



SCHOOL OF
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MANAGEMENT

Effects of the European Union's Development Aid on Trade in
Sub-Saharan Africa

An Analysis of the Role of Democracy

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Abstract

This thesis examines the impact of the European Union's development aid on export and import levels in Sub-Saharan Africa, focusing on the role of democracy levels in the recipient countries. Using a multiple regression model with panel data from 1990 to 2018 across 27 countries, the study assesses the influence of the EU's aid on trade, while also considering the factors GDP, population, life expectancy, gross capital formation, and agricultural land. Findings indicate an insignificant relationship between the EU's aid and trade growth, where neither the EU's aid nor the level of democracy in recipient countries showed a significant impact on export or import levels. However, the economic factors agricultural land, gross capital formation and population size emerged as significant influences, suggesting that internal dynamics and demographic trends may play a more critical role in shaping trade. This research highlights the complexity of aid-trade relationships and the importance of considering unique regional contexts in aid strategies.

Keywords: EU, exports, imports, Sub-Saharan Africa, democracy

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1. Introduction

1.1 Introduction

In a world characterised by complex global challenges, the European Union stands as one of the most influential actors in international development. As the main trading partner of developing countries, as well as the world's largest multilateral donor of development aid, the EU plays a significant role in shaping the path of numerous African nations, particularly those in the Sub-Saharan region (European Parliament, 2021a). The EU's commitment to aiding the development of Sub-Saharan African countries is not only a reflection of its focus on reducing global poverty, but is also tied to broader objectives, including fostering economic growth and stability in the region. This emphasis on economic growth is linked to the promotion of trade, as one of the development aid's aims is to improve trade capacities, and thereby facilitating greater market access and economic diversification.

In Sub-Saharan Africa (SSA), the state of democratic governance varies widely, which might affect the effectiveness of development aid in stimulating trade. It could be assumed that countries with a higher level of democracy, aid could potentially be managed more effectively. However, in countries with weaker democratic structures, the benefits of aid on trade growth could be compromised by factors such as corruption and mismanagement. These issues could detract from the aid's intended economic benefits and hinder the progress of trade development. Therefore, understanding the interplay between the level of democracy, the effectiveness of the EU's development aid, and the impact on trade growth is crucial for a comprehensive evaluation of the EU's role and strategies in the SSA region.

1.2 Aim and research question

The aim of the study is to identify the extent to which the European Union's development aid, specifically ODA, influences export and import levels respectively in Sub-Saharan African countries, as well as whether these effects are influenced by the level of democracy in the recipient nations. The research question is therefore formulated as such:

To what extent does the European Union's development aid influence the export and import levels in Sub-Saharan African countries? Additionally, do these effects vary based on the level of democracy in the recipient countries?

Addressing these questions is important not only for a comprehensive understanding of the EU's role in SSA's development but also for shaping future aid and trade policies that can promote sustainable growth and democracy in the region. This research seeks to analyse these dimensions of international relations, offering insights into the complex nexus between aid, trade, and democracy in SSA.

1.3 Method and limitations

The thesis uses a multiple regression model with panel data, and this approach allows for a comparison across countries over an extended period of time. A fixed effects model is used to control for time-invariant characteristics unique to each country, enhancing the accuracy of the findings. The analysis period is 1990–2018 and includes 27 of the 48 countries in the region of Sub-Saharan Africa. In *table 1* under section 5.3, a full list of included and excluded countries is presented.

1.4 Disposition

The study begins with an introduction and background, setting the context and significance of the research. The previous research section then delves into a review of existing literature, highlighting any gaps or areas in need for further investigation. Some theoretical frameworks are then discussed, followed by a detailed section that describes the method employed. Data used in the study is presented in the data section, where its sources and characteristics are detailed. The section on the specification of the regression model explains the used model, along with its structure and justification. The findings are presented in the results section and analysed in the discussion section. The thesis then summarises the conclusions that encapsulates the key insights of the study, supported by a reference list and an appendix.

2. Background

2.1 Sub-Saharan Africa

Sub-Saharan Africa is a region in Africa consisting of 48 countries (listed in *table 1*) located south of the Sahara Desert (World Bank, n.d). It is a diverse region that receives much attention and research focus, primarily due to the development issues it confronts. Poverty, economic inequality, environmental disasters, rising conflict and violence as well as low levels of democracy are topics that are highly relevant for many countries in the region. In the economic landscape, 33 out of the 48 countries in SSA are considered as least developed countries, indicating the economic difficulties that are widespread in the region (UNCTAD, 2022). In 2023, the most recent economic update showed a decline of real GDP to 2.5%, compared to 3.6% in 2022. Still recovering from the Covid-19 pandemic, countries in SSA are continually facing inflation, high borrowing costs, exchange-rate pressures and political instability (IMF, 2023).

Even though the region faces challenges, there is high potential for future development in many aspects. With a young and fast growing population, the region represents the world's largest anticipated growth in consumer population. Moreover, the region has one of the world's most diverse ecosystems, the largest free trade areas and widespread access to a variety of natural resources, presenting important factors in the region's future economic and social development potential (ITA, 2022).

2.2 EU's Development aid to Sub-Saharan Africa

The European Union has long been a major provider of Official Development Assistance (ODA) globally, with Sub-Saharan Africa being one of the primary recipients. ODA refers to the financial resources, consisting of the net disbursements of loans or grants, given by developed countries' governments or official agencies, to developing countries with the aim of promoting economic and social development. The term is defined, governed and measured by the Development Assistance Committee (DAC), and the EU's ODA thereby aligns with the principles and guidelines of the DAC (Perkins, 2012, p. 502). The ODA provided by the EU institutions (European Commission and the European Investment Bank) play a crucial role in the broader framework of the EU's commitment to fostering sustainable development in SSA (European Commission, 2021).

With the primary goal of targeting economic and welfare development, the EU's approach to ODA in SSA includes various strategies where both democracy and trade are important targets, receiving focus through different ways. In the aspect of governance and democracy, the importance of democratic institutions and human rights are emphasised, while trade related sectors receiving ODA include economic infrastructure, productive capacity and trade-related structural adjustments (European Commission, 2022). However, there is no way of measuring the exact amount of the ODA that is strictly "trade-related" (WTO, 2023a). To set the perspective, the EU's ODA in 1990 to the 27 countries examined was measured at 2807 million US dollars, compared to 20 639 million in 2018, both measured in current US dollars. This shows an increase of approximately 636 percent over 28 years.

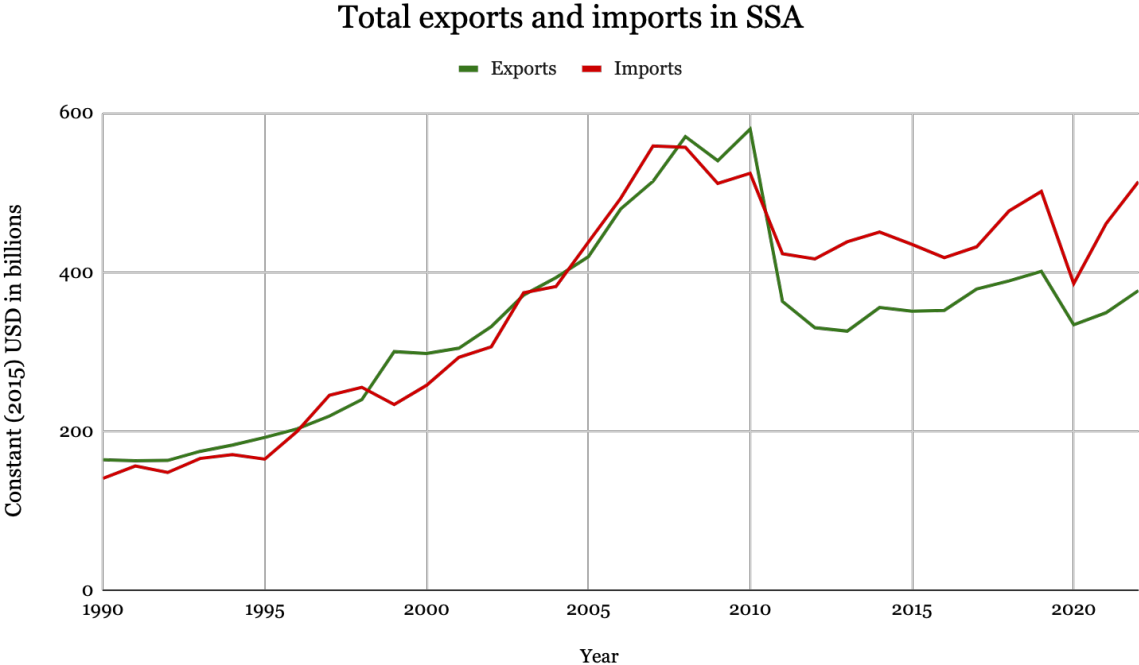
2.3 Trade in Sub-Saharan Africa

In 2022, Sub-Saharan total value of imports of goods and services was measured to be 513.1 billion constant US dollars, and the total value of exports was 376.5 billion constant US dollars (World Bank, 2022). Today, SSA represents 70 percent of all goods and services from exports from Africa, particularly strong in its commercial services exports. Comparing this to the period of 2005 to 2019 when the five countries in North Africa accounted for about one-third of the share of African trade, this sets the perspective to how trade in SSA has increased over the years (WTO, 2019). Primary products such as oil, gas and minerals account for a third or more of the exports from most of the countries in SSA, but agricultural exports also play a vital role in many countries' economies. However, this dependence on a narrow range of commodities makes the region's economies particularly vulnerable to fluctuations in global prices, affecting their stability and growth prospects (Todaro & Smith, 2020, p. 619).

Considering that many of the countries in SSA are developing countries, initiatives that aim to increase trade becomes a central development target as countries are already lagging behind economically (OECD & WTO, 2011). One example of an initiative created with this aim is the Aid for Trade (AfT) assistance program initiated in 2005 by the World Trade Organization (WTO), designed to help developing countries improve their trade capabilities through financial and technical assistance (WTO, 2023b). Another example is the National Indicative Programmes and the regional Multi-annual Indicative Programme for Sub-Saharan Africa, that respectively contribute to supporting the cooperation with the EU in the region, as well as the African Continental Free Trade Area (AfCFTA) to increase intra-continental trade

(European Commission, n.d). By improving the conditions and increasing trade, the region could utilise its potential to enhance its economic and social development.

Diagram 1. Total exports/imports of goods and services in SSA from 1990-2022



Source: World Bank DataBank

2.4 Democracy in Sub-Saharan Africa

Despite countries in Sub-Saharan Africa showing an increase in democracy levels over the past decades, the region remains marked by a wide variety of political regimes. While multi-party elections were almost unheard of in 1990, they have become more common today. Yet they often do not result in changes of power, raising questions about their effectiveness and openness of the political systems in place. The phenomenon of democratic backsliding, a global trend observed in recent years, has not spared SSA. This reversal is evident in various forms and degrees across different countries in the region. In some cases, there have been outright reversals in democratic practices, while in others, the erosion of democratic norms has been more subtle. The impact of this backsliding is uneven, with some countries experiencing more profound setbacks than others (European Parliament, 2021b).

The vulnerability of these countries stems from both external and internal factors. Externally, many countries in the region struggle with socio-economic challenges, including high levels of poverty, limited access to education and healthcare, and inadequate infrastructure. These issues are compounded by ongoing conflicts and general insecurity, which

not only disrupt daily life but also impede long-term development and political stability. Internal factors encompass weak institutions, lack of judicial independence, manipulation of electoral and constitutional laws, and restrictions on civil and political rights. Moreover, there are widespread issues concerning the restriction of civil and political rights, including suppression of free speech, censorship of the media, and restriction of civil liberties. Authoritarian regimes in the region have increasingly used the guise of legality to maintain control (European Parliament, 2021b).

3. Previous research

Despite the significance of understanding to what extent the EU's development aid impacts trade in Sub Saharan Africa and the role of democracy in the recipient countries, there appears to be a lack of research directly addressing this question. While there are studies exploring the link between development aid, trade and democracy respectively, there is a noticeable gap in literature that combines these three elements, especially when it comes to development aid specifically from the EU. Since the EU is a central contributor in aspects of developing aid as well as incentivising trade, these connections present an opportunity for original research.

3.1 Aid and trade

Research indicates that trade and aid are closely interconnected in Sub-Saharan Africa, possibly more so than in other regions of the world (World Bank, 2010). Trade is seen as a powerful driver of both economic and social development, particularly critical in supporting developing nations. Consequently, the role of aid in fostering trade has been studied, but receiving multifaceted results. There are studies establishing a positive effect of aid and its effect on trade, but there is also research that presents opposite results. Many of the critical studies question the methods used and instead focus on aspects such as specific sectors, other variables and the conditions of the aid.

One study by Wagner, using the gravity model to predict total exports from a donor to recipient with foreign aid as one of the independent variables, finds that the aid-trade linkage is not restricted to any single sector (2003). The result is particularly true for goods that are important resources for the countries receiving aid. The strongest links between aid and increased trade are seen in SSA, suggesting that sometimes aid might be given in ways that also benefit the donor country's trade (Wagner, 2003). Furthermore, Cali and te Velde's research also presents that aid has a positive and significant impact on trade performances. They examine the impact of economic aid on trade-related performance with an exports' demand model that shows how the types of aid for trade influences exports across a large subset of developing countries. The study reveals that while aid for trade broadly facilitates trade by lowering costs, its impact on exports is most pronounced when targeting economic infrastructure. This indicates that strategic investments in infrastructure and other trade-related activities are most effective in promoting trade flows (Cali & te Velde, 2010).

The Aid for Trade (AfT) program initiated in 2005 by the World Trade Organization (WTO), is designed to help developing countries improve their trade capabilities through financial and technical assistance (WTO, 2023b). However, a report by UNCTAD indicates that while AfT has highlighted the connection between aid and trade, it confronts significant challenges, including the risk of being seen merely as a gesture towards a "development round," particularly by countries that don't receive substantial AfT benefits (UNCTAD, 2007). Additionally, the OECD points out difficulties with the AfT program, such as the inability to establish a counterfactual and the challenge of considering other influential factors like political and social conditions (OECD, 2009). While the AfT program shows the important mechanism between aid and trade, researchers still highlight these difficulties. This shows that there are critical aspects in giving aid to help trade, which also can be applied to the development aid given by the EU.

Furthermore, there are additional researchers presenting other problems with aid and its impact on trade. Rajan and Subramanian (2005) use a regression method that exploits both cross-country and within-country variation, and argue that the large inflow of money that aid creates can lead to a real appreciation of the recipient country's domestic currency. This in turn, can reduce the country's competitiveness on the international market and therefore affect their trade volumes negatively. Rajan and Subramanian explain three reasons for this outcome, firstly that the money inflow that aid creates, increases the demand for the local currency and thereby bidding up its value. Secondly, aid is often directed towards industries that are capital-intensive rather than labour-intensive. This can affect the recipient countries, that often have more labour intensive industries, negatively in terms of exports. Since the aid is directed to the capital intensive industry, this becomes at expense of the labour-intensive one, which initially has a higher export potential due to its comparative advantage. Lastly, the aid inflow increases the domestic prices since it stimulates the demand. This will affect the sector producing traded goods harder than the local ones, since the traded goods then face global competition, leading to a worse trade balance. Concluding, the inflow of aid has effects on the domestic economic market and therefore affects trade in ways that are not only positive.

3.2 Trade and democracy

Democratisation and its linkages to trade is a subject closely related to the discussion on globalisation. Previous research has explored the relationship between democracy and trade openness, particularly since the 1980s when the shift towards free trade and democratic

governance gained momentum in developing regions. However, studies have typically examined how democratic policies affect trade, rather than if democratic countries trade more. Decker and Lim (2008) aimed to clarify this by applying the gravity equation on a panel regression with trade data, examining how democracy might influence trade. They found that democracies generally trade more than countries not being as democratic (Decker & Lim, 2008).

Furthermore, Durmaz and Kagochi investigate the effects of democracy on trade within SSA countries by using the gravity model, and their findings indicate that higher democracy significantly enhances their trade. The study also reveals that democratic nations tend to trade more amongst themselves, possibly due to similar business environments and reduced transaction costs associated with better-functioning institutions and lower corruption. The research suggests that democratic institutions could be conducive to more intensive trade relationships (Durmaz & Kagochi, 2018).

Moreover, Yu (2010) explores the relationship between democracy and trade by applying the gravity equation, which is presented with mixed results. While there is a generally positive association between a country's level of democracy and its trade volumes, the effect is not always statistically significant when controlling for endogeneity. Specifically, the findings indicate that increased democratisation in importing countries may lead to higher product quality and stricter trade standards, potentially reducing their import volumes. Conversely, exporting countries' democratisation is shown to have a varying impact on trade (Yu, 2010). Further, Cali and Razzaque (2015) and Cali and te Velde (2011) also include a democratic index as an instrument in their research of the effectiveness of the WTO aid for trade program discussed earlier. The index included the civil liberties and political rights in the countries, and both studies find the instrument as significant. The results show that the level of freedom in a country is an important factor in the effectiveness that aid has on trade.

3.3 Aid and democracy

When evaluating whether development aid is more effective in countries with higher democracy levels, Collier and Dollar (2004) offer valuable insights, employing a cross-country regression that tests the relationship between aid, investment, and policy in developing countries. They suggest that while aid can be a valuable tool for development, its success largely depends on the internal dynamics of the recipient countries. Good governance and sound policy

environments significantly amplify the effectiveness of aid, whereas aid provided in the absence of these elements may not achieve its intended developmental goals. Further, a study using the benchmark model by Svensson (1999), provides insights into the effectiveness of aid in relation to the democratic context of recipient countries. The study concludes that the positive impact of aid is more pronounced in countries with established democratic systems. Svensson mentions that in such environments, aid is more likely to be utilised effectively for development purposes. Conversely, in less democratic countries, aid may not be as effectively deployed, often diverted for non-developmental or self-serving used by those in power.

Burnside and Dollar (2000), using ordinary least squares and two-stage least squares methods, found that the effectiveness of aid appears to be conditional on the economic policies of the recipient countries. Their study finds that aid might be more impactful where if it were more systematically conditioned on good policy environments. However, Burnside and Dollar also mentions that aid allocation historically has not favoured countries with good policies, indicating a potential mismatch between aid distribution and its effectiveness. Easterly et al. (2004), employing a two-stage least squares method and expanding the data set of the original study, critically assesses the conclusions drawn by Burnside and Dollar in regarding the effectiveness of aid. While Burnside and Dollar suggested that aid is more effective in countries with good fiscal, monetary, and trade policies, Easterly and his colleagues challenge this assertion. By expanding the dataset used in the original study, they find that the positive interaction between aid and good policies is not a robust outcome. In fact, the significance of this interaction often disappears or even reverses. Further, a study by Berthélemy (2006), uses a three dimensional panel data set combining time dimensions, the donor and the recipient. The study finds that on average, aid donors target recipients with better governance indicators, for example higher levels of democracy and the absence of violent conflicts. This shows that even in the previous research of democracy, there are contrasting conclusions of the linkages between aid and democracy.

3.4 Concluding previous research

Concluding the previous research, there are studies affirming that development aid is effective in enhancing trade, particularly when it targets economic infrastructure. However, research also indicates that the impact of aid on trade can vary, influenced by factors such as the type of aid provided, whether it is sector-specific, and the characteristics of the recipient countries. Previous research focusing on democracy shows that democratic governance generally

is associated with increased trade activity, but the strength and consistency of this relationship depend on various economic and political factors. Lastly, the studies focusing on aid and democracy also present contrastive aspects of the relationship. There are several researches revealing that the effectiveness of aid is more impactful in democratic countries, but also studies questioning these. Of the critical ones there is research indicating a historical potential mismatch between aid allocation and its effectiveness, and also studies finding that results from previous research are not robust when expanding the dataset.

4. Theory

This section introduces a theoretical framework that emphasises the relevance of this research. There are theoretical grounds for believing that aid has a positive impact on trade in Sub-Saharan African countries, but there are also reasons to believe its opposite. This also holds when analysing the role of democracy in the region, in how the recipient countries level of democracy affects their ability to utilise the aid effectively.

The proposition that aid can lead to an increase in trade, for both exports and imports, is grounded in several economic principles. The economic intuition for providing aid comes from the belief of contributing to the development in a country. The EU provides aid with the presumed goal of facilitating the progresses of the countries in SSA. With this objective in mind, one of the EU's aims could be to promote trade in the recipient countries by increasing both their export and import levels. However, there are reasons to believe that the export and import levels are affected differently, since the strategic objectives of development aid typically focuses on enhancing a country's productive capacities and export oriented sectors, rather than import sectors (OECD, 2009). Practically, aid can boost trade through investments in infrastructure where improved infrastructure can reduce transportation and communication costs, making it easier and cheaper to trade. Additionally, development aid also often includes components aimed at education and skill development. This could increase the productivity in the workforce, leading to the production of goods and services that are more appealing in the international market, and hence increased exports. Furthermore, development aid can foster economic stability, creating a more secure and predictable environment for business activities. Stable economies are more attractive to international investors, facilitating trade by reducing risks associated with uncertainty (OECD, 2015).

The economic rationale behind the belief that a more democratic country allocates aid more effectively, compared to a less democratic country, seems straightforward. For a country to have higher index values of democracy, this comes with institutional, political, economic and social conditions that indicate a better standard of living and governance. With the institutional and political factors, there is reason to believe that high levels of stability is in line with a better ability to absorb the aid that is given. This in turn, sets the ground of being able to efficiently develop the country's export and import levels on the world market, therefore creating a positive correlation between democracy and trade.

Lastly, there are also reasons to adopt a more critical view of the aid, trade and democracy relationship. In the interpretation between aid's impact on trade, aid could rather focus more on humanitarian and development goals, which may not directly increase either exports or imports. While regarding the role of democracy in trade, a critical view may suggest that democratic nations do not necessarily prioritise trade development in their aid utilisation. These economic intuitions challenge the belief that aid and democracy automatically result in increased trade, showing the importance of a more comprehensive examination of how aid, trade and democracy are connected.

5. Methodology

5.1 Multiple regression model with panel data

A multiple regression model with panel data is employed to explore the impact of the EU's development aid on trade levels in Sub-Saharan Africa from 1990 to 2018, while also considering the influence of democracy. Panel data, which merges cross-sectional and time series data, allows for comparisons across countries over this extended period. This approach is valuable in assessing dynamic relationships, as it can capture both the individual characteristics of different countries and changes over time (Dougherty, 2016, p. 529-530). The multiple regression aspect of the model enables the examination of the dependent variable, trade levels, measured in terms of exports and imports, in relation to several independent variables. These include the levels of the EU aid, democracy indexes of the recipient countries, as well as other control variables.

5.2 Fixed effects model

The regression analysis is built on an OLS-model that is controlled for fixed effects, applied to panel data. It controls for unobserved individual-level characteristics in the countries, that might be correlated with the dependent variable. These fixed effects models capture these country's individual-specific characteristics that are constant over time but vary across different countries, assuming that each country in SSA has its own individual characteristics that may influence its trade outcomes. These could include geographical, cultural, or systemic factors that do not vary over the time. By using the fixed effects estimator, the analysis aims to isolate the effect of the EU's development aid and the level of democracy on trade by controlling for these unobserved, time-invariant characteristics (Dougherty, 2016, p. 532).

The fixed effects estimator is only available if there is some individual specific variation over time in all explanatory variables, which needs to be tested towards its opposite, namely the random effects model. To test this, the Hausman test is performed in Stata. For both the data set of imports and exports, the p-value is statistically significant, meaning that the fixed effects model is the appropriate choice (Dougherty, 2016, p. 532).

5.3 Choice of time period

The analysis includes the time frame spanning from 1990 to 2018. The rationale for choosing this particular time frame is the availability of data. The democracy index used

extends up to the year 2018, which is why that is the cut-off point for the analysis. Data related to development aid and trade growth are also often subject to reporting and data collection constraints. As a result, consistent data can be challenging to obtain, especially for earlier years, and therefore it is essential to acknowledge that the time frame chosen does not provide a complete historical perspective.

5.4 Choice of countries

The study examines Sub-Saharan Africa since it is a region characterised by low-income economies, with many countries facing significant developmental challenges. This economic profile makes the region a particularly relevant subject for investigating the effects of development aid. Due to inconsistencies and gaps in data, the analysis includes 27 of the 48 countries in the region. For some of these countries, essential data points are either missing entirely or not consistently recorded over the period and such gaps could lead to an inaccurate analysis. However, this limitation might affect the generalizability of the study's findings across the region, where the excluded countries could have unique characteristics that might not be captured. *Table 1* displays the countries that are included and excluded in the study, along with the reasons for each country's exclusion.

Table 1. Countries included and excluded in the study, along with reason for exclusion

Countries included	Countries excluded	Reason for excluding
1. Benin	1. Angola	1. Lacking exports/imports data
2. Botswana	2. Burundi	2. Lacking exports/imports data
3. Burkina Faso	3. Cabo Verde	3. Lacking exports/imports data
4. Cameroon	4. Central African Republic	4. Lacking exports/imports data
5. Comoros	5. Chad	5. Lacking exports/imports data
6. Republic of Congo	6. Côte d'Ivoire	6. Lacking exports/imports data
7. Democratic Republic of Congo	7. Equatorial Guinea	7. Lacking exports/imports data
8. Eswatini	8. Eritrea	8. Lacking exports/imports, GDP, democracy & aid data
9. Gabon	9. Ethiopia	9. Lacking exports/imports data
10. Kenya	10. Gambia	10. Lacking exports/imports data
11. Madagascar	11. Ghana	11. Lacking exports/imports data
12. Mali	12. Guinea	12. Lacking exports/imports data
13. Mauritania	13. Guinea Bissau	13. Lacking exports/imports data
14. Mauritius	14. Lesotho	14. Lacking exports/imports data
15. Mozambique	15. Liberia	15. Lacking exports/imports & GDP data
16. Namibia	16. Malawi	16. Lacking exports/imports, GDP & democracy data
17. Niger	17. Sao Tome and Principe	17. Lacking exports/imports data
18. Nigeria	18. Seychelles	18. Lacking democracy data
19. Rwanda	19. Somalia	19. Lacking exports/imports & GDP data
20. Senegal	20. South Sudan	20. No data prior independence in 2011
21. Sierra Leone	21. Zambia	21. Lacking exports/imports data
22. South Africa		
23. Sudan		
24. Tanzania		
25. Togo		
26. Uganda		
27. Zimbabwe		

6. Data

This section describes the variables employed in the study, which were chosen to ensure a robust and comprehensive analysis.

6.1 Dependent variable

The dependent variables of the two regression models are exports and imports respectively. Exports is defined as the value of all goods and services produced in one country and provided to the rest of the world, while imports is defined as the opposite: provided from the rest of the world (World Bank, 2022). This data is collected from the World Bank Database for each country, and both are measured as the percentage of each country's annual level of GDP. By measuring the percentage of GDP, the data is standardised, allowing for more meaningful comparisons across countries. This approach ensures that these variables are considered relative to the size of each country's economy, rather than in absolute terms.

Analysing exports and imports separately, rather than aggregating them into a single trade figure, is a deliberate choice aimed at being able to distinguish how they can be influenced by different factors. This approach allows for a clearer identification of how aid and democracy levels uniquely may affect each aspect of trade.

6.2 Independent variables

The regression model consists of seven independent, also known as explanatory, variables. Since the aim is to analyse how the level of aid affects trade as well as how the democracy level influences these effects, the main independent variables are development aid and democracy. Besides these, there are several control variables included: real GDP, population size, life expectancy, gross capital formation and agricultural land.

6.2.1 Development aid from the European Union

The study uses detailed data from The Organization for Economic Cooperation and Development (OECD) database, specifically examining development aid provided through Official Development Assistance (ODA). The ODA given by the EU institutions to individual countries in SSA, and measured as a percentage of the recipient countries GDP (OECD, 2020). A notable aspect of the data is that in some years, the net ODA flows had a negative value in a couple of countries. This is because the net ODA flows include calculations of loan repayments as negative, and therefore deducted from the ODA. When the loan

repayments are higher than the new ODA, the total outcome becomes negative. This accounting practice ensures a more accurate representation of the net financial contributions towards development aid, taking into account both the inflow of new aid and the outflow related to loan repayments (OECD n.d.).

6.2.2 Democracy

The democracy index that is used is the Polity IV Democracy Index, developed by the Center for Systemic Peace. Polity IV is a dataset in political science that measures the level of democracy in different countries. It assigns scores ranging from -10 (fully institutionalised autocracy) to +10 (fully institutionalised democracy), based on factors like competitiveness of political participation, executive recruitment, and constraints on chief executives. Data for the index is derived from a variety of sources, including academic research and government documents, with scores reflecting qualitative judgments about political regimes. Widely used in research and policy analysis, the Polity IV Democracy Index is instrumental in studying democracy, governance, and political transitions, although it has faced criticism for potential subjective scoring and methodological biases (Center for Systemic Peace, 2021).

6.2.3 Population size

Population size, sourced from the World Bank Databank, is incorporated as a control variable to adjust for potential scale effects, as population can significantly influence a country's trade capacity. This control variable is important, as countries with larger populations may naturally have larger economies and greater trade flows simply due to their size, not necessarily because of more effective aid utilisation. Conversely, smaller nations might have lower trade volumes, which could be incorrectly interpreted as a lack of aid effectiveness without accounting for their population size. There could also be reasons to think that a larger population affects trade negatively as well, and by using population size as a control variable, the analysis enables the chance to see the effects of it.

6.2.4 Real GDP

Real GDP (Gross Domestic Product) in USD, with 2015 as the base year, is employed as a control variable for each country. This measure, also obtained from the World Bank data, reflects the economic output adjusted for inflation, providing a consistent comparison of economic size over time. By using GDP as a control variable, the analysis accounts for the economic capacity of countries. This ensures that the trade figures are not misleadingly

influenced by inflationary effects, allowing for a more accurate assessment of the impact of aid on trade.

6.2.5 Life expectancy at birth

The analysis includes life expectancy at birth as a control variable, measured in years, sourced from the World Bank Database. This inclusion is based on the premise that life expectancy is an essential indicator of a nation's health, which can influence productivity and economic stability, thus affecting trade. With life expectancy as a control variable, the analysis ensures that the findings did not distort the varying health statuses in different countries. The rationale behind this is that countries with higher life expectancy often have a more productive workforce and better economic conditions, potentially leading to improved trade outcomes.

6.2.6 Gross capital formation

Gross capital formation (GCF) is incorporated as another control variable, with data sourced from the World Bank Databank. Investments captured under this variable, such as in infrastructure, technology, and machinery, are fundamental to enhancing a country's productive capabilities, which directly influence its ability to engage in and benefit from international trade. To maintain consistency with other variables in the study, the data was measured as a percentage of GDP. Including this variable enables a more nuanced understanding of the results, by controlling for the influence of domestic investment.

6.2.7 Agricultural land

The study also includes the variable agricultural land as a percentage of total area as a control variable, with data sourced from the World Bank Database. The extent of agricultural land indicates a country's developmental stage and economic structure. The variable is particularly relevant for Sub-Saharan Africa, since it is characterised by diverse economic activities with a significant emphasis on agriculture, and demands an analysis that accounts for the agricultural landscape. Countries with larger agricultural sectors often have economies and trade patterns that are fundamentally different from those with more industrial sectors. By incorporating agricultural land as a control variable, it allows for a clearer understanding of how development aid and trade interact within these varied economic contexts.

6.3 Interaction term

The model includes an interaction term which is $aid_{i,t} \cdot democracy_{i,t}$. This term is essential for understanding how the impact of the European Union's development aid ($aid_{i,t}$) on exports and imports is potentially moderated by the level of democracy ($democracy_{i,t}$) in the recipient countries. A significant result of the interaction term would indicate that the effectiveness of the EU aid in affecting trade is dependent on the democratic level of the recipient country.

6.4 Summarising statistics of the data

In table 2, compiled statistics for the data are presented, including the minimum value, mean value, and maximum value, as well as the standard deviation for the countries in the SSA region. The purpose is to provide the reader with an overview of the values and variation for each variable in the region and to interpret their significance.

Table 2: Minimum value, mean value, maximum value & standard deviation for SSA countries

Variable	Unit	Minimum	Mean	Maximum	Standard Deviation
Exports	% of GDP	3.3	27.66	83.8	16.94
Imports	% of GDP	7.1	33.1	88.3	15.28
Aid	% of GDP	-0.55	0.90	6.83	0.96
Democracy	Scale -10 to 10	-9	1.45	10	5.63
Life Expectancy	Years	14.1	56.12	74.52	6.85
Real GDP	Constant million USD	319.19	277.95	574.23	734.57
GCF	% of GDP	-2.4	21	79.4	9.13
Population size	Number of residents	431 119	20 151 768	198 387 623	29 009 743

7. Specification of regression model

7.1 Regression model

The following model (1) serves as the baseline for the analysis, incorporating all the variables. The regression equations for exports and imports respectively are as follows:

$$\begin{aligned} Exports_{i,t}/Imports_{i,t} = & \beta_0 + \beta_1 \cdot aid_{i,t} + \beta_2 \cdot democracy_{i,t} + \beta_3 \cdot aid_{i,t} \cdot democracy_{i,t} + \beta_4 \cdot \\ & Population_{i,t} + \beta_5 \cdot GCF_{i,t} + \beta_6 \cdot GDP_{i,t} + \beta_7 \cdot LifeExpectancy_{i,t} + \\ & \beta_8 \cdot AgriculturalLand_{i,t} + \alpha_i + \varepsilon_{i,t} \quad \mathbf{(1)} \end{aligned}$$

Where i represents an individual country, t is time in years, α_i denotes country specific effects and $\varepsilon_{i,t}$ is error term accounting for randomness and unobserved factors. The betas ($\beta_0, \beta_1, \dots, \beta_8$) in the regression equations represents the coefficients or estimated impacts of the corresponding independent variables on the dependent variable. Each beta coefficient quantifies the expected change in the dependent variable (either exports or imports) for a one-unit change in the independent variable, holding all other variables constant. Each variable within the model is believed to have a distinct effect on trade, and the model aims to quantify these effects.

7.2 Hypothesis

This section presents the two hypotheses of the study, with the first one focusing on the effect of the EU's development aid on trade, and the other on the moderating role of democracy.

- (1) There is significant correlation between the level of the EU's development aid to Sub-Saharan Africa and the recipient countries' export and import levels.
- (2) The level of democracy in Sub-Saharan African countries does significantly moderate the impact of the EU's development aid on export and import levels.

For the first one, the null-hypothesis is that there is no significant correlation between the dependent variables exports and imports respectively, and the level of development aid received. The alternative hypothesis is that there is a significant effect of how the development aid yields the recipient countries' expanded imports and exports.

The second hypothesis explores how the level of democracy influences the effects observed in the first hypothesis. By interacting the democracy factor in the analysis, this can show how

efficient the effects of aid are, depending on the recipient countries' democracy levels. The null-hypothesis is that the level of democracy does not have a significant impact on the development aid's effect on trade growth, in either imports or exports respectively.

7.3 Summary of expected outcomes

The following table outlines the summary of the anticipated impacts of each independent variable on the dependent variables exports and imports.

Table 3: Summary of expected outcomes for all independent variables

Variable	Expected outcome
Aid	+
Democracy	+
Life Expectancy at birth	+
Gross Domestic Product	+
Gross Capital Formation	+
Agricultural Land	+
Population size	+
Interaction term	+

7.4 Possible weaknesses of regression model

The model being used, while robust in its approach, can still face potential limitations. One weakness could lie in the nature of the fixed effects model. While this model is effective in controlling for time-invariant characteristics unique to each country, it may overlook the influence of time-variant factors that could also significantly impact trade. For instance, economic crises or significant policy changes within countries are not directly accounted for, which could skew the results. Additionally, while the study accounts for endogeneity, statistical issues are challenging to completely eliminate in econometric analyses. Another possible challenge is the assumption of linearity in the model's relationships. Real-world economic phenomena can often exhibit nonlinear dynamics and the linear regression model may not accurately capture these complexities. For example, the impact of the EU aid on trade growth in SSA might not be linear; it could vary at different aid levels or under different economic conditions.

8. Robustness checks

The regressions of the study is based on an ordinary least squares (OLS) model with panel data that has been adjusted for fixed effects. To ensure that the regressions provide estimators that are as accurate as possible, various tests have been performed. The aim of conducting these tests is to identify and correct any potential issues. Hence, the models are tested for the normality of the residuals, heteroskedasticity, autocorrelation and multicollinearity, as well as dealing with endogeneity. All test results are presented in the appendix.

8.1 Normality of residuals

In evaluating the performance of a regression model, it is necessary to check that the residuals conform to a normal distribution. The normality assumption is fundamental for the validity of various statistical tests associated with regression analysis, as well as for the standard OLS regression estimate to be BLUE (Best Linear Unbiased Estimators). To test for the normality of residuals, a Shapiro-Wilk test in Stata is performed. The resulting plots reveal some small deviations from the diagonal, indicating that the residuals do not follow a normal distribution. To address the apparent non-normality of residuals, robust standard errors are used. Robust standard errors are particularly suitable for data that exhibit heteroskedasticity and autocorrelation, issues often presented in time-series and panel data. Applying Robust standard errors helps ensure more reliable statistical inferences, which are adjusted to these issues. Although this method does not directly address the issue of non-normality, it mitigates the impact of non-normal residuals on estimates, leading to more robust and reliable conclusions (Dougherty, 2016, p. 457-458).

8.2 Heteroskedasticity

Heteroskedasticity refers to the condition in regression analysis where the variance of the residuals is not the same across all levels of the independent variables. Heteroskedasticity can lead to inefficient estimates and affect the reliability of hypothesis testing, as well as it violates the assumption of homoskedasticity, which is essential for the OLS regression estimates to be BLUE (Dougherty, 2016, p. 293). To test for heteroskedasticity, a Breusch Pagan test is performed in Stata. The test for both exports and imports reveals significant heteroskedasticity, indicating that the variance of the residuals is not constant across the range of independent variables in the models. This suggests that the assumption of homoskedasticity is violated, and that it can affect the validity of the statistical tests associated with the regression

analysis (Dougherty, 2016, p. 293-294). Variability over time, potentially resulting in heteroskedasticity, may arise from shifting economic conditions, such as during phases of greater or lesser economic stability, as well as from the varying impacts due to differing degrees of political stability. To address this issue, robust standard errors are employed in the fixed effects model, providing a more reliable set of regression results that account for the detected heteroskedasticity (Dougherty, 2016, p. 305-306).

8.3 Autocorrelation

Autocorrelation refers to the correlation between a variable and its lagged value, meaning a variable's past value at a specific time point. When measuring data over time, autocorrelation happens when the values of variables are correlated with each other at different time points, which can violate the assumption of independence of observations in an OLS regression, potentially leading to biased and inefficient parameter estimates (Dougherty, 2016, p. 445).

A way to test this if the data is autocorrelated is to use the Durbin-Watson test in SPSS, that shows a value between zero and four, where the value of two indicates no autocorrelation (Dougherty, 2016, p. 452). When running this test for both the exports dataset as well as the import dataset, they both show a positive autocorrelation with values below two. The test shows a lower value for imports than exports, indicating a larger positive autocorrelation for the dataset of imports. This could be since many economic policies and development programs have long-term effects and tend to be implemented over extended periods. The impact of such initiatives may not be fully observed in the short term, leading to autocorrelation as past policy effects continue to influence present data. Robust standard errors are used to adjust for this issue by providing a more robust estimation of the standard errors (Dougherty, 2016, p. 447).

8.4 Multicollinearity

Multicollinearity is a statistical phenomenon where two or more independent variables are highly correlated. It can cause problems in a multiple regression model, making it difficult to discern the individual effects of the independent variables on the dependent variable (Dougherty, 2016, p.171). The regression output provides that multicollinearity is not a significant concern in the current models, after testing for it in SPSS. The collinearity diagnostics, indicated by the Tolerance and Variance Inflation Factor (VIF) values, fall within

acceptable ranges. None of the VIF values exceeds the common limit of 5, with the highest being 2.16 for GDP for imports and 2.21 for exports. Tolerance values exceed the 0.1 or 0.2 threshold, indicating minimal multicollinearity among the variables.

8.5 Endogeneity

The study acknowledges the possibility of endogeneity, which can arise from various reasons. Endogeneity in a statistical model occurs when an explanatory variable is correlated with the error term, potentially due to omitted variable bias, measurement error, or reverse causality, and this can result in biased estimates (Woolridge, 2012, p. 534). A particular concern is the issue of reverse causality. While it might be assumed that development aid affects trade growth, it could also be possible that trade growth affects aid levels as countries become more integrated.

To address potential endogeneity along with related issues, the data is lagged by one year. Lagging the independent variables helps to reduce reverse causality by temporarily separating cause and effect, as well as addressing autocorrelation since lagging values can help capture a correlation between the current value of a variable and its past values. It also helps to manage omitted variables bias, under the assumption that any unobserved factors affecting the independent variables and the trade outcomes in the used period of time would not have the same influence on lagged variables. The reason for lagging one year is to capture the dynamic effects in political processes, policy or economic changes. Since the main variables democracy and aid are affected by time, it is important to see how the effects change over time. When lagging more than one year, the results do not differ significantly, which is why the data analysis remains lagged by only one year. As lagging all independent variables by one year changes the regression equations, they are now formulated respectively as follows:

$$\begin{aligned} Exports_{i,t}/Imports_{i,t} = & \beta_0 + \beta_1 \cdot aid_{i,t-1} + \beta_2 \cdot democracy_{i,t-1} + \beta_3 \cdot aid_{i,t-1} \cdot democracy_{i,t} \\ & + \beta_4 \cdot Population_{i,t-1} + \beta_5 \cdot GCF_{i,t-1} + \beta_6 \cdot GDP_{i,t-1} + \beta_7 \cdot LifeExpectancy_{i,t-1} + \beta_8 \cdot \\ & AgriculturalLand_{i,t-1} + \alpha_i + \varepsilon_{i,t} \quad (2) \end{aligned}$$

8.6 Conclusion of robustness checks

In order to proceed to testing the hypotheses with a regression analysis, it is important to adjust for all of the above suggested measures. This is to get as robust results as possible, and to avoid drawing faulty conclusions from the future analysis. By having various control

variables, a large number of observations stretching over a relatively long time, lagging the independent variables as well as using robust standard errors, the analysis will produce more accurate results. When choosing which robust standard errors to use, the outcome revealed that the regression results remained consistent, indicating that the choice between different robust standard errors did not significantly impact the analysis. By running the robustness checks and adjusting the data with the results gained from them, the regression will give more accurate results.

9. Results

The following results focus on looking at the variables aid, democracy and the interaction variable that reveals the relationship between how aid and trade changes with different democracy levels. The section also includes a presentation of the outcomes associated with the control variables. The export results will be presented firstly, followed by the import results.

9.1 Exports

Table 4. Export regression results

Variables	Coefficient and p-value
Aid	-0.991 (0.140)
Democracy	-0.166 (0.455)
Population	0.000 (0.582)
GDP	0.000 (0.224)
GCF	0.163 (0.098)*
Life expectancy	-0.176 (0.150)
Agricultural land	0.504 (0.011)**
Interaction variable	0.082 (0.481)

Brackets show the robust p-value for each variable

*** *significance on the 1% level*

** *significance on the 5% level*

* *significance on the 10% level*

The results indicate that the impact of the EU's development aid on exports in recipient countries, represented by the 'aid' variable, is non-significant. Similarly, the democracy variable, the interaction variable as well as all control variables except for GCF and agricultural land, shows a non-significant result.

The significant values received in the regression are of the variables GCF and agricultural land. GCF is positively significant on the 10% level, with a coefficient value of 0.163. This result is interpreted as when GCF increases with one percentage unit, the export levels grow by the value of the coefficient. This is in line with the hypothesis of the analysis, where the expected results were to be positive. The expected results are valid for the variable of agricultural land as well, where the increase of one percentage of the total land area results

in a percentage growth of exports with 0.504, that is statistically significant on the 5% level with a p-value of 0.011.

When looking at the R-squared value, the model accounts for approximately 10% of the within country variation in exports. This suggests that other unobserved factors play a significant role. However, the overall R-squared indicates that when considering both within-group and between-group variations, the model's variables explained only 4.45%. The low overall R squared value implies that there may be other country-specific factors or external variables not included in the model that significantly affect export levels across the Sub-Saharan region.

9.2 Imports

Table 5. Import regression results

Variables	Coefficient and p-value
Aid	1.096 (0.149)
Democracy	-0.168 (0.405)
Population	0.297 (0.000)***
GDP	0.000 (0.212)
GCF	0.490 (0.000)***
Life expectancy	-0.095 (0.667)
Agricultural land	0.326 (0.245)
Interaction variable	-0.007 (0.942)

Brackets show the robust p-value for each variable

- *** significance on the 1% level
- ** significance on the 5% level
- * significance on the 10% level

Table 5 displays results showing the influence of independent variables on import levels. From the findings, neither aid nor democracy show any significance on imports, as their coefficients in the regression model do not reach the threshold of statistical significance as indicated by their p-values. This outcome suggests that within the context of this analysis, these variables do not have a measurable impact on import levels. Furthermore, the interaction variable, which represents the combined effect of democracy and aid, is not significant, implying that the combined effect of democracy and aid does not significantly influence imports.

The variables GDP, agricultural land and life expectancy show insignificant p-values. However, the variable GCF exhibited a highly significant p-value of 0.000, showing a positive relation with imports with a coefficient of 0.490. Similarly, population size demonstrates a significant positive relationship with imports. The significance of population size, with a p-value of 0.000, underscores its robustness as a predictor of import levels in the region. These positively significant results are in line with the expected outcomes of the analysis.

The R-squared values for the import model are also notably low, falling below 2%. This indicates that the model accounts for a relatively small proportion of the total variation in exports across the observed countries and time periods. The within R-squared is a little higher, being approximately 15%. This suggests that when focusing on variation within countries over time, the model accounts for a more substantial portion of the changes in imports.

10. Discussion

When addressing the research question of whether the EU's development aid to Sub-Saharan Africa has a significant impact on the recipient countries export and imports levels, the results show no significant impact. The question of how these effects of development aid are influenced by the level of democracy in the recipient countries, also presents non-significant results. The regression results therefore do not support the hypothesis of the analysis due to the presence of high p-values associated with most of the independent variables, and thereby not making it possible to establish a relationship between the EU development aid, trade and democracy outcomes in SSA.

There are various potential reasons for the insignificant results that the empirical analysis finds. The first, and most obvious, explanation is that there does not exist a relationship between the EU's development aid and the trade levels in SSA. Another explanation lies in the reasons for giving aid, and the strategies used. Since this analysis uses the aggregate aid as the variable, one cause could be that the aid has been given for other reasons than to impact the recipient countries export and import levels, and that various forms of aid have different effects at different time intervals. Even though parts of the ODA accounts for trade-related aid, the goal for the EU could still focus on other trade-related variables such as trade facilitation or other aspects that could be measured in other ways than through export and import levels. Further, the insignificant results may reflect an inappropriate strategy in how the aid is given, potentially indicating that the ODA provided may not be sufficient to address specific trade needs of these countries. Finally, a point could be made in regards to the EU and its role as an aid donor. The donations could possibly be made out of self-interest, which would translate to positive trade results within the EU, rather than to show effects in this analysis of the SSA region.

For the second research question, of whether the effects of aid's impact on trade is based on the level of democracy in the recipient countries, the insignificant empirical findings can have different explanations as well. The first explanation being that there is no relationship is a possible interpretation, meaning that the combined effect of democracy and aid on export and import levels are non existing. Secondly, the role of democracy might not influence the specific measurement of total export and import volumes that is used in this analysis, but could possibly have effects on other trade-related measures, for example on specific industries. Thirdly, democracy is a broad term and the index used includes many factors that might contradict the

effects of each other. More specific variables might be better at explaining the combined effect with aid, for example looking at institutional quality.

However, despite the complexity of the research question and the non-significance of many variables, the following analysis concentrates on the variables that demonstrated significance. This is to provide understanding of specific factors in the interplay between development aid, trade, and democracy that are most impactful in the context of SSA.

A noteworthy finding is the positive relation between agricultural land and exports, indicating that as the amount of agricultural land increases, so do the exports. This relationship is statistically significant, underlining the importance of agriculture in driving export growth within the region. This finding suggests that as countries in the region expand their agricultural land, they potentially enhance their export capabilities. This relationship can inform policy making and aid allocation by the EU, advocating for more investments in agricultural infrastructure, technology, and skills development. Understanding the role of agricultural land in trade can lead to more targeted and effective development aid strategies, focusing on agricultural development as a means to boost trade.

The positive significance of the relation between population and imports in SSA suggests that countries with larger populations are likely to have higher import levels. This relationship could be driven by several factors. The intuition is pretty straight forward, that larger populations could correspond to increased consumer demand in both volume and diversity. In SSA, where many countries are still developing their domestic production capabilities, this could be particularly true. Additionally, domestic industries may not yet be developed enough to produce a wide range of goods, especially in developing regions. This limitation means that as the population grows and diversifies its needs, the country must rely more on imported goods to satisfy these requirements. In the context of the EU's development aid to SSA, understanding the relationship between imports and population size could be important. It implies that aid strategies might need to be tailored not only on boosting trade but also on improving infrastructure and industrial growth to meet the needs of growing populations.

The significant results of gross capital formation (GCF) for both imports and exports, reveals its important role as an economic indicator. GCF, which captures investments that are foundational for a country's productive capabilities, directly influences a nation's ability

to engage and benefit from international trade. The positive significant relation of GCF with imports and exports indicates that this economic indicator is crucial in determining trade levels. This contributes insights to the broader research question by highlighting the potential pathways through which development aid can influence trade outcomes, and democratisation in recipient countries.

Future research could consider country-specific analyses to account for the diverse contexts within SSA. Sector-specific impact studies could investigate which areas of the economy are most responsive to aid, enhancing the understanding of where aid is most effective in promoting trade. Another aspect of future research could be to target specific parts of aid, as more trade-related variables could have an effect when isolated. These approaches could offer a more detailed understanding of the relationship between the EU's development aid and trade in SSA.

11. Conclusions

The aim of this thesis has been to examine the extent to which the European Union's development aid to Sub-Saharan Africa impacts the trade growth of the recipient countries, and to explore whether the effects of this aid is moderated by the level of democracy. The previous research provided some support for the hypothesis that the EU development aid positively influences trade in SSA countries. However, the varied and sometimes contradictory findings in the existing literature, suggests a need for more comprehensive analyses.

When delving into the research question of the impact of the EU's development aid on the trade levels of SSA countries, the results yielded by this regression analysis are insignificant. The data does not provide a robust statistical basis to state that the EU aid has a significant, direct impact on the import or export levels of these countries. Similarly, when exploring the interaction between the level of democracy and the effect of the aid, the results are insignificant as well. However, certain variables notably stood out for their significant impact. Agricultural land was significant for exports, while population size was significant for imports, and lastly gross capital formation showed significant results for both, underscoring the importance of demographic trends and investment in shaping trade. In conclusion, this thesis has not been able to provide a significant effect of the questions that are examined, but finds other important aspects related to the subjects of aid, trade and democracy. Lastly, it is important to be aware of the possible weaknesses of the model and the limitations of the study, to understand that these results do not negate the possibility that reality can be captured with other conclusions.

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Appendix

Robustness tests:

A1: Results from Shapiro-Wilk test for all independent variables

Variable	Observations	Z	p > z
Residuals	783	5.398	0.000

A1 presents the Shapiro-Wilk test results for the residuals. With 783 observations included, the test statistic (Z) is 5.398. The p-value obtained is 0.000, indicating a significant departure from normality of the residuals and that the residuals therefore does not conform to the assumptions of a normal distribution.

A2: VIF results for all independent variables

Variable	VIF	Tolerance level (1/VIF)
Aid	1.23	0.81
Democracy	1.35	0.74
Life expectancy	1.54	0.65
GDP	1.24	0.81
Population	1.22	0.82
Agricultural Land	1.17	0.86
GCF	1.12	0.89
	Mean: 1.27	

A2 provides the Variance Inflation Factor (VIF) results for all the independent variables. VIF is a measure of multicollinearity within a multiple regression. A VIF value above 10 indicates high multicollinearity. The variables in this study show VIF values well below this threshold, suggesting that multicollinearity is not a concern. The tolerance levels, which are the inverse of VIF, further confirm this as they are all above the commonly used cut-off point of 0.10.

A3: Results from Breush-Pagan test for heteroskedasticity, exports

Variable	Chi-squared (χ^2)	p > χ^2
Fitted values of exports	21.91	0.000

A3 presents the Breusch-Pagan test results for heteroskedasticity in the regression model using fitted values of exports. The test yields a Chi-squared value of 21.91 and a p-value of 0.000, indicating the presence of heteroskedasticity in the model. This suggests that the variance of the residuals is not constant across levels of the independent variable.

A4: Results from Breush-Pagan test for heterskedasticity, imports

Variable	Chi-squared (χ^2)	p > χ^2
Fitted values of imports	9.14	0.0025

A4 shows the results from the Breusch-Pagan test for heteroskedasticity regarding the imports in the regression model. The Chi-squared value stands at 9.14 with a p-value of 0.0025, which indicates significant heteroskedasticity, suggesting that the variance of residuals is not uniform across the observations.

A5: Results from Wooldrige test for autocorrelation, exports

F-statistic	p > F
46.948	0.000

A5 illustrates the Wooldridge test for autocorrelation for the export data. The F-statistic is 46.948, and the associated p-value is 0.000. These results strongly suggest the presence of autocorrelation in the panel data model, indicating that the residuals are not independent across time.

A6: Results from Wooldrige test for autocorrelation, imports

F-statistic	p > F
53.594	0.000

A6 displays the results from the Wooldridge test for autocorrelation for the import data. With an F-statistic of 53.594 and a p-value of 0.0000, the test indicates a statistically significant autocorrelation within the panel data, suggesting that the residuals in the model for imports are correlated across time.