


UNIVERSITY OF CAPE COAST



**DRIVERS OF EXPORT PERFORMANCE IN AFRICA: EVIDENCE  
FROM MACHINE LEARNING APPROACH**

**SOLOMON OPOKU**

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**BY  
SOLOMON OPOKU**

**Thesis Submitted to the Department of Economic Studies of the School of  
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Master of Philosophy Degree in Economics.**

**DECEMBER 2023**

## DECLARATION

### Candidate's Declaration

I hereby declare that this thesis is the results of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature..... Date .....

Name: .....

### Supervisor's Declaration

We hereby declare that the preparation and presentation of this thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's signature..... Date .....

Name: .....

Supervisor's signature..... Date .....

Name: .....

## ABSTRACT

There has been discussion on what factors contribute to Africa's export performance for many years. The factors that are most important for Africa's export performance are still unclear, nonetheless, given that prior research has focused on the preferential selection of covariates within the framework of many potential drivers of export performance. The fundamental issue with these contributions is that, depending on certain model assumptions and specifications, even shaky variables can be considered significant. To deal with this and properly inform policy, the study conducted a systematic review on drivers of export performance from 1980 to 2021. The study then employed four machine learning regularization algorithms approaches, namely standard lasso, minimum BIC lasso, square root lasso and the elasticnet, to analyze trends in a dataset with 87 covariates and determine the main factors influencing Africa's export. The findings indicated that, 7 factors (public private partnership investment, net trade, service traded, stock traded, domestic credit, inflation, gasoline price) were the actual drivers of export performance in Africa. The inferential estimates were obtained by applying double-selection Lasso, partialing-out lasso instrumental variable regression, and partialing-out lasso linear regression.

Policy recommendations are also provided to inform policy appropriately.

## KEYWORDS

Africa

Artificial intelligence

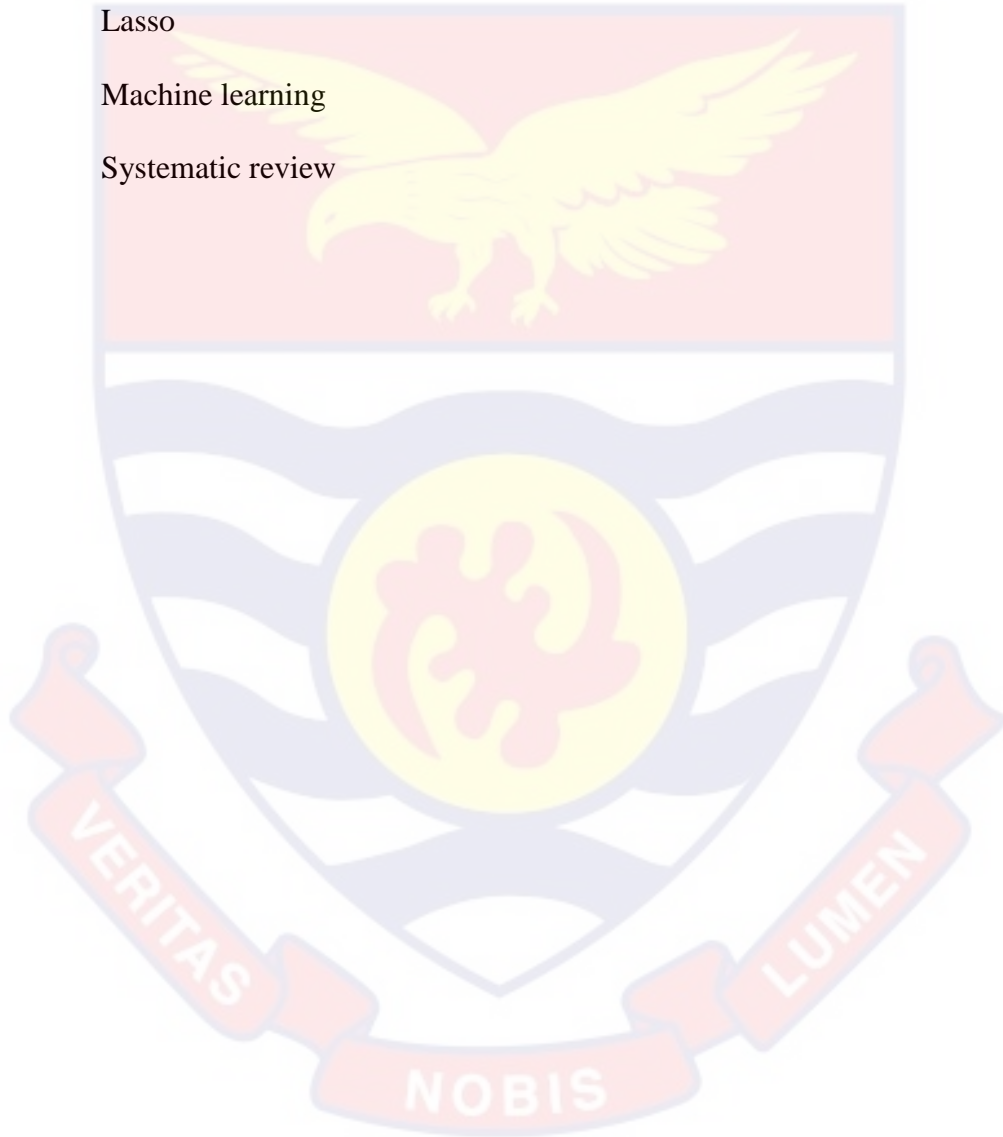
Elasticnet

Export performance

Lasso

Machine learning

Systematic review



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## DEDICATION

To my parents Mr. Samuel Pobee and Mrs. Grace Amoah



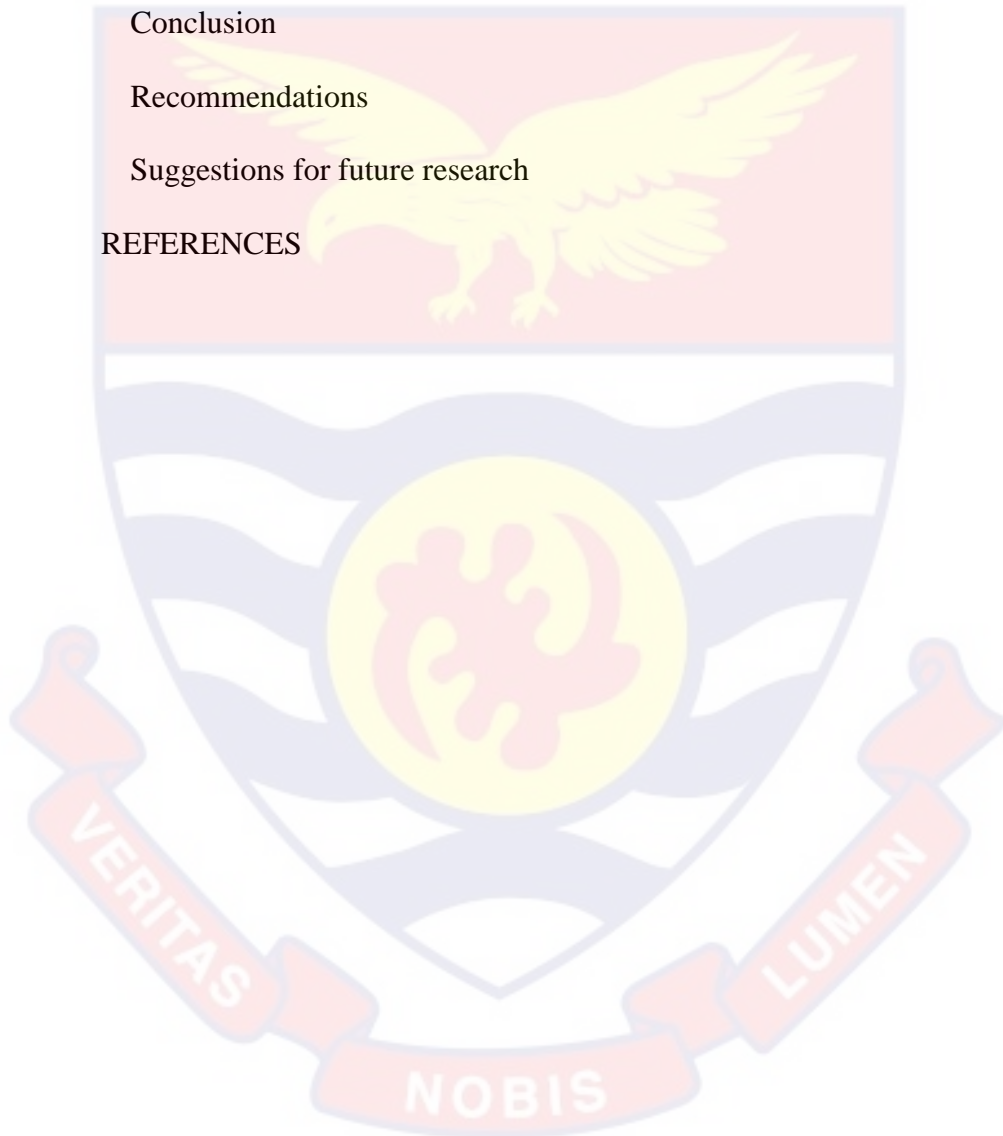
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## LIST OF ABBREVIATIONS

AfCFTA	African Continental Free Trade Area
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
AU	African Union
BIC	Bayes Information Criterion
CV	Cross-Validation
DSL	Double-Selection Lasso
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
IMF	International Monetary Fund
KNN	K-Nearest Neighbor
OLS	Ordinary Least Squares
POIVLR	Partialing-Out Lasso Instrumental Variable Regression
POLR	Partialing-Out Lasso Linear Regression
PPP	Public-Private Partnership Investment
RBV	Resource-Based View Theory
SDG	Sustainable Development Goal
UNCTAD	United Nations Conference on Trade
VEC	Vector Error Correction
WB	World Bank
WDI	World Development Index
WTO	World Trade Organization

## CHAPTER ONE

### INTRODUCTION

This chapter covers the background to the study, the statement of the problem, the research objectives, the significance of the study, and organization of the study.

#### **Background of the study**

The debate on the factors that influence exports performance continues to draw interest in the academic world, the development communities, and the political field due to the benefits it has for the world economy through macro-economic transformation and stability, poverty reduction, and sustainable development (Vohra, (2001). Efforts are been made by all stakeholders to explore the key drivers necessary for export performance. Countries that have been able to increase their exports globally have benefited from economic growth (Lee, 2011). It is widely agreed in the literatures on international trade that, exports specifically, has the effect of enhancing firm productivity and ultimately contributing to economic growth (Ngo & Nguyen, 2020). Export has improved the standard of living of the world's economy through the creation of jobs, foreign currency earning, increasing productivity, creating international diplomatic relations among nations, and gaining knowledge about international markets and countries (Sénquiz-Díaz, 2021).

Export performance has gained interest from international development organizations such as the World Trade Organization (WTO), African Union (AU), World Bank (WB), and International Monetary Fund (IMF). Global initiatives led by the World Bank, International Monetary Fund, and World Trade Organization, are working to promote a global rule-based,



open, non-discriminatory, and equitable multilateral trading system in line with Sustainable Development Goal (SDG) 17.11, which aims to strengthen the international trade system, particularly for the benefit of developing nations, by 2030. This coordinated initiative intends to increase emerging nations' export performance capacities to benefit from the importance that comes with exports. Furthermore, the African Union (AU) is actively pursuing the expansion of intra-African trade among its member nations by 2063, a vision realized through the implementation of the African Continental Free Trade Area (AfCFTA). Consequently, an upsurge in research endeavors has emerged to elucidate the determinants of export performance, aligning with the objectives of these development communities.

The interest of academic communities in export performance has resulted in a vast body of literature looking into the determinants of exports performance across the globe. Some of these papers include Akepanidaworn et al., (2022) who concluded that improving the quality of infrastructure and educational systems, especially tertiary education, reducing income inequality, conducting market research, and improving transport are the key drivers of export performance, while ÖZDEN, (2022) concluded that exchange rate, foreign direct investment, and gross domestic product are the determinants of exports performance. Mwakanemela, (2014) established that trade openness, foreign direct investment (FDI) inflow, and inflation matter most when it comes to the drivers of exports performance, while Munemo, (2016) concluded that inflation and exchange rate drive exports performance. Zhu, (2013) found natural resources as a major determinant of exports performance while Brau and Pinna, (2013) found tourism as the main drivers of exports

performance. Further empirical evidence by Radosevic, (2007), indicated that institutional quality, infrastructure, and well-developed transport were the drivers of exports performance. Dalango, (2020) concluded empirically that per capita GDP and capital formation have a positive relationship with export performance. There is no consensus among researchers from these vast literature on the factors that really drive export performance. A rigorous assessment of the drivers of export performance is essential to provide with a comprehensive and unbiased understanding of relevant studies.

Within the African context, despite its abundant natural and human resources, diverse economies, and substantial market potential, the continent faces considerable hurdles in significantly contributing to global exports. Notably, data from the World Trade Organization reveal that as of 2019, Africa's share of world exports remained below 3%, underscoring the formidable barriers to export performance on the continent (Azenui & Rada, 2021). Many of the challenges confronting Africa's export performance that hinder its ability to leverage the full benefits presented by international trade span across various domains such as economics, institutions, and infrastructure, resulting in a complex network of barriers that need urgent resolution for the continent's export potential to be realized. Africa's economic landscape is characterized by an excessive dependency on primary commodities as the main source of exports. This concentration on primary products enhances their vulnerabilities to price instability, external shocks, and insufficient value-added activities, which hamper the efforts to achieve economic diversification (Yaméogo et al., 2014). Africa faces challenges in accessing finance and protecting intellectual property. While the infrastructure



deficit is a big barrier to Africa's export performance, the effective transfer of commodities across borders has been hindered by inadequate transportation networks, unstable energy sources, and restricted access to contemporary logistics and trade facilitation facilities. These difficulties make transactions more expensive, prolong delivery periods, and restrict the number of markets open to African exporters

Furthermore, following the development of the coronavirus pandemic and the challenges it brought to the world economies such as limitations of direct contact with people, restrictions on movement and travel, and total change in active lifestyle, it is more important than ever to identify the primary forces driving export performance. Understanding the main forces behind export performance is a crucial step in developing and putting into practice policies to promote, maintain, and expand trade among African countries. To further address the trade deficit the continent, suffer, knowledge from drivers of export performance would help policymakers, development communities, and researchers map out trade liberalization programmed to foster the deficiency the African continent faces in terms of trade.

### **Statement of the problem**

The literature on the drivers that influence African export performance is growing. Many of these previous studies about export performance have identified variables such as tourism, GDP, real exchange rate, labor force, and foreign direct investment as the drivers of export performance (Refiana & Rudi Purwono, 2021; Hanson, 2010; Hunegnaw, 2017; Papadogonas et al., 2007; Cieřlik & Michałek, 2018). Technology, trade policy, employment, (Desai, 2013; Sekkat & Varoudakis, 2002; ), trade liberalization, official

development assistance, transport systems, and industrialization (Santos-Paulino, 2002; Gençtürk & Kotabe, 2001; Tsekeris, 2017; Ngo & Nguyen, 2020) have also been highlighted as the determinants of export performance. However, there has not been agreement among researchers on the determinants of Africa's export performance in the literature.

A noticeable challenge in the current academic literature is that the selection of variables necessary for export performance is often based on the discretion of the researcher, which raises concerns regarding the biased selection of export performance variables that may appear influential under specific assumptions, model specifications, or estimation techniques, including those with weak relevance. Furthermore, this propensity to favor certain covariates amid a myriad of potential determinants of export performance also contributes to inconclusive outcomes in regression problems involving big data, which makes the variables necessary for export performance inconclusive (Ofori et al., 2021).

Tackling this challenge and therefore effectively guiding policy can be achieved by using machine learning techniques that use more regularization for predictions and inference for analysis (Zou & Hastie, 2005b). Machine learning is artificial intelligence that focuses on the development of algorithms and models that enable computer systems to learn and improve from data without being explicitly programmed. It entails the development of mathematical models and statistical techniques that enable computers to automatically recognize patterns, forecast the future, and make predictions based on data. Algorithms used in machine learning are trained on huge data sets and iteratively tweaked to improve their performance when addressing

particular problems or generating precise predictions without explicit programming instructions. These algorithms learn from experience, recognize patterns, spot trends, and make accurate assessments or predictions. Machine learning has been used in so many areas, such as games (Ćwiklinski et al., 2021), health (Cieślik & Michałek, 2018), banking risk management (Leo et al., 2019), education (Sakulkueakulsuk et al., 2018) astronomy (Pearson et al., 2018), pharmacy (Thibault & Lebel, 2019). In economics, machine learning has been used to determine key variables in different areas such as economic growth (Ofori Obeng & Aongu., 2022), and finance (Ofori Obeng., 2023), among others. With the exception of (Ofori Obeng., 2023) and (Ofori Obeng & Aongu., 2022), most of these works on machine learning are on the Western world, American, and Asia. Knowledge of the drivers of export performance is crucial for African economies because it will assist in the planning, modeling, and targeting of export performance in an attempt to achieve, sustain, and share export gains in line with the implementation of the African Continental Free Trade Area (AfCFTA). These form the basis for this work on using machine learning to determine key variables necessary for export performance in Africa.

### **Purpose of the study**

The study sought to estimate the drivers of export performance for Africa.

### **Specific objectives**

In line with the purpose, the study sought to achieve the following specific objectives; To

1. Conduct a systematic review of export performance.
2. Identify the drivers of export performance.

3. Estimate the inferential for the selected variables.

### **Significance of the study**

The study will contribute by providing evidence-based insight from machine learning algorithms into the key drivers of exports performance, which will empower African governments and other agencies to make informed policy decisions that will help promote export performance which will lead to economic growth across Africa. Again, the findings may prove crucial to the course by assisting in the planning, modeling, and targeting of export performance following renewed attempts to achieve, sustain, and share export performance gains in line with the implementation of the African Continental Free Trade Area (AfCFTA), the institution of the African Union Agenda 2063, and achieving SDG 17.11. Additionally, it will serve as a source for researchers who need to undertake additional research in this area.

### **Organization of the study**

This study comprises five chapters. introduction, a literature review, data and research methods, results and discussion, and conclusions and recommendations. Chapter one, which is the introduction, talks about the background of the study, research gaps, the problem statement, the purpose of the study, the objectives of the study, the significance of the study, and the organization of the study. Chapter two of the paper contains the literature review, which is further divided into theoretical and empirical reviews of the theoretical underpinnings of the study. Chapter three talks about the study design, the data employed in the study, and research methods. It includes the data source, data extraction, systematic review methods, and synthesis methods, as well as the empirical analysis of the study conducted to explore

the determinants of export performance in Africa. Chapter Four talks about the results and the discussion, which focuses on the empirical presentation of the results, while conclusions and recommendations are presented in Chapter Five.





## CHAPTER TWO

### LITERATURE REVIEW

#### Introduction

This section focuses on a review of theories and works underpinning exports the review covers both empirical frameworks and theoretical evidence related to export performance.

#### Theoretical review

This section outlines some theories that explain export performance. They include Competitive advantage theory, Porter's Diamond Theory, Market Power Theory, and Resource-Based View Theory. These theories have been used as the theoretical basis for the study.

**Competitive advantage theory:** The competitive advantage theory, put forth by Michael Porter in 1985, stands as a pivotal framework guiding the strategies of countries and businesses in the global marketplace. At its core, this theory advocates for the adoption of policies that facilitate the development of superior goods or services, allowing them to command premium prices in international markets and maximize profits (Ma, 2000). Porter's theory contends that to thrive in the realm of exports, both companies and countries must meticulously analyze and capitalize on their inherent strengths. By doing so, they can differentiate themselves from competitors and establish a distinct advantage in the global market, thereby increasing the likelihood of export performance (Wen-Cheng et al., 2011). Barney, (1991) complements Porter's framework by highlighting the pivotal role of scarce and critical resources in generating a competitive advantage. According to Barney, these resources, if not only scarce and important but also

challenging to imitate, replace, or replicate, can be instrumental in maintaining a sustained competitive edge. The theory underscores the idea that the possession of unique and difficult-to-replicate resources is a key factor in achieving and sustaining a competitive advantage. This conceptual framework provides valuable insights into how countries can navigate the complexities of global trade and achieve lasting success in the export sector. The ability to offer superior goods or services that set a country apart from its competitors becomes a critical component of export performance. The emphasis on leveraging strengths and distinctive capabilities aligns with the notion that a tailored approach, rather than a one-size-fits-all strategy, is essential for success in the international arena.

In the context of this study, the application of competitive advantage theory becomes evident. Countries that identify and strategically utilize their strengths in specific export industries position themselves favorably for export performance. By concentrating on these strengths, be they technological, human capital, or resource-based, countries can distinguish themselves in the global market, gaining a competitive edge that directly contributes to their export performance. The theory not only underscores the importance of differentiation but also emphasizes the ongoing need for countries to adapt and evolve their strategies to remain competitive in the ever-changing landscape of international trade.

**Porter's Diamond Theory:** The Porter Diamond model, introduced by Michael Eugene Porter in 1990, serves as an illuminating framework that dissects the elements capable of steering a nation's market or economy toward a competitive advantage over others. This groundbreaking theory, articulated

by Porter, revolves around the idea that a nation or company can gain a competitive edge by harnessing factors such as the availability of conducive factor conditions, demand conditions, supporting industries, and a strategically aligned government or firm strategy (Smit, 2010). The four pivotal factors within the Porter Diamond model, as elucidated by Bakan & Doğan, (2012) include demand conditions, related and supporting industries, firms' strategies, and the structure of rivalry within the market. Investigating why certain countries and firms outpace others in terms of competitiveness involves a comprehensive examination of these interconnected factors. It becomes evident that these elements do not operate in isolation; rather, they interact dynamically, creating an environment that nurtures innovation and competitiveness on a global scale. A nuanced understanding of the drivers of export performance is critical in this context. The intricate interplay between factors such as factor conditions (including skilled labor and infrastructure), demand conditions (reflecting local market needs and preferences), related industries and supporting sectors, firms' strategic choices, and government policies collectively shapes a country's export activity. This comprehensive understanding provides insightful information about how a country can carve out and sustain a competitive edge in the dynamic landscape of global markets. In essence, the Porter Diamond model offers a holistic perspective on the multifaceted dynamics that underpin a nation's competitiveness in the international arena. By delving into the intricate relationships between various factors, it reveals the mechanisms through which nations can foster innovation, enhance productivity, and ultimately achieve a commanding position in the global marketplace. As countries seek to navigate the



complexities of international trade, this model serves as a valuable guide for policymakers and businesses alike, emphasizing the importance of a coordinated and strategic approach that addresses all facets of the competitive landscape.

**Market Power Theory:** In 1934, economist Abba P. Lerner introduced the market power theory, which delves into the dynamics of pricing within economic entities, be they companies or entire countries. According to Lerner, the possession of market power empowers a company or nation to establish prices that surpass the marginal cost, thereby resulting in the accrual of economic rents. This phenomenon is particularly concerning for consumers, as they bear the repercussions in the form of deadweight loss, an inefficiency in resource allocation (Lerner, 1995). Lerner's conceptualization of market power extends beyond economic ramifications, incorporating a political dimension. He argues that large companies, often wielding significant market power, are not only economically unnatural but also pose a threat to a country's political structure. This perspective suggests that such entities might influence political processes and structures in ways that are not always transparent or beneficial to the overall well-being of the nation (Jamison, 2020). Furthermore, the assessment of market power is intricate, with the size of a company alone providing an unclear indication of its control over the market. (Jamison, 2020) emphasizes the nuanced nature of market power assessment, highlighting that the mere size of a company does not necessarily equate to dominance in the market. The discourse on market power underscores the critical role of pricing policies adopted by countries or companies. When businesses possess substantial market power, they have the capacity to set higher prices. This

pricing strategy can significantly impact their competitive standing in global markets. Essentially, a reliance on market power to dictate high export prices can hinder a nation or business from effectively competing with others that offer more reasonably priced goods or services.

In the context of this study, the relationship between market power and export performance becomes evident. Nations or businesses that leverage market power to set elevated export prices may encounter challenges in the global marketplace. Competitors offering similar goods or services at more competitive prices are likely to gain a comparative advantage, potentially diminishing the market share and overall export performance of entities relying on high pricing strategies. Consequently, the study emphasizes the intricate interplay between market power, pricing strategies, and international competitiveness, recognizing the far-reaching implications for economic efficiency and global market dynamics.

**Resource-Based View Theory:** The Resource-Based View (RBV) Theory, initially proposed by Birger Wernerfelt in 1984 and later refined by B. Barney in 1991, represents a seminal perspective in understanding the sources of enduring competitive advantage for both nations and companies (Kshetri, 2008). This theory asserts that sustained competitiveness hinges on possessing resources that are simultaneously valuable, rare, difficult to imitate, and irreplaceable. Barney's work particularly highlights the role of a company's ability to cultivate or acquire such unique and strategic resources, shaping its performance and competitive standing in relation to its industry counterparts (Barney, 1991). Barney extends the RBV to include the realm of countries, linking a nation's resources to the potential for sustained competitive

advantage. This nuanced perspective underscores that a country's resource endowments, when effectively leveraged, can significantly influence its competitive position in the global landscape. Russo & Fouts, (1997) further delved into the implications of the RBV, investigating the impact of resources on corporate and environmental performance as well as profitability. Their study, conducted within the framework of the Resource-Based View Theory, concluded that environmental performance is positively correlated with firms' growth. This reinforces the idea that not only can strategic resources contribute to a company's competitiveness, but they can also have broader implications for corporate success and sustainability.

In the context of the current study, the Resource-Based View Theory accentuates the paramount importance of a country's resource endowments and its ability to effectively harness them for export activities. The identification, development, and utilization of these resources become pivotal factors that can spell success for exports. By integrating the RBV into the broader analysis, the study acknowledges the multifaceted nature of the global business environment. The recognition that no single theory offers a comprehensive understanding of the drivers of export performance underscores the study's approach. The convergence of theories, including Competitive Advantage, Porter Diamond, and RBV, reflects the complexity of the global marketplace. This integrated perspective recognizes that success in export performance requires a nuanced understanding of diverse factors, encompassing market conditions, competitive dynamics, and the strategic utilization of unique resources. In embracing this holistic approach, the study aims to provide a more comprehensive and nuanced understanding of the

intricate web of factors that contribute to effective export performance strategies.

### **Empirical Review**

This section presents the empirical works that was derived from the systematic review of the study.

In recent years, the exploration of the determinants of export performance has been a focal point in academic research, with numerous studies shedding light on the intricacies of this multifaceted subject. One such noteworthy study by Epaphra, (2016) delves into the determinants of export performance specifically in the context of Tanzania. Employing sophisticated analytical tools such as the Johansen cointegration and Granger causality approach, Epaphra's investigation spans the substantial period from 1966 to 2015. The key determinants identified in his study encompass real GDP, trade liberalization, and exchange rates. Intriguingly, the results also spotlight the nuanced impact of Official Development Assistance, revealing a negative correlation with export performance. This underscores the intricate relationship between external financial assistance and a nation's ability to enhance its export activities. In examining the determinants of export performance of seven East African countries using data from the World Indicators Index from 1990 to 2014, Özgür & Abdulakadir , (2018), employed panel data analysis. Their analysis indicated that labor force, industrialization, foreign direct investment, and the exchange rate have a positive relationship with the export performance of the seven East African countries while inflation hurts export performance with GDP not having any effect on export performance.



Fugazza; (2004) empirically, used the quantile regression techniques in determining drivers of export performance and concluded, that there is a strong connection between macroeconomic soundness, good quality institutions, good transport systems, and access to international and export performance. Again, particularly for Africa and the Middle East, the trade barrier is still an issue when it comes to export performance. By using time series data from 1981 to 2018 to find the determinants of export performance in Ethiopia, Dalango, (2020) employed the ARDL model and concluded empirically that, foreign direct investment, per capita GDP, and capital formation have a positive relationship with export performance in Ethiopia, while inflation has an inverse relationship with export performance in Ethiopia.

In examining the relationship between bilateral governance performance indicators and exports performance in Vietnam, for the period 1996 to 2014, Nguyen & Wu, (2020) concluded that the export performance of Vietnam has a positive relationship with bilateral indicators and regional trade agreements. They also found a negative relationship between export performance and tariffs in importing countries.

The level of import and exchange rate of Malaysia has a positive relationship with the export performance of the country, whereas inflation has a negative relationship with export, again it was reviewed empirically that Foreign direct investment has an inverted-U shape relationship with export performance of Malaysia. This claim was established after the OLS model was employed for a data sample from 1957 to 2013 (Yee et al., 2016). In examining the relationship between agriculture and manufacturing sectors and

export performance in Tanzania, Shombe, (2008) statistically employed time series data for the period 1970 to 2005 and found a positive relationship. That is both agriculture and export performance, manufacturing and export performance were cointegrated.

In finding the drivers of export performance of Pakistan at firm level analysis, Din et al., (2009) based on a survey of export-oriented firms and concluded that, foreign-owned companies perform better because they have more resources and expertise than domestically-owned companies. Again, the amount of investment in technologies that are focused on the market or the client has a beneficial impact on export performance, the primary supply-side issue hurting the firms' export is the absence of intellectual property for product and process standards. Using social capital theory with a sample size from Ghana and Bosnia and Herzegovina, it was statistically concluded that innovativeness is advantageous for firms competing in a competitive market for export performance (Boso et al., 2013).

In an attempt to review export performance papers between 1998 to 2005, Sousa et al., (2008) concluded that export assistantship, market research, innovation capabilities, educational level, and political stability are the determinants of export performance for the period. Freeman and Styles, (2014) empirically concluded that access to specific locations that made one access to good network opportunities, skilled labor, government agencies, and export-service infrastructure were advantageous and promoted export performance outcomes.

In the face of the global COVID-19 crisis, Akepanidaworn et al., (2022) examined the raising of Armenia's export performance by employing the gravity model in its estimation, It was established that, improving the quality of infrastructure, improving the educational system, especially tertiary education, reducing income inequality, conducting market research, and improving transport network all help in raising the export performance of Armenia. In forecasting export performance for Turkey using artificial intelligence, ÖZDEN, (2022) used quarterly historical data for the period 2013 to 2021. After training and testing the dataset, exchange rate, foreign direct investment, and gross domestic product were found to be the main determinants of Turkey for the period. Finally, the machine learning model was determined to be the best-predicting model as compared to the other techniques in Turkey.

Again, using the Ordinary Least Square (OLS) method and Vector Error Correction (VEC) model under the time series framework for the period 1980 to 2012, to explore the impact of inflation, trade openness, and FDI inflows, on manufacturing export performance in Tanzania, Mwakemela, (2014) concluded empirically that trade openness and FDI inflow are positively related to the manufacturing performance of export whiles inflation has an inverse relationship with manufacturing performance of export. Investigating the relationship between foreign aid and export performance in developing countries, Munemo, (2016) connected the impact of foreign aid on developing countries to the fluctuations in the exchange rate of the. Based on singling out foreign aid, the author was not able to conclude empirically the

effect it has on export performance and recommended the use of different export performance determinants to be used.

Using cross-country panel data for the period 1992 to 2006 in finding drivers of export performance, it was established that the export performance of a country is attributed to investments in research and development, the level of imports, investments in education, and foreign direct investment. Involvement in knowledge creation, capital deepening as well and institutional quality. The natural resources effect on export was found to be complicated, (Zhu, 2013).

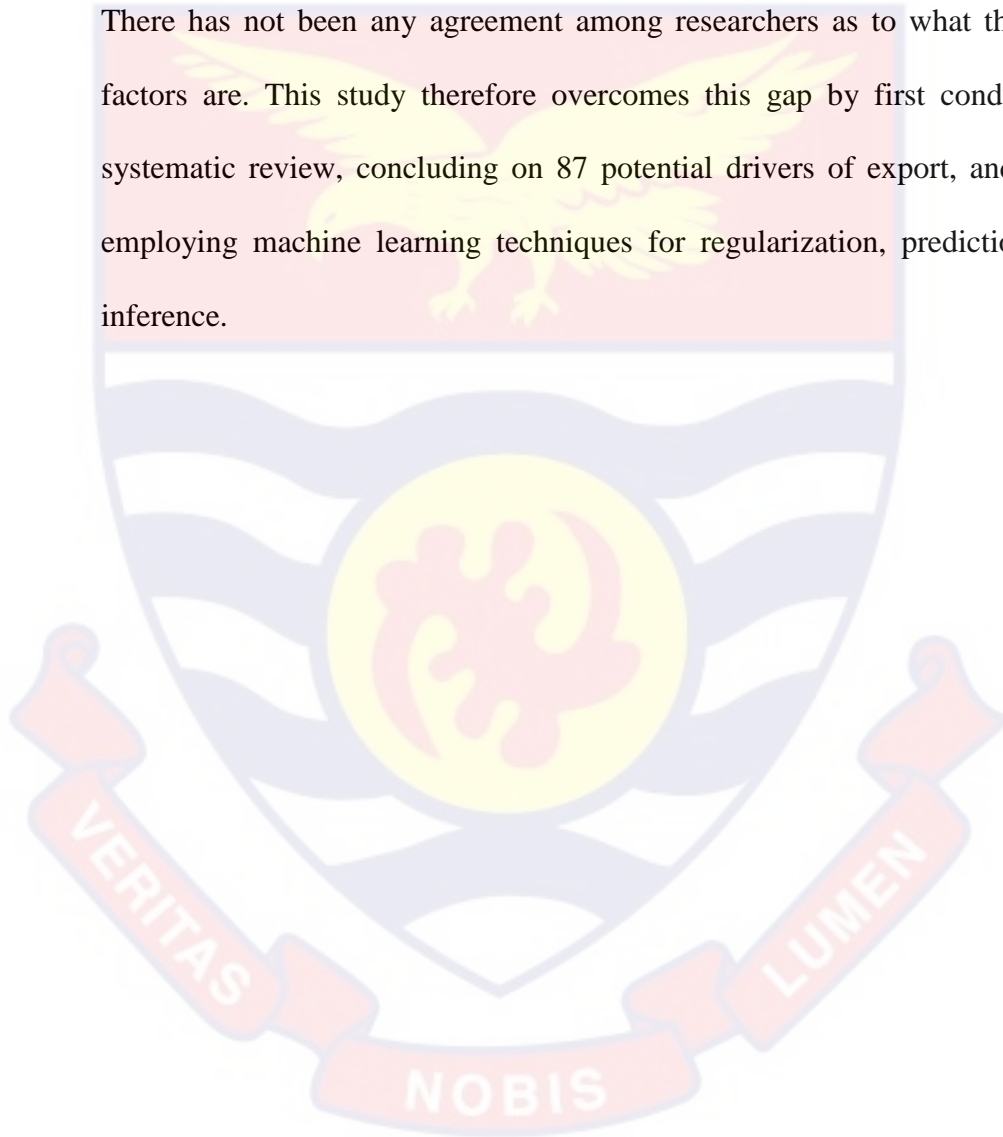
In determining influential factors for export performance using panel data analysis for the ASEAN region, the panel ARDL model was used between the period 2000 to 2015 inclusive, it was concluded that FDI, interest rate, and economic growth have a positive impact on the success of export of ASEAN countries, (Oo et al., 2019). In examining institutions, infrastructural and trade, Radosevic, (2007) worked with a panel of 284,049 bilateral trade flows from 1988 to 2002, with bilateral trade and tariffs data, and concluded that institutional quality and infrastructure have a positive impact on export performance and supported the claim that interdependency between communication institutional quality, infrastructure, and well-developed transport and the propensity to be part of the trading system. Brau and Pinna, (2013) found evidence to support the claim of tourism has a positive impact on international trade and the export of a country as a whole.



## Conclusion

This chapter looked at both the theoretical and empirical literature on export performance in Africa. From the empirical review, the factors that affect export performance in Africa are diverse and multifaceted, with different studies pointing to different factors as the primary determinants.

There has not been any agreement among researchers as to what the actual factors are. This study therefore overcomes this gap by first conducting a systematic review, concluding on 87 potential drivers of export, and finally employing machine learning techniques for regularization, predictions, and inference.



## CHAPTER THREE

### RESEARCH METHODS

#### Introductions

This section presents the research design, research philosophy, the data, the empirical model, the estimation techniques used for both systematic review and for selecting variables deemed important for export performance in Africa, and the techniques for providing inferential for the selected variables.

#### Research Design

In line with the objective of the study to determine the drivers of export performance in Africa, the study adopted the positivist philosophy. According to positivists, social reality is stable and can thus be observed and recorded objectively without interfering in any way with the events under study (Visano, 2016). The positivist philosophy offers the researcher the chance to objectively analyze social and economic processes and to explain relationships between variables. Additionally, positivist philosophy is in favor of using quantitative research methods, as is the case with this thesis. The building of mathematical models to investigate the link between quantitative measurements is suited for the positivist ideology. This study used the quantitative approach, which is grounded in positivist philosophy (Cantab, 2018). The quantitative approach enables the researcher to put the social and economic world into a structure of causality and nullifies the role of human effect.

The study adopted the explanatory research under the quantitative approach since its purpose is explanatory, specifically through the use of a machine learning strategy, such as the lasso technique, in evaluating the data

utilized in this study. The researcher can determine the size and kind of cause-and-effect correlations thanks to the explanatory design. The primary purpose of an explanatory study design is to examine how particular changes to current processes affect them. The explanatory research design offers the optimum research strategy based on the overall goal of the current investigation.

### **Data**

This study used data from a variety of sources such as the World Bank (WDI) and UNCTAD to examine the drivers of export performance in Africa. The dataset, which spans the years 1980 to 2021, enables an examination of the trends, patterns, and factors that have influenced export performance throughout the years. Approximately 87 variables have been selected through review of relevant literature on export performance and the availability of data within the WDI and UNCTAD databases. The study utilized a comprehensive set of data, taking into consideration macroeconomic variables such as gross domestic product and inflation (Epaphra, 2016; Purusa & Istiqomah, 2018). Official development assistance and exchange rates were also considered (Otor, 2014; Economic et al., 2017), export assistantships (Pacheco-López, 2005). Variables such as institutional quality and corruption, trade liberalization, regional trade agreements (Epaphra, Nguyen & Wu, (2020,2016), and institutions such as market research, improving transport networks, and investments in education (Zhu, 2013)

It is important to note that 38 African countries were included in this study, and the inclusion of variables and countries is all subject to data availability.

## **Estimation Strategy**

### **Systematic review approach**

#### **Introduction**

This section presents the approach used for the systematic review, which combined both meta-analyses, the vote-counting method, and narrative analysis from 1980 to 2021. Studies on the factors that impact export performance are of considerable interest to scholars, corporate leaders, and policymakers alike. Even though there is increasing significance attached to studies on export performance, there is limited agreement among researchers on variables definition and effective execution thereof. To date, researchers have employed various variables to assess export performance (Cavusgil & Zou, 1994). There have been a few structured inquiries into the influence of multiple factors on export performance. It is imperative to conduct a thorough examination of prior research to establish a fundamental consensus on export performance within the time frame and come up with a comprehensive review to help the study. The primary objective of this review is to document the advancements made in export performance research over the past 40 years and explore machine learning techniques to determine the actual ones while simultaneously surveying a large number of studies. Review approach to conclude the set of studies reviewed, we employ an appropriate literature review approach.

An effective technique for illustrating a body of literature is a meta-analysis (Hedges & Tipton, 2010).

Meta-analysis enables the methodological and quantitative integration of various primary research studies by calculating an overall effect size while

accounting for variations in effect sizes, thereby generating highly valid results. Nonetheless, to utilize a conventional meta-analysis, certain conditions must be met, such as ensuring the use of consistent measurements for independent and dependent variables across all studies. Currently, available research on export performance exhibits significant incongruities in their results concerning the employed empirical methods, underlying theoretical concepts, and definitions of variables linked to export performance, as well as in the methodology for measuring export performance. Additionally, the majority of export performance studies do not present their statistical data, such as correlation matrices, which are typically required for meta-analysis. As a result, implementing a pure meta-analysis becomes a challenging task. Therefore, the most suitable approach in this scenario would be to use the vote-counting method. The vote-counting method provides a summary of the association between the independent and dependent variables (Cwikel et al., 2000). One limitation of the vote-counting method is that it overlooks differences in sample sizes and assumes that effect sizes remain constant across all studies. To address this drawback, we utilize a combination of the vote-counting method and narrative analysis, which is more of a subjective viewpoint of the meta-analysis. Narrative analysis is a form of qualitative meta-analysis that provides verbal descriptions of the patterns identified in condensed research.

### **Scope and search criteria of the review**

The scope of the review centered on the published empirical studies from the period of 1980 to 2021. Four criteria are established to grant studies inclusion in the analysis. Firstly, the articles must be empirical and include the



necessary data for conducting a narrative review. Secondly, the focus of the empirical study must be on export performance measures as the dependent variable. Thirdly, the review only encompasses studies that analyze data at the country and firm levels. Lastly, the analysis is restricted to publications in the English language.

### **Empirical Strategy**

This paper has two empirical focuses. The first part is centered on outlining the methods used to select variables, while the second part presents the inferential models. The study does not explore traditional panel estimation techniques for the analysis because the panel least squares estimator is not suitable for explicitly selecting variables from the pool of 87 potential drivers of export performance. Although there has been debate by some scholars who argue that by using appropriate theories, researchers can effectively select relevant covariates in regression problems, or they may turn to systematic reviews to identify essential factors that determine the outcome variable (Saura et al., 2022). This may not be possible because the presence of additional predictors without a corresponding observation may cause the required matrix  $X'X$  to be invertible. Even if it is possible to include them all, overfitting might occur because of too many covariates (James et al., 2013) and so the panel-corrected standard errors and generalized method of moments may not be dependable to estimate the model of 87 potential determinants of export performance in Africa in this study.

The way to handle this econometric issue is by utilizing machine learning regularization methods that are useful in selecting variables, irrespective of the number of covariates, the model specification, nonlinearity,

and time. (Robert, 1996). The core objective of the Machine Learning model is to acquire knowledge from the provided data and produce forecasts based on the patterns detected during the learning phase. The study explores the Bias-Variance tradeoff theory which groups the mean squared error into residual variability (noise), the squared Bias, and the variance. The noise is an irreducible error and cannot be eliminated in statistical models  $E(Y - f(X))^2$ . While the square bias refers to the difference between the actual value and the predicted values  $E\{f(X) - Ef(X)\}^2$  and the variance is the difference in the expectation of the function relating predicted to the actual and the model estimated from the observed data and applied to the new predicted  $E\{Ef(X) - f(X)\}^2$ . Machine learning teaches itself about the input variable in a manner that the predicted values are as near as possible. In this study, the approach involves the training of modern machine learning regularization algorithms, which can recognize patterns in the fundamental dataset, to pinpoint the principal drivers of export performance in Africa. The study employed the method as specified by (Ofori et al., 2022) by training four shrinkage model algorithms namely elasticnet, squareroot lasso, minimum BIC, and standard lasso are explored to accomplish objective two of the work, while the double-selection lasso linear regression (DSL) partialing-out lasso linear regression (POLR), and partialing-out lasso instrumental variable regression (POIVLR) are explored to achieve objective three.

## **Specification of the Regularization Model**

### **Standard Lasso Model Specifications**

Tibshirani (1996), introduced the Least Absolute Shrinkage Selection Operator (Lasso), which helps in addressing the challenge of the traditional

regression techniques with variable selection for a large dataset by;

1. Improves the model's interpretability by getting rid of irrelevant variables that have no linkage with the response variable.
2. Improves the precision of predictions because the reduction and exclusion of irrelevant predictors can decrease variance without significantly increasing bias.
3. Minimizes the over-fitting associated with the model
4. No restrictions on the dimensions of data.

With the study's main objective, The Standard lasso method is employed to identify the significant catalysts of export performance by penalizing the model coefficients utilizing a tuning parameter lambda ( $\lambda$ ) (Belloni et al., 2014). Our objective function for the standard Lasso is specified in equation

(1). We again introduce the penalty ( $\lambda \sum_{j=1}^p (|\alpha_j|)$ ) in our algorithm to identify the crucial predictors of export performance from a group of numerous potential predictors which is  $\hat{\alpha}_{lasso}$  in equation (2).

$$A_L = \frac{1}{N} \sum_{i=1}^N \varepsilon_{if}(y_{it}, \alpha_0 + X_{it}\alpha') + \lambda \sum_{j=1}^p (k_j |\alpha_j|) \dots \dots \dots (1)$$

$$\hat{\alpha}_{lasso} = \min \{SSE + + \lambda \sum_{j=1}^p (|\alpha_j|)\} \dots \dots \dots (2)$$

From equation (1),  $y_{it}$  is the total export performance for country  $i$  at year  $t$  whereas  $X_{it}$  is a vector of all the 87 possible determinants of export performance. The goal, hence, is to reduce the sum of squared errors of the model using the penalty  $\lambda \sum_{j=1}^p (|\alpha_j|)$ . When the lambda which is the turning parameter is zero ( $\lambda = 0$ ) then we will have a complete model as that of the least square estimator. Again when  $\lambda \rightarrow \infty$  we will have an intercept model



only (i.e. none of the predictors remains in the model).

**The minimum BIC lasso**

The minimum BIC lasso has the same objective and penalty function as the standard lasso, with the only difference with the minimum BIC lasso and the standard lasso is the selection of variables which is based on the model with the least minimum BIC. It has the same objective and penalty function as the standard lasso.

In all, Lasso is an extension of OLS by adding a penalty  $\lambda \sum_{j=1}^p (|\alpha_j|)$  to RSS and equate to the total of absolute non-intercept values alpha coefficient multiplied by the lambda ( $\lambda$ ) parameter that adjusts the penalty to be more lenient or stricter.

**Square root lasso model specification**

(Zou, 2006) introduced the squareroot lasso technique to improve upon the uniformity of the regularization method in the standard lasso. An Oracle property ( $z_j$ ) is added to the lasso penalty  $\lambda \sum_{j=1}^p (|\alpha_j|)$ . Compared to the standard and minimum BIC Lasso, the oracle feature improves the ability to shrink or select a subset, even when the number of data attributes increases at a faster rate than the number of observations. The squareroot lasso technique can be used as a substitute in this study for the standard and the minimum BIC lasso model to achieve the main objective of the study. The objective function in equation (3) is estimated to get the squareroot lasso estimator in equation

(4)  $\hat{\alpha}_{squarerot\ lasso}$

$$A_L = \frac{1}{N} \sum_{i=1}^N \epsilon_i f(y_{it}, \alpha_0 + X_{it} \alpha') + \lambda \sum_{j=1}^p (z_j |\alpha_j|) \dots \dots \dots (3)$$

$$\hat{\alpha}_{\text{sqrt lasso}} = \min \left\{ \text{SSE} + \lambda \sum_{j=1}^p (z_j |\alpha_j|) \right\} \dots \dots \dots (4)$$

Where  $y_{it}$  is the dependent variable total export performance of a country  $i$  in a particular year  $t$  while  $X_{it}$  is a vector that comprises all 87 potential determinants of export performance for all countries,  $\alpha'$  is related to the parameter lambda  $\lambda$

**Elasticnet Model Specification**

The Elasticnet method combines the Lasso and Ridge regression to choose variables effectively by overcoming its limitation (Zou & Hastie, 2005). One limitation of the lasso is that, If there are set of variables that are closely related, the lasso regression has a tendency to choose one variable from that set and disregard the others. Another limitation is associated with the penalty function  $\lambda \sum_{j=1}^p (|\alpha_j|)$ . If  $p$  is large while  $n$  is small, (high-dimensional data with limited examples), then the lasso will choose a maximum of  $n$  variables before it reaches its limit. To overcome these limitations the elastic net adds the quadratic  $\|\alpha\|^2$  to the penalty function of the lasso. According to (Zou & Hastie, 2005) If the covariates are strongly interrelated, it is possible to obtain sparse and reliable regularization that outperforms the lasso regression algorithms. Another advantage is variable selection is flexible with the elastic net. The objective function of the elastic net therefore becomes

$$A_{en} = \frac{1}{N} \sum_{i=1}^N \text{Eif}(y_{it}, \alpha_0 + X_{it}\alpha') + \lambda \sum_{j=1}^p k_j \left\{ \frac{1-\varphi}{2} \alpha_j^2 + |\alpha_j| \right\} \dots \dots \dots (5)$$

From equation (5),  $\varphi$  is the elastic net parameter that has been added to the lasso penalty, it takes values between [0 1] inclusive. When  $\lambda > 0$  and

$0 < \varphi < 1$  then there will be sparse results. Again when the  $\varphi = 1$  then the elasticnet becomes standard lasso while if  $\varphi = 0$  it becomes ridge regression.

### **Choosing the Right Tuning Parameter**

The biggest challenge in regularization is getting the right tuning parameter lambda ( $\lambda$ ). The higher the lambda, the higher the severity of the penalty and a severe penalty causes all predictors with weak effect on the outcome variables to be excluded from the model, while a small lambda causes the penalty term to be weak and predictors with weak effect to be included in the model. (i.e.  $\lambda = 0$  the model becomes OLS because all variables will be included, and the penalty goes away. As  $\lambda \rightarrow \infty$  the model goes away as all predictors shrink to zero). Choosing a good lambda ( $\lambda$ ) is necessary for the regularization model to perform well and give a good estimate (Wang et al., 2006). The cross-validation CV information criteria, Bayesian criterion BIC, and finally the Akaike information criterion AIC are depended on to make the right selection of lambda  $\lambda$  for the model (Tibshirani & Taylor, 2012). Because of the advantages the CV and BIC have over AIC, this study explores the CV and the BIC (Zou et al., 2007) because they estimate at a faster rate, and with a small sample size, it is volatile.

### **The Inferential Models Specifications**

#### **Lasso model inferential specification**

One of the limitations of the previously mentioned techniques for selecting variables is that they do not offer crucial estimates and confidence intervals required for inference. To overcome this limitation, the study utilize the lasso inferential technique to provide robust estimates on the selected determinants of export performance in Africa by running the Double Selection

Lasso Linear Model, the Partialing-Out Lasso Regression Model, and finally the Partialing-Out Lasso Instrumental Variable Regression. By using the selected covariates from the main objective

**Double Selection Lasso Linear Model**

By following (Ofori et al., 2021), the specification of the DSL model

becomes

$$E[Y|d, x] = \theta\varphi' + \phi\alpha' \dots\dots\dots (6)$$

Where  $Y$  is the total export performance, which is modeled to depend on  $\theta$  which contains  $J$  covariate of determinants of export performance that is the selected variables from the elastic net and the lasso, and  $\phi$  which also contains  $p$  control variables (weak coefficient). The DSL's main focus is to produce an estimate on  $J$  while relaxing an estimate on  $p$

**Partialing-Out Lasso Regression Model**

The partialing-out lasso linear regression (POLR) as used in the DSL has the additional benefit of improving the accuracy of inference as the model becomes more intricate.

$$E[Y|d, x] = \rho\varphi' + \sigma\alpha' \dots\dots\dots (7)$$

Where  $Y$  is the export performance, which is modeled to depend on  $\rho$  which contains  $J$  covariate of determinants of export performance that is the selected variables from the elastic net and the lasso, and  $\sigma$  which also contains  $p$  control variables (weak coefficient). The POLR provides inferential statistics only on  $J$  while relaxing estimates on  $p$

**Partialing-Out Lasso Instrumental Variable Regression:**

For inferences about selected variables of the regularization model to be valid, POLIVR take care of all the endogeneity problems that may arise as

the parameters increase (Chernozhukov et al., 2015). The (POLIVR) is specified as

$$y = \psi\varphi'_d + \theta\varphi'_f + X\alpha' + e \dots\dots\dots (8)$$

From equation (8),  $y$  is the total export performance,  $\psi$  contains  $J_d$  which is endogenous variables of interest while  $J_f$  contains exogenous variables of interest.  $X$  contains  $P_x$  control variables

**Data Engineering Partitioning**

Strongly balanced dataset is a key requirement for Regularization process to perform better, with this, the K-nearest neighbor (KNN) data engineering technique is applied. In theory, the KNN chooses the close neighbors using a distance metric, then calculates the mean or mode of the missing observation. The mean rule which deals with missing observations in numerical variables by using the Minkowski distance is used in this study.

$$d(i, j) = (|X_{i1} - X_{j1}|^q + |X_{i2} - X_{j2}|^q + \dots + |X_{ip} - X_{jp}|^q)^{\frac{1}{q}} \dots\dots\dots (9)$$

Where  $q$  is the Minkowski coefficient, while the Minkowski distance is captured by  $d(i, j)$  with the variables represented by  $x$ . By partitioning the dataset into 70% training and 30% testing, the study follows the approach of (Ofori et al., 2022).



## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### Introduction

This chapter uses a variety of machine learning regularization approaches to provide a detailed analysis of the study on export promotion in Africa. The training and testing datasets' summary statistics are provided in this chapter. Additionally, it displays the outcomes of the square root, elasticnet, minimum BIC, and standard lasso methods, as well as the key covariates that each algorithm chose. It also presents the best algorithm and the covariates it selected. The outcome of the systematic review is also presented and finally, the chapter presents the inferential and their interpretations for the selected covariates, using the remaining covariates as control variables.

#### Exploratory Data Analysis

For simplicity, the results of the data partitioning are the extent of the exploratory data analysis, the distribution of export promotion, and the summary statistics. From the summary statistics in Table 1, it can be seen that, on average, export performance (i.e., export growth) in Africa over the period was valued at 6.96% for the training dataset as compared to 7.75% for the testing dataset. Again, on average, the interest rate was valued at 5.52% in the training set as compared to 6.75% in the testing set. Also, the average tariffs represent 14.87% in the training set as compared to 17.06% in the testing set. Additionally, the average domestic investment across the continent was valued at 21.54% in the training set compared to 20.70% in the testing set.

**Table 1: Summary statistics for training and testing datasets**

Variable	Obs	Mean Training	Std.dev training	Min training	Max training	Mean testing	Std.dev testing	Min testing	Max testing
Exportangrowth	1118(478)	-6.961	12.689	-36.448	9.424	-7.747	13.285	-36.448	9.424
Gdp (in billion)	1119(479)	28.79	6.459	0.147	520	27.220	70.450	0.147	574
Tradeopen	1119(479)	66.324	35.202	-36.936	217.787	67.389	36.904	-55.672	225.023
Merchandise	1119(479)	51.056	30.255	-51.49	187.595	52.905	31.973	-63.759	183.026
Interstrate	1119(478)	5.523	24.675	-178.862	153.522	6.754	30.206	-169.058	163.328
Tariffmanu	1119(479)	14.647	27.923	-165.97	265.29	16.866	37.543	-174.3	297.31
Tariff	1119(479)	14.871	27.908	-172.25	258.87	17.063	37.478	-180.89	290.05
Exchanger (in billion)	1119(479)	0.032	0.386	0	6.720	0.016	0.275	0	5.600
Assistance (in billion)	1119(479)	0.640	0.800	-0.023	8.240	0.621	0.887	-0.014	11.400
Taxtrade (in billion)	1119(479)	-27.260	773.500	-7.990	1.890	36.440	445.800	-7.210	1.320
Invtranspo (in billion)	1119(479)	1.220	4.097	-3.680	51.200	1.114	4.121	-3.340	53.200
Fdi (in billion)	1119(479)	0.551	1.271	-1.430	11.600	0.568	2.202	-1.980	41.300
Saving	1119(479)	14.631	18.32	-60.117	97.163	16.003	21.06	-58.08	95.125
Domesticinvestment	1119(479)	21.544	11.904	-83.126	89.381	20.698	15.505	-79.36	92.828
fixedcapitalformat~n	1119(479)	20.195	16.404	-122.591	93.547	19.748	17.252	-112.611	92.831
Inflation	1119(478)	9.138	34.966	-456.643	557.202	4.16	48.683	-494.733	183.312
Laboradvancedu	1119(479)	75.3	65.42	-231.3	580.28	79.388	74.46	-254.92	595.87
Laborbasicedu	1119(479)	65.345	117.054	-517.01	1117.37	69.767	135.467	-501.88	1149.82
Laborintermediateedu	1119(479)	42.158	104.715	-618.74	393.52	46.003	95.509	-570.9	417.98
Laborforce	1119(479)	7456927.1	9503097.1	71819	68600000	6968725.8	10003689	74420	70600000
Industrialization	1119(479)	11.213	11.849	-165.047	49.879	10.606	14.455	-154.545	47.801

**Table1 Cont'd: Summary statistics for training and testing datasets**

Variable	Obs	Mean Training	Std.dev training	Min training	Max training	Mean testing	Std.dev testing	Min testing	Max testing
Research	1119(479)	0.192	0.62	-2.945	2.819	0.109	0.666	-3.067	2.487
Ict (in billion)	1119(479)	0.196	1.229	-10.600	9.650	0.141	1.040	-9.590	6.570
Eduexp	1119(479)	12.682	28.754	-288.464	130.278	9.003	36.686	-309.679	86.252
Imports	1119(479)	36.965	20.616	-34.754	117.154	37.563	22.486	-51.211	117.029
Depositinterestrate	1119(479)	9.112	11.555	-32.098	203.375	9.264	10.461	-43.012	103.208
Agricemployment	1119(479)	51.046	22.677	4.6	92.37	50.773	21.072	4.83	92.35
Industryemployment	1119(479)	14.668	8.384	2.2	43.7	14.74	8.009	2.22	43.39
Serviceemployment	1119(479)	34.286	15.704	4.9	72.41	34.489	14.85	5.1	73.81
Easebusiness	1119(479)	38.186	28.976	-99.777	95.412	35.645	31.379	-109.339	82.6
Agricland	1119(479)	47.652	20.54	2.446	100.725	46.064	20.749	2.559	82.555
Agricmachinery	1119(479)	18519.89	27899.313	-346	175557	16048.132	21912.09	-402	115000
Unemployment	1119(479)	8.76	7.039	-20.98	31.84	8.942	7.214	-17.2	29.77
Netmigration	1119(479)	-13328.669	86434.912	-903529	859739	-12994.477	139653.69	-2162873	1372202
Healthexp	1119(478)	4.989	7.496	-27.702	77.511	5.658	9.503	-22.705	82.299
Taxexport	1119(479)	-.613	14.583	-173.733	29.281	.462	8.353	-102.641	38.388
Electriccon	1119(479)	646.949	722.734	-425.932	4766.652	588.813	653.503	-125.427	4574.026
Agricrawmaterial	1119(478)	1.453	2.204	-22.772	18.483	1.164	2.665	-26.781	9.288
Dcreditfinancial	1119(479)	33.101	44.803	-317.755	295.805	32.557	31.165	-251.298	220.656
Dcreditprivate	1119(478)	20.43	24.641	-98.227	142.422	18.842	22.758	-51.289	127.203
Domesticsaving	1119(479)	18.292	19.741	-91.307	149.079	18.059	20.344	-102.94	89.702
Merchand (in billion)	1119(478)	5.527	13.130	0.500	116	5.251	14.120	0.600	124

**Table1 Cont'd: Summary statistics for training and testing datasets**

Variable	Obs	Mean Training	Std.dev training	Min training	Max training	Mean testing	Std.dev testing	Min testing	Max testing
Netbartertrade	1119(479)	122.765	44.388	1.313	388.574	117.878	43.269	21.397	357.576
Netbilate (in billion)	1119(478)	0.432	0.506	-0.011	6.070	0.428	0.685	-0.017	11
personalremittances	1119(478)	4.563	18.705	-4.471	235.924	4.466	16.642	-5.804	228.446
Tourism (in billion)	1119(479)	0.585	1.912	-6.480	14.300	0.502	1.419	-3.630	12.100
interestpayment	1119(479)	8.056	31.047	-179.016	217.262	6.764	27.132	-162.156	208.779
Wagesalaries	1119(479)	33.614	23.241	3.888	85.871	32.966	21.978	3.168	85.412
aaxincomeprofit	1119(479)	31.086	31.075	-250.549	211.393	28.084	37.024	-270.83	219.369
Fuelprice	1119(479)	.605	.617	-5.14	4.34	.563	.764	-5.66	4.05
Gasolineprice	1119(479)	.747	.575	-5.03	3.11	.728	.736	-5.54	3.65
Pop (in million)	1119(478)	19.710	26.3084	63.261	208	18.672	29.029	0.064	213
nonfinancialinvest	1119(479)	7.472	19.63	-76.655	157.073	5.45	18.59	-81.736	146.507
Foreigner (in billion)	1119(478)	556.200	1.960	-2.730	16	574.900	1.841	-581	14.800
Multilate (in billion)	1119(479)	0.143	0.336	-2.340	4.300	0.149	0.293	-0.258	3.720
Domestic (in billion)	1119(478)	1020	3270	-1400	41400	1157	4119	-853	48.500
financialacquisition	1119(479)	-5.879	22.906	-138.159	126.06	-6.332	21.095	-134.234	94.223
monetarysector	1119(478)	19.499	17.768	-98.227	104.894	18.9	15.684	-23.369	93.505
interestexpenses	1119(479)	8.048	31.041	-179.016	217.262	6.764	27.132	-162.156	208.779
humancapital	1119(479)	.361	.149	-.329	.908	.352	.17	-.377	.826
finalconsumption	1119(479)	85.369	18.32	2.837	160.117	83.997	21.06	4.875	158.08
firmbanks	1119(479)	16.149	30.895	-120.7	181.62	14.047	30.411	-125.6	170.78
energyuse	1119(479)	595.893	561.253	-4050.335	3149.08	589.255	541.957	-2204.288	3334.161



**Table 1 Cont'd: Summary statistics for training and testing datasets**

Variable	Obs	Mean Training	Std.dev training	Min training	Max training	Mean testing	Std.dev testing	Min testing	Max testing
intellectua (in billion)	1119(479)	0.041	0.189	-0.018	2.120	0.035	0.1576	-0.005	2.020
servicetrade	1118(478)	17.006	.961	14.087	19.308	17.056	.958	14.087	19.308
stocktrade	1118(478)	4.116	5.136	-6.721	12.32	3.693	5.312	-6.721	12.32
Nettrade (in billion)	1118(478)	-0.940	1.448	-4.404	0.708	-0.819	1.348	-4.404	0.708
Pppinvest (in billion)	1118(478)	1.093	0.864	0.117	2.890	1.175	0.877	0.117	2.890
gni growth	1118(478)	4.894	33.887	-198.183	340.165	7.246	43.809	-236.215	362.824
debt servicing	1118(478)	16.126	13.907	-45.445	134.803	15.284	15.525	-98.718	129.694
reserves	1118(478)	76.357	289.142	-18.37	3840.101	67.698	250.875	0	3636.657
youth	1118(478)	22.775	26.014	-53.64	186.415	21.555	24.544	-47.785	151.285
unfpa	1118(478)	1622579.9	1690998.1	-6559999.9	9270000.5	1605737	1506257.4	-999999.97	8045615.2
unicef	1118(478)	5838953.4	8130049.8	-19410000	57924221	5663867.5	8688918.7	-5670000	56022209
undp	1118(478)	4680214.9	4557803.5	-11670000	36919998	4615116.9	3965845.7	-150000.01	21940001
logistics	1118(478)	1.991	1.469	-4.96	8.48	1.992	1.533	-5.48	7.28
gfinal (in billion)	1118(478)	3.827	9.394	-13.190	83.370	3.174	8.941	-12.690	82.320
productscore	1118(478)	39.757	32.809	-113.519	88.362	36.875	33.119	-120.487	78.912
infrascore	1118(478)	6.109	117.341	-690	390	3.18	130.324	-650	330
gov effec	1118(478)	-.487	.862	-3.112	4.187	-.569	.764	-2.631	2.463
livestock pro	1118(478)	76.371	30.256	13.52	198.83	73.955	30.243	13.97	214.89
credit info	1118(478)	-.902	21.095	-192	41	-1.071	20.881	-198	25
electric distri los	1118(478)	18.525	18.305	-169.658	112.942	19.453	18.18	-143.846	117.259
industry	1118(478)	-1.364	40.787	-283.779	232.671	-.294	35.297	-250.097	224.782



**Table 1 Cont'd: Summary statistics for training and testing datasets**

Variable	Obs	Mean Training	Std.dev training	Min training	Max training	Mean testing	Std.dev testing	Min testing	Max testing
finflowm (in billion)	1118(478)	0.1430	0.337	-2.343	4.304	0.149	0.293	-0.258	3.722
fin assets acq	1118(478)	-5.955	22.74	-138.159	126.06	-6.384	20.898	-134.234	94.223
nonfin assets invs	1118(478)	7.989	19.186	-76.655	157.073	5.857	18.42	-81.736	146.507
insurance ser	1118(478)	8.075	34.452	-12.523	429.325	7.734	29.854	-10.14	396.46
tradeservices	1118(478)	17.006	.961	14.087	19.308	17.056	.958	14.087	19.308
Tradeadj (in billion)	1118(478)	-96.820	158.700	-344.200	324.700	-89.720	166.200	-344.200	324.700
stockstraded	1118(478)	4.116	5.136	-6.721	12.32	3.693	5.312	-6.721	12.32
est Standard lasso	1119(479)	.999	.03	0	1	0	0	0	0
est MinBIC lasso	1119(479)	.999	.03	0	1	0	0	0	0
est Sqrt lasso	1119(479)	.999	.03	0	1	0	0	0	0
est elasticnet	1119(479)	.999	.03	0	1	0	0	0	0
sample	1119(479)	1	0	1	1	2	0	2	2

Source: Author (2023)

From Table 1, it can also be seen that personal remittances on average represent 4.56% in the training dataset and 4.47% in the testing dataset. Again, wages and salaries have an average value of 33.61% in the training set as compared to 32.97% in the testing set. Also, on average, stock traded value was 4.12% in the training set as compared to 3.69% in the testing set.

Furthermore, trade in service had an average value of 17% in the training set as compared to 17.06% in the testing set. Additionally, logistics averagely represent 1.99% in the training dataset as compared to 1.992% in the testing dataset. Human capital has an average value of 0.36% in the training set as compared to 0.35% in the testing set. Again, the average gasoline price value was 0.75% in the training dataset as compared to 0.73% in the testing dataset. See Table 1 for the full summary statistics for both the training and testing datasets.

Table 2 presents the variables, the description of the variables, and the source of the variables used in the study.

**Table 2: Variable definition and data source**

Variable	Description	Source
exportangrowth	Exports of goods and services (annual % growth)	WDI
gdp	GDP (current US\$)	WDI
tradeopen	Trade (% of GDP)	WDI
merchandise	Merchandise trade (% of GDP)	WDI
interestrate	Real interest rate (%)	UNCTAD
tariffmanu	Tariff rate, applied, simple mean, manufactured products (%)	WDI
tariff	Tariff rate, applied, simple mean, all products (%)	WDI
exchangerate	Official exchange rate (LCU per US\$, period average)	UNCTAD
assistancereceived	Net official development assistance and official aid received (current US\$)	WDI
taxotrade	Taxes on international trade (current LCU)	WDI
investmenttransport	Investment in transport with private participation (current US\$)	WDI
fdi	Foreign direct investment, net inflows (BoP, current US\$)	WDI
Saving	Gross domestic savings (% of GDP)	UNCTAD
domesticinvestment	Gross capital formation (% of GDP)	WDI
inflation	Inflation, consumer prices (annual %)	UNCTAD
laboradvancededu	Labor force with advanced education (% of total working-age population with advanced education)	WDI
laborbasicededu	Labor force with basic education (% of total working-age population with basic education)	WDI
laborintermediateedu	Labor force with intermediate education (% of total working-age population with intermediate education)	WDI
laborforce	Labor force, total	WDI
industrialisation	Manufacturing, value added (% of GDP)	WDI
research	Research and development expenditure (% of GDP)	WDI
ict	Investment in ICT with private participation (current US\$)	WDI
eduexp	Government expenditure on education, total (% of government expenditure)	WDI
imports	Imports of goods and services (% of GDP)	WDI
depositinterestrate	Deposit interest rate (%)	UNCTAD
agricemployment	Employment in agriculture (% of total employment) (modeled ILO estimate)	WDI
industryemployment	Employment in industry (% of total employment) (modeled ILO estimate)	WDI
serviceemployment	Employment in services (% of total employment) (modeled ILO estimate)	WDI
easebusiness	Ease of doing business score (0 = lowest performance to 100 = best performance)	WDI
agricland	Agricultural land (% of land area)	WDI
agricmachinery	Agricultural machinery, tractors	WDI

unemployment	Unemployment, total (% of total labor force) (modeled ILO estimate)	WDI
netmigration	Net migration	WDI
healthexp	Current health expenditure (% of GDP)	WDI
taxexport	Taxes on exports (% of tax revenue)	WDI
electriccon	Electric power consumption (kWh per capita)	WDI
agricrawmaterial	Agricultural raw materials imports (% of merchandise imports)	WDI
dcreditfinancial	Domestic credit provided by financial sector (% of GDP)	WDI
dcreditprivate	Domestic credit to private sector (% of GDP)	WDI
netbartertrade	Net barter terms of trade index (2000 = 100)	WDI
netbilateralaid	Net bilateral aid flows from DAC donors, Total (current US\$)	WDI
personalremittances	Personal remittances, received (% of GDP)	WDI
tourism	International tourism, receipts (current US\$)	WDI
interestpayment	Interest payments (% of expense)	WDI
wagesalaries	Wage and salaried workers, total (% of total employment) (modeled ILO estimate)	WDI
aaxincomeprofit	Taxes on income, profits and capital gains (% of total taxes)	WDI
fuelprice	Pump price for diesel fuel (US\$ per liter)	WDI
gasolineprice	Pump price for gasoline (US\$ per liter)	WDI
population	Total population	UNCTAD
nonfinancialinvest	Net investment in nonfinancial assets (% of GDP)	WDI
foreignerasset	Net foreign assets (current LCU)	WDI
multilateraflow	Net financial flows, multilateral (NFL, current US\$)	WDI
domesticcredit	Net domestic credit (current LCU)	WDI
financialacquisition	Net acquisition of financial assets (% of GDP)	WDI
monetarysector	Monetary Sector credit to private sector (% GDP)	WDI
humancapital	Human capital index (HCI) (scale 0-1)	WDI
finalconsumption	Final consumption expenditure (% of GDP)	WDI
firmbanks	Firms using banks to finance working capital (% of firms)	WDI
energyuse	Energy use (kg of oil equivalent per capita)	WDI
intellectualproper~e	Charges for the use of intellectual property, payments (BoP, current US\$)	WDI
servicetrade	Trade in services (% of GDP)	UNCTAD
stocktrade	Stocks traded, total value (% of GDP)	UNCTAD
nettrade	Net trade in goods (BoP, current US\$)	UNCTAD
pppinvest	Public private partnerships investment in transport (current US\$)	WDI
gni growth	GNI growth (annual %)	WDI
debt servicing	Total debt service (% of exports of goods, services and primary income)	WDI
reserves	Total reserves (% of total external debt)	WDI
youth	Unemployment, youth total (% of total labor force ages 15-24) (national estimate)	WDI



unfpa	Net official flows from UN agencies, UNFPA (current US\$)	WDI
unicef	Net official flows from UN agencies, UNICEF (current US\$)	WDI
undp	Net official flows from UN agencies, UNDP (current US\$)	WDI
logistics	Logistics performance index: Overall (1=low to 5=high)	WDI
productscore	Statistical performance indicators (SPI): Pillar 3 data products score (scale 0-100)	WDI
infrascore	Statistical performance indicators (SPI): Pillar 5 data infrastructure score (scale 0-100)	WDI
gov effec	Government Effectiveness: Estimate	WDI
livestock pro	Livestock production index (2014-2016 = 100)	WDI
credit info	Depth of credit information index (0=low to 8=high)	WDI
electric distri los	Electric power transmission and distribution losses (% of output)	WDI
industry	Industry (including construction), value added (annual % growth)	WDI
fin flow multi	Net financial flows, multilateral (NFL, current US\$)	WDI
fin assets acq	Net acquisition of financial assets (% of GDP)	WDI
nonfin assets invs	Net investment in nonfinancial assets (% of GDP)	WDI
insurance ser	Insurance and financial services (% of commercial service exports)	WDI
tradeadjust	Terms of trade adjustment (constant LCU)	UNCTAD

### Regularization Results on the drivers of export performance in Africa

This section presents the findings for Objective 2 of the studies. From Figures 1, 2, 3, and 4, it is clear that the Elasticnet and lasso algorithms chose different number tuning parameters as drivers of export performance in Africa, even though they used the same number of covariates. It's important to note that, from Fig. 1 and under ten-fold cross-validations, standard lasso with ( $\lambda=0.16$ ) selected 13 covariates as the main predictors of export performance in Africa (pppinvest, nettrade, servicetrade, stocktrade, domesticcredit, inflation, agricrawmaterial, gasolineprice, industry, multilateraflow, netbartertrade, assistancereceived, industrialisation). While the squareroot lasso selected 14





gasolineprice, industry, multilateraflow, netbartertrade, assistancereceived, industrialisation).

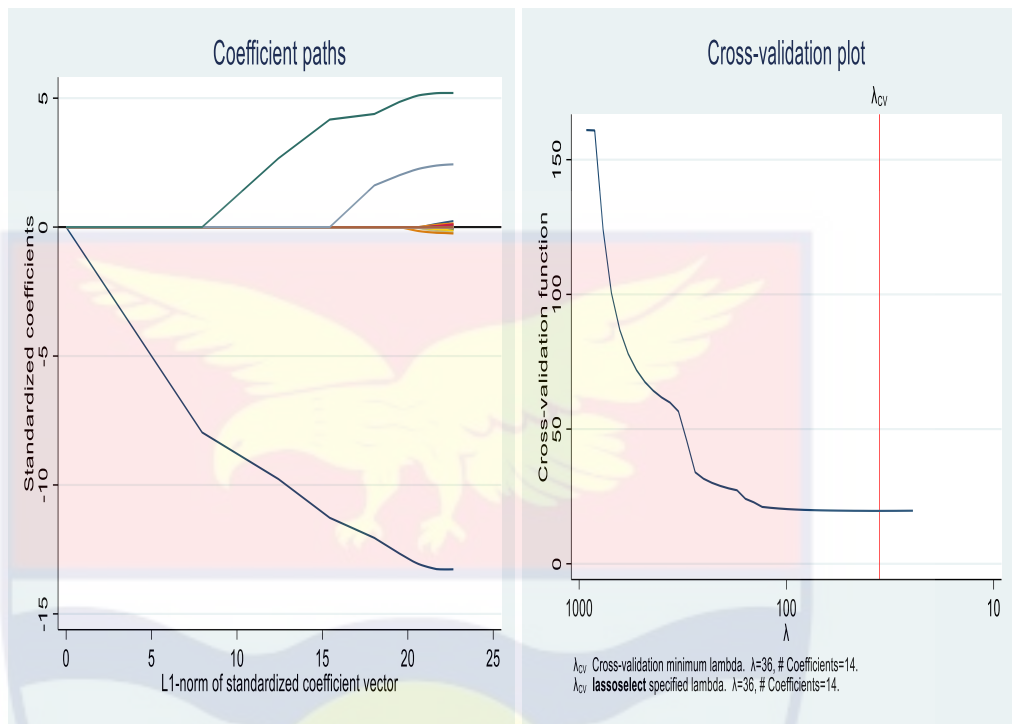


Figure 2: coefficient path plot (left) while cross-validation plot (right).

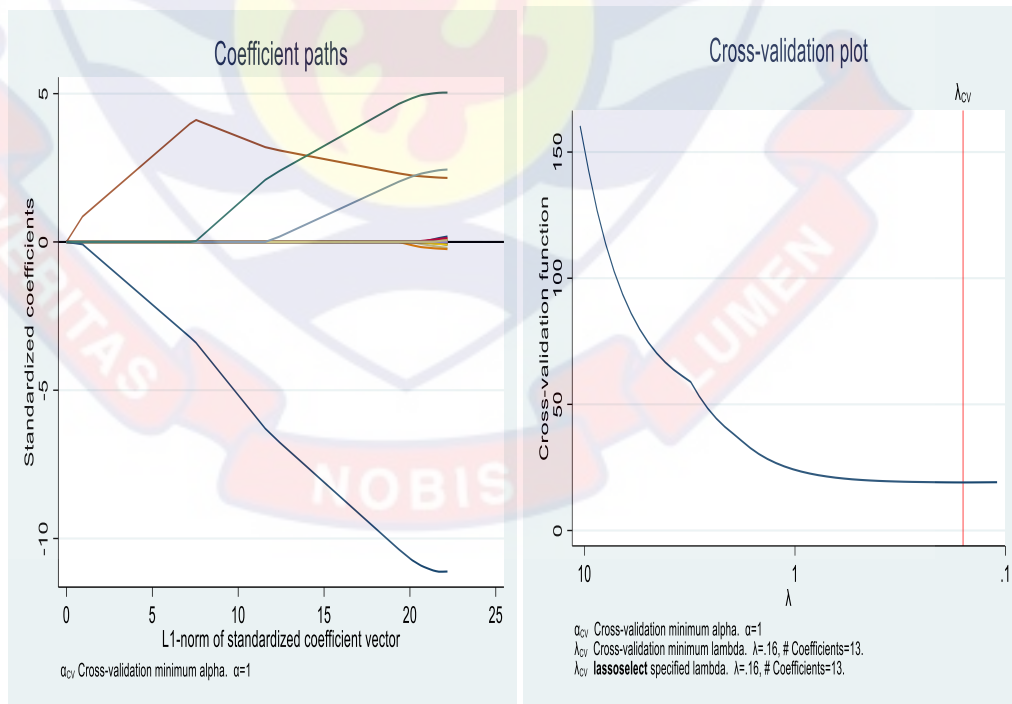


Figure 3: coefficient path plot (left) while cross-validation plot (right)

The minimum BIC lasso has the best regularization model. It chose only seven (7) of the 87 covariates as the most important predictors of export performance in Africa. It also has the lowest mean square error of all the regularization techniques. These covariates are pppinvest (public-private partnership investment), Nettrade, stocktrade, servicetrade, gasoline price, domestic credit, and inflation. How covariates enter and leave the various regularization models is presented in the Table 3.

**Table 3: How variables enter and leave the model**

	Standard lasso	MinBIC	Square lasso	Elasticnet
pppinvest	x	x	x	x
nettrade	x	x	x	x
servicetrade	x	x	x	x
stocktrade	x	x		x
domesticcredit	x	x	x	x
inflation	x	x	x	x
agricrawmaterial	x		x	x
gasolineprice	x	x	x	x
industry	x		x	x
multilateraflow	x		x	x
netbartertrade	x		x	x
assistancereceived	x		x	x
industrialisation	x		x	x
fixedcapitalformation			x	
youth_			x	
_cons	x	x	x	x

Source: Author (2023)

### **Inferential Results for the Main Drivers of Export Performance**

In this section, the third objective of the study is met by using the DSL, POLR, and POIVLR estimation methods for the key predictors of export performance in Africa that were chosen by the minimum BIC lasso algorithm. With robustness to misspecification, endogeneity, and heteroskedasticity, the study relies on the DSL. In order to accurately inform policy, the study

produced six separate results. First is the full summary for African countries, followed by east, west, central, south, and north African countries, respectively. The groupings of the countries are done according to the United Nations Conference on Trade Development's (UNCTAD) geographical classification. With a total observation of 1,596 across all subgroups, the variables of interest for the full summary statistics were 7, while the variables of interest for the subgroups east, west, central, south, and north are 21, 18, 10, 12, and 11 covariates, respectively. While the control variables for the estimations are 79 across all groups, the instrument for the estimation is seen to be 7.

From Table 4, Service trade, which encompasses a wide range of services, including financial services, tourism, education, healthcare, information technology, consulting, and many more, is empirically proven to be a key driver of export performance in Africa at a significant level of 1%. The estimation from the results shows that a 1% increase in service trade boosts export performance by 2.65%. The results again suggest that a 1% increase in service trade for East African countries boosts export performance by 2.5%, while a 1% increase in service trade for West African countries increases export performance by 2.6%. Countries in Central, South, and North Africa experience a 2.65%, 2.63%, and 2.6% increase in export performance from a 1% increase in service trade, respectively.

**Table 4: Inferential statistics**

VARIABLES	all countries			North Africa			South Africa		
	model 1 DSL	model 2 POLR	model 3 POIVLR	model 4 DSL	model 5 POLR	model 6 POIVLR	model 7 DSL	model 8 POLR	model 9 POIVLR
pppinvest	-0.000*** 0	-0.000*** 0	-0.000*** 0	-0.000*** 0	-0.000*** 0	-0.000*** 0	-0.000*** 0	-0.000*** 0	-0.000*** 0
nettrade	0.000*** 0	0.000*** 0	0.000*** 0	0.000*** 0	0.000*** 0	0.000*** 0	0.000*** 0	0.000*** 0	0.000*** 0
servicetrade	2.650*** -0.205	2.305*** -0.241	2.305*** -0.241	2.609*** -0.208	2.311*** -0.241	2.311*** -0.241	2.636*** -0.206	2.309*** -0.241	2.309*** -0.241
stocktrade	0.342*** -0.064	1.011*** -0.084	1.011*** -0.084	0.340*** -0.065	1.008*** -0.084	1.008*** -0.084	0.341*** -0.065	0.996*** -0.084	0.996*** -0.084
gasolineprice	1.421*** -0.503	0.926 -0.575	0.926 -0.575	1.651*** -0.545	1.091* -0.609	1.091* -0.609	1.361*** -0.519	0.785 -0.577	0.785 -0.577
domesticcredit	0 0	0 0	0 0	0 0	-0.000* 0	-0.000* 0	0 0	-0.000* 0	-0.000* 0
inflation	-0.005 -0.006	0.005 -0.007	0.005 -0.007	-0.005 -0.006	0.006 -0.007	0.006 -0.007	-0.003 -0.007	0.004 -0.007	0.004 -0.007
Observations	1,596	1,596	1,596	1,596	1,596	1,596	1,596	1,596	1,596
Vars of Interest	7	7	7	11	11	11	12	12	12
Controls	79	79	79	79	79	79	79	79	79
Wald	213.7	1971	1971	2109	2033	2033	2286	2084	2084
ChiP-value	0			0			0	0	0
Controls selected	56	56	56	71	71	71	70	70	70
Chi P-value		0	0		0	0			
Instruments			7						
Instruments Selected			0						



**Table 4 Cont'd: Inferential statistics**

VARIABLES	contral africa			west africa			east africa		
	model 10	model 11	model 12	model 13	model 14	model 15	model 16	model 17	model 18
pppinvest	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	0	0	0	0	0	0	0	0	0
nettrade	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	0	0	0	0	0	0	0	0	0
servicetrade	2.653***	2.304***	2.304***	2.608***	2.319***	2.319***	2.540***	2.329***	2.329***
	-0.204	-0.241	-0.241	-0.211	-0.24	-0.24	-0.208	-0.241	-0.241
stocktrade	0.342***	1.007***	1.007***	0.346***	0.999***	0.999***	0.349***	1.023***	1.023***
	-0.064	-0.084	-0.084	-0.066	-0.085	-0.085	-0.064	-0.084	-0.084
gasolineprice	1.515***	0.950*	0.950*	1.706***	0.707	0.707	1.887***	0.879	0.879
	-0.519	-0.577	-0.577	-0.587	-0.632	-0.632	-0.556	-0.611	-0.611
domesticcredit	0	-0.000*	-0.000*	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
inflation	-0.005	0.004	0.004	-0.005	0.005	0.005	-0.006	0.007	0.007
	-0.006	-0.007	-0.007	-0.006	-0.007	-0.007	-0.006	-0.007	-0.007
Observations	1,596	1,596	1,596	1,596	1,596	1,596	1,596	1,596	1,596
Vars of Interest	10	10	10	18	18	18	21	21	21
Controls	79	79	79	79	79	79	79	79	79
Wald	2418	2042	2042	2149	2149	2149	2203	2316	2316
ChiP-value	0	0	0	0	0	0	0	0	0
Controls selected	64	64	64	73	73	73	76	76	76
Chi P-value									
Instruments	7								
Instruments Selected									

Source: Author (2023)

This finding confirms a study by Goubar et al., (2021), who concluded that the export performance of small and medium-sized businesses is improved by the experimental knowledge offered by trade mobility initiatives such as education, training, and information to individuals exporting. According to an investigation by Wolfmayr, (2012), services have a considerable and favorable effect on the export market shares of manufactured goods. Again, the findings of the study are in line with a study by Lodefalk, (2014), who concluded empirically that increasing the number of services purchased is related to a higher export intensity. African governments should consider measures to promote service trade, foster a skilled workforce, and create an enabling environment for service providers to access global markets, ultimately driving export performance in this vital sector. This is more so considering the large population growth of Africa; we can concentrate on developing our human resource and take advantage from it as the competitive advantage theory suggest.

Additionally, at 1% significant level, the results show that gasoline price (fuel price) is a statistically significant covariate when it comes to export performance in Africa, which means fluctuations in gasoline price significantly influence Africa's export performance, and much attention must be given to this. From the statistics, it shows that a 1 percent change in gasoline prices affects export performance in Africa by 1.4%. Across the various geographical sub-groups, East African countries experience the highest effect of a change in gasoline price on export performance, followed by West African countries. A one percent change in gasoline prices affects east African economies by 1.88%, while a 1 percent change for west African

countries results in a 1.7% change in export performance. Again, a 1 percent change for North African countries in gasoline prices results in a 1.6% change in export performance. South African countries experience the least change in export performance, as a percentage change resulted in a 1.3% change in export performance. The study confirms the finding of Klier & Linn, (2010) who empirically concluded that the price of gasoline has a significant effect on vehicle sales in the international market. Again, a study by Hong, (2016) empirically concluded that Vietnamese coffee export prices are affected by gasoline prices. Gasoline is a fundamental input for transportation, and transportation costs are a significant component of export expenses. When gasoline prices rise, it becomes more expensive for exporters to transport goods domestically and to ports for international shipment. Higher transportation costs can reduce profit margins and make exports less competitive in global markets. The finding that gasoline prices significantly influence export performance highlights the interconnectedness of energy prices with export competitiveness. To mitigate the negative effects of gasoline price fluctuations on exports, African governments and businesses should consider strategies that enhance energy efficiency, reduce dependency on fossil fuels, and provide stability in energy pricing. Considering the market power theory, which delves into the dynamics of pricing within the economy, gasoline price has the effect of significantly affecting export performance in Africa.

Public-private partnership investment (PPP) has emerged as a statistically significant at one percent and a key driver of export performance, according to the results in Table 4. This finding suggests that the level of PPP

investment in African countries plays a crucial role in promoting and driving its export activities. PPP investments often focus on critical infrastructure projects such as ports, airports, roads, and energy facilities. These investments can improve African countries' logistical and transportation capabilities, making it more efficient and cost-effective for businesses to engage in international trade. When infrastructure and services are well developed through PPP efforts, foreign and local private investors are more likely to launch or grow export-oriented firms. In line with African Union Agenda 2063, African governments should actively promote and facilitate PPP investment and establish clear and supportive regulatory frameworks to attract private sector investment. A stable and predictable regulatory environment is crucial for encouraging private sector participation, especially in sectors that have a direct or indirect impact on export performance, such as infrastructure, logistics, and technology. With abundance of natural resource in Africa; a positive relationship can be achieved between PPP investment and export performance in Africa through resource-based view theory.

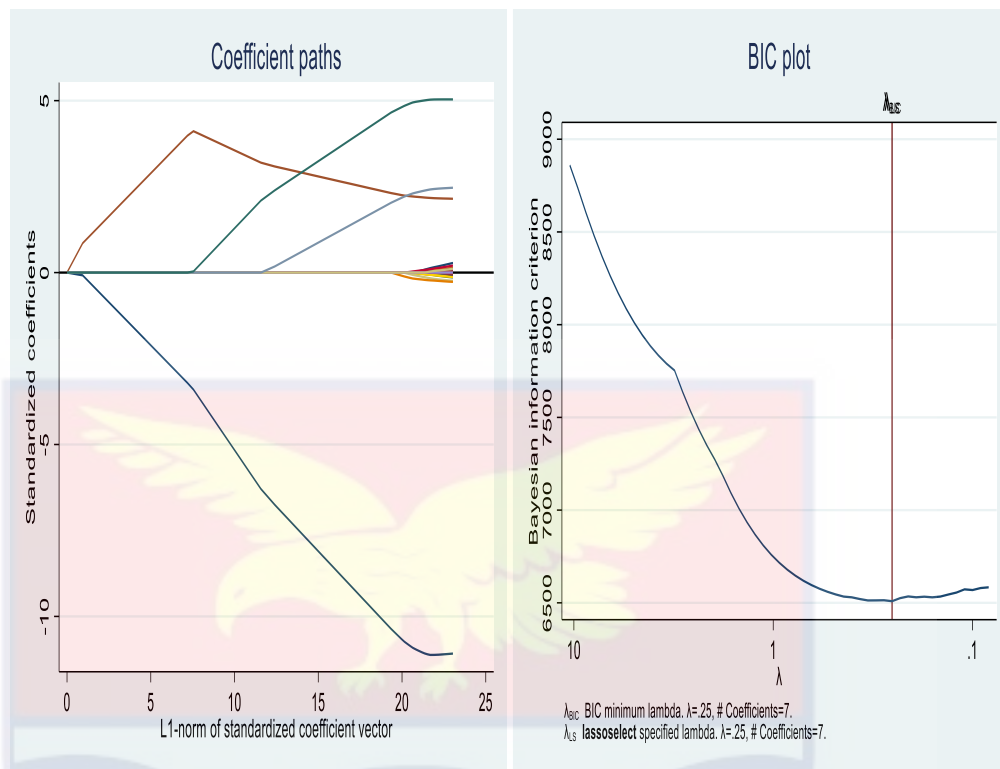


Figure 4: coefficient path plot (left) while cross-validation plot (right)

Again, from the results in objective two, inflation and domestic credit are key drivers of export performance, but they are statistically not significant at 5% in objective three. African countries Policymakers should still consider a holistic approach that will bring inflation down and encourage domestic credit, since inflation and domestic credit are key drivers according to the lasso regression in objective two.

The findings indicate that stock trading, which is a component the financial market, is statistically significant. East African countries experience the highest change in export performance when there is a change in stock traded, while North African countries experience the lowest change in export performance. It is observed that a one percent increase in the stock market leads to a 0.34% increase in export performance among African nations. By facilitating access to the required financial resources, encouraging innovation



and the development of infrastructure, reducing risks, and establishing an atmosphere that is favorable for investment and economic confidence, the stock market essentially helps to increase export performance. Together, these elements give companies the ability to grow their export operations, access foreign markets, and ultimately propel export performance within their nation.

When governments in African economies give these variables significant consideration, this can aid in export performance.

Finally, the findings for all African nations show that net trade is a statistically significant driver of export performance. The term "net trade" usually refers to the difference between an economy's imports and exports over a given time frame. Net trade and export performance have a positive and statistically significant association, which shows that countries with trade surpluses typically see stronger export performance. This is in line with the theory that a trade surplus can boost export performance since it indicates a competitive advantage in global markets. When African countries consistently export more than they import, they accumulate foreign currency reserves, which can be reinvested to further promote export-oriented industries. Therefore, African governments should focus their attention on export performance techniques such as trade agreements among African nations, trade facilitation measures, and export-oriented laws that increase a nation's ability to compete internationally and finally reduce the import of goods and services that can be produced locally.

## CHAPTER FIVE

### SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

#### Introduction

This chapter provides a summary of the research findings on drivers of export performance in Africa: evidence from machine learning. Along with important findings from the research, it also offers significant suggestions based on data analysis that can help guide policy in the direction of export performance in Africa. This chapter also includes recommendations for additional research.

#### Summary

Exports have been a major factor and the driving force for macroeconomic stability, poverty alleviation, and sustainable development for nations across the world. The dynamic relationship between export performance and a nation's economic health has been widely acknowledged, with success stories from various corners of the world attesting to the transformative power of robust export, but Africa has benefited a little from it. While exports have indeed made positive contributions to the continent's economic growth, the scope of these advantages has been rather constrained. This poses significant queries regarding the variables affecting Africa's export performance and the possible barriers preventing its full involvement in the international trade sphere. The first objective of the study was to conduct a systematic review of various drivers of African export performance with a combination of both meta-analyses, the vote-counting method, and narrative analysis. The review focuses on empirical literature from 1980–2021, requiring articles to be empirical, focused on export performance measures,

analyze data at country and firm levels, and be published in English. Based on available data and pertinent research on export performance, 87 variables were chosen.

The second objective of the study was to identify the drivers of export performance in Africa. Unlike previous studies that focused on a few variables and traditional econometric techniques, this study used 87 potential drivers of export performance according to the literature on exports and employed machine learning techniques, basically standard lasso, minimum BIC lasso, squareroot lasso, and elasticnet algorithms, in determining drivers of export performance in Africa. From the lasso and elasticnet estimation techniques, which were discussed in the previous chapter, the standard lasso and elasticnet selected 13 covariates each as drivers of export performance among African nations, while the squareroot lasso and minimum BIC lasso selected 14 and 7 covariates, respectively. The best model was found to be the minimum BIC, which selected the least number and has the smallest mean square error.

Finally, the study explores the best model for predicting export performance and provided inferential for the selected covariates. The goal was to examine the extent to which the selected covariates influence export performance in Africa, it was discovered empirically that inflation and domestic credit though a major drivers of export performance in Africa according to minimum BIC model but it was statistically insignificant from the estimation techniques while public-private partnership investment, net trade, service trade, stock traded, and gasoline price were all found to be significant even at 1% when it comes to drivers of export performance in

Africa as presented in Table 4, the summary statistics for both the training and testing dataset was also presented in Table 2.

## **Conclusion**

By using the most recent developments in machine learning to pinpoint the primary export performance drivers, The study broadens our understanding of African export performance. The study's approach involves using a large dataset covering 38 African countries from 1980 to 2021 to train algorithms for four different machine learning regularization models: the standard lasso, the minimum BIC lasso, the squareroot lasso, and the elasticnet. According to our findings, machine learning methods are strong and useful for lowering the model complexity involved in large-scale regression issues. The study findings show that, the key drivers of export performance in Africa are public-private partnership investment, net trade, net service traded, stock traded, gasoline price, inflation, and domestic credit. Furthermore, the study indicated from the inferential estimations that service traded has the highest impact on export performance in Africa, with a percentage change in service traded causing a 2.65% change in export performance in Africa. This figure varies across the various sub-geographical groups in Africa. Again, gasoline prices and stock trading were empirically proven to have a 1.4% and 0.34% impact on export performance whenever there is a percentage change in them, respectively.

## **Recommendations**

In line with the implementation of AfCFTA and achieving African Union Agenda 2063, the study recommended that African policymakers invest strategically in improving the human capital of their economies through

quality education, technology, and facilities to help improve the service exported from Africa. Improvement in services such as sports personnels, researchers, and technical people can be crucial in turning around the low rate of exports from Africa since service trade is a major promotor of export performance in Africa. It is again recommended that African policymakers should actively promote and facilitate public-private partnership investment and establish clear and supportive regulatory flamework to attract private sector investment. Key example is the one-distract-one-factory policy by the Ghana government. Furthermore, it is recommended that policymakers implement macroeconomic management, which will stabilize fuel prices and maintain low inflation, which will attract private investors.

#### **Suggestions for future research**

The study leaves room for future research. Scholars can utilize a similar technique to inform policy regarding the goods and products that African nations should produce to expand export performance. Such a finding would be crucial following the implementation of the African continental free trade area. Again, poverty is one of the biggest challenges the African continent faces. The technique can be expanded by other researchers to come up with variables to address poverty and inequality in Africa. Finally, the study can be done at the individual country level to inform policy in individual countries.



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