



SCHOOL OF
ECONOMICS AND
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*“An investigation into how Sub-Saharan Africa’s human
development is affected by Chinese versus German
Foreign Direct Investments from 2005-2022”*

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Abstract

The purpose of this investigation is to examine how Chinese and German Foreign Direct Investments (FDI) affect human development in Sub-Saharan Africa (SSA), as measured by the Human Development Index (HDI), and to explore potential reasons for any differences in their respective impacts. The investigation is based on two multiple linear regression models, both implementing OLS fixed effects estimation, and secondary panel data from 44 SSA countries covering the period 2005–2022. The regression analysis finds a weak but statistically significant relationship between Chinese FDI inflows and HDI, at a 5% level of significance. It finds no statistically significant relationship between German FDI inflows and HDI at any level of significance.

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1 Introduction

Since 1990, Foreign Direct Investment (FDI) net inflows to Sub-Saharan Africa (SSA) have shown a positive trend (World Bank, 2023) and have been one of the most important forms of cross-border capital flow (World Bank, 2014). Up until 2015 FDI inflows increased rapidly, but since then the flows have fluctuated extensively. In 2021, they reached an all-time high of 71.34 billion USD, declining in 2023 to 40.63 billion USD, similar to the levels seen in the early 2010s (World Bank, 2023). Not only have the levels of inflow changed, but also the key investors. According to the World Bank (2014), the European Union (EU) and its member countries have long been the most important investors in Africa, but recently, Asia's economic activity in terms of FDI has increased. China, who previously primarily acted as a recipient of FDI, has emerged as a prominent investor in SSA. As a result, the dynamics have shifted, and a power play between the EU and China has arisen.

FDI presents both significant opportunities and complex challenges. Dupasquier and Osakwe (2005) describe that it can drive economic growth, generate employment, foster global integration and promote transfer of technology and skills. However, they also mention that FDI inflows to Africa often are hindered by factors such as political instability, weak infrastructure, corruption and protectionist policies. Even when investments occur, the outcomes can include uneven distribution of benefits and environmental degradation (K4D Emerging Issues, 2019), as well as displacement of local business and profit repatriation (CFI, n.d.). The differing investment strategies of China and the EU, shaped by distinct motivations and sectoral priorities, further influence the nature and impact of their investments in Africa (Friedrich Naumann Foundation, 2024). These dynamics highlight the multifaceted character of FDI, where investor intent, local conditions and sectoral focus all affect its economic, social and environmental outcomes.

It is therefore relevant to examine whether FDI from China and the EU have different effects on human development in SSA. However, due to limited macroeconomic data and the absence of aggregated EU FDI data for the region, Germany will instead be investigated. Germany is one of the biggest investors in Africa, like China, (UNCTAD, 2023) and is also aligned with the EU's

overall investment strategy as it is a member of the union, emphasizing the relevance of the choice.

Accordingly, this investigation seeks to answer the following research question: “Do Foreign Direct Investment (FDI) inflows from China and Germany respectively impact human development in Sub-Saharan Africa, and do the impacts differ?”. In an extension, given that we find differences between Chinese and German FDI, we will also explore potential underlying determinants and their implications.

There is extensive research on the impact of FDI, Chinese FDI particularly, and differing investment motives on development in Africa and SSA. However, comparative studies between two investing countries are rare, and no existing research has directly compared the effects of Chinese and German FDI on human development in the region. This study therefore contributes to the field by introducing a new comparative perspective.

To assess the developmental impacts of FDI in SSA, the commonly used Human Development Index (HDI) is used. Moreover, HDI, like many other indicators, is not a perfect measure of development but provides a more holistic indication of human development than other measurements such as Gross Domestic Product.

The research question will be examined using a series of Ordinary Least Squares (OLS) regressions with fixed effects estimation. The regression analysis will be based on secondary panel data, with HDI as the dependent variable and a range of explanatory variables, including FDI inflows from China and Germany. This will be complemented with a review of the investment context, key variables, theoretical frameworks and previous research. Various econometric tests will also be conducted to address potential issues such as inconsistency and bias that may affect the reliability of the results. Finally, the findings will be evaluated based on statistical and economic significance, as well as potential weaknesses such as endogeneity.

2 Background

This chapter aims to explore the central concepts outlined in the introduction in further detail. This will include relevant definitions and explanations of important concepts.

2.1 Definitions of Important Concepts

Human Development Index

The World Health Organization (n.d.) describes that the Human Development Index (HDI) measures a country's average achievements within the three dimensions health, standard of living and knowledge. Health is measured as life expectancy at birth, standard of living is measured as GNI per capita in PPP terms in USD and knowledge is measured as mean years and expected years of schooling. Moreover, they explain that HDI ranks from 0 to 1, where a higher HDI value indicates a higher human developmental level in a country.

Foreign Direct Investment: Stock & Inflow

According to Hayes (2025), the term Foreign Direct Investment (FDI) generally refers to a situation where an investor, company or government from one country acquires an ownership stake in a business or project located in another country. It typically involves a substantial share, usually 10% or more, of voting power and long-term lasting investments, rather than short-term stock investments in a single foreign company.

FDI flows represent transactions during a specific period (annually or quarterly), while FDI stocks reflect the total accumulated value at the end of that period (UNCTAD, n.d.). An analogy can clarify the difference. Imagine a bathtub. FDI inflows and outflows are the water added or removed during the period, while the stock is the total water in the tub at the end of the period – an accumulation of past inflows and outflows.

In this investigation, FDI flows in millions of USD will be used. There is no clear consensus in the literature on whether flows or stocks are preferable. Instead, data availability often determines the choice. Generally, FDI stock is more suitable for examining the long-term presence of investment across countries, while FDI flow is better for analyzing recent trends. Given this study's focus on the recent rise in Chinese FDI to SSA, and the greater availability of flow data, FDI flows will be used.

Sub-Saharan Africa

In this investigation, Sub-Saharan Africa (SSA) refers to 49 of the 54 countries on the African continent, located south of the Sahara Desert. The term includes all countries part of the typically categorized subregions of Western, Eastern, Central and Southern Africa (McKenna, 2025). A list of specific countries comprising Sub-Saharan Africa is outlined in *Appendix A*. Certain countries (5) have an overwhelming lack of data or gained independence after 2005, and have been excluded from this investigation. These are also outlined in *Appendix A*.

2.2 Regulation of FDI in the EU and Its Member States

With the Lisbon Treaty in 2009, FDI became an exclusive competence of the EU, as part of the common commercial policy (European Commission, n.d.-a). In areas where the EU has an exclusive competence, only the EU is allowed to adopt legal acts (EUR-Lex, n.d.). This means that the EU handles FDI policies on behalf of its members, such as Germany, and hence creates a unified framework for European FDI that ensures consistent objectives of FDI and equal treatment of FDI recipients (European Commission, n.d.-a).

However, an official at the Ministry of Foreign Affairs (interview, 6 May 2025) explained that while the EU holds exclusive competence over FDI and hence is solely responsible for the FDI regulations, it does not control the specific investments made by member states or how those investments are financed. He also stated that this means that member states and national companies retain the ability to make decisions about their own outbound investments to non-EU countries, as long as these decisions align with the EU's overarching framework and regulations. Therefore, in sub-chapters 2.3, 2.4.2 and 2.5.2 both the EU and Germany will be discussed, alongside China.

2.3 Overview of European, German and Chinese FDI to Africa

As outlined by Qiang et al. (2021), the EU and its member states, such as Germany, have a historical and strategic relationship with both Africa as a whole and SSA, shaped by trade, development and investments. An important aspect of this relationship is FDI. They highlight that the EU has been Africa's main source of FDI historically, accounting for up to two-thirds of

total FDI into the continent until 2005. They also describe that in SSA, the absolute value of European FDI stock increased until 2014, followed by a decline between 2014 and 2018. However, they note that the EU's overall share has been decreasing since the early 2000s, falling to below 50 percent by 2018. Regarding Germany specifically, it ranked among the top five OECD investor economies in terms of FDI flows to Africa between 2001 and 2011 (World Bank, 2014), and belonged to the top 10 global investor economies in Africa by FDI stock throughout the rest of the investigated time period (UNCTAD, 2020) (UNCTAD, 2023).

Moreover, Qiang et. al (2021) emphasize that while the European FDI stock and share has declined, FDI from Asia has grown steadily since the 2000s, with its share rising from 5 percent in 2003 to 23 percent in 2018. A significant contributor to this growth has been China's increasing involvement in SSA. In a report from 2023, the International Monetary Fund points out that the economic relationship between China and SSA has strengthened, and over the past 20 years China has become a leading trade partner, a key lender and a significant source of FDI. It is stated that since 2006, China's FDI flows have increased significantly and in 2021 they accounted for around 23 percent, or approximately 3 billion USD, of the annual FDI inflows to the region. In the report it is also underlined that despite the recent rise in Chinese FDI inflows, which have contributed to the accumulation of FDI stock, China's share of total FDI stock in SSA remains relatively modest. In 2021, it corresponded to about 4.4 percent of the total stock.

2.4 China, EU & Germany Investment Initiatives and Approaches

2.4.1 China's Investment Initiatives and Approach

China began seeking influence on the African continent as early as the 1960s, but these early efforts were largely unsuccessful, in part due to their strong ideological focus, as noted by Ide-Jetro (n.d.). However, they explain that China's transition to a more market-driven economy, combined with its increasing demand for natural resources and broader global outlook, led to a renewed interest in Africa. This economic paradigm shift alone laid the foundation and the motives for China's recent investment policy into Africa.

A guiding strategy that China follows with regard to FDI into Africa is referred to as “infrastructure-for-resources” (IFR), or the “Angola Model”, according to Lebogang and Makhura (2022). In their article they discuss that China’s strategy is to invest in and build critical infrastructure in a country, and in return, secure favorable access to the country’s natural resources, which are essential for supporting China’s expansive manufacturing sector. This type of strategy, which is heavily focused on the tangible return that China receives, highlights the general motive that drives Chinese foreign investments. Without an abundance of natural resources, Chinese investment motives are significantly reduced, further enforcing the priority of personal gain as opposed to African development from a Chinese investment perspective.

During the timespan of this investigation, China’s FDIs in SSA have mostly been channeled through the Belt and Road Initiative (BRI) and the Forum on China–Africa Cooperation (FOCAC), as presented by Calabrese and Chen (2024). They describe that FOCAC was established in 2000 with the aim of strengthening economic and political ties between China and African countries, and that since 2018 it has been viewed as a cooperation platform within BRI. They also state that during the 2024 FOCAC summit, the Chinese government announced that it would provide Africa with nearly 51 billion USD in loans, investments and aid over the next three years. However, this financial commitment is lower than it was before the pandemic. Moreover, as outlined by Tsuji (2025), the BRI, launched in 2013, is a Chinese-led infrastructure investment initiative aimed to enhance China’s global connectivity with Africa, Eurasia and Latin America. Tsuji (2025) also notes that despite substantial infrastructure investments in areas such as transportation and energy across Sub-Saharan Africa, many Western countries are skeptical and view the BRI as a strategic tool for China to expand its global economic and political influence.

2.4.2 EU’s and Germany’s Investment Initiatives and Approaches

The European Commission (n.d.-b) emphasizes that the EU seeks a cooperative partnership with Africa based on equality and mutual benefit. The organization states that the EU’s objectives in cooperating with SSA are closely aligned with the Sustainable Development Goals (SDGs). Accordingly, it is explained that the EU’s efforts focus on addressing key challenges related to

sustainable and inclusive growth, human development, climate change, environmental degradation, migration, and the promotion of effective governance, democracy and human rights.

These priorities are reflected in two major strategic frameworks, namely the Global Gateway Strategy (2021) and the Joint Communication: Towards a Comprehensive Strategy with Africa (2020) (European Commission, n.d.-b). It is stated that the Joint Communication is a template for EU's renewed relationship with Africa, and proposes to cooperate in five key areas related to the green transition and energy access, digital transformation, sustainable growth and jobs, peace, security and governance, and finally migration and mobility. The Joint Communication also laid the foundation to the initiative the Global Gateway Strategy. This strategy aims to strengthen the EU's relationship with the rest of the world and to invest in digital, energy and transport infrastructure, as well as improving education and healthcare systems (European Commission, n.d.-c). It is also explained that its first major milestone was the 150 billion euros Africa-Europe Investment Package, from the EU to Africa, with the goal of enhancing the EU's relationship with its African partners.

In relation to the research question, it is also highly relevant to understand EU's approach to Africa since the early 2000s. From the Cotonou Agreement, signed in 2000, and the Joint Africa–EU Strategy, adopted in 2007, it is clear that the EU's FDI strategies in Africa were also previously characterized by commitment to fostering social, economic and ecological sustainability (European Parliament, n.d.). However, it is argued that these strategies followed more of a donor-recipient model and was not as strongly based on mutual cooperation as it is today.

In addition to the EU-level initiatives, Germany has launched several efforts to increase investment in, and strengthen their relations with, SSA. To begin with, the Sub-Saharan Africa Initiative of German Business (SAFRI) was founded in 1998 as the successor to the Southern Africa Initiative of German Business (SAFRI, n.d.). It is explained that they promote partnership-based and sustainable economic relations by facilitating dialogue and exchange between German and African businesses, political leaders and financial institutions. While the

organization does not directly invest in SSA, it acts as a catalyst by creating networks and encouraging German business engagement in the region.

As outlined by Bundesregierung (2023), another major initiative is the G20 Compact with Africa (CwA), launched during Germany's G20 Presidency in 2017, and supported by the IMF, World Bank Group and African Development Bank. Bundesregierung highlights that CwA's aim is to attract more private FDI by improving macroeconomic conditions, financial frameworks and the local business environment in participating African countries. Moreover, it is argued that CwA is framed as a "win-win" initiative, as it fosters governmental and economic reforms in Africa while offering German and G20 firms access to growing markets and resources. Lastly, they state that Germany more recently has also emphasized cooperation in green energy as part of its broader climate agenda.

In early 2023, the German Federal Ministry for Economic Cooperation and Development (BMZ) also introduced a revised Africa Strategy (BMZ, 2025). It is explained that it supports the achievement of the SDGs and the African Union's Agenda 2063, while promoting investment and addressing global challenges through mutual cooperation. Moreover, in BMZ's official report on the strategy, it is explicitly stated that their partnership is grounded in shared values and interests, and should be based on respect and reciprocity (BMZ, 2023). Consequently, the revised Africa Strategy appears to adopt a collaborative approach, built on common goals and mutual accountability. It should also be mentioned that while the strategy was revised in 2023 and therefore will not affect the results of this investigation, it highlights Germany's recent overall approach and values.

In summary, it can be concluded that Germany's investment approach in SSA focuses on facilitating and attracting investment through structural reforms, improving the business climate and aligning economic cooperation with global sustainability goals, through long-term, partnership-based cooperation.

2.5 China, EU & Germany Investment Areas

2.5.1 China's Investment Areas

In the literature, it is widely discussed that China and the EU prioritize investments in different sectors. As discussed by Tang et al. (2024), China tends to channel its FDI into labor-intensive and resource-intensive sectors, rather than knowledge-intensive ones. They emphasize that this trend also applies to China's FDI in Africa and SSA, which shows a strong concentration in natural resource extraction, construction and light manufacturing, while only a small share is allocated to knowledge-intensive sectors. In addition, China places high priority on infrastructure investment, which is particularly important as it drives economic growth. China has financed hydroelectric power projects, invested in road and railway networks, and contributed to Africa's information and communications infrastructure (Renard, 2011). However, during the FOCAC summit 2024, China announced a new interest for investing in green energy and renewable technology sectors (Calabrese & Chen, 2024).

2.5.2 EU's and Germany's Investment Areas

In contrast, RFI (2024) notes that all of the EU's investment and cooperation initiatives emphasize sustainable economic, social, and ecological development, along with the importance of supporting Africa's digital and technological transition. They argue that sectors such as renewable energy, transport, internet access, education, and vaccine production have been identified as key beneficiaries of both public and private EU investments, with the latter supported by the European Investment Bank. Similarly, Germany's investment initiatives primarily focus on areas such as health and social protection, peace and inclusive societies, climate and energy, as well as infrastructure and digitalization (BMZ, 2023). This demonstrates that the EU and Germany channel their FDI into a broader range of sectors compared to China.

To conclude, the contrasting investment strategies of the EU and Germany on the one hand, and China on the other hand, highlight the relevance of the research question, and it is reasonable to expect that the impact of their respective FDIs on HDI will differ as a result.

3 Previous Research

This chapter reviews existing literature on the impact of FDI on human development in SSA, with a particular focus on studies that apply empirical methods aligning with the approach of this investigation. The review provides a foundation for the investigation's expected outcomes and will be used to evaluate the validity and implications of the results. While few studies directly compare the effects of Chinese and German FDI on HDI in SSA, related research is more common, particularly on the impact of Chinese FDI or FDI in general on broader welfare outcomes in SSA or Africa. Moreover, the literature is organized chronologically, beginning with the earliest studies and progressing to the most recent.

3.1 Literature Investigating the Effects of Chinese FDI

To begin with, a report by the K4D Emerging Issues (2019), funded by the UK Department for International Development along with other government departments, examines the impact of Chinese development investments in Africa and highlights the multifaceted effects of these. While Chinese investments contribute to national economic growth, help reduce Africa's infrastructure gap and create jobs, their impact on local economic development is mixed, and negative social and environmental effects have been detected, according to the report. It is also stated that Chinese-owned mines have been found to have worse labor standards than their non-Chinese competitors. The report further argues that Chinese companies tend to ignore the social and environmental impacts and, hence, invest in sectors such as hydropower and extractives, with the aim of gaining a competitive advantage over Western competitors. However, as mentioned in the report, one has to be aware that it is hard to draw any robust conclusions due to the limited evidence base.

Moreover, a study by Fang (2021) examines how Chinese FDI in Africa affects African countries' potential to achieve the 2030 Sustainable Development Goals (SDGs), all of which are directly or indirectly related to the Human Development Index (HDI). The study uses panel data from 2015 to 2019 for two samples of 44 and 28 African countries, and applies both a random effects model and an ordered probit model. It found that Chinese FDI contributes to achieving economic and environmental SDGs, while no significant effect was observed on social SDGs.

The results of the study also show that the impact of FDI on certain SDGs was significantly positive, for example on SDG 8 (Decent Work and Economic Growth), which is directly linked to HDI. According to the paper, the reason for China's positive effect on environmental SDGs is that it has recently started to pay more attention to the environmental impact of its investments. In contrast, the limited impact on social SDGs is described to primarily be due to China's support for sectors like education and healthcare being delivered mainly through small-scale aid rather than long-term investments. The study also highlights that African countries' progress toward sustainable development is strongly influenced by country-specific factors.

Another study by Akrofi Atitianti and Dai (2021), assesses the impact of Chinese FDI on the welfare, measured as HDI, in Africa. The study is based on a 16-year panel data-set, consisting of the Chinese FDI stock in 52 African economies from 2003 to 2018, and two estimation techniques are used, namely fixed effects and instrumental variables. The authors found that Chinese FDI has a significantly positive impact on HDI in both Africa as a whole and SSA specifically, despite being widely viewed as exploitative and primarily directed toward resource-rich countries with weak institutions. The study also emphasizes the importance of effective governance for achieving welfare improvements through FDI.

Lastly, a paper by Sylvaire et al. (2022) investigates the effects from a broader perspective, more precisely the impact of China's FDI on Africa's inclusive development. The results are based on a regression model with fixed effects, and panel data from 48 African countries covering the period 2003 to 2020 is used. They found that Chinese FDI has a positive and significant effect on African countries' GDP per capita, employment rate, trade openness, crime rate and quality of human capital, where the latter is explained by Chinese FDI enterprises providing technical training, improving the laborers competitiveness and income. Their findings also indicated that the development is inclusive. This suggests a positive effect of FDI on human development, in line with the previous study.

3.2 Literature Investigating the Effects of German FDI

Previous literature on FDI from Germany, or even the EU more broadly, to SSA is limited. Likewise, studies assessing the impact of foreign or domestic investment on human development

in key sectors targeted by German FDI, such as health, sustainable energy, infrastructure and digitalization, are scarce. Nevertheless, two relevant studies have been identified and will be discussed in this chapter. These studies examine investments in health and education, and the impact of FDI on electricity access, which both are central areas of German FDI in SSA.

A paper by Paul Schultz (1999) examines investments in health and education in Africa. Specifically, Côte d'Ivoire and Ghana during the period 1985 to 1989 are investigated using OLS, IV and ML (maximum likelihood) estimators. The author argues that investments in health and education implies human capital development, which contribute to higher future living standards. The findings of the paper also show that basic primary and secondary education generate strong private and social returns, while higher education is associated with high public costs and tends to primarily benefit the wealthier segments of the population. However, the study suggests that introducing tuition fees and means-tested financial aid could improve both the equity and efficiency of higher education. Moreover, the paper proposes that improved health and nutrition, particularly through investments in areas such as child nutrition, could enhance productivity and lead to economic gains.

A study by Aluko et al. (2023) explores the impact of FDI on electricity access in Africa, using data from a sample of 36 African countries between 2000 and 2017, and applying an IV-GMM estimation method. The authors find that FDI is generally associated with improved access to electricity. Interestingly, this relationship appears to be stronger in countries with weaker governance. Conversely, it is argued that the marginal impact of FDI diminishes in countries with stronger institutional frameworks, possibly because these countries are already closer to achieving broad electricity access. According to the authors, these findings suggest that FDI can help to expand the energy access in Africa, particularly when institutional gaps exist. In turn, improved access to electricity is important for human development.

3.3 Literature Investigating the General Effects of FDI on HDI

As discussed in 3.2, existing literature on the human development effects of FDI from Germany or the EU to SSA is limited. However, both Germany and the EU are significant investors in the region. It can therefore be assumed that broader studies on the impact of FDI on human

development in SSA also, to some extent, capture the effects of German and European FDI. This sub-chapter therefore aims to review the existing literature on the general relationship between FDI and human development in the region.

A paper by Gohou and Soumaré (2012) assesses the effects of FDI on welfare, measured by HDI and real GDP per capita, across different African regions. The study uses a balanced sample of 52 African countries over the period 1990–2007. To examine whether FDI reduces poverty in Africa, the authors conduct a Granger causality test on panel data. They also run panel regressions for Africa's five free trade areas – AMU, ECCAS, ECOWAS, IGAD, and SADC – to assess whether FDI has varying effects across regions. At the continental level, the study finds a strong positive relationship between FDI and welfare improvements. However, significant regional differences are observed. According to the findings, FDI tends to have a greater relative impact on welfare in poorer countries, although it may yield greater absolute benefits in wealthier ones. The relationship between FDI and welfare is found to be positive and significant in East and Central Africa, non-significant in Northern and Southern Africa, and ambiguous in Western Africa. These results of the study strengthen the complexity and regional variability of the relationship between FDI and HDI in SSA.

Moreover, a paper by Fauzel et al. (2015) examines the effect of FDI on poverty alleviation or welfare maximization in 16 SSA countries over the period 1990 to 2010, using a dynamic Panel vector error correction model. The results of this study instead show that FDI has a positive effect on both economic and social development for the investigated SSA countries, as it helps to attain economic welfare in terms of higher growth and social welfare in terms of poverty reduction. However, the authors emphasize that inclusive development policies and appropriate institutions are needed to maximize the benefits from FDI inflows.

Moreover, a study by Anetor et al. (2020) examines the impact of FDI, foreign aid and trade on poverty reduction in SSA. The analysis is based on data from 29 countries in the region, covering the period from 1990 to 2017. They employ a single model using the Feasible Generalized Least Squares (FGLS) technique to assess the effects of the three variables on poverty reduction. The study finds that FDI and foreign aid have a negative impact, while trade has a positive and

significant effect on reducing poverty, particularly in low-income countries. The authors suggest that the negative effects of FDI and foreign aid are likely due to the low levels of FDI, which are insufficient to reduce poverty, and the inadequate allocation of aid.

Finally, a recent study by Adamu and Aigbedion (2025) investigates the effects of FDI on human development in Western Africa from 2010 to 2022. The study adopts a Panel Quantile regression for analyzing the data, and comes to an interesting conclusion. It discovers that FDI harms human development in Western African countries with low HDI while benefiting the human development of countries in the region with high HDI. While there is much literature supporting that how FDI affects human development in African countries depends largely on the country-specific social and economic circumstances, this direct connection to the level of HDI is unique.

3.4 Summary of Previous Research

Table 1: Summary of Previous Research

Author	Time period	Investor	Region	Findings
K4D Emerging Issues (2019)	2010-2019	China	Africa	Positive relationship between FDI and economic growth, infrastructure and supply of jobs. Broader negative social and environmental effects.
Fang (2021)	2015-2019	China	44 and 28 African countries	Positive relationship between FDI and economic and environmental SDGs, but negative relationship between FDI and social SDGs. Likely due to lack of long-term investments in social sectors.
Akrofi Atitianti and Dai (2021)	2003-2018	China	52 African countries	Positive relationship between FDI and HDI in Africa and SSA. Effective

				governance needed.
Sylvaire et al. (2022)	2003-2020	China	48 African countries	Positive relationship between FDI and GDP/capita, employment rate, trade openness, crime rate and quality of human capital. Inclusive development.
Paul Schultz (1999)	1985-1989	Not specified	Côte d'Ivoire and Ghana	Investments in health and education are positively correlated with human capital and standard of living. Stronger private and social returns of investments in basic and secondary education, than in higher education.
Aluko et al. (2023)	2000-2017	Not specified	36 African countries	FDI is associated with improved electricity access. Higher marginal impact for countries with weaker governance.
Gohou and Soumaré (2012)	1990-2007	Not specified	52 African countries	Positive relationship between FDI and welfare in East and Central Africa, non-significant relationship in North and South Africa, vague relationship in Western Africa.
Fauzel et al. (2015)	1990-2010	Not specified	16 SSA countries	Positive relationship between FDI and social and economic development. Inclusive development policies and appropriate institutions needed.
Anetor et al. (2020)	1990-2019	Not specified	29 SSA countries	FDI negatively correlated with poverty reduction. Likely due to insufficient FDI-levels.

Adamu and Aigbedion (2025)	2010-2022	Not specified	Western Africa	Negative relationship between FDI and HDI in countries with low HDI, positive relationship in countries with high HDI.
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3.5 Aspects Unique to this Investigation

A review of previous literature on FDI in SSA reveals few commonalities except for the overarching theme that is being investigated. Similarly, this investigation distinguishes itself in a few aspects. Most notably, its comparative focus on China and Germany is entirely unique, reinforcing the study’s relevance and its potential to make a novel contribution to the field. However, this limits the opportunities for direct comparison with previous literature, and as previously discussed the analysis will draw on related literature.

Furthermore, the combination of geographic and historical scope in this investigation is unique. While several studies have examined the impact of FDI on human development in SSA, some even observing the effect of Chinese FDIs specifically, none have done so over the period 2005–2022. Most existing research covers either earlier or significantly shorter time periods. Given that Chinese FDI in SSA is a relatively recent development, analyzing this more current period strengthens the relevance of the findings. Moreover, no existing studies appear to have specifically investigated the impact of German FDI on HDI in SSA.

The methodological approach and the selection of explanatory variables further differentiate this investigation. While the use of panel data and statistical regressions is common, the application of a Fixed Effects OLS-adapted regression is relatively rare. The explanatory variables are chosen with careful consideration and are supported by previous literature, but the specific combination of variables used in this study is unique.

3.6 Strengths and Weaknesses of Previous Literature

As outlined above, previous studies differ in their methods, theoretical frameworks, time periods, datasets and conclusions. On the one hand, this inconsistency might suggest unreliability, but on

the other hand, and to a greater extent, it reinforces the view that the relationship between FDI and HDI is highly complex. This view is in turn very important when designing policies to improve human development in SSA. Moreover, the diverse methodological approaches in previous literature demonstrate methodological innovation and creativity, which is valuable in a field that still lacks consensus on both optimal methods and expected outcomes. Like this study, many other investigations also face data limitations, which is common for low-income regions such as SSA. These limitations often result from weak institutions, a large informal economy, political or logistical challenges and historically low research incentives among wealthier countries.

Another limitation stemming from the limited research on this topic is the lack of papers from highly rated, well-recognized journals addressing the relationship between FDI and HDI. Consequently, much of the literature referenced in this study lacks international recognition, which might weaken the credibility and reliability of their conclusions.

4 Theory

This chapter presents the theoretical framework of this investigation, focusing on theories relevant to the relationship between FDI, different investment approaches and human development. It begins with an overview of the Endogenous growth theory, more specifically the Romer model, followed by an explanation of Spillover effects and concludes with the Capability approach.

4.1 Endogenous Growth Theory – the Romer Model

A core component of HDI is the standard of living, which is measured using Gross National Income (GNI). According to OECD (n.d.-b), GNI represents the total income earned by a country's residents across all sectors, regardless of where that income is generated. It is explained that while it is similar to GDP, which measures all income produced within a country's borders, GNI focuses on the income of a country's citizens, irrespective of their geographic location. For this reason, it is stated that GNI is used in HDI as an indicator of the standard of living. GNI and GDP are however often closely correlated and tend to follow similar trends.

Economic growth theory was first introduced by Robert Solow in 1956 through his neoclassical growth model “the Solow model”, which is a foundational framework that identifies the exogenous drivers of economic growth, according to Jones and Vollrath (2013). They further state that since the introduction of economic growth theories, they have been expanded to explore the endogenous factors influencing long-term growth. One key extension is explained to be the Romer model, developed by Paul Romer, which emphasizes the role of technology as a central growth driver. In this model, technological progress refers to the introduction of new varieties of goods into the economy.

Jones and Vollrath (2013) explain that the Romer model adopts the following production function (1): $Y = K^\alpha (AL_Y)^{1-\alpha}$, where the capital stock K and labor L_Y combine to produce output Y , using the stock of ideas or technology A . α is a parameter representing the balance between consumption and saving, with a value between 0 and 1. For the sake of this investigation, it is specifically this technological term that is of relevance. They explain that unlike the Solow model, where technological development is exogenous and assumed to grow at a constant rate, Romer’s model expresses technological change (2) in its simplest form as: $\dot{A} = \theta L_A$, where \dot{A} is the number of new ideas produced at any given point in time, θ is a measure of the general productivity of the Research & Development (R&D) sector in a country, and L_A refers to the number of workers in the R&D sector actively contributing to the discovery of new ideas.

The Romer equations discussed so far are general and do not promote long-term economic growth. Jones and Vollrath (2013) emphasize that in the Romer model, as is the case in the Solow model, it is a country’s “steady state” that is determinative of its long-term economic growth. “Steady state” refers to a long-term equilibrium state of growth that every country is working toward achieving. They further state that when technological development is adapted to apply to a country’s steady state, the equation (3) becomes the following: $g_Y = g_A = \frac{\lambda n}{1-\phi}$, where long-term economic growth g_Y corresponds to long-term technological development g_A . λ is a parameter determining the productivity of the R&D sector, n is the population growth and ϕ

is a parameter determining if the existence of ideas contributes or harms the production of new ideas.

As the Romer model suggests, technological development is essential in driving a country's long-term economic growth and reaching its steady state. Moreover, FDI is widely recognized to be a major source of transfer of technology and know-how, emphasizing FDI's ability to initiate and promote growth according to the model (Balasubramanyam et al., 1996). As GNI and GDP are closely correlated, it is in extension expected that FDI should contribute positively to a country's long-term GNI growth and standard of living.

4.2 Spillover Effects

Spillover effects are a well-established concept in economics, particularly in the context of FDI and the operations of multinational corporations in host countries. They refer to indirect or unintended consequences of an event or action that extend beyond its original scope. A study by Blomstrom et al. (1999) examines the efficiency spillovers resulting from FDI. They observe that while positive spillovers from foreign investors to the local economy do occur, there is little consensus on the magnitude of these effects. The authors also investigate the key determinants of such spillovers, emphasizing the role of appropriable technology made available through foreign investment. This aligns with the Romer model, which similarly underscores the critical role of technology in driving long-term economic growth.

FDI-induced spillovers can take various forms, with technology transfer being a key channel. Foreign firms often introduce advanced production techniques and managerial practices (OECD, 2002). Knowledge diffusion is another common indirect effect, as new firms bring innovative methods in production, marketing and quality control that tend to spread to local communities (Smarzynska Javorcik, 2004). This is further strengthened when local workers are employed and trained by foreign companies (World Bank, 2019). Moreover, the companies often establish collaborations with local suppliers, which places demand on quality and efficiency (Havranek & Irsova, 2011). These spillovers enhance local knowledge and human capital, contributing to improvements in both the education and income components of HDI. Indirectly, they may also

contribute to improved living standards and health outcomes by increasing productivity, generating jobs with higher income and supporting institutional learning.

While it is widely accepted that FDI generates spillover effects, there is less agreement on whether these effects are always beneficial to the host country. A study by Borensztein et al. (1998) found that for FDI to produce highly positive spillover effects, the host country must possess a minimum level of human capital. Without this, the country may struggle to absorb and utilize the technology and knowledge transferred through FDI. This suggests that the effectiveness of FDI-induced spillovers can be country-specific.

4.3 The Capability Approach

Another highly relevant theory for evaluating the impact of Chinese versus German FDI on HDI is Amartya Sen's Capability approach. Sen was one of the founders of the HDI (Nobel Prize Museum, 2020) and according to Todaro and Smith (2020) he developed this normative framework to assess development and social justice based on individuals' access to, or achievement of, capabilities and functionings. They explain that functionings refers to the various things people value doing or being, such as attending school or living a long and healthy life. These can be categorized as either elementary, such as being nourished or able to move freely, or complex, such as participating in a community or having self-respect. Moreover, they state that capabilities, in contrast, represent the actual freedom and ability to achieve these functionings.

Sen (1999) also emphasizes that extended capabilities or choice over functionings, which more simply can be explained as increased freedom, should be the goal of development. While he acknowledges that factors such as increased GDP, well-functioning social and economic institutions, political and civil rights, and technological progress can all serve as important means to expanding freedom, he argues that these should not be seen as ends in themselves. The primary objective of development should instead be the enhancement of freedoms according to him.

5 Data & Variables

A large degree of the data used in this investigation is collected from the World Bank. This includes the variables *Political Stability and Absence of Violence/Terrorism* (World Bank, n.d.-e), *Electricity Access* (World Bank, n.d.-a), *Inflation* (World Bank, n.d.-b), *Trade Openness* (World Bank, n.d.-c) and *Gross Domestic Product* (World Bank, n.d.-d). This is complemented with data from the Human Development Reports (n.d.) on *Human Development Index*, China Africa Research Initiative by Johns Hopkins (2025) with data on *Chinese Foreign Direct Investment Inflows* as well as OECD (n.d.-a) with data on *German Foreign Direct Investment Inflows*. The data on *Chinese and German FDI inflows* is presented as a share of GDP in each Sub-Saharan African country to improve comparability.

5.1 Dependent Variable

The investigated dependent variable is human development, represented by the commonly used *Human Development Index*. As this investigation aims to explore the relationship between *FDIs* and *HDI* from China and Germany respectively, particularly in terms of the improvements or deterioration in human development over time, the regressions will make use of the *annual change in HDI*, otherwise known as the variable's first difference transformation. *HDI*, as mentioned in sub-chapter 2.1, ranges on a scale from 0 to 1, where a higher value represents a higher level of human development (World Health Organization, n.d.). *Annual change in HDI* is calculated by taking the difference in *HDI* between the current and previous level, divided by the previous level, resulting in a percentage value. *Change in HDI* is abbreviated as *dhdi* in this investigation.

5.2 Independent (Explanatory) Variables

The two regressions share the same dependent variable, as well as the same five independent variables. Given the objective of this investigation, *FDI Inflow as a share of GDP* for both China and Germany respectively act as the primary independent, or explanatory, variables. Further independent control variables are: *Political Stability and Absence of Violence/Terrorism*, *Electricity Access*, *Inflation* and *Trade Openness*. These control variables are included as they

are expected to play a part in determining *HDI*. By including them, the regression will provide a more realistic portrayal of the specific effect of *FDI* on *HDI*, as other determining factors are controlled for.

5.2.1 FDI Inflow as a Share of GDP

As the investigation aims to determine the difference in the effect of *Chinese and German FDI*s, this variable will be included as *Chinese FDI inflows as a share of each respective SSA country's total GDP* and *German FDI inflows as a share of each respective SSA country's total GDP*. The variables are included as a percentage share of the GDP of each respective SSA country to enhance comparability between the recipient countries' relative level of *FDI* and its effect on human development. *Chinese and German FDI Inflows as a Share of GDP* are abbreviated as *cfdi* and *gfdi* respectively in this investigation.

5.2.2 Political Stability and Absence of Violence/Terrorism

The World Governance Indicators capture six key dimensions of governance, as outlined by the World Bank (n.d.-e). *Political Stability and Absence of Violence/Terrorism* is one of these dimensions and is included in this investigation to indicate governmental functionality and stability. It is stated that the variable measures perceptions of the likelihood of political stability and/or politically-motivated violence, including terrorism, and ranges from approximately -2.5 to 2.5, where a higher value corresponds to increased political stability and less violence/terrorism. Governance indicators are frequently used in the literature on *HDI*, as seen in studies by Akrofi Atitianti and Dai (2021) and Fang (2021), since the quality of governance is crucial both for attracting *FDI* and for determining how effectively it contributes to human development in recipient countries. *Political Stability and Absence of Violence/Terrorism* is abbreviated as *polstab* in this investigation.

5.2.3 Electricity Access

A common way to measure infrastructure is through a country's *Electricity Access*, which in this study is measured as the percentage of the population with access to electricity (World Bank, n.d.-a). Infrastructure plays a crucial role in shaping *FDI*s' impact on human development, and the variable *Electricity Access* was, among others, included by Akrofi Atitianti and Dai (2021) to

control for infrastructure level when investigating *HDI*. *Electricity Access* is abbreviated as *elac* in this investigation.

5.2.4 Inflation

Inflation is defined as the average percentage change in prices of a standardized basket of goods on an annual basis in a country, which in this investigation is measured by the consumer price index (World Bank, n.d.-b). *Inflation* is included as a proxy for macroeconomic stability in a country, which in turn is commonly recognized to have a determinative role related to *HDI*. *Inflation* is therefore a common control variable in HDI investigations, namely in articles by Fauzel et al. (2015) and Gohou and Soumaré (2012). *Inflation* is abbreviated as *infl* in this investigation.

5.2.5 Trade Openness

Trade Openness is measured as the sum of exports and imports of goods and services as a share of GDP (World Bank, n.d.-c). Similar to the other explanatory variables, a country's level of openness is often included as a control variable when examining the effects of *FDI* on human development, as it influences the volume of *FDI* attracted and, consequently, its developmental impact. This is supported by previous literature, such as the studies by Fauzel et al. (2015), Gohou and Soumaré (2012) and Anetor et al. (2020), which include *Trade Openness* as a control variable in their analyses of human development. *Trade Openness* is abbreviated as *tradeop* in this investigation.

5.3 Descriptive Statistics

Table 2 presents the descriptive statistics for all variables, providing an overview of their values and variation across the SSA region.

Table 2: Description of Units and Common Descriptive Statistics of Variables

Variable	Unit	Minimum	Maximum	Mean	Std. Dev	No. of Obs.
Change in HDI	% annual	- 5.38 %	8.10 %	1.08 %	1.22 %	791
Chinese FDI Inflow	% of GDP	- 1.49 %	7.34 %	0.14 %	0.47 %	773
German FDI Inflow	% of GDP	- 1.93 %	1.01 %	0.01 %	1.30 %	779
Political Stability & Absence of Violence/Terrorism	Scale from approximately -2.5 to 2.5	- 2.70	1.20	- 0.52	0.87	792
Electricity Access	% of population	1.30 %	100 %	43.9 %	27.3 %	790
Inflation	% annual	- 8.97 %	5570 %	8.87 %	27.5 %	770
Trade Openness	% of GDP	2.70 %	3480 %	70.8 %	42.0 %	706

5.4 Expected outcomes

In the following sub-chapter, the expected effect of each explanatory variable on HDI, based on the information provided in Chapter 3: Previous Research, Chapter 4: Theory, and basic economic assumptions will be presented. Additionally, Table 3 provides an overview of the expected outcomes.

5.4.1 FDI Inflow as a Share of GDP

While there is no clear consensus on the exact impact of *FDI* on *HDI*, the theories and prior research generally suggest a positive relationship. Romer's growth model links *FDI* to economic growth through technology transfer and capital access, while spillover effects can improve human capital and income. These outcomes are, in turn, expected to expand individuals capabilities and freedoms, as emphasized by the Capability approach. However, previous

research often notes that the effect of *FDI* is shaped by contextual factors. Additionally, as outlined in Chapter 2: Background, Germany and China follow different investment strategies. Germany tends to focus more on social and environmental progress, and China more on economic outcomes. As a result, both *German and Chinese FDI* are expected to positively affect *HDI*, with *German FDI* likely having a greater overall impact.

5.4.2 Political Stability and Absence of Violence/Terrorism

Governmental stability and functionality are both widely assumed, and empirically supported in studies like those by Akrofi Atitianti and Dai (2021) and Fauzel et al. (2015), to have a positive impact on human development and to enhance the welfare gains from *FDI*. Similarly, *Political Stability and Absence of Violence/Terrorism* is assumed to increase the freedom and hence the capabilities of individuals, with a positive effect on human development according to the Capability approach. Therefore, a positive effect of *Political Stability and Absence of Violence/Terrorism* is also expected in this study.

5.4.3 Electricity Access

This variable reflects a country's infrastructure level, where a well-developed infrastructure is expected to enable productive, long-term investments and broader spillover effects. In addition, and in line with the Romer model, *Electricity Access* can be seen as an indicator of technological development, promoting economic growth. *Electricity Access* can also be associated with greater individual freedom, which is the core objective of human development according to the capability approach. Moreover, a positive link between infrastructure and welfare improvement is both assumed and supported by the findings of Akrofi Atitianti and Dai (2021). Therefore, *Electricity Access* is expected to have a positive impact on *HDI*.

5.4.4 Inflation

High and unstable *Inflation* signals economic instability and increased investment risk, which is expected to reduce investment incentives and discourage innovation. This harms economic growth according to the Romer model and weakens *FDI*-related spillover effects. From a capability perspective, *Inflation* decreases individuals' real incomes and purchasing power, thereby limiting their freedom to achieve their valued functionings. Moreover, *Inflation* often

disproportionately affects the most vulnerable groups in society. The papers by Fauzel et al. (2015) and Gohou and Sourmaré (2012) also support a negative relationship between high *Inflation* and social and economic welfare, which is closely linked to *HDI*. In this investigation, it is therefore expected that high *Inflation* has a negative impact on *HDI* and that higher *Inflation* will weaken the positive effect of *FDI* on *HDI*.

5.4.5 Trade Openness

Open economies are more accessible and attract more investment, which, according to studies by Anetor et al. (2020) and Gohou and Soumaré (2012), contributes to welfare improvements from *FDI*. In line with the theory about spillover effects, *Trade Openness* also fosters competition and knowledge transfers, which contributes to a higher human development. Thus, *Trade Openness* is expected to have a positive impact on *HDI*.

Table 3: Expected outcome for all variables

Variable	Source	Expected outcome
Change in HDI	Human Development Reports	Dependent variable
Chinese FDI inflows as a share of GDP	FDI: China Africa Research Initiative – Johns Hopkins GDP: World Bank WDI	+
German FDI inflows as a share of GDP	FDI: OECD GDP: World Bank WDI	+
Political stability and absence of violence/terrorism	World Bank WGI	+
Electricity access	World Bank WDI	+
Inflation	World Bank	-
Trade openness	World Bank WDI	+

5.5 Potential measurement issues

Several potential measurement issues can be identified in relation to the variables used in this study. To begin with, few of the investigation’s central concepts can be measured with simple

variables, although suitable proxies serve as indicators. For example, *HDI* is a composite index that does not fully capture human development and welfare from all socio-economic perspectives. Reliable data is also essential for accurate estimates, and in this regard, China's transparency on *FDI* reporting can possibly be questioned. Moreover, the variable *Political Stability and Absence of Violence/Terrorism* is based on perceptions, which are subjective and may be biased or inconsistent, and a potential issue with the *Inflation* variable is that it may not reflect the actual price levels experienced by the population, as many of the countries in SSA have a large informal sector. Additionally, data is missing for several countries and years, which reduces the precision of the variable estimates.

Investigating the relationship between *FDI* and human development using these variables is however supported by previous research, and the variables serve as useful tools for comparative analysis despite their limitations.

6 Method

This chapter is structured chronologically, beginning with a presentation of the type of data used and the analytical model. It then explores the econometric tests conducted to determine the appropriate regression models and concludes with the specification of the final regression models.

6.1 Multiple Regression Analysis with Panel Data

To address the research question of this investigation, whether there is a difference in the human development impacts of *FDI inflows from China and Germany* into SSA, during the period 2005–2022, unbalanced panel data is used. This data choice is suitable as it allows for comparisons across multiple countries over a long time span. More precisely, as Eric (2019) states, panel data combines time-series and cross-sectional elements, which makes it possible to analyse both how countries differ from each other and how they change over time. An additional advantage of panel data, explained by him, is that it includes more information and typically enables a large number of observations, which increases the statistical precision of the estimates.

In cross-sectional data, the number of observations is n , in time-series data it is t , which yields $t \times n$ observations in panel data (Stock & Watson, 2020).

This investigation applies a multiple regression model, where various explanatory variables are used to explain the dependent variable, which in this case is the *change in the HDI*. As outlined by Stock and Watson (2020), the regression coefficient (β) attached to each explanatory variable ($x_{i,t}$) indicates its effect on the dependent variable while holding the other variables constant. They further mention that multiple regression analysis allows for the control of several relevant variables simultaneously, increasing the precision of the estimates and the reliability of the estimated relationships by reducing omitted variable bias.

6.2 Fixed Effects Model

In this investigation, an OLS model with fixed effects estimation is applied. Both time and country-specific effects are controlled for, as it is reasonable to assume that these factors influence the outcome of the regression. Stock and Watson (2020) highlight that country-specific effects, denoted by μ_i , capture all characteristics that are unique to each country but constant over time, such as geography or cultural norms. Including these helps prevent the estimates of the explanatory variables' impact on HDI from being biased by unobserved, time-invariant country-level traits. Moreover, they explain that time-specific effects, denoted by λ_t , instead account for factors that are common across all countries at a specific point in time, such as pandemics or global economic conditions. The aim of including time-specific effects is to ensure that such shocks are not attributed to the independent variables in the model. Finally, an idiosyncratic error term is included, denoted by $v_{i,t}$, which they state captures all other variation that is specific to country i year t , and that is not explained by the included variables or fixed effects.

The choice of an OLS model with fixed, rather than random, effects is further supported by the results of a Hausman FE vs. RE test. As stated by Baltagi (2014) the null hypothesis of the Hausman test is that the random effects (RE) estimates are consistent and efficient, while the alternative hypothesis is that RE estimates are inconsistent. He further explains that if the test

rejects the null hypothesis at a five percent level of significance, a fixed effects model is preferred. Conversely, if the null fails rejection, a random effects model is considered more appropriate.

In this study, the Hausman test was performed on both the baseline (1) regression and the modified (2) regression, and in both cases the p-value was 0.00. Consequently, the null hypothesis was rejected, justifying the use of a fixed effects model for both regressions.

6.3 Scope of the Study and Model

To effectively address the research question, despite data constraints, the scope of the study and the model has been limited. First, because of limited data availability in the SSA region, the analysis is restricted to the period 2005–2022, covering 18 years of observations. Moreover, the study focuses exclusively on countries within SSA. Of the region’s 49 countries, 44 are included in the analysis. Eritrea, Eswatini, Lesotho, and Somalia were excluded due to insufficient data, while South Sudan was omitted because it gained independence in 2011, midway through the investigated time period.

Data is also missing for some variables, resulting in an unbalanced panel dataset. For the variable *Trade Openness*, data is missing for Djibouti 2005–2012, Ethiopia 2005–2010, and for the entire time period for four countries: Liberia, Malawi, Nigeria and São Tomé and Príncipe. However, data on *Trade Openness* is still available for a clear majority of the countries and years. In addition, there is some missing data for the variables *Inflation*, *Chinese FDI* and *German FDI*. In contrast, no data is missing for any country or time period for the variables *HDI*, *Electricity Access* and *Political Stability and Absence of Violence/Terrorism*. The unbalanced panel dataset is used in both the original and modified regression models. However, to test the robustness of the findings, an additional analysis is conducted using a balanced dataset, in which countries with incomplete data are fully excluded from the sample. This is further described in sub-chapter 6.5.3.

6.4 Econometric tests

When working with OLS models, there is a wide range of assumptions that should be upheld to ensure optimal results. Given the aspiration of acquiring optimal results, certain econometric tests are conducted to test for these assumptions. Among these tests include checking for: heteroskedasticity, stationarity, multicollinearity and autocorrelation. While it is unlikely that all OLS assumptions will be upheld, the intention is that testing for the assumptions will provide clarity on the consistency, biasness and overall reliability of the results that the regressions produce (Statistics How To, n.d.-a). The tests also provide the possibility to adapt and improve the econometric specifications if necessary.

6.4.1 Heteroskedasticity

As stated by Corporate Finance Institute (n.d.-a), heteroskedasticity refers to the idea that the variance of a given variable's residuals (or error term) is unequal. Mathematically, this is often expressed as the following: $Var(e_i) \neq \sigma^2$. They emphasize that one of the assumptions when working with OLS models is that of homoskedasticity, meaning that the residuals are drawn from a population with constant variance. The presence of heteroskedasticity violates this assumption, and causes issues for tests and results reliant on valid standard errors. Lastly, they explain that while heteroskedasticity does not lead to inconsistency or bias, it can invalidate the results of a regression due to using dubious standard errors.

To address this potential problem, a modified Wald test for groupwise heteroskedasticity in a fixed effect regression model is run (Baum, 2000). Baum outlines that this test includes the null hypothesis that there is homoskedasticity, while the alternative hypothesis, conversely, supports that the existence of heteroskedasticity cannot be eliminated. The Wald test for the baseline (1) and modified (2) regression model resulted in p-values of 0.00. Hence, the null hypothesis is rejected, suggesting the presence of heteroskedasticity in both regression models.

A commonly used remedy when faced with the violation of the homoskedasticity assumption is to use robust standard errors, sometimes referred to as Huber-White standard errors. This is supported by Mansournia et al. (2021). This type of standard error includes an adjustment for the

fluctuating variance of regular standard errors to ensure that they remain valid. For the baseline (1) regression and the modified (2) regression, robust standard errors are therefore used with reference to the results provided from the respective Wald tests.

6.4.2 Stationarity

Stationarity refers to the condition where a variable's mean, variance and covariance remain constant over time (Statistics How To, n.d.-b). In other words, shifting the time period does not change the shape of the data's distribution. It is further stated that this assumption is crucial for valid results in time series analysis and remains important in panel data due to the time-series dimension within the dataset. However, testing for stationarity in panel data is more complex and requires different methods than in standard time series analysis.

Two common tests for assessing stationarity in panel data are the Levin-Lin-Chu (LLC) test and the Im-Pesaran-Shin (IPS) test. Since the LLC test requires a balanced dataset, only the IPS test is applied in this study. The IPS test assumes a null hypothesis of non-stationarity, or that the panels have a unit root, and an alternative hypothesis that some panels are stationary, according to Bornhorst and Baum (2001). They explain that the IPS test runs Augmented Dickey-Fuller (ADF) tests on each panel unit and averages their t-statistics to assess overall stationarity. However, a key limitation is that the IPS test can only confirm if some panels are stationary, not all. In contrast, the ADF test, used for time series, tests whether the entire series is stationary under the alternative hypothesis (Minitab, n.d.). Given this limitation, the IPS test in this investigation is used primarily to identify variables that are clearly non-stationary and require first-difference transformations, rather than to confirm full stationarity across all panels. For the scope of this study, the IPS test is considered sufficient.

A common way to address non-stationary data is to perform a first-difference transformation to the given variable, as stated by Vossen (n.d.). He mentions that this transformation effectively shifts the focus of the series from levels to changes between periods. Furthermore, he explains that the transformation occurs as follows: $\Delta Y_t = Y_t - Y_{t-1}$, where Y represents a certain observation and t indicates the specific year of that observation. By shifting the focus to change rather than levels, first-difference transformation removes trends over time as well as unit roots, effectively emulating stationarity.

Table 4 below shows the results of IPS tests performed on each respective variable in the baseline (1) and modified (2) regression.

Table 4: P-values from IPS tests for stationarity for Baseline (1) and Modified (2) Regressions

Variable	Baseline (1) Regression	Modified (2) Regression
dhdi	0.0000	0.0000
cfdi	0.0000	0.0000
cfdi _{t-1}	-	*
cfdi _{t-2}	-	*
cfdi _{t-3}	-	*
gfdi	0.0000	0.0000
gfdi _{t-1}	-	*
gfdi _{t-2}	-	*
gfdi _{t-3}	-	*
polstab	0.0001	0.0001
elac	1.0000	1.0000
infl	*	*
tradeop	0.0501	0.0501

“*” Inconclusive results due to too few panel observations to provide an accurate test.

“-” Variable not applicable to given regression.

As shown in the results above, at the 5% significance level in the baseline (1) and modified (2) regression, both variables *elac* and *tradeop* have p-values that prevent rejection of the null hypothesis, indicating the presence of unit roots and thus non-stationarity. As a result, first-difference transformations were applied to both variables. The variable *infl* yields inconclusive results in the IPS test, making it difficult to determine whether a first-difference transformation is appropriate. Therefore, it was retained in its original form and assumed to be

stationary. All other variables show low p-values, meaning that stationarity can not be rejected. Accordingly, no transformation was applied to these variables.

All lagged variables included in the modified (2) model show inconclusive results, similar to *infl*. This is presumably due to a reduced number of observations in the modified (2) model caused by the inclusion of lags. For consistency's sake, and given that an inconclusive result neither supports nor disproves stationarity, no transformation is performed on any of these variables.

6.4.3 Multicollinearity

Multicollinearity is an econometric issue that occurs when two or more of the independent variables share a high degree of correlation, as explained by Hayes (2024). He further highlights that when multicollinearity occurs, it risks causing spurious and misleading results. In this investigation, the presence of multicollinearity is explored in two methods: a correlation matrix and using the diagnostic measure Variance Inflation Factors (VIF). Below, a correlation matrix is presented for the baseline (1) model. Due to the lagged variables increasing the number of independent variables in the modified (2) model, multicollinearity is only tested using VIF for this model.

Table 5: Correlation Matrix for Dependent and Independent Variables in Baseline (1) Regression

	dhdi	cfdi	gfdi	polstab	elac	infl	tradeop
dhdi	1.000						
cfdi	-0.031	1.000					
gfdi	-0.030	0.036	1.000				
polstab	-0.025	0.047	0.091	1.000			
elac	-0.286	0.110	0.106	0.442	1.000		
infl	-0.111	-0.011	-0.008	-0.124	0.005	1.000	
tradeop	-0.037	0.252	0.052	0.369	0.377	-0.102	1.000

A general rule of thumb is that correlation values above 0.8 and below -0.8 respectively spark concern for multicollinearity and its associated issues (Stataiml, 2024). In Table 5 above, no such correlation values can be identified, suggesting that multicollinearity is not an issue. The difference in correlation between *Chinese FDI (cfdi)* and *German FDI (gfdi)* relative to *Trade Openness (tradeop)* is also interesting to note.

VIF is used as a contingent method to ensure that no multicollinearity exists. The Corporate Finance Institute (n.d.-b) describes that the measure is calculated according to the following equation: $\frac{1}{1-R_i^2}$, where R_i^2 represents the unadjusted coefficient of determination when regressing the i^{th} independent variable on the others. In general, a VIF of 4 or above indicates that a certain degree of multicollinearity persists. It is however stated that only VIF values exceeding 10 that call for active correction, usually in the form of excluding the variable from the econometric specification entirely.

It is worth noting that it is not possible to calculate VIFs on a fixed effects model. Multicollinearity is however independent of the estimation method and consequently a pooled OLS regression was run, from which VIFs were calculated. The fact that the VIFs were calculated through a different estimation method will not have an impact on their ability to identify potential multicollinearity in this investigation's variables.

Below is an accumulated list of the VIFs for each respective independent variable:

Table 6: Explanatory Values and their associated VIFs for both Regression Models

Variable	Baseline (1) Regression	Modified (2) Regression
cfdi	1.10	1.31
cfdi _{t-1}	-	1.20
cfdi _{t-2}	-	1.20
cfdi _{t-3}	-	1.30
gfdi	1.03	1.05
gfdi _{t-1}	-	1.06
gfdi _{t-2}	-	1.06
gfdi _{t-3}	-	1.05
polstab	1.41	1.50
elac	1.49	1.53
infl	1.06	1.06
tradeop	1.33	1.51

“-” Variable not applicable to given regression.

Once again it is affirmed that no multicollinearity is present among the independent variables. Accordingly, no corrections are necessary with regard to multicollinearity.

6.4.4 Autocorrelation

Autocorrelation is another econometric issue that arises when the error terms in a regression model are correlated over time within the same unit (Smith, 2024). According to Stock and Watson (2020), the presence of autocorrelation violates a key assumption of an OLS regression, namely that the error terms should be independent across observations. They further state that this is problematic, as it often leads to biased standard errors, incorrect significance levels and, consequently, misleading conclusions.

There are several tests to test for autocorrelation, largely dependent on which structure of data is being used. For panel data an appropriate test is the Wooldridge test with the null hypothesis that no first-order autocorrelation occurs, as outlined by Wiggins and Poi (n.d.). They further describe that the alternative hypothesis states that autocorrelation exists, for which the remedy is to use robust standard errors, similarly to the case of heteroskedasticity.

The Wooldridge test was performed on both regressions: baseline (1) and modified (2). The test found p-values of 0.0063 and 0.0509 for the baseline (1) and modified (2) regressions respectively. As such, the test suggests that autocorrelation occurs in the first regression, but not the latter, at a 5% significance level. However, as it was previously determined that heteroskedasticity was present in both regressions, robust standard errors will nonetheless be used, mitigating the potential regressive weaknesses associated with autocorrelation.

6.4.5 R-Squared

R-squared, or the coefficient of determination, is a statistical measure that outlines the degree to which the variability in the dependent variable can be explained by the independent variable(s) in a regression (Taylor, n.d.). In other words, the term is a “goodness of fit” and an evaluation of the explanatory power a regression possesses. $R^2 \in [0, 1]$, where a value of 1 indicates perfect explanation while 0 is to be interpreted as that the independent variables in no way explain the variation in the dependent variable (Taylor, n.d.). Taylor however emphasizes that the measure should not be used in isolation when assessing a statistical model as it provides no insight on directional causality of relationships or the correctness of the econometric specification, and it can thus be misleading.

In this investigation, considering that a fixed effects estimation model is used, “R-squared within” will be the coefficient of determination used. “R-squared within” is most appropriate as it explores how well the regression explains variation within each panel unit over time, the ultimate objective of a fixed effects model using panel data.

6.5 Specification of Empirical Model

In this sub-chapter two empirical equations will be presented: a baseline (1) model and a modified (2) model. Other possible equations were identified and contributed to finalizing the presented models. These are mentioned in sub-chapter 6.5, but the results and specifications of these regressions will not be discussed in detail.

6.5.1 Regression (1): Baseline Model

$$\begin{aligned} \text{Change in } HDI_{i,t} = & \beta_0 + \beta_1 \times \text{Chinese Inflow of FDI as Share of GDP}_{i,t} + \beta_2 \times \text{German} \\ & \text{Inflow of FDI as Share of GDP}_{i,t} + \beta_3 \times \text{Political Stability and Absence of Violence/} \\ & \text{Terrorism}_{i,t} + \beta_4 \times \text{First Difference of Electricity Access}_{i,t} + \beta_5 \times \text{Inflation}_{i,t} + \beta_6 \\ & \times \text{First Difference of Trade Openness}_{i,t} + \mu_i + \lambda_t + v_{i,t} \end{aligned}$$

From the specification, it is evident that a two-way error component model is used, incorporating country-specific (μ_i) and time-specific (λ_t) effects, as well as a general error term ($v_{i,t}$) to capture other inaccuracies. Moreover, as outlined in 5.4.1, the following is expected: $\beta_2 > \beta_1 > 0$.

The abbreviated model looks as follows:

$$\begin{aligned} \Delta hdi_{i,t} = & \beta_0 + \beta_1 \times cfdi_{i,t} + \beta_2 \times gfdi_{i,t} + \beta_3 \times polstab_{i,t} + \beta_4 \times \Delta elac_{i,t} + \beta_5 \times infl_{i,t} \\ & + \beta_6 \times \Delta tradeop_{i,t} + \mu_i + \lambda_t + v_{i,t} \end{aligned}$$

6.5.2 Regression (2): Modified Model

Determining a perfect econometric specification for a complex indicator like *HDI* is practically impossible. However, the low R^2 and statistical insignificance of several variables in the baseline (1) model motivated the development of a modified version. One of the main factors that the baseline (1) model failed to account for was the delayed effect that the explanatory variables have on *HDI*. It is unrealistic to expect that investments in SSA will have an immediate impact on *HDI*. The modified model therefore aims to capture this time lag and to offer a more realistic representation of how *FDI* influences *HDI*. To address this idea, both *FDI* variables are

transformed into their one-year, two-year and three-year lagged values and included in the modified (2) regression.

In terms of econometric specification, the modified model adopts the following structure:

$$\begin{aligned}
\text{Change in HDI}_{i,t} = & \beta_0 + \beta_1 \times \text{Chinese Inflow of FDI as Share of GDP}_{i,t} + \beta_2 \times \text{Chinese} \\
& \text{Inflow of FDI as Share of GDP}_{i,t-1} + \beta_3 \times \text{Chinese Inflow of FDI as Share of GDP}_{i,t-2} \\
& + \beta_4 \times \text{Chinese Inflow of FDI as Share of GDP}_{i,t-3} + \beta_5 \times \text{German Inflow of FDI as} \\
& \text{Share of GDP}_{i,t} + \beta_6 \times \text{German Inflow of FDI as Share of GDP}_{i,t-1} + \beta_7 \times \text{German} \\
& \text{Inflow of FDI as Share of GDP}_{i,t-2} + \beta_8 \times \text{German Inflow of FDI as Share of GDP}_{i,t-3} \\
& + \beta_9 \times \text{Political Stability and Absence of Violence/Terrorism}_{i,t} \\
& + \beta_{10} \times \text{First Difference of Electricity Access}_{i,t} + \beta_{11} \times \text{Inflation}_{i,t} + \beta_{12} \\
& \times \text{First Difference of Trade Openness}_{i,t} + \mu_i + \lambda_t + v_{i,t}
\end{aligned}$$

The obvious difference to the baseline (1) model is that the variables for *Chinese and German FDI inflows* respectively are lagged for up to three years. It is also worth noting that both *Electricity Access* and *Trade Openness* are transformed to first differences, based on the results for econometric tests on stationarity.

The abbreviated model looks as follows:

$$\begin{aligned}
\Delta hdi_{i,t} = & \beta_0 + \beta_1 \times cfdi_{i,t} + \beta_2 \times cfdi_{i,t-1} + \beta_3 \times cfdi_{i,t-2} + \beta_4 \times cfdi_{i,t-3} + \beta_5 \times gfdi_{i,t} \\
& + \beta_6 \times gfdi_{i,t-1} + \beta_7 \times gfdi_{i,t-2} + \beta_8 \times gfdi_{i,t-3} + \beta_9 \times polstab_{i,t} + \beta_{10} \times \Delta elac_{i,t} \\
& + \beta_{11} \times infl_{i,t} + \beta_{12} \times \Delta tradeop_{i,t} + \mu_i + \lambda_t + v_{i,t}
\end{aligned}$$

6.5.3 Regression (1) with Balanced Dataset

As a robustness test, the baseline (1) regression is also performed using an entirely balanced dataset. In practice, this means that all countries that lack data on any of the included variables are removed. The countries omitted to accomplish a balanced dataset are outlined in *Appendix C*.

The ambition with this regression is to test whether the results from the baseline (1) regression are significantly different when using a balanced dataset. If they are not, the original baseline (1) regression is used as it includes more observations and provides a better representation of SSA as a whole.

The regression based on balanced data uses the same specification as the original baseline (1) model, and its results are presented below. It is included here solely to assess whether unbalanced data may have influenced the original results.

Table 7: Results of Baseline (1) Regression with Balanced Data

Variable	Baseline (1) Regression: Balanced Data
Constant	0.0194*** (0.00245)
Chinese FDI inflows as a share of GDP	0.130*** (0.0441)
German FDI inflows as a share of GDP	- 0.0970 (0.119)
Political stability and absence of violence/terrorism	0.00381** (0.00144)
First Difference of Electricity access	- 0.00903 (0.0157)
Inflation	- 0.0171 (0.0113)
First Difference of Trade openness	- 0.00644 (0.00523)
R^2 (within)	0.3950
Number of Observations	527

Dependent Variable: Change in HDI

The parentheses represent the standard error of each respective variable.

**** significant at the 1% level*

*** significant at the 5% level*

** significant at the 10% level*

The results with the balanced data do not vary significantly from the results with the unbalanced dataset seen in Table 9 in sub-chapter 7.1. As such, and as mentioned, the baseline (1) regression with balanced data will only be used as a robustness test. Moreover, the results suggest that missing data does not significantly influence the outcomes. The same will hold for the modified model, which is why a separate regression for this model using balanced data has not been conducted.

6.6 Further Attempts to Improve Model

As previously noted, defining an accurate econometric specification is challenging, especially without a clear theoretical framework to model the relationship between *HDI* and *FDI*. This is common in under-researched areas or topics lacking consensus in prior studies. Given the high risk of misspecification, which could weaken the validity of the findings, a range of alternative regressions were run as a robustness check. The goal was to better understand the relationship between *HDI* and *FDI*, and to see if any specification produced stronger statistical significance. Among the models tested were the following:

Table 8: Collection of other performed Regression Models as Robustness Test

Test	Description
1.	A model including dummy variables that only allowed for FDI inflows (in other words all FDI flows ≥ 0)
2.-4.	Models that tested lagging all independent variables for 2, 3, 4 and 5 time periods respectively
5.	A model that included FDI inflows as a share of total inflows into each respective country rather than as a share of GDP
6.	A model that included interaction variables between several of the independent variables
7.	A model that only included country-specific effects

None of the regressions using modified models produced a stronger or more significant relationship between *HDI* and *FDI*. In fact, most showed no statistically significant relationship at all. More importantly, none of the tested specifications had stronger theoretical support than the baseline (1) or modified (2) models. However, running these regressions provided confidence in that, despite their imperfections, the chosen model specifications are sufficient representations of the relationships between *HDI* and *FDI*, backed by theoretical and general logical arguments.

6.7 Strengths and Weaknesses of Empirical Model

Firstly, the incorporated fixed effects in the empirical model will be discussed. As argued earlier in this chapter, a key strength of the fixed effects model is its ability to control for unobserved, time-invariant country characteristics, such as geography or culture, that might otherwise bias the results. This supports the study's aim to identify a general, region-wide relationship between *FDI* and *HDI* in SSA, and also removes the need to control for initial *HDI* levels. However, this country-specific control can also be a limitation. As noted in previous studies, the *FDI–HDI* relationship often depends on domestic economic and social conditions. By removing these factors, the model limits insight into how this relationship changes based on domestic circumstances in specific SSA countries.

Moreover, an advantage of the empirical model is that the incorporated control variables are supported by previous research, as outlined in the sub-chapters 5.2.1-5. A disadvantage is however that there is no theory defining the exact variables that should be included to capture the variation in *HDI*, as discussed in sub-chapter 6.6.

7 Results & Analysis

7.1 Results

7.1.1 Baseline (1) & Modified (2) Regression Model

This sub-chapter will present the results of the two performed regressions. The two models primarily differ in terms of their specification, where the modified regression implements lags to test the delayed effect that the *FDI* is expected to have on *HDI*.

Table 9: Results of Baseline (1) & Modified (2) Regression

Variable	Baseline (1) Regression	Modified (2) Regression
Constant	0.0201*** (0.00217)	0.0201*** (0.00128)
Chinese FDI inflows as a share of GDP	0.134** (0.0605)	0.161** (0.0628)
1-year lagged Chinese FDI inflows as a share of GDP	-	0.269** (0.103)
2-year lagged Chinese FDI inflows as a share of GDP	-	0.0456 (0.0864)
3-year lagged Chinese FDI inflows as a share of GDP	-	- 0.0181 (0.0763)
German FDI inflows as a share of GDP	- 0.0631 (0.146)	- 0.0229 (0.114)
1-year lagged German FDI inflows as a share of GDP	-	- 0.152 (0.114)
2-year lagged German FDI inflows as a share of GDP	-	- 0.0349 (0.0912)
3-year lagged German FDI inflows as a share of GDP	-	- 0.0341 (0.0801)
Political stability and absence of violence/terrorism	0.00398*** (0.00116)	0.00528*** (0.00147)
First Difference of Electricity	- 0.00109 (0.0144)	0.00295 (0.0145)

access		
Inflation	- 0.00351*** (0.00124)	- 0.00333*** (0.00119)
First Difference of Trade openness	- 0.00132 (0.00368)	- 9×10^{-9} (0.00434)
R^2 (within)	0.3898	0.4154
Number of Observations	641	565

Dependent Variable: Change in HDI

The parentheses represent the standard error of each respective variable.

**** significant at the 1% level*

*** significant at the 5% level*

** significant at the 10% level*

“-” Variable not applicable to given regression.

7.2 Analysis and Discussion

7.2.1 Statistical Significance

The baseline (1) model reveals a moderate, positive relationship between *Chinese FDI* (as a share of GDP) and *HDI*, significant at the 5% level. A one percentage point increase in Chinese *FDI* corresponds to a 0.134 percentage point rise in *HDI*. In contrast, *German FDI* shows no significant effect. Among the control variables, *Political Stability and Absence of Violence/Terrorism* is positively associated with *HDI*, while *Inflation* has a negative effect, both significant at the 1% level. *Electricity Access* and *Trade Openness* are not statistically significant.

In the modified (2) model, which includes up to three years of lagged *FDI*, the positive relationship between *Chinese FDI* and *HDI* remains significant at the 5% level for both the current and one-year lagged values, with coefficients of 0.161 and 0.269 respectively, indicating a stronger relationship than in the baseline model. Two and three-year lags of *Chinese FDI* are not significant, nor is *German FDI* in any form. The results for the other control variables also remain consistent across both models. *Political Stability and Absence of Violence/Terrorism*

maintains a positive, and *Inflation* a negative, relationship with *HDI* in the modified model, both at the 1% level. *Electricity Access* and *Trade Openness* continue to show no significant effect.

Furthermore, the R^2 for model (1) is 0.3898 and for model (2) 0.4154, indicating a slight improvement in explanatory power when accounting for lagged effects. This similar level of explanatory power is expected, as both use the same dataset but with different transformations. While R^2 values below 50% are common in fixed effects models, since much variation is absorbed by country-specific factors, the risk of model misspecification or omitted variable bias cannot be ignored, and is addressed in sub-chapter 7.2.4.

7.2.2 Economic Significance

The aim of the investigation was primarily to assess whether FDI inflows from China and Germany are linked to changes in human development in SSA. If significant relationships were found, a secondary goal was to compare the impacts of Chinese and German FDI on HDI, and to explore whether differences in investment approaches yield different outcomes.

In both the baseline (1) and modified (2) models, unlagged and one-year lagged *Chinese FDI* show a positive and statistically significant relationship with *HDI*, though the effects' magnitudes remain modest. The finding that *Chinese FDI* contributes positively to *HDI* aligns with the expected outcome of the investigation, but the small magnitude limits its economic significance. The modest relationship suggests that *FDI* alone is not a transformative tool for human development in SSA and that broader structural factors likely play a more important role. To some extent, the finding also supports previous research, which often concludes that *HDI* is a complex measure heavily influenced by domestic conditions (Aluko et al. 2023) (Fauzel et al. 2015) (Adamu & Aigbedion, 2025) (Gohou & Soumaré, 2012). However, many of these conditions fall outside the scope of this analysis. For policymakers, this underscores the importance of considering complementary strategies beyond simply attracting *FDI* to enhance human development in the region.

Moreover, the lack of a statistically significant relationship between *German FDI* and *HDI* in both the baseline (1) and modified (2) models reflects the ambiguous link between *FDI* and human development found in earlier research. Several factors may explain this insignificance,

including the generally smaller scale of German investments compared to Chinese ones, data limitations or potential model misspecifications – topics further explored in sub-chapter 7.2.4. As a result, no strong conclusions about the economic significance of *German FDI* can be drawn from this study alone. Accordingly, this finding should not be used by policymakers as a basis for human development strategies in the region without careful consideration.

The modified (2) model is in several regards stronger than the baseline (1) model, in part due to its consideration of delayed *FDI* effects. It contributes as a robustness measure to affirm that *FDI* has a delayed effect on *HDI*, at least a one-year delay. The results of the modified (2) model also reinforce the baseline conclusion that *Chinese FDI*, while statistically relevant, is not a dominant driver of *HDI* in SSA. This on its own bears a certain economic significance.

7.2.3 Comparison with Previous Research, Background & Theory

This sub-chapter compares the findings of this investigation with existing research, background information and theory on *FDI* and human development in SSA, revealing both several similarities and differences.

The positive and statistically significant relationship between *Chinese FDI* and *HDI* in both the baseline (1) and modified (2) models aligns with the studies by Akrofi Atitianti and Dai (2021) and Sylvaire et al. (2022), which also suggest that Chinese investments have a positive impact on human development in the region. However, other investigations, including Fang (2021) and K4D Emerging Issues (2019), present a more complex view and highlight that while *Chinese FDI* might stimulate economic growth, its social and environmental effects are often mixed or even negative. This study's modest effect size for *Chinese FDI* supports that more cautious interpretation – while the relationship is statistically present, the impact is limited, implying that *Chinese FDI* alone is not sufficient for substantial improvements in *HDI* in SSA. This interpretation also aligns with the information presented in Chapter 2: Background, which emphasizes China's focus on resource extraction, infrastructure development and the pursuit of global influence through *FDI* to SSA (Tang et al. 2024) (Ide-Jetro, n.d.). In turn, these Chinese priorities tend to promote economic advancement, reflected in *HDI*, but place less focus on

fostering mutual cooperation, and environmental and social sustainability. This can possibly explain why *Chinese FDI* has a positive, but small, correlation with *HDI*.

This finding can also be interpreted from a theoretical perspective. According to the Romer model (Jones & Volrath, 2013), the technological advancements introduced through *Chinese FDI inflows* should promote economic growth and increases in GNI. Combined with the additional technological and knowledge spillover effects generated by *FDI* (Balasubramanyam et al. 1996), this reinforces the potential positive impact on *HDI*. However, the theory on spill-over effects also emphasizes that countries must possess a certain threshold of human capital development to fully benefit from new technology and knowledge (Borensztein et al. 1998). Given the low income levels and limited human capital in many SSA countries, this may help explain the relatively weak relationship observed between *FDI* and *HDI*. Moreover, the theoretical implication that *Chinese FDI inflows* can lead to increased income is, from the perspective of the capability approach, linked to enhanced individual capabilities, as higher income serves as a means to achieve greater freedom (Sen, 1999). However, this must be weighed against the risk that the benefits of growth may be unevenly distributed. Moreover, there are concerns that China does not sufficiently consider the social or environmental consequences of its investments, which can negatively impact human development and restrict individual freedom.

To continue, *German FDI inflows* are not statistically significant in either model. This differs from previous research suggesting that *FDI* generally has a mixed but significant impact on human development. It also contrasts the findings of Paul Schultz (1999), which showed that investments in health and education, areas highly aligned with the priorities of *German FDI*, are positively correlated with human capital and standard of living. Furthermore, the finding contradicts the information presented in Chapter 2: Background, which pointed to a positive relationship between *German FDI* and *HDI* in SSA, based on the EU's and Germany's commitment to long-term partnerships aligned with the Sustainable Development Goals (European Commission, n.d.-b). Multiple factors could potentially explain the lack of significance. According to the Romer model (Jones & Volrath 2013), the scale of *FDI* is an important determinant of its impact on economic growth, and by extension, on *HDI*. Greater investment levels increase R&D participation and the productivity of technological development.

Since *German FDI* is smaller in scale compared to *Chinese FDI*, this may explain the lack of a significant impact. The lower investment levels are also likely to result in fewer spillover effects. Additionally, the non-significant relationship might be due to Germany's sustainable investments yielding returns only over an even longer time horizon, or due to issues with the data or model specifications. The latter are examined in more detail in sub-chapter 7.2.4.

The finding that *Political Stability and Absence of Violence/Terrorism* is positively and significantly associated with *HDI* in both the baseline (1) and modified (2) model, is in line with the findings of Akrofi Atitianti and Dai (2021) and Fauzel et al. (2015). Similarly, *Inflation* is negatively and significantly related to *HDI* in the both models, consistent with results from Fauzel et al. (2015) and Gohou and Soumaré (2012). The significant positive relationship for *Political Stability and Absence of Violence/Terrorism* and the negative relationship for *Inflation* are also both consistent with theoretical expectations. Greater political stability is associated with increased individual freedom, which is the ultimate goal of development according to the Capability approach (Sen, 1999). In contrast, high *Inflation* tends to disproportionately harm the poorer segments of the population and reduce real income, thereby limiting individual freedom and reducing the ability to achieve expanded capabilities and choice over functionings. Moreover, well-functioning governance and the absence of violence tend to boost investment incentives and enhance the potential for positive spillover effects, such as the transfer of technology and knowledge, which increase human capital and production efficiency. These outcomes are associated with positive economic growth, in line with the Romer model (Jones & Volrath, 2013). The opposite is true for high *Inflation*.

The remaining explanatory variables, *Trade Openness* and *Electricity Access*, are not statistically significant in either regression model. This contrasts with previous research, such as the studies by Anetor et al. (2020) and Fauzel et. al (2015), which predict a positive relationship between *Trade Openness* and welfare, and the study by Akrofi Atitianti and Dai (2021), which suggests a similar relationship for *Electricity Access*. Moreover, no clear theoretical support for the statistical insignificance can be found in the Romer model, spillover theory or the capability approach. Therefore, it is possible that this outcome stems from data limitations and/or model specifications issues outlined in sub-chapter 7.2.4.

7.2.4 Potential Weaknesses

This sub-chapter outlines key limitations of the study to ensure transparency and clarify the methodological boundaries within which the results should be interpreted.

First, the dataset and R^2 will be discussed. Regarding the dataset, missing values and potential issues with data quality, common in low-income regions such as SSA, raise concerns about measurement errors and sample representativeness. A larger and more reliable dataset would likely improve the precision and robustness of the regression estimates. Moreover, the relatively low R^2 values suggest possible model misspecification, both in terms of variable selection and econometric approach. Specifying a model for *HDI* is however inherently difficult, as no established theory defines its exact determinants. Therefore, similar to much of the precious literature, this study relies on logical reasoning and empirical support.

A further concern is endogeneity, which occurs when explanatory variables are correlated with the error term, violating the OLS assumption of exogeneity and resulting in biased estimates, as stated by Kovac (2023). He explains that common sources of endogeneity include omitted variable bias, simultaneity and measurement errors. In this study, potential omitted variables include the quality of education and the level of natural resource dependency in Sub-Saharan African countries. These factors could influence the amount of *FDI* attracted and the way it is utilized, as well as the human development. Simultaneity is also relevant in relation to the investigation, for instance as it remains unclear whether *FDI* improves *HDI* or if higher *HDI* attracts more *FDI*. Additionally, measurement errors in explanatory variables, as previously addressed, can introduce bias if these errors correlate with the other explanatory variables.

One method to address endogeneity is through instrumental variables (IVs). Mehta (2015) describes that a valid instrument must be correlated with the endogenous explanatory variable, uncorrelated with the error term and unrelated to the dependent variable. Two potential IVs for *FDI* will be suggested. First, the average outward *German* and *Chinese FDI* to all countries excluding SSA, and second, the average *German* and *Chinese FDI inflows* to other SSA countries, excluding the country in question. The first is expected to be highly exogenous but possibly more weakly correlated with the SSA country inflows. The second is likely to be more

strongly correlated with actual *FDI inflows* but potentially less exogenous, as human and economic development in one country might cause spillovers in neighboring countries.

In summary, acknowledging these limitations enhances the credibility of the study and supports a more nuanced interpretation of the findings.

8 Conclusion

The objective of this investigation has been to determine the effect, if any, of *Chinese* and *German FDI* inflows on human development in SSA, and to compare their respective effects. To accomplish this, two multiple linear regression models of OLS fixed effects character have been created from a set of panel data on 44 SSA countries ranging from 2005–2022. The empirical analysis is supported by a background discussion, a review of relevant literature and theoretical perspectives including Romer’s growth theory, Spillover effects and the Capability approach. While prior research has largely focused on the effects of general *FDI* or *Chinese FDI* on human development in Africa, comparative studies are limited. This study therefore contributes with a new perspective to the field.

The differing investment strategies of China and Germany (and the EU), outlined in Chapter 2: Background, along with supporting theoretical arguments, generally suggest that *German FDI* should have a more positive impact on human development than *Chinese FDI*. However, this assumption is difficult to verify, as no existing studies specifically examine the effects of *German FDI* on human development. Additionally, previous literature offers no clear consensus on the impact of *FDI*, or *Chinese FDI* in particular, on *HDI*, with findings ranging from positive to ambiguous or negative outcomes. This reflects the complexity and uncertainty surrounding the *FDI–HDI* relationship in the region.

The regression analysis reveals that *Chinese FDI inflows*, as a share of GDP, have a weak but statistically significant positive relationship with *HDI*, both directly and with a one-year lag. In contrast, *German FDI* shows no significant effect. The latter contradicts both the background information and theoretical expectations. Among the control variables, *Political Stability and Absence of Violence/Terrorism* is significant and positively associated with *HDI*, while *Inflation*

is significantly negative. Surprisingly, *Electricity Access* and *Trade Openness* are not statistically significant in either model, underscoring the challenge of accurately modeling the drivers of human development.

Although the results offer some policy insight, they do not point to clear policy recommendations. The modest positive impact of *Chinese FDI* and the insignificance of *German FDI* may be due to factors such as model misspecification, data limitations or endogeneity. Given the complexity of the FDI–HDI relationship, it is evident that *FDI* alone is unlikely to drive sustained improvements in human development, but rather should be part of a broader development strategy tailored to local needs and institutional contexts. We therefore suggest that future research should examine country-specific factors that influence *FDI's* developmental impact more in depth and expand the range of control variables to better explain variation in *HDI*.

To conclude, it is challenging to investigate SSA due to data limitations and lack of prior professional studies. Despite this, our findings suggest that *Chinese FDI* shares a modest but statistically significant positive relationship with human development in SSA, while the impact of *German FDI* remains unclear and requires further study. The SSA region faces many challenges but also a realm of opportunities, not least through *FDIs*. Gaining deeper insight into the effects of *FDI* through future research offers valuable potential for shaping effective development strategies and revealing these opportunities.

Use of Generative Artificial Intelligence

Artificial intelligence, namely ChatGPT, has been used in several capacities in this investigation. It has been an avid aid in finding possible sources through its usual and “deep-search” functions. It was also used for idea generation in the early stages of the project. Furthermore, it has been used to assist with removing excessive passages as well as for language revision of self-written text. Econometrically, ChatGPT has been used to find appropriate commands and econometric tests, and to explain how they work in Stata. Such commands and econometric tests, along with all sources found, have in turn been carefully evaluated and chosen based on their credibility and appropriateness.

Reference List

- Adamu, M. M., Ezie, O., & Aigbedion, M. (2025). Effect of Foreign Direct Investment on Human Development in West Africa. *International Journal of Research and Innovation in Social Science*, <https://dx.doi.org/10.47772/IJRISS.2025.9010286>
- Akrofi Atitianti, P., & Dai, Q. (2022) Does Chinese Foreign Direct Investment Improve the Welfare of Africans?. *Journal of African Business*, vol. 23, no. 4, <https://www.tandfonline.com/doi/full/10.1080/15228916.2021.1969192?scroll=top&needAccess=true#d1e235>
- Aluko, O., Opoku, E., Ibrahim, M., & Kufuor, N. (2023). Put on The light! Foreign Direct Investment, Governance and Access to Electricity. *Energy Economics*, vol. 119, <https://doi.org/10.1016/j.eneco.2023.106563>
- Anetor, F. O., Esho, E., & Verhoef, G. (2020). The Impact of Foreign Direct Investment, Foreign Aid and Trade on Poverty Reduction: Evidence from Sub-Saharan African countries. *Cogent Economics & Finance*, vol. 8, no. 1, <https://doi.org/10.1080/23322039.2020.1737347>
- Balasubramanyam, N, V., Salisu, M., & Sapsford, D. (1996). Foreign Direct Investment and Growth in EP and is Countries. *The Economic Journal*, vol. 106, no. 434, pp. 92-105, <https://doi.org/10.2307/2234933>
- Baltagi, B. H. (2014) Panel Data and Difference-in-Differences Estimation [pdf], <https://www.sciencedirect.com/topics/social-sciences/hausman-test>
- Baum, C. (2000). XTTEST3: Stata module to compute modified wald statistic for groupwise heteroskedasticity, https://www.researchgate.net/publication/4997563_XTTEST3_Stata_module_to_compute_Modified_Wald_statistic_for_groupwise_heteroskedasticity [Accessed 25 May 2025]
- Blomstrom, M., Globerman, S., & Kokko, A. (1999). The Determinants of Host Country Spillovers from Foreign Direct Investment: A review and synthesis of literature. *Inward Investment, Technological Change and Growth*, working paper no. 76, <https://ideas.repec.org/p/hhs/hastef/0339.html>
- BMZ. (2025). Africa Strategy of the Federal Ministry for Economic Cooperation and Development, <https://www.bmz.de/en/countries/bmz-africa-strategy> [Accessed 8 May 2025]
- BMZ. (2023). Shaping the Future with Africa [pdf], <https://www.bmz.de/resource/blob/137602/bmz-afrika-strategie-en.pdf> [Accessed 8 May 2025]
- Borensztein, E., De Gregorio, J., & Lee, J. W. (1998). How does Foreign Direct Investment Affect Economic Growth? *Journal of International Economics*, vol. 45, no.1, pp. 115-135, [https://doi.org/10.1016/S0022-1996\(97\)00033-0](https://doi.org/10.1016/S0022-1996(97)00033-0)

Bornhorst, F., & Baum, C. (2001). IPSHIN: Stata module to perform Im-Pesaran-Shin panel unit root test, <https://ideas.repec.org/c/boc/bocode/s419704.html> [Accessed 25 May 2025]

Bundesregierung. (2023). Promoting Africa as a Sustainable Business Partner, <https://www.bundesregierung.de/breg-de/service/archiv/compact-with-africa-conference-2245262> [Accessed 8 May 2025]

Calabrese, L., & Chen, Y. (2024). FOCAC 2024: A revival of China-Africa relations, <https://odi.org/en/insights/focac-2024-a-revival-of-china-africa-relations/> [Accessed 15 April 2025]

CFI. (n.d.) Foreign Direct Investment (FDI), <https://corporatefinanceinstitute.com/resources/economics/foreign-direct-investment-fdi/> [Accessed 23 May 2025]

China Africa Research Initiative. (2025). Chinese FDI in Africa Data, <https://www.sais-cari.org/chinese-investment-in-africa> [Accessed 15 April 2025]

Corporate Finance Institute. (n.d.-a). Heteroskedasticity, <https://corporatefinanceinstitute.com/resources/data-science/heteroskedasticity/> [Accessed 5 May 2025]

Corporate Finance Institute. (n.d.-b). Variance Inflation Factor (VIF), <https://corporatefinanceinstitute.com/resources/data-science/variance-inflation-factor-vif/> [Accessed 5 May 2025]

Dupasquier, C., & Osakwe, P. (2005). Foreign Direct Investment in Africa: Performance, challenges and responsibilities, African Trade Policy Centre, working paper, no. 21, United Nations Economic Commission for Africa, <https://repository.uneca.org/bitstream/handle/10855/12601/bib.%2053710.pdf?sequence=1&isAllowed=y>

Eric. (2019). Aptech, Introduction to the Fundamentals of Panel Data, web blog post, <https://www.aptech.com/blog/introduction-to-the-fundamentals-of-panel-data/> [Accessed 7 May 2025]

European Commission. (n.d.-a). Investment, https://policy.trade.ec.europa.eu/help-exporters-and-importers/accessing-markets/investment_en [Accessed 8 April 2025]

European Commission. (n.d.-b) Sub-Saharan Africa, https://international-partnerships.ec.europa.eu/countries/sub-saharan-africa_en#cooperation-approach [Accessed 8 April 2025]

European Commission. (n.d.-c). Global Gateway, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/stronger-europe-world/global-gateway_en [Accessed 8 April 2025]

- EUR-Lex. (n.d.). Division of Competences, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM:competences> [Accessed 16 April 2025]
- European Parliament. (n.d.). Africa – Fact Sheets on the European Union, <https://www.europarl.europa.eu/factsheets/en/sheet/180/africa> [Accessed 8 April 2025]
- Fang, Y. (2021). Influence of Foreign Direct Investment from China on Achieving the 2030 Sustainable Development Goals in African Countries. *Chinese Journal of Population, Resources and Environment*, vol. 19, no.3, pp. 213-220, <https://doi.org/10.1016/j.cjpre.2021.12.023>
- Fauzel, S., Seetanah, B. & Sannasse, RV. (2015). Foreign Direct Investment and Welfare Nexus in Sub Saharan Africa. *The Journal of Developing Areas*, vol. 49, no. 4, pp. 271-283, <https://dx.doi.org/10.1353/jda.2015.0133>
- Friedrich Naumann Foundation. (2024). Competing with China in Africa Strategic Suggestions on the EU Global Gateway [pdf], https://www.gmfus.org/sites/default/files/2024-09/Broschüre%20A4%20EU%20Global%20Gateway%20Study%20ENG_web.pdf
- Gohou, G., & Soumaré, I. (2012). Does Foreign Direct Investment Reduce Poverty in Africa and are there Regional Differences? *World Development*, vol. 40, no. 1, pp. 75-95, <https://doi.org/10.1016/j.worlddev.2011.05.014>
- Havranek, T., & Irsova, Z. (2011). Estimating Vertical Spillovers from FDI: Why results vary and what the true effect is. *Journal of International Economics*, vol. 85, no. 2, <https://doi.org/10.1016/j.jinteco.2011.07.004>
- Hayes, A. (2025). Foreign Direct Investment (FDI): What it is, types, and examples, <https://www.investopedia.com/terms/f/fdi.asp> [Accessed 7 April 2025]
- Hayes, A. (2024). Multicollinearity: Meaning, examples, and FAQs, <https://www.investopedia.com/terms/m/multicollinearity.asp#:~:text=Multicollinearity%20is%20a%20statistical%20concept,coefficient%20is%20%2B%2F%2D%201.0> [Accessed 25 May 2025]
- Human Development Reports. (n.d.). United Nations Development Programme, <https://hdr.undp.org/data-center/documentation-and-downloads> [Accessed 15 April 2025]
- Ide-Jetro. (n.d.). China in Africa, https://www.ide.go.jp/English/Data/Africa_file/Manualreport/cia_03.html [Accessed 11 April 2025]
- International Monetary Fund. (2023). Regional Economic Outlook Sub-Saharan Africa [pdf], <https://www.imf.org/en/Publications/REO/SSA/Issues/2023/10/16/regional-economic-outlook-for-sub-saharan-africa-october-2023>

Jones, C. I., & Vollrath, D. (2013). Introduction to Economic Growth, 3rd ed, Norton & Company, Inc, New York

Kovac, D. (2023). IntellectusConsulting, What is Endogeneity?, web blog post, <https://www.statisticssolutions.com/what-is-endogeneity/> [Accessed 13 May 2025]

K4D Emerging Issues. (2019). The Development Impact of Chinese Development Investments in Africa [pdf], https://assets.publishing.service.gov.uk/media/5e9d791386650c031f757047/EIR26_The_development_impact_of_Chinese_development_investment_in_Africa.pdf

Lebogang, T. L., & Makhura, B.R. (2022). China's Infrastructure-for-Resources Model: An ideal solution to addressing Uganda and Angola's development agenda. *Journal of African Foreign Affairs*, vol. 9, no. 2, pp. 69-83, <https://doi.org/10.31920/2056-5658/2022/v9n2a4>

Mansournia, M. A., Nazemipour, M., Naimi, A. I., Collins, G. S., & Campbell, M. J. (2021). Reflections on Modern Methods: Demystifying robust standard errors for epidemiologists. *International Journal of Epidemiology*, vol. 50, no. 1, p. 346-351, <https://doi.org/10.1093/ije/dyaa260>

McKenna, A. (2025). Sub-Saharan Africa. Britannica, <https://www.britannica.com/place/sub-Saharan-Africa> [Accessed 4 April 2025]

Mehta, D. (2015). Control Variables in Research [pdf], <https://pdf.sciencedirectassets.com>

Minitab. (n.d.). Interpret All Statistics and Graphs for Augmented Dickey-Fuller Test, https://support.minitab.com/en-us/minitab/help-and-how-to/statistical-modeling/time-series/how-to/augmented-dickey-fuller-test/interpret-the-results/all-statistics-and-graphs/?utm_source=chatgpt.com [Accessed 25 May 2025]

Nobel Prize Museum. (2020). The Nobel Prize, https://nobelprizemuseum.se/wp-content/uploads/2020/09/NPM_Nomineringar_alla_Ekonomipriset.pdf [Accessed 20 May 2025]

OECD. (2002). Foreign Direct Investment for Development: Maximizing benefits, minimizing costs. OECD Publishing [pdf], https://www.oecd.org/content/dam/oecd/en/publications/reports/2002/09/foreign-direct-investment-for-development_g1gh2cf5/9789264199286-en.pdf [Accessed 21 May 2025]

OECD. (n.d.-a). Foreign Direct Investment Statistics by Partner Country, Data Explorer, [https://data-explorer.oecd.org/vis?df\[ds\]=DisseminateFinalDMZ&df\[id\]=DSD_FDI%40DF_FDI_CTRY_IND_SUMM&df\[ag\]=OECD.DAF.INV&dq=.T_FA_F.USD_EXC%2BRC.....W.._T.A.&lom=LASTNPERIODS&lo=2&to\[TIME_PERIOD\]=false](https://data-explorer.oecd.org/vis?df[ds]=DisseminateFinalDMZ&df[id]=DSD_FDI%40DF_FDI_CTRY_IND_SUMM&df[ag]=OECD.DAF.INV&dq=.T_FA_F.USD_EXC%2BRC.....W.._T.A.&lom=LASTNPERIODS&lo=2&to[TIME_PERIOD]=false) [Accessed 15 April 2025]

OECD. (n.d.-b). Gross National Income, <https://www.oecd.org/en/data/indicators/gross-national-income.html#:~:text=Definition,primary%20incomes%20for%20all%20sectors> [Accessed 21 May 2025]

Paul Schultz, T. (1999). Health and Schooling Investments in Africa. *Journal of Economic Perspectives*, vol. 13, no. 3, pp. 67-88, <https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.13.3.67>

Qiang, C., Kusek, P., Stenberg, V., Viney, E. (2021). World Bank Blogs, The Road to Recovery in Sub-Saharan Africa: Capitalizing on transformative opportunities from shifting FDI patterns, web blog post, <https://blogs.worldbank.org/en/africacan/road-recovery-sub-saharan-africa-capitalizing-transformative-opportunities-shifting-fdi> [Accessed 12 May 2025]

Renard, M-F. (2011). China's Trade and FDI in Africa. Working Paper, African Development Bank, <https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Working%20126.pdf> [Accessed 2 May 2025]

RFI. (2024). Why Europe is Banking on Africa for its Big-Ticket Investments, <https://www.rfi.fr/en/international/20240519-why-europe-is-banking-on-africa-for-its-big-ticket-investments> [Accessed 8 May 2025]

SAFRI. (n.d.). The Sub-Saharan Africa Initiative of German Business, <https://safri.de/en/about-us.html> [Accessed 8 May 2025]

Sen, A. (1999). *Development as Freedom*, Oxford: Oxford University Press, https://books.google.se/books?id=NOs75PEa618C&printsec=frontcover&hl=es&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Smarzynska Javorcik, B. (2004). Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages. *American Economic Review*, vol. 94, no.3, pp. 605-627, <https://pubs.aeaweb.org/doi/pdfplus/10.1257/0002828041464605>

Smith, T. (2024). Autocorrelation: What it is, how it works, tests, <https://www.investopedia.com/terms/a/autocorrelation.asp> [Accessed 15 May 2025]

Statistics How To. (n.d-a). Gauss Markov Theorem & Assumptions, <https://www.statisticshowto.com/stationarity/> [Accessed 6 May 2025]

Statistics How To. (n.d.-b). Stationarity & Differencing: Definition, examples & types, <https://www.statisticshowto.com/stationarity/> [Accessed 6 May 2025]

Stock, J. H., & Watson, M. W. (2020). *Introduction to Econometrics*. 4th edn, United Kingdom: Pearson Education Limited

Sylvaire, T., Qing, W., Ran, C., Kassai, D., Vincent, N., Douce, D., Frank, O-K., Nicaise, N., Traore, F., & Boris, A. (2022). The Impact of China's Foreign Direct Investment on Africa's Inclusive Development. *Social Sciences & Humanities Open*, vol. 6, no.1, <https://doi.org/10.1016/j.ssaho.2022.100276>

- Stataiml. (2024). Thresholds for Detecting Multicollinearity, https://stataiml.com/posts/60_multicollinearity_threshold_ml/?utm [Accessed 2 May 2025]
- Tang, K., Owusu, S., & Ndubusi, G. (2024). Chinese Investment in Africa: A Double-Edged Sword for Low-carbon Industrialization, <https://www.bu.edu/gdp/2024/07/28/chinese-investment-in-africa-a-double-edged-sword-for-low-carbon-industrialization/> [Accessed 10 April 2025]
- Taylor, S. (n.d.). R-squared. Corporate Finance Institute, <https://corporatefinanceinstitute.com/resources/data-science/r-squared/> [Accessed 7 May 2025]
- Todaro, M., & Smith, S. (2020). Economic Development, United Kingdom: Pearson
- Tsuji, C. (2025). Belt and Road Initiative. Encyclopaedia Britannica, <https://www.britannica.com/topic/Belt-and-Road-Initiative> [Accessed 15 April 2025]
- UNCTAD. (n.d.). Foreign Direct Investment: Inward and outward flows and stock, annual, <https://unctadstat.unctad.org/datacentre/reportInfo/US.FdiFlowsStock> [Accessed 5 April 2025]
- UNCTAD. (2020). Investment Flows in Africa Set to Drop 25% to 20% in 2020, <https://unctad.org/news/investment-flows-africa-set-drop-25-40-2020> [Accessed 12 May 2025]
- UNCTAD. (2023). World Investment Report 2023 [pdf], https://unctad.org/system/files/non-official-document/wir2023-regional_trends_africa_en.pdf
- Vossen, V. (n.d.). The First Difference Estimator. Tilburg Science Hub, <https://tilburgsciencehub.com/topics/analyze/causal-inference/panel-data/first-difference/> [Accessed 25 May 2025]
- Wiggins, V., & Poi, B. (n.d.). Testing for Panel-Level Heteroskedasticity and Autocorrelation, <https://www.stata.com/support/faqs/statistics/panel-level-heteroskedasticity-and-autocorrelation/> [Accessed 25 May 2025]
- World Bank. (n.d.-a). Access to Electricity (% of population), <https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS> [Accessed 15 April 2025]
- World Bank. (2014). Foreign Direct Investment Flows into Sub-Saharan Africa [pdf], <https://documents1.worldbank.org/curated/en/505071468203651135/pdf/860600BRI0WB0H00Box382147B00PUBLIC0.pdf>
- World Bank. (2023). Foreign Direct Investment, Net Inflows (BoP, current US\$) - Sub-Saharan Africa, <https://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD?locations=ZG> [Accessed 11 April 2025]
- World Bank. (2019). Global Investment Competitiveness Report [pdf], <https://openknowledge.worldbank.org/server/api/core/bitstreams/736358db-40d6-5ad3-8571-45c89ee8a697/content>

World Bank. (n.d.-b). Inflation, Consumer Prices (annual %),
<https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG> [Accessed 15 April 2015]

World Bank. (n.d.-c). Trade Openness (Long Series),
<https://databank.worldbank.org/trade-openness-long-serie/id/a16d7265#> [Accessed 15 April 2025]

World Bank. (n.d.-d). World Development Indicators,
<https://databank.worldbank.org/source/world-development-indicators> [Accessed 15 April 2025]

World Bank. (n.d.-e). Worldwide Governance Indicators,
<https://databank.worldbank.org/source/worldwide-governance-indicators#> [Accessed 15 April 2025]

World Health Organization. (n.d.). Human Development Index,
<https://www.who.int/data/nutrition/nlis/info/human-development-index> [Accessed 5 April 2025]

Appendices

Appendix A: List of Sub-Saharan African Countries

Angola	Benin	Botswana	Burkina Faso	Burundi
Cabo Verde	Cameroon	Central African Republic	Chad	Comoros
Congo, Democratic Republic of the	Congo, Republic of the	Côte d'Ivoire	Djibouti	Equatorial Guinea
Eritrea*	Eswatini*	Ethiopia	Gabon	Gambia, The
Ghana	Guinea	Guinea-Bissau	Kenya	Lesotho*
Liberia	Madagascar	Malawi	Mali	Mauritania
Mauritius	Mozambique	Namibia	Niger	Nigeria
Rwanda	São Tomé and Príncipe	Senegal	Seychelles	Sierra Leone
Somalia*	South Africa	South Sudan**	Sudan	Tanzania
Togo	Uganda	Zambia	Zimbabwe	

Note:

* = Countries excluded from the investigation due to a lack of comprehensive data.

** = Countries excluded from the investigation due to gaining independence after 2005.

Appendix B: Interview Consent

The interview and the interviewee is referred to as “an official at the Ministry of Foreign Affairs (interview, 6 May 2025)” in sub-chapter 2.2.



“An investigation into how Sub-Saharan Africa’s human development is affected by Chinese versus German Foreign Direct Investments from 2005-2022”

Sofia Klämfeldt Forslid and Philip Carle

Interview Consent Form.

I have been given information about “*An investigation into how Sub-Saharan Africa’s human development is affected by Chinese versus German Foreign Direct Investments from 2005-2022*”

and discussed the research project with *Sofia Klämfeldt Forslid* who is/are conducting this research as a part of a Bachelor’s/Master’s in *Economics* supervised by *Andreas Ek*.

I understand that, if I consent to participate in this project, I will be asked to give the researcher a duration of approximately *10 minutes* of my time to participate in the process.

I understand that my participation in this research is voluntary, I am free to refuse to participate and I am free to withdraw from the research at any time.

By signing below I am indicating my consent to participate in the research as it has been described to me. I understand that the data collected from my participation will be used for the thesis only and will be deleted after completion, and I consent for it to be used in that manner.

Name: *Matthias Jernbäcker*

Email: *Matthias.jernbacker@gmail.com*

Telephone: *070-4719117*

Signed: *[Signature]*

Appendix C: List of Omitted Sub-Saharan African Countries in
Balanced Data Regression

Comoros	Congo, Democratic Republic of the	Djibouti	Ethiopia
Guinea	Guinea-Bissau	Liberia	Malawi
Nigeria	São Tomé and Príncipe	Sierra Leone	Sudan
Zimbabwe			