: Summary statistics - triennial panel data

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Gini Coeff.	234	0.22	0.16	0.02	0.80
Coeff. Of Var.	234	0.49	0.46	0.05	2.68
Wghtd. Coeff. Of Var.	234	0.53	0.62	0.05	3.94
Btw. Reg. Ineq. Share	126	19.54	23.36	0.01	94.74
Wthn. Reg. Ineq. Share	126	80.46	23.36	5.26	99.99
ODA (% of GNI)	227	9.39	8.54	0.00	62.19
FDI (% of GDP)	232	4.54	8.30	-3.75	84.89
Trade (% of GDP)	220	70.21	35.77	21.45	280.12
GDP per capita	226	1610.41	2073.88	194.87	10160.34
Population (in Mio.)	234	19.43	28.11	0.72	182.20
Urbanization	232	37.99	17.02	8.25	88.12
Agric. Employment	234	54.63	20.96	4.84	92.26
Unemployment Rate	234	7.76	7.67	0.38	35.27
Control of Corruption	234	-0.64	0.54	-1.55	1.22
Public Expenditure	213	14.73	6.83	0.95	54.80

Table C7.: Pairwise Correlation Table of the annual variables

	Gini Coeff.	Coeff. of Variation	Wghtd. Coeff. of Variation	Btw. Reg. Ineq. Share	Wthn. Reg. Ineq. Share	ODA (% of GNI)	FDI (% of GDP)	Trade (% of GDP)	GDP pc	Pop. (in Mio.)	Urbaniz.	Agric. Empl.	Unemp. Rate	Control of Corruption
Coeff. of Variation	0.9622* (0.000)													
Wghtd. Coeff. of Variation	0.8836* (0.000)	0.9559* (0.000)												
Btw. Reg. Ineq. Share	-0.0367 (0.4767)	0.0004 (0.9936)	0.1491* (0.0037)											
Wthn. Reg. Ineq. Share	0.0367 (0.4767)	-0.0004 (0.9936)	-0.1491* (0.0037)	-1.0000* (0.000)										
ODA (% of GNI)	-0.0217 (0.5722)	0.0043 (0.9113)	-0.013 (0.7347)	0.1555* (0.0025)	-0.1555* (0.0025)									
FDI (% of GDP)	0.0669 (0.0777)	0.0515 (0.1745)	0.0597 (0.1157)	0.1231* (0.0169)	-0.1231* (0.0169)	0.2259* (0.000)								
Trade (% of GDP)	0.02 (0.608)	-0.013 (0.7389)	0.0387 (0.3214)	0.0797 (0.1239)	-0.0797 (0.1239)	0.0045 (0.9081)	0.2892* (0.000)							
GDP pc	-0.0018 0.9626	-0.0503 0.1907	-0.0124 0.7477	-0.019 0.7137	0.019 0.7137	-0.4299* (0.000)	-0.0476 0.2156	0.2927* (0.000)						
Pop. (in Mio.)	-0.0745* (0.0484)	-0.0682 (0.071)	-0.0974* (0.0098)	-0.3167* (0.000)	0.3167* (0.000)	-0.1577* (0.000)	-0.0876* (0.0209)	-0.2594* (0.000	-0.045 (0.2413)					
Urbaniz.	0.1100* (0.0036)	0.0459 (0.2259)	0.1067* (0.0048)	0.2170* (0.000)	-0.2170* (0.000)	-0.3265* (0.000)	0.1165* (0.0021)	0.3761* (0.000)	0.6686* (0.000)	-0.1084* (0.0041)				
Agric. Empl.	0.0597 (0.1138)	0.1092* (0.0038)	0.0645 (0.0876)	-0.0013 (0.9802)	0.0013 (0.9802)	0.4451* (0.000)	-0.033 (0.3853)	-0.4378* (0.000)	-0.6260* (0.000)	0.0515 (0.173)	-0.5168* (0.000)			
Unemp. Rate	-0.0552 (0.1441)	-0.0604 (0.1098)	0.003 (0.9369)	-0.0328 (0.5248)	0.0328 (0.5248)	-0.3608* (0.000)	-0.0512 (0.1776)	0.3885* (0.000)	0.6694* (0.000)	-0.1857* (0.000)	0.3496* (0.000)	-0.7725* (0.000)		
Control of Corruption	-0.0693 (0.0835)	-0.072 (0.0722)	-0.1140* (0.0043)	-0.0198 (0.7173)	0.0198 (0.7173)	-0.0942* (0.0203)	-0.0223 (0.5794)	0.0987* (0.0167)	0.3718* (0.000)	-0.1798* (0.000)	0.0395 (0.326)	-0.4473* (0.000)	0.5232* (0.000)	
Public Expend.	0.0217 (0.5849)	0.0089 (0.823)	0.0005 (0.989)	-0.0816 (0.1254)	0.0816 (0.1254)	0.1015* (0.0104)	0.0472 (0.2337)	0.2574* (0.000)	0.2057* (0.000)	-0.3042* (0.000)	-0.0438 (0.2698)	-0.2493* (0.000)	0.3891* (0.000)	0.5008* (0.000)

Values in parentheses denote significance levels of the correlation coefficients. Coefficients with an asterisk are significant below the 1% level.

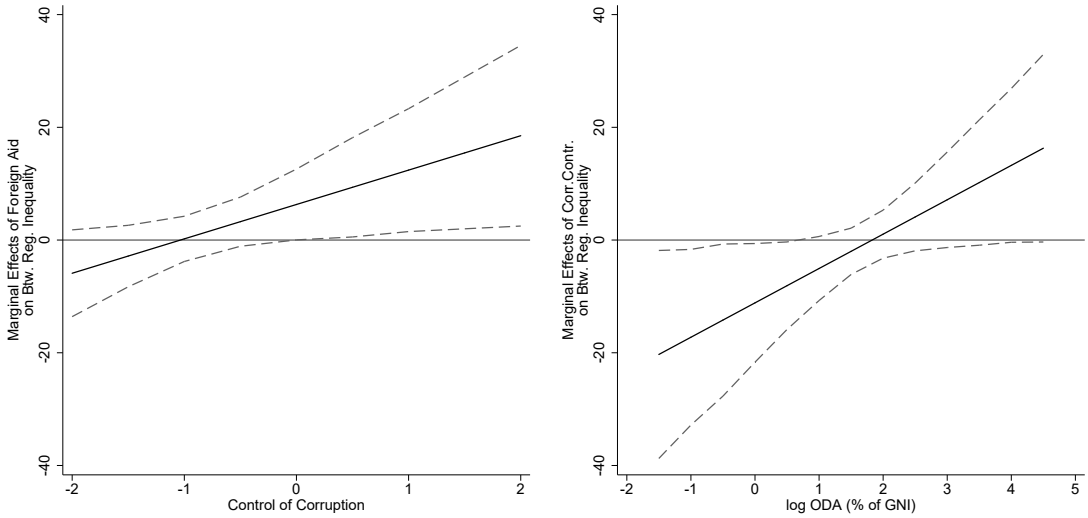

Figure C.11.: Marginsplot for Between Regional Inequality in Table 5.9

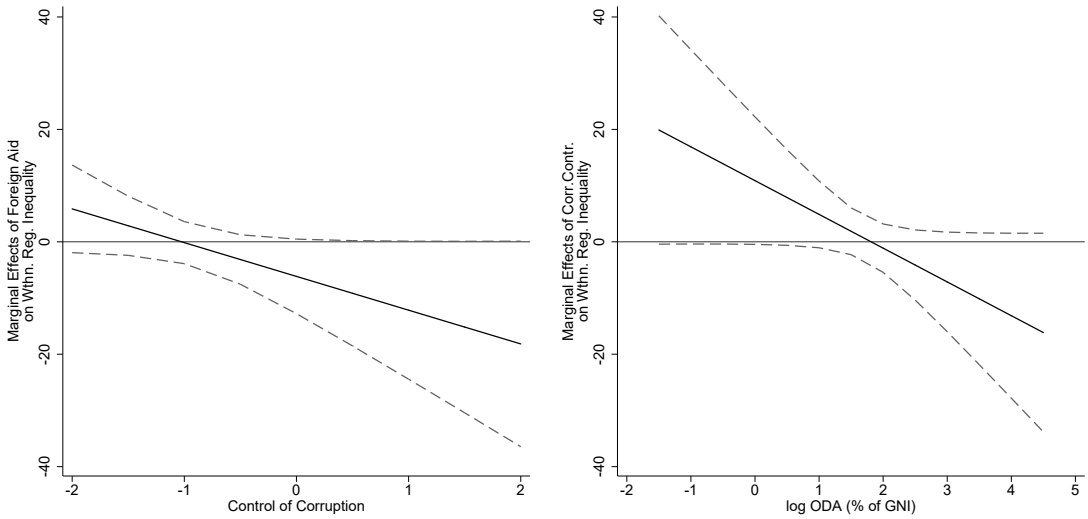

Figure C.12.: Marginsplot for Within Regional Inequality in Table 5.9

C.2. Basic outline of the dynamic panel data estimation (difference and system GMM)

For a good introduction into dynamic panel estimation methods in addition to the original papers, see Arellano (2003) and Bond (2002). Several further studies, such as Kiviet et al. (2017) and Kiviet (2020), provide some guidance concerning specific model specification issues. Additionally, Kiviet (2020) provides a good overview for general autoregressive distributed lag (ADL) models. Furthermore, Roodman (2009a) provides a good instruction on implementing system GMM with the Stata module `xtabond2` and Kripfganz (2019) for the Stata module `xtdpdgmm`. For a detailed discussion of the instrument set in system GMM and necessary conditions for their validity see Roodman (2009b). The following elaboration on difference and system GMM can be found in more detail in almost all mentioned papers.

The use of GMM and the definition of the instrument set that largely defines difference and system GMM originated with Holtz-Eakin et al. (1988). These estimators were further developed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). Arellano and Bond's contribution is a test for autocorrelation appropriate for linear GMM regression on panels, which is especially important when lags are used as instruments. The Arellano-Bond and Arellano-Bover/Blundell-Bond dynamic panel estimators are general estimators designed for situations with small number of yearly observations and large panels with a linear functional relationship. The Arellano-Bond estimation starts by transforming all regressors, usually by differencing, and uses the generalized method of moments (GMM), which is called difference GMM. The Arellano-Bover/Blundell-Bond estimator augments Arellano-Bond by making an additional assumption that first differences of instrument variables are uncorrelated with the fixed effects. This allows the introduction of more instruments and can improve efficiency. It builds a system of two equations - the original equation and the transformed differenced one and is known as system GMM.

The difference and system GMM estimators are designed for panel analysis and embody the following assumptions about the data-generating process. The process may be dynamic, with current realizations of the dependent variable influenced by past ones. There may be arbitrarily distributed fixed individual effects. This argues against cross-section regression, which must essentially assume fixed effects away, and in favor of a panel setup, where variation over time can be used to identify

parameters. Some regressors may be endogenous. The idiosyncratic disturbances (those apart from the fixed effects) may have individual-specific patterns of heteroskedasticity and serial correlation. The idiosyncratic disturbances are uncorrelated across individuals. Also, some regressors can be predetermined but not strictly exogenous, such that they are independent of current but not of past disturbances. The lagged dependent variable is an example. Another example in the current study would be the distribution of foreign aid in recipient countries, which might take past regional inequalities into account. The estimators do not assume that good instruments are available outside the immediate data set and use 'internal' instruments based on lags of the instrumented variables.

The general model of the data-generating process is as follows:

$$y_{it} = \alpha y_{i,t-1} + x_{it}^{'}\beta + \varepsilon_{it}; \tag{C.1}$$

$$\varepsilon_{it} = \mu_i + \upsilon_{it};$$

$$E(\mu_i) = E(\upsilon_{it}) = E(\mu_{it}\upsilon_{it}) = 0;$$

The disturbance term has two orthogonal components: the fixed effects, μ_{it}, and the idiosyncratic shocks, υ_{it}. Differencing equation C.1 provides:

$$\Delta y_{it} = (1-\alpha)y_{i,t-1} + x_{it}^{'}\beta + \varepsilon_{it}; \tag{C.2}$$

So the model equally can be thought of as being for the level or increase of y.

C.2.1. Fixed Effects

One problem in applying OLS to Equation C.2 is that $y_{i,t-1}$ is correlated with the fixed effects in the error term, which results in the "dynamic panel bias" highlighted by Nickell (1981). The positive correlation between a regressor and the error violates an assumption necessary for the consistency of OLS. This bias results in inflated coefficient estimates for lagged regional inequality by attributing predictive power to it that actually belongs to the recipient countries' fixed effect. With a large number of yearly observations, large T, the impact of one year's shock on the country's fixed effect and the endogeneity problem would disappear. Roodman (2009a) points out that with OLS regressions the lagged dependent variable, $y_{i,t-1}$, is positively correlated with the error, ε_{it}, resulting in upwards biased coefficient estimates. The

opposite is the case for within-group estimation controlling for individual fixed effects. Correspondingly, good estimates of the true parameter should lie in or near the range between these values. As Bond (2002) points out, these bounds provide an useful check on results from theoretically superior estimators.

To directly remove dynamic panel bias a different transformation of the data is needed, which removes the fixed effects while avoiding the propensity of the within-groups transformation to make every observation of y* endogenous to every other for a given individual. The transformation should have full row rank so that no further information is lost. Furthermore, the transformed variables should minimally depend on lagged observations of the original variables so that they remain available as instruments. One approach is to transform the data by first differencing to remove the fixed effects (difference GMM). Applying the transformation to C.1 provides

$$\Delta y_{it} = \alpha \Delta y_{i,t-1} + \Delta x_{it}^{'} \beta + \Delta \upsilon_{it}; \tag{C.3}$$

Although the fixed effects are gone, the lagged dependent variable is still potentially endogenous, because the $y_{i,t-1}$ term in $\Delta y_{i,t-1} = y_{i,t-1} - y_{i,t-2}$ is correlated with the $\upsilon_{i,t-1}$ in $\Delta \upsilon_{it} = \upsilon it - \upsilon_{i,t-1}$. Similarly, any predetermined variables in x that are not strictly exogenous become potentially endogenous because they may be related to $\upsilon_{i,t-1}$, too. However, the first-difference transformation has a weakness. It magnifies gaps in unbalanced panels. This leads to the second transformation, called "forward orthogonal deviations" or "orthogonal deviations" (Arellano and Bover, 1995). Instead of subtracting the previous observation from the contemporaneous one, it subtracts the average of all future available observations of a variable. No matter how many gaps, it is computable for all observations except the last for each individual, so it minimizes data loss. And because lagged observations do not enter the formula, they are valid as instruments. In fact, Arellano and Bover (1995) show that in balanced panels, any two transformations of full row rank will yield numerically identical estimators, holding the instrument set fixed.

C.2.2. Instruments

The estimators are build assuming that the researcher has no appropriate instruments, such that he must draw instruments from within the dataset. Natural candidate instruments for $y^*_{i,t-1}$ are $y_{i,t-2}$ and, if the data are transformed by differencing, $\Delta y_{i,t-2}$. In the differenced case, for example, both $y_{i,t-2}$ and $\Delta y_{i,t-2}$ are mathemati-

cally related to $\Delta y_{i,t-1} = y_{i,t-1} - y_{i,t-2}$ but not to the error term $\Delta v_{it} = v_{it} - v_{i,t-1}$ as long as the v_{it} are not serially correlated. The simplest way to incorporate either instrument is with 2SLS, which leads to the Anderson and Hsiao (1982) difference and levels estimators. To improve efficiency, one can take the Anderson-Hsiao approach further, using longer lags of the dependent variable as additional instruments. Introducing more information should improve efficiency. But in standard 2SLS, the sample size reduces with long lag length used, because observations for which lagged observations are unavailable are dropped.

Working in the GMM framework, Holtz-Eakin et al. (1988) show a way around this trade-off. They build a set of instruments from the second lag of y, one for each time period, and substitute zeros for missing observations, resulting in "GMM-style" instruments:

$$\begin{pmatrix} 0 & 0 & \cdots & 0 \\ y_{i1} & 0 & \cdots & 0 \\ 0 & y_{i2} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & y_{i,T-2} \end{pmatrix}$$

In unbalanced panels, one also substitutes zeros for other missing values. The resulting columns of $\mathbf{Z}$, each taken as orthogonal to the transformed errors, correspond to a set of moment conditions,

$$E(\mathbf{Z}'\hat{E}) = 0 \Rightarrow \sum_i y_{i,t-2}\hat{e}^*_{it} = 0 \text{ for each } t \geq 3$$

which are based on the expectation of $E(y_{i,t-2}\varepsilon^*_{it}) = 0$. Alternatively, one can "collapse" the instrument set into one column:

$$\begin{pmatrix} \cdot \\ y_{i1} \\ \vdots \\ y_{i,T-2} \end{pmatrix}$$

This embodies the same expectation but conveys slightly less information, because it generates one moment condition, $\sum_{i,t} y_{i,t-2}\hat{e}^*_{it} = 0$.

It is recommended to include all valid lags of the untransformed variables as instruments, where available. For endogenous variables, that means lags 2 and higher. For a variable, x, that is predetermined but not strictly exogenous, lag 1 is also

valid, because υ^*_{it} is a function of errors no older than $\upsilon^*_{i,t-1}$ and $x^*_{i,t-1}$ is potentially correlated only with errors $\upsilon^*_{i,t-2}$ and older. For $y_{i,t-1}$, which is predetermined, realizations $y_{i,t-2}$ and earlier can be used, giving rise to stacked blocks in the instrument matrix of the form

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \cdots \\ y_{i1} & 0 & 0 & 0 & 0 & 0 & \cdots \\ 0 & y_{i2} & y_{i1} & 0 & 0 & 0 & \cdots \\ 0 & 0 & 0 & y_{i3} & y_{i2} & y_{i1} & \cdots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \ddots \end{pmatrix} \quad \text{or, collapsed} \quad \begin{pmatrix} 0 & 0 & 0 & \cdots \\ y_{i1} & 0 & 0 & \cdots \\ y_{i2} & y_{i1} & 0 & \cdots \\ y_{i3} & y_{i2} & y_{i1} & \cdots \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix}$$

Because in the standard, uncollapsed form each instrumenting variable generates one column for each time period and lag available to that time period, the number of instruments is quadratic in T. To limit the instrument count, one can restrict the lag ranges used in generating these instrument sets. Or one can collapse them.

Arellano and Bond (1991) compare the performance of difference GMM with the OLS, within-groups, and Anderson-Hsiao (Anderson and Hsiao, 1982) difference and levels estimators using Monte Carlo simulations of 7 x 100 panels. Difference GMM exhibits the least bias and variance in estimating the parameter of interest, although in their tests the Anderson-Hsiao levels estimator does nearly as well for most parameter choices. Blundell and Bond (1998) further demonstrate that difference GMM performs poorly for cases of y being close to a random walk. Past levels convey little information about future changes, hence, untransformed lags are weak instruments for transformed variables. To increase efficiency Blundell and Bond (1998) develop an approach outlined in Arellano and Bover (1995). Instead of transforming the regressors to eliminate the fixed effects, it transforms - differences - the instruments to make them exogenous to the fixed effects. This is valid assuming that changes in any instrumenting variable are uncorrelated with the fixed effects $E(\Delta x_{it}\mu_i) = 0$ for all i and t. This is to say, $E(x_{it}\mu_i)$ is time invariant. If this holds, then $\Delta x_{i,t-1}$ is a valid instrument for the variables in levels:

$$E(\Delta x_{i,t-1}\varepsilon_{it}) = E(\Delta x_{i,t-1}\mu_i) + E(x_{i,t-1}\upsilon_{it}) - E(x_{i,t-2}\upsilon_{it}) = 0 + 0 - 0$$

In essence, Arellano-Bond use levels to instrument differences and Blundell-Bond use differences to instrument levels. For random walk-like variables, past changes may be more predictive of current levels than past levels are of current changes so that the new instruments are more relevant. Again validity depends on the assumption that

the υ_{it} are not serially correlated. Otherwise, $x_{i,t-1}$ and $x_{i,t-2}$, being correlated with past and contemporary errors, may correlate with future errors as well. In general, if x is endogenous, $\Delta x_{i,t-1}$ is available as an instrument because $\Delta x_{i,t-1} = x_{i,t-1} - x_{i,t-2}$ should not correlate with υ_{it}; earlier realizations of Δx can serve as instruments as well. If x is predetermined, the contemporaneous $\Delta x_{it} = x_{it} - x_{i,t-1}$ is also valid as an instrument, because $E(x_{it}\upsilon_{it}) = 0$.

But the new assumption depends on the assumption of stationarity. The Blundell-Bond approach instruments $y_{i,t-1}$ with $\Delta y_{i,t-1}$, which from the point of view of C.2 contains the fixed effect μ_i - yet it is assumed that the levels equation error, ε_{it}, contains μ_i too, which makes the proposition that the instrument is orthogonal to the error, that $E(\Delta y_{i,t-1}\varepsilon_{it}) = 0$, counterintuitive. The assumption can hold only if the data-generating process is such that the fixed effect and the autoregressive process governed by α, the coefficient on the lagged dependent variable, offset each other in expectation across the whole panel.

Blundell and Bond (1998) establish that α must have an absolute value less than unity so that the process converges. The authors derive the assumption that $E(\Delta x_{it}\mu_i) = 0$ from a more precise one about the initial conditions of the data-generating process. Conditioning on μ_i in the simple autoregressive model without controls such as $y_{it} = \alpha y_{i,t-1} + \mu_i + \upsilon_{it}$, y_{it} can be expected to converge over time to $\mu_i/(1-\alpha)$ - the point where the fixed effect and the autoregressive decay just offset each other.[48] For the time-invariance of $E(y_{it}\mu_i)$ to hold, the deviations of the initial observations, y_{i1}, from these long-term convergent values must not correlate with the fixed effects, such that $E[\mu_i(y_{i1} - \frac{\mu_i}{(1-\alpha)}] = 0$. Otherwise, the regression to the mean that will occur, with individuals with higher initial deviations having slower subsequent changes as they converge to the long-run mean, will correlate with the fixed effects in the error. If this condition is satisfied in the first period, then it will be satisfied in subsequent periods as well. Generalizing to models with further control variables, this assumption about initial conditions is that, controlling for the covariates, faster-growing individuals are not systematically closer or farther away from their steady states than slower-growing ones.

To exploit the new moment conditions for the data in levels while retaining the original Arellano-Bond conditions for the transformed equation, Blundell and Bond (1998) designed a system estimator. This involved building a stacked data set with

[48] This can be seen by solving the following equality $E(y_{it}|\mu_i) = E(y_{i,t-1}|\mu_i)$ by using $y_{it} = \alpha y_{i,t-1} + \mu_i + \upsilon_{it}$.

twice the observations; in each individual's data, the untransformed observations follow the transformed ones. The GMM formulas and the software treat the system as a single-equation estimation problem because the same linear relationship with the same coefficients is believed to apply to both the transformed and untransformed variables.

In system GMM, one can include time-invariant regressors, which would disappear in regressors because all instruments for the levels equation are assumed to be orthogonal to fixed effects, as to all other time-invariant variables. In expectation, removing them from the error term does not affect the moments that are the basis for identification. As for GMM-style instruments, the Arellano-Bond instruments for the transformed data are set to zero for levels observations and the new instruments for the levels data are set to zero for the transformed observations. One could enter a full GMM-style set of differenced instruments for the levels equation, using all available lags, in direct analogy with the levels instruments entered for the transformed equation.

C.2.3. Test Statistics

The Sargan/Hansen test for joint validity of the instruments is standard after GMM estimation. In addition, Arellano and Bond (1991) develop a test for autocorrelation in the idiosyncratic disturbance term, υ_{it}. The full disturbance, ε_{it}, is presumed autocorrelated because it contains fixed effects, and the estimators are designed to eliminate this source of trouble. However, if the υ_{it} are themselves serially correlated of order one then $y_{i,t-2}$ is endogenous to $\upsilon_{i,t-1}$ in the error term in differences, $\Delta\varepsilon_{it} = \upsilon_{it} - \upsilon_{i,t-1}$, making it a potentially invalid instrument. Thus, one needs to restrict the instrument set to lags 3 and longer of y.

To test for autocorrelation, the Arellano-Bond test is applied to the residuals in differences. Because $\Delta\upsilon_{it}$ is mathematically related to $\Delta\upsilon_{i,t-1}$ via the shared $\upsilon_{i,t-1}$ term, negative first-order serial correlation is expected in differences and evidence of it is uninformative. To check for first-order serial correlation in levels, one needs to look for second-order correlation in differences, because this will detect correlation between the $\upsilon_{i,t-1}$ in $\Delta\upsilon_{it}$ and the $\upsilon_{i,t-2}$ in $\Delta\upsilon_{i,t-1}$. In general, one checks for serial correlation of order l in levels by looking for correlation of order $l+1$ in differences. The Arellano-Bond test for autocorrelation is valid for any GMM regression on panel data, as long as none of the regressors is "post-determined", depending on future

realizations.

C.2.4. Instrument proliferation

A large count of instruments relative to the sample size may result in misleading asymptotic results about the estimators and related specification tests. One problem which applies to instrumental variable estimators generally is that numerous instruments can overfit endogenous variables. Another problem is specific to feasible efficient GMM (FEGMM), in which sample moments are used to estimate an optimal weighting matrix for the identifying moments between the instruments and the errors. According to Roodman (2009b), these problems can generate results that at once are invalid and appear valid because of weakened specification tests.

A large number of instruments can overfit instrumented variables, failing to expunge their endogenous components and biasing coefficient estimates towards those from non-instrumenting estimators. There exists a general assumption that the instrument count should not be too high relative to the panel width in some vague sense but remain unclear. The bias with endogenous regressors is far worse. Kiviet (2020) provides the following inequalities as a rough guideline for the total number of employed instruments L, where K is the total number of estimated coefficients, N is the number of panels, T number of yearly observations, and q_K and q_L may possibly be in the range of $4 < q_K < q_L < 10$.[49]

$$K + 4 \leq L < q_K K \quad \text{and} \quad q_L L < NT - T - K \tag{C.4}$$

Imprecise estimates of the optimal weighting matrix pose another problem. Difference and system GMM are typically applied in one- and two-step variants. Roodman (2009b) highlights that the two-step procedure uses a weighting matrix that is the inverse of an estimate, $\mathbf{S}$, of $Var[\boldsymbol{z}'\varepsilon]$, where $\mathbf{z}$ is the instrument vector. This 'optimal' weighting matrix makes two-step GMM asymptotically efficient. The elements of the optimal matrix, as second moments of the vector of moments between instruments and errors, are fourth moments of the underlying distributions, which can be hard to estimate in small samples. One common symptom of the difficulty of approximating this ambitious matrix with limited data is that the estimate can

[49] According to Kiviet (2020) the motivations for these inequalities is that L should be strictly larger than K to assure the existence of at least the first four moments of the GMM coefficient estimates.

be singular. Thus, a high instrument count can lead two-step GMM far from the theoretically efficient ideal. But the choice of the weighting matrix does not affect consistency of two-step GMM.

A standard specification check for two-step GMM is the Hansen (1982) J-test. If the equation is overidentified, as almost always in the case of difference and system GMM, the empirical moments will generally be non-zero. In this case, under the null hypothesis of joint validity of all instruments, the moments are centered around 0 in distribution. The J statistic is distributed χ^2 with degrees of freedom equal to the degree of overidentification. If errors are believed to be homoskedastic the older Sargan (1958) statistic is applied.

A high p-value of the Hansen test provides evidence for the validity of the results. However, in cases with a large number of instruments the J-statistics may produce implausibly perfect p-values of 1. Again, there is no precise guidance on what is a relatively safe number of instruments. Furthermore, the difference-in-Hansen test checks the validity of a subset of instruments. This is done by computing the increase in the Hanses J-test when the given subset is added to the estimation. Under the same null of joint validity of all instruments, the change in J is χ^2 distributed, with degrees of freedom equal to the number of added instruments. By weakening the overall Hansen J-test, a high instrument count also weakens the difference-in-Hansen test.