CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE
Faculty of Economics and Management
Department of Economics

Dissertation for the degree of *Philosophiæ Doctor* (PhD)

IMPACT OF AGRICULTURE ON ECONOMIC GROWTH IN ANGOLA

–

VLIV ZEMĚDĚLSTVÍ NA HOSPODÁŘSKÝ RŮST V ANGOLE

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2024

BIBLIOGRAPHIC ENTRY

Author:	PhDr. Ing. Mário Augusto Caetano João, PhD.
University:	Czech University of Life Sciences in Prague
Faculty:	Faculty of Economics and Management
Department:	Department of Economics
Title of Dissertation:	Impact of Agriculture on Economic Growth in Angola
Degree Program:	Sector Economics and Economics of Enterprise (4-years)
Field of Study:	Economics
Supervisor:	Prof. Ing. Lukáš Čechura, PhD.
Academic Year:	2024/2025
Number of Pages:	210
Keywords:	Economic growth, agriculture, ARDL model, Angola

ABSTRACT

The economy of Angola depends, as in all other countries, on three fundamental sectors such as crop and animal production, hunting and forestry (primary sector), extraction industry and manufacturing (secondary sector) and all sorts of services (tertiary sector). Their performance is vital to secure economic growth and development. Economic sectors are an integral part of the economic cycle of countries or regions. In theory, the primary, secondary and tertiary sectors are interconnected and make the economy run. Most developed countries, for example, do not invest much in the primary sector, protects its production with also sort of policy measures. Countries considered underdeveloped have family farming as their biggest or only source of income.

The constant need to produce and develop the conditions for survival and existence of a society in the development phase gives economic activity a certain primacy in basic innovations and transformations.

These transformations, initiated in the production activity, have repercussions over a long term throughout the entire value chain, as this is characterized by close interdependence between all segments of the value chain that make it up. In this way, the impulses from each segment are always transmitted to the others, with only discrepancies and differences in intensity in the responses of each one, depending on the respective nature and intensity of the existing connections with the sector in which the impulse took place.

Economic growth in most developing countries is dependent on industrialization, mostly reliant on the agricultural sector. Angola is rich in mineral resources, namely oil and diamonds, responsible for more than 25 percent of GDP, 60 percent of fiscal revenues, 90 percent of exports and, consequently, the most important source of foreign exchange. Ate the same time, the country has undoubtedly one of the greatest agricultural potentials in Southern Africa,

considering the country's water resources, favorable climate and available arable land. This potential is, however, largely unexploited, with only 5.9 million hectares cultivated in the 2022-2023 agricultural season, out of 35 million hectares of available arable land. Crop and animal production is lower than its demand, and Angola imports more than two thirds of the food it needs.

Between 2015 and 2020, Angola experienced a strong financial and economic crisis resulting from the drop in oil prices and consequently oil revenues. To minimize its effects, the Government launched several initiatives to diversify the economy, which involved increasing domestic production with a view of reducing imports and diversifying exports mainly of agribusiness products.

Considered a basis for the country's development and an important engine for the diversification of the economy, the agriculture sector is a development catalyzer for other economic sectors through the creation of surpluses that can be transformed and commercialized.

Subsequently, this study is designed to analyze the impact of the agricultural sector on economic growth in Angola and suggest recommendations for a better policy framework of the agricultural sector for a structural growth of the economy.

In this regard, research questions were defined to support the primary objectives of the study, namely: (i) analyze the trend of world agricultural with particular focus on Angola; (ii) examine the contribution of agriculture and other variables in Angola's GDP (iii) measure the long and short-run impact of the agricultural value added on economic growth in Angola; and (iv) what policy recommendations can be made to increase agricultural production and secure sustainable economic growth in Angola.

For this research, annual time-series data from 1993 to 2022 were used and acquired from the Angola National Statistics Office and Central Bank, as well as the World Bank's World Development Indicators (WDI), International Monetary Fund's World Economic Outlook database and FAO Statistical Database (FAOSTAT).

Different statistical and econometric approaches were used to analyze the data, including descriptive statistics, Pearson correlation, unit root and stationarity tests, the autoregressive distributed lag (ARDL) model, error correction model (ECM), diagnostic tests and the Granger causality tests.

The study findings show evidence of a long-run correlation between the dependent and independent variables. In the short run results show to be statistically insignificant. Agricultural value added shows the best reaction in all lags involved, indicating that economic growth would, *caeteris paribus*, respond positively to improvement in agricultural performance in Angola, contributing to economic growth, although delayed by 3 years. Consequently, agricultural value-added development would improve both the contribution of agricultural employment and agricultural exports towards economic growth, as well contribute to a better rural development in Angola.

Should the government of Angola continue to improve economic policies and adopt agricultural export-oriented measures (assuming production surpluses), alongside the adoption of productivity-enhancing technologies, it should impact positively economic growth.

The impact of agricultural performance in the short-run is limited since changes that occur in the Angolan agricultural sector in the short-run do not have a clear impact on economic growth. This means that rationalized and calibrated economic policies with structural and sustainable agricultural measures are necessary to boost economic growth in the short-run and, consequently, guarantee sustainable long-run performance.

Keywords: Economic growth, agriculture, ARDL, Angola.

ABSTRAKT

Ekonomika Angoly závisí, stejně jako ve všech ostatních zemích, na třech základních sektorech, jako je rostlinná a živočišná výroba, myslivost a lesnictví (primární sektor), těžební průmysl a výroba (sekundární sektor) a všechny druhy služeb (terciární sektor). Jejich výkon je zásadní pro zajištění hospodářského růstu a rozvoje. Ekonomická odvětví jsou nedílnou součástí hospodářského cyklu zemí nebo regionů. Primární, sekundární a terciární sektor jsou teoreticky propojeny a zajišťují chod ekonomiky. Většina vyspělých zemí například do primárního sektoru příliš neinvestuje, jeho produkci chrání také jakýmisi politickými opatřeními. Země považované za málo rozvinuté mají rodinné zemědělství jako svůj největší nebo jediný zdroj příjmů.

Neustálá potřeba vytvářet a rozvíjet podmínky pro přežití a existenci společnosti ve fázi rozvoje dává ekonomické aktivitě určité prvenství v základních inovacích a transformacích.

Tyto transformace, započaté ve výrobní činnosti, mají dlouhodobé dopady na celý hodnotový řetězec, protože se vyznačuje úzkou vzájemnou závislostí mezi všemi segmenty hodnotového řetězce, které jej tvoří. Tímto způsobem jsou impulsy z každého segmentu vždy přenášeny do ostatních, pouze s nesrovnalostmi a rozdíly v intenzitě v odpovědích každého z nich, v závislosti na příslušné povaze a intenzitě existujících spojení se sektorem, ve kterém impuls proběhl. .

Hospodářský růst ve většině rozvojových zemí je závislý na industrializaci, většinou se spoléhá na zemědělský sektor. Angola je bohatá na nerostné zdroje, konkrétně ropu a diamanty, zodpovědné za více než 25 procent HDP, 60 procent fiskálních příjmů, 90 procent exportu a v důsledku toho nejdůležitější zdroj deviz. Do stejné doby má země nepochybně jeden z největších zemědělských potenciálů v jižní Africe, s ohledem na vodní zdroje země, příznivé klima a dostupnou ornou půdu. Tento potenciál je však z velké části nevyužit, v zemědělské sezóně 2022–2023 bylo

obděláno pouze 5,9 milionu hektarů z 35 milionů hektarů dostupné orné půdy. Rostlinná a živočišná produkce je nižší než její poptávka a Angola dováží více než dvě třetiny potravin, které potřebuje.

V letech 2015 až 2020 zažila Angola silnou finanční a ekonomickou krizi v důsledku poklesu cen ropy a následně i výnosů z ropy. K minimalizaci jeho dopadů vláda zahájila několik iniciativ k diverzifikaci ekonomiky, které zahrnovaly zvýšení domácí produkce s cílem snížit dovoz a diverzifikovat vývoz především produktů agropodnikání.

Zemědělství, které je považováno za základ rozvoje země a důležitý motor pro diverzifikaci ekonomiky, je katalyzátorem rozvoje pro další hospodářská odvětví prostřednictvím vytváření přebytků, které lze transformovat a komercializovat.

Následně je tato studie navržena tak, aby analyzovala dopad zemědělského sektoru na ekonomický růst v Angole a navrhla doporučení pro lepší politický rámec zemědělského sektoru pro strukturální růst ekonomiky.

V tomto ohledu byly definovány výzkumné otázky na podporu primárních cílů studie, konkrétně: (i) analyzovat trend světového zemědělství se zvláštním zaměřením na Angolu; (ii) zkoumat příspěvek zemědělství a dalších proměnných k HDP Angoly (iii) měřit dlouhodobý a krátkodobý dopad zemědělské přidané hodnoty na hospodářský růst v Angole; a (iv) jaká politická doporučení lze učinit pro zvýšení zemědělské produkce a zajištění udržitelného hospodářského růstu v Angole.

Pro tento výzkum byla použita roční data časových řad od roku 1993 do roku 2022 a získána z Angolského národního statistického úřadu a centrální banky, stejně jako Světové ukazatele rozvoje (WDI) Světové banky, databáze Světového ekonomického výhledu Mezinárodního měnového fondu a statistické údaje FAO. Databáze (FAOSTAT). K analýze dat byly použity různé statistické a ekonometrické přístupy, včetně deskriptivní statistiky, Pearsonovy korelace, jednotkových kořenových a stacionárních testů, modelu autoregresního distribuovaného zpoždění

(ARDL), modelu korekce chyb (ECM), diagnostických testů a Grangerových testů kauzality.

Výsledky studie ukazují lepší důkaz dlouhodobé korelace mezi závislými a nezávislými proměnnými než v krátkém období. Zemědělská přidaná hodnota vykazuje nejlepší reakci ze všech zúčastněných zpoždění, což naznačuje, že hospodářský růst by, *caeteris paribus*, pozitivně reagoval na zlepšení zemědělské výkonnosti v Angole, může přispět k hospodářskému růstu, i když se zpožděním o 3 roky. V důsledku toho by rozvoj zemědělské přidané hodnoty zlepšil jak příspěvek zaměstnanosti v zemědělství, tak zemědělského vývozu k hospodářskému růstu, a také by přispěl k lepšímu rozvoji venkova v Angole.

Pokud by vláda Angoly pokračovala ve zlepšování hospodářské politiky a přijímání zemědělských exportně orientovaných opatření (za předpokladu přebytků produkce), spolu s přijetím technologií zvyšujících produktivitu, mělo by to pozitivně ovlivnit hospodářský růst.

Dopad zemědělské výkonnosti je v krátkodobém horizontu omezený, protože změny, ke kterým v angolském zemědělském sektoru v krátkodobém horizontu dochází, nemají jasný dopad na hospodářský růst. To znamená, že racionalizované a kalibrované hospodářské politiky se strukturálními a udržitelnými zemědělskými opatřeními jsou nezbytné pro posílení hospodářského růstu v krátkodobém horizontu a následně pro zajištění udržitelné dlouhodobé výkonnosti.

Klíčová slova: Ekonomický růst, zemědělství, ARDL, Angola.

ACKNOWLEDGEMENTS

I would especially like to thank prof. Ing. Lukáš Čechura, PhD, supervisor of my dissertation, who has always didactically devoted countless hours of his time to assist me during these six years of scientific journey. His systematic guidance, remarks and wisdom helped me to improve my work substantially.

Words of thanks also go to my childhood friends Judson and Vado who encouraged me to never give up, repeating countless times that the sky is the limit.

Finally, I dedicate this dissertation to the family Caetano João, especially my parents Augusto and Jordana, as well as my siblings Irene and Michel, my niece Nikki and nephew David, my kids Marley, Jordana and Shaila, and last, but not least, to my beloved wife Lukeny.

STATEMENT

In accordance with Czech legislation, namely § 47b of Act No. 111/1998 Coll. in the valid wording, I agree to the publication of my dissertation by the faculty, in an unabridged form electronically in the publicly accessible channels of the Czech University of Life Sciences Prague. I declare that I prepared the dissertation independently using the sources and literature listed in the list of cited literature.

Prague, 24 October 2024

_____

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CONTENTS

BIBLIOGRAPHIC ENTRY II

ABSTRACT III

ABSTRAKT VI

ACKNOWLEDGEMENTS IX

STATEMENT IX

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE 0

CONTENTS 1

LIST OF TABLES, FIGURES AND GRAPHS 6

TABLES 6

FIGURES 6

GRAPHS 7

LIST OF ACRONYMS AND ABBREVIATIONS 10

1. INTRODUCTION 14

1.1 PROBLEM STATEMENT 16

1.2 RESEARCH OBJECTIVES 18

1.3 SCOPE OF THE STUDY 18

1.4 RESEARCH QUESTIONS 18

1.5 HYPOTHESIS 19

1.6 SIGNIFICANCE OF THE RESEARCH 19

1.7 STRUCTURE OF THE RESEARCH 20

2. LITERATURE REVIEW 21

2.1 ECONOMIC GROWTH 21

2.1.1 CONCEPT DEFINITIONS 21

2.1.2 THEORETICAL LITERATURE ON ECONOMIC GROWTH 23

2.1.2.1 The Harrod-Domar Model 25

2.1.2.2 The Solow Model 26

2.1.2.3 The Ramsey-Cass-Koopmans Model 27

2.1.2.4 The Diamond Model 28

2.1.2.5 Endogenous models 29

2.1.3 EMPIRICAL LITERATURE ON ECONOMIC GROWTH 32

2.1.3.1 Foreign Direct Investments 33

2.1.3.2 Human capital 36

2.1.3.3 Social factors 38

2.1.3.4 Political factors 39

2.1.3.5 Technology 41

2.1.3.6 Financial system 42

2.1.3.7 Inflation 43

2.1.3.8 Natural resources 44

2.1.3.9 Geographic position 45

2.2 AGRICULTURE AND ECONOMIC GROWTH 45

2.2.1 EMPIRICAL LITERATURE 48

2.2.1.1 The literature on developed economies 49

2.2.1.2 The literature on developing economies 50

3. BACKGROUND INFORMATION 57

3.1 AGRICULTURE AND ITS CONTRIBUTION TO THE WORLD ECONOMY 57

3.1.1 AGRICULTURE IN DEVELOPED ECONOMIES 62

3.1.1.1 United States 63

3.1.1.2 European Union 67

3.1.2 AGRICULTURE IN EMERGING MARKETS AND DEVELOPING ECONOMIES 70

3.1.2.1 South and East Asia & Middle East and North Africa 72

3.1.2.2 Latin America and the Caribbean & Central Asia 74

3.1.2.3 Sub-Saharan Africa 78

3.2 ECONOMIC DEVELOPMENT OF ANGOLA 84

3.2.1 ECONOMIC POLICY AND PERFORMANCE 86

3.2.1.1 Contribution of the agricultural sector to the Angolan economy 107

4. RESEARCH STRUCTURE AND METHODOLOGY 122

4.1 DATA SOURCES, ESTIMATION PERIOD AND ECONOMETRIC TOOL 122

4.2 DETERMINATION OF VARIABLES 122

4.3 OPTIMAL LAG SELECTION 123

4.4 RESEARCH METHODOLOGY AND MODEL DESIGN 124

4.4.1 UNIT ROOT AND STATIONARITY TESTS 124

4.4.1.1 ADF test 125

4.4.1.2 Phillips-Perron test 126

4.5 THE ECONOMETRIC ARDL MODEL 127

4.5.1 LONG-RUN MODEL 128

4.5.2 SHORT-RUN DYNAMICS AND ERROR CORRECTION MODEL 130

4.6 DIAGNOSTIC TESTS 131
4.6.1 NORMALITY 131
4.6.2 MULTICOLLINEARITY 132
4.6.3 AUTOCORRELATION 133
4.6.4 HETEROSCEDASTICITY 135
4.6.5 STABILITY 136
4.7 GRANGER CAUSALITY 136
5. DATA ANALYSIS, RESULTS AND DISCUSSION 139
5.1 PRIMARY EMPIRICAL DATA ANALYSIS 139
5.1.1 PERFORMANCE ANALYSIS OF VARIABLES 139
5.1.1.1 GDP growth 139
5.1.1.2 Inflation 142
5.1.1.3 Gross fixed capital formation 143
5.1.1.4 Agricultural value added 144
5.1.1.5 Trade Openness 145
5.2 CORRELATION ANALYSIS RESULTS 146
5.3 DESCRIPTIVE STATISTICS RESULTS 148
5.4 OPTIMAL LAG SELECTION 149
5.5 STATIONARITY AND UNIT ROOT TESTS RESULTS 149
5.5.1 ADF AND PP UNIT ROOT TEST RESULTS 149
5.6 ARDL BOUND TESTS RESULTS FOR COINTEGRATION 152
5.7 ARDL MODEL ESTIMATION RESULTS 153
5.7.1 LONG-RUN RELATIONSHIP 153

5.7.2 SHORT-RUN RELATIONSHIP 156

5.8 DIAGNOSTIC TESTS RESULTS 159

5.8.1 NORMALITY TESTS 159

5.8.2 MULTICOLLINEARITY 160

5.8.3 AUTOCORRELATION TEST 161

5.8.4 HETEROSCEDASTICITY 162

5.8.5 STABILITY 162

5.9 CAUSALITY RESULTS ANALYSIS 163

5.10 DISCUSSION 165

6. CONCLUSIONS 172

6.1 SUMMARY CONCLUSIONS 172

6.2 POLICY RECOMMENDATIONS 175

6.3 ACCOMPLISHMENT OF RESEARCH OBJECTIVES 181

6.4 LIMITATIONS OF THE RESEARCH 183

7. BIBLIOGRAPHY 185

7.1 PRIMARY SOURCES 185

7.2 SECONDARY SOURCES 185

ANNEXURES 208

ANNEXURE A: DATA SET 209

ANNEXURE B: CURRICULUM VITAE 210

ANNEXURE C: OPTIMAL LAG SELECTION 212

ANNEXURE D: OPPONENT'S RECOMMENDATIONS 213

LIST OF TABLES, FIGURES AND GRAPHS

TABLES

Table 1: Summary of dependent and independent variables used in the model 123

Table 2: Interpretation of VIF values 133

Table 3: Pearson correlation coefficients and level of significance (*) 148

Table 4: Descriptive statistics results 149

Table 5: ADF and PP unit root tests with constant 150

Table 6: ADF and PP unit root tests with constant and trend 150

Table 7: ADF and PP unit root tests with without constant and trend 151

Table 8: Long-run estimation results 154

Table 9: Short-run dynamics and error correction model results 157

Table 10: Variance inflation factor results 160

Table 11: Breusch-Godfrey test for autocorrelation 161

Table 12: White's test for heteroscedasticity 162

Table 13: Granger Causality Test 164

FIGURES

Figure 1: GNI per capita of Emerging Markets and Developed Economies, 2022 61

Figure 2: Angolan agriculture value chain before the independence 109

Figure 3: Map of Angola (Physical) 116

Figure 4: Soil types of Angola 119

Figure 5: Procedure to perform the ADF test 126

Figure 6: Procedure to perform the ARDL model 131

Figure 7: Correlation coefficient results 147

Figure 8: ARDL bounds testing 153

Figure 9: 1900 – 1961 Agribusiness Logistics in Angola 176

Figure 10: 1961 – 2008 Agribusiness Logistics in Angola 177

Figure 11: 2008 – 2022 Agribusiness Logistics in Angola 177

GRAPHS

Graph 1: World Bank country classification, 2024 61

Graph 2: United States' main macro agricultural indicators, 2022 64

Graph 3: United States leading position in crops and livestock production, 2022 65

Graph 4: United States' main commodity group trade balance, 2021 65

Graph 5: Main US trading partners by destination and origin, 2022 66

Graph 6: Top exported and imported US agricultural goods, 2022 66

Graph 7: European Union main macro agricultural indicators, 2022 67

Graph 8: European Union leading production in crops and livestock, 2022 68

Graph 9: European Union main commodity group trade balance, 2022 68

Graph 10: Main EU trading partners by destination and origin, 2022 69

Graph 11: Top exported and imported EU agricultural goods, 2022 69

Graph 12: EMDE main macro agricultural indicators, 2022 71

Graph 13: SEA & MENA main macro agricultural indicators, 2022 72

Graph 14: SEA & MENA leading position in crops and livestock production, 2022. 73

Graph 15: Major crop and livestock producers in SEA & MENA, 2022 74

Graph 16: LAC & CA macro indicators, 2022 75
Graph 17: LAC & CA country macro indicators, 2022 75
Graph 18: LAC & CA agricultural indicators, 2022 76
Graph 19: LAC & CA leading position in crops and livestock production, 2022 77
Graph 20: Major agriculture producers in LAC & CA, 2022 77
Graph 21: Sub-Saharan Africa macro indicators, 2022 78
Graph 22: SSA country macro indicators, 2022 81
Graph 23: SSA agricultural indicators, 2022 82
Graph 24: SSA leading position in crops and livestock production, 2022 83
Graph 25: Major agriculture producers in SSA, 2022 83
Graph 26: Angola's economic growth rates 88
Graph 27: Angola's oil sector: price and production 89
Graph 28: Oil and non-oil GDP growth rates in Angola 89
Graph 29: Sectorial contribution to GDP in Angola, 2022 90
Graph 30: Determinants of fiscal oil revenues in Angola 94
Graph 31: Angola government fiscal balance 94
Graph 32: Structure of government revenues in Angola 95
Graph 33: General government gross debt 97
Graph 34: Debt-to-GDP ratio in Sub-Saharan Africa 97
Graph 35: Monetary base behavior in Angola 98
Graph 36: BNA interest rates and inflation behavior 99
Graph 37: Credit to real sector in Angola 100
Graph 38: Oil (mbpd) production in SSA, 2021 102

Graph 39: Angola total government revenues and its structure 103
Graph 40: Angola FX reserves and month of imports coverage 103
Graph 41: Angola BoP 104
Graph 42: Angola main commodity group trade balance, 2022 105
Graph 43: Angola trade balance 105
Graph 44: Angola FDI net flows 106
Graph 45: Kwanza volatility against US dollar 107
Graph 46: Agricultural value-added growth 113
Graph 47: Imports of goods in Angola, 2022 114
Graph 48: Angola's GDP performance 142
Graph 49: Inflation behavior in Angola 142
Graph 50: Angola's GFCF performance 143
Graph 51: Angola's agricultural value-added performance 145
Graph 52: Angola's trade openness performance 146
Graph 53: Normality test 159
Graph 54: CUSUM test results 163

LIST OF ACRONYMS AND ABBREVIATIONS

ADF	Augmented Dickey-Fuller
ADLI	Agricultural Demand Led-Industrialization
AgrVA	Agricultural Value Added
AIC	Akaike Information Criterion
APA	American Psychological Association
ARDL	Autoregressive Distributed Lag
ARIMA	Autoregressive Integrated Moving Average
BDA	National Development Bank
BG	Breusch-Godfrey
BIC	Bayesian Information Criterion
BNA	Angola National Bank
BODIVA	Angolan Debt and Securities Exchange
BoP	Balance of Payments
CA	Central Asia
CAP	Common Agricultural Policy
CGE	Computable General Equilibrium
CUSUM	Cumulative Sum
df	Degrees of freedom
DF	Dickey-Fuller
dL	Low boundary
dU	Upper boundary

ECCAS	Economic Community of Central African States
ECM	Error Correction Model
ECT	Error Correction Term
EFF	Expanded Financing Program
EMDE	Emerging Markets and Developing Economies
EU	European Union
FACRA	Angolan Active Venture Capital Fund
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	FAO Statistical Database
FDI	Foreign Direct Investment
FGC	Credit Guarantee Fund
FPE	Final Prediction Error criterion
FX	Foreign Exchange
G7	Group of the 7 Most Industrialized Countries
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
CGSA	Cooperative of Cattle Producers of Southern Angola
GLS	Generalized Least Squares
GMM	Generalized Method of Moments
GNI	Gross National Income
HQC	Hannan–Quinn Information Criterion
ICT	Information, And Communication Technologies
IDP	Internally Displaced People

IGAPE	Institute of Management of State Assets and Holdings
IMF	International Monetary Fund
INE	Angola Statistical Office
INF	Inflation
ISEP	Institute for the Public Business Sector
LAC	Latin America and the Caribbean
LDC	Least Developed Countries
LIE	Low-Income Economies
LMIE	Lower Middle-Income Economies
masl	Meters above sea level
mbpd	Million Barrels per Day of Oil
MENA	Middle East and North Africa
MEP	Ministry of Economy and Planning
MINAGRIF	Ministry of Agriculture and Forestry of Angola
MINFIN	Ministry of Finance
mm	Millimeters
NDP	National Development Plan
NEG	New Economic Geography
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
OLG	Overlapping Generations
PAC	Credit Support Project
PP	Phillips-Perron

PPP	Public-Private Partnership
PREI	Formalization of the Informal Economy Program
PRODESI	Production Support, Export Diversification and Import Substitution Program
PROPRIV	Privatization Program
R&D	Research and Development
SADC	Southern African Development Community
SAM	Social Accounting Matrix
SEA	South and East Asia
SIC	Schwarz Information Criterion
SSA	Sub-Saharan Africa
TFP	Total Factor Productivity
TO	Trade Openness
UMIE	Upper Middle-Income Economies
US	United States
US$	Unites States dollars
VAR	Vector Auto-Regression
VAT	Value-added Tax
VEC	Vector Error Correcting
VIF	Variance Inflation Factor
WB	World Bank
WEO	World Economic Outlook
WTO	World Trade Organization

1. INTRODUCTION

Food and non-food agricultural production is extremely important for the social and economic development of every country, producing goods and employing thousands of people, hence being the basis of the local, regional and world economy. There are several types and forms of agriculture, among which small-scale farming stands out as the most resilient. It has been gaining ground in the market, encompassing a large part of rural establishments and acting as the major player for rural development and catalyzer of local economies.

Technological advances to boost animal and crop production have helped farmers to increase productivity. However, given the fact that technologies imply financial and non-financial resources for high investments, doing business environment, knowledge and capacity building, value chains and market appropriate infrastructures, many farmers are unable to keep up with the market, showing a great structural imbalance between them. In developed markets, governments support farmers with specific financing instruments and products, as well as market access policies with incentives.

According to Food and Agriculture Organization of the United Nations (FAO), in 2021, Africa's agricultural population was 48 percent of the total population (460 million), and the agricultural value added accounted for US$ 425 billion of its total gross domestic product (GDP), representing roughly 10 percent of its total GDP (FAO 2023). Food and non-food agricultural production has not only an economic impact, but also a political and social impact. Trajectories and performances are different from one country or region to another, between the main subsectors, between agri-climatic zones, according to production systems or between different types of producers. The contribution of the agricultural sector to the economic growth of countries with strong agricultural dependence is strongly interdependent with their population dynamics and their consequent economic and social challenges.

In Angola, European dominance has transformed the subsistence agriculture into commercial agriculture. Before its independence in 1975, Angola became a major producer and exporter of cotton, coffee, corn, banana, tobacco, sugar cane and cane sugar, and sisal. But with the independence in 1975 and consequent civil war until 2002, agriculture became risky, and with the boost of the extractive industries, especially oil and diamonds production, agricultural value chains disappeared, and imports rapidly substituted local production, especially of agricultural goods. Since 2019, amid the financial and economic crisis in Angola, foreign exchange became scarce, and inflation triggered the paradigm shift from import of consumer goods to local production.

According to Ministry of Agriculture and Forestry of Angola (MINAGRIF), in the 2021/2022 agricultural campaign, almost 80 percent of the production of food and agricultural goods is provided by smallholder farmers, providing the main livelihood for almost 3 million Angolan families (MINAGRIF, 2022). With fertile soils, abundant water, favorable climate, and almost 35 million hectares of arable lands available for agricultural development, out of which only 6 percent is being used, Angola has an incredible agricultural potential. Agricultural production in 2022 increased to around 24.8 million tons, marking an increase of 5.6 percent compared to 2021.

However, with all its potential, only 15 percent of the overall arable land is currently cultivated, and 20 percent is suitable for irrigation. Agriculture in Angola is also commonly linked to poverty and inequality, hence less capacity to cumulate capital and scale up agricultural production. Millions of people live in poverty in the in rural areas. The main source of their income and employment derives from agricultural activity, and indirectly since the state of agriculture influences that of the rural non-agricultural economy. It is expected that food and non-food agricultural production help alleviate poverty in general, contributing significantly to general economic growth by feeding the agribusiness value chain and linking with other sectors of the economy.

Consequently, agriculture alone will struggle to contribute to economic growth and impact the development of the country. It needs investments and development in other fields or sectors to thrive. For this reason, an increase in agricultural production per se may not contribute to economic growth as it does in other countries with different stages of development.

Hence, this study analyses the contribution of agriculture performance on economic growth in Angola and what policies and measures would help boost its productivity.

1.1 PROBLEM STATEMENT

European presence in Angola, mainly Portuguese colonial power but also Belgian and German businessmen helped transform Angola into one of the main producers and exporters of agricultural products, including coffee, cotton, and bananas, especially from 1850s to 1975. The abundance of arable land, water and a diversity of climatic conditions that are suitable to produce a variety of agricultural goods triggered the attention of the European presence in Angola to continuously explore its potential. Agricultural value chains were developed with solid value segments going from development of inputs (seed, fertilizer and chemical producing companies) sold to the farmers, crop production, cleaning, sorting, packaging, processing, transportation, to supplying the domestic market or the capital of the Portuguese colonial empire or external markets identified by the colonial power.

However, as a result of the liberation and civil war (1961 – 2002), exports of these products started to decline in the 1980s and practically ended in the 1990s, which led to the collapse of commercial agricultural production and Angola's agricultural potential has remained unexploited since then. Angola used to export more than 200 thousand tons of coffee a year to international markets and today only exports around 2 tons a year to international markets. Less than 15 percent of the 35 million hectares of arable land in the country is currently being used for farming.

Angola has been trying to diversify its economy from the extractive sector (mainly oil, gas and diamonds) accounting in 2022 for more than 25 percent of GDP, 60 percent of government revenues and around 90 percent of exports. One of the sectors with potential to boost diversification efforts is agriculture due to its hydric and climatic potential, as well as land availability. Efforts are put on revitalizing the rural economy and the vast agricultural resources at its disposal. The focus is to transition from the vulnerably subsistence farming to a sustainable commercial agriculture based on agriculture solid value chains.

In recent years, the percentage of agriculture in Angola's economy has grown rapidly, reaching in average 5 percent per year in the last 4 years, which has led to an increase in the share of agriculture in the GDP from 5.8 percent to 8.6 percent of GDP during the period 2011-2022.

However, Angola's economic history reveals many challenges ahead to unlock agriculture full potential, namely (i) capacity building of the farmers to increase productivity; (ii) capacity building of the financial sector to be able to de-risk agriculture activities, (iii) readiness (maturity) of other value chain segments to absorb agriculture products; and (iv) capacity building of the public service to create market infrastructures and be able to enhance de doing business environment, including access to foreign markets (preferential and free trade areas), allowing value chain segments to emerge and create demand for agriculture goods.

Additionally, due to its booming population growth, averaging 3.1 percent in the last 10 years, creating pressure on food supply, rising prices (inflation) and on purchasing power thus deepening poverty and inequality, agriculture must be growing at a faster pace, to be able to supply the value chains and fight against poverty food insecurity, malnutrition and inequality.

Given these challenges, this study seeks to analyze the impact of agriculture on economic growth in Angola and discuss and propose policy recommendations and policy measures to enhance quality and quantity of produced goods.

1.2 RESEARCH OBJECTIVES

The main objective of this study is to examine and quantify the relationship between agriculture and economic growth in Angola. The investigation employs an Autoregressive Distributed Lag (ARDL) approach for cointegration and the Granger causality test to examine the importance of agriculture in economic growth in the short and long-run, as well as the direction of causality. The bi-directional relationship analysis between agricultural sector growth and economic growth is fundamental to design and implementation of successful economic development policies in Angola.

Additionally, this study aims at analyzing agricultural development trends and international best practices, as well as review agricultural policies and policy measures in Angola.

1.3 SCOPE OF THE STUDY

Assess and determine the significance of agriculture on the economic growth of Angola. This research is confined to Angola and the annual data period ranges from 1993 to 2022, hence, 30 observations.

1.4 RESEARCH QUESTIONS

This research seeks to answer the following research questions:

(i) *What is the trend in world agriculture, and its performance and challenges in Angola?*

(ii) *What is the contribution of agriculture and other variables used in the research to Angola's GDP growth?*

(iii) *Is there a long or short run relationship between agriculture and economic growth?*

(iv) *Is there a causal effect between GDP growth, inflation, gross fixed capital formation (GFCF), agricultural value added (AgrVA) and trade openness?*

(v) *What policy recommendations could help enhance agricultural sector productivity to further unlock its diversification potential and take advantage of regional and international economic integration?*

1.5 HYPOTHESIS

The following null and alternative hypothesis will be tested in accordance with the objectives of the dissertation to verify if the agricultural sector has an impact on economic growth during the period 1993 to 2022:

- H_0: Agricultural sector growth does not have significant impact on economic growth in Angola; and
- H_a: Agricultural sector growth has significant impact on economic growth in Angola.

The hypothesis above will be verified on a 5 percent significance level (0.05) in both short and long terms. If the probability of the *p*-value is more than the significance level the null hypothesis will be accepted. If the probability of the *p*-value is less than the significance level the null hypothesis will be rejected.

1.6 SIGNIFICANCE OF THE RESEARCH

The novelty of this study is that no prior studies assessing the impact of agriculture on economic growth in Angola were developed. Its findings can support policymakers from Angola and its developing partners in conducting effective policies and policy measures to pursue a sustainable agricultural performance for both economic and social gains.

1.7 STRUCTURE OF THE RESEARCH

The structure of this research is as follows: Chapter 2 reviews literature, divided into definitions, theoretical and empirical findings. Chapter 3 gives an overview of the contribution of agriculture for the global, African, and Angolan economic development, as well as Angolan agriculture policies and policy measures to enhance its productivity. Chapter 4 covers the research structure, data and methodology, with the model design and empirical and econometric procedure. Chapter 5 delivers the analysis, results and discussions. Chapter 6 provides final conclusions and recommendations on how to adjust agriculture policies and policy measures to increase agriculture production and productivity for food security and food import substitution where comparative advantages are identified.

The citation of the bibliography used in this research will follow the American Psychological Association (APA) standard (Publication Manual, 7th edition).

2. LITERATURE REVIEW

Many theoretical and empirical studies have analyzed the identification of the determinants of economic growth, in particular the correlation between agriculture and economic growth. Some studies showed positive and some other negative impact of agriculture on economic growth. However, most findings showed that strong agriculture activity leads to economic growth.

2.1 ECONOMIC GROWTH

The last 30 years have seen a disruption of economic growth models, triggered by Romer's (1986) fundamental contribution to the endogenous model theory, showing that it was possible to devise mathematical models without sacrificing the general equilibrium properties of models based on neoclassical technologies and individual optimizing behavior. This brought a different perspective and consequently interest in economic growth modelling.

2.1.1 Concept definitions

The concept of economic growth focuses on the quantitative growth of productive capacity, not on the qualitative transformation of the structure of the economy. The theory of economic growth tries to find the determinants of the rate of economic growth and to identify the policies that support its increase. The most used measure of growth is the growth rate of gross domestic product (GDP), which is the amount of goods and services produced in a specific period, often in an annual basis. Since the time horizon for the study of economic growth is long-term, this research did not focus much on short-term fluctuations (economic cycles) and measure economic growth as the rate of growth of a natural product.

According to the cited literature, there is no single-variable recipe that can explain economic growth. Therefore, to explain economic growth, it is considered

that it is an interaction between some socio-economic factors and institutional indicators.

One of the basic economic problems that has received a lot of attention in economic literature remains the same over the years: what causes economic growth? Why are there countries that grow faster than others? What are the causes of the disproportionate growth rate in individual countries? Are the factors causing different growth rates country-specific? Attempts to answer these questions have offered various justifications that have included economic, social, cultural, political and, more recently, institutional factors.

The competitiveness of an economy is usually linked to economic performance measured by economic growth. The main political goal of the country is to stimulate production as a necessary basis for economic and social development. The determinants of economic growth can change in space and time. Depending on the methodological or theoretical approach (exogenous or endogenous growth theory) or on the time span analysis (short-term, medium-term or long-term perspective), the set of specific factors (variables) related to economic growth that are often considered is quite wide (Barro, 1991; Sala-i-Martin, 1997). Factors commonly included in growth regression equations typically include such basic economic indicators as employment, inflation, current account balance, government debt, exports and imports, foreign direct investment, fixed capital gross formation, etc., but also others related variables such as the quality and quantity of a country's workforce, natural resources, technological development, or social and political factors.

Many scholars have investigated the determinants of economic growth in many countries, and various theories of economic growth have been developed. There is a large body of literature on the relationship between different sectors of the economy and economic growth in both developed and developing countries, with various generated empirical findings ranging from positive, negative to mixed in short or long-term. One of the main sources of differences in outcomes stems largely from

the intermediation mechanism through which the effects of different sectors' spillovers on recipient countries are affected. Several factors, such as the trade policy regime, the quality of human resources, and the maturity of the domestic financial sector, have been proposed and collectively subsumed under the term absorptive capacity of the receiving country. Recently, the factor of institutional quality has been emphasized, which is supposed to predetermine the host country to take advantage of growth.

2.1.2 Theoretical literature on economic growth

In his work on the Wealth of Nations (1776 [1976, pp. 387–396]), Adam Smith noted that not only capital accumulation, but also institutional and social factors and technological progress play a key role in the process of economic development of a country. However, most believe that the starting point of the theory of economic growth is the neoclassical model of Robert Solow. The basic assumptions of the model are constant returns to scale, diminishing marginal productivity of capital, exogenously determined technical progress and substitutability between capital and labor (Solow, 1956, pp. 66-68). As a result, the model emphasizes the savings or investment ratio as an important determinant of short-run economic growth. Technological progress, although important in the long run, is considered exogenous to the economic system and is therefore not adequately explored by this model. Regarding the issue of convergence/divergence, the model assumes convergence of growth rates on the basis that the growth of poor economies will be faster compared to rich ones.

The role of technological progress or advancement as a key driver of long-term economic growth has been explored in more recent studies that accept constant and increasing returns to capital. These theories, referred to as endogenous growth theories, suggest that the introduction of new accumulation factors such as innovation, knowledge, etc. would induce self-sustaining economic growth. Studies published by Romer (1986) and Lucas (1988) highlighted three important sources of

growth, particularly new knowledge (Romer, 1990), innovation (Aghion & Howitt, 1992; Grossman & Helpman, 1991c) and public infrastructure (Barro, 1990). Unlike its neoclassical counterpart, according to this theory, politics is supposed to play a significant role in promoting growth on a long-term basis. Regarding the convergence/divergence debate, endogenous growth models suggest that there would be no convergence at all.

In a similar vein, the New Economic Geography (NEG) suggests that economic growth tends to be an unbalanced process favoring initially advantaged economies (Krugman, 1991; Fujita et al., 1999). On the other hand, this body of literature develops a formalized system of explanation that explicitly emphasizes the compound effects of increasing returns to scale, imperfect competition, and nonzero transport costs. The core of this theory is that economic activity tends to cluster in a particular region and choose a place with high local demand, resulting in a reinforcement process. The spatial distribution of economic activity can be explained by agglomeration (or centripetal) forces and dispersion (or centrifugal) forces. The former include backward and forward linkages, externalities, and shrinking economies, while the latter include negative externalities, transportation costs, and increased competition. As a result, the NEG deals with the location of economic activity, agglomeration and specialization rather than economic growth. However, growth results can be derived from these models.

Another source of literature is the cumulative cause of the growth theory developed by Myrdal (1957, p. 40) and Kaldor (1970, pp. 340-341). Central to this theory is the "cumulative causation" argument, in which initial conditions determine the economic growth of places in a self-sustaining and incremental manner. Consequently, the emergence of economic inequalities between economies is the best possible outcome. Although there are positive spillovers that spread growth from more to less developed economies, the system cannot be brought into equilibrium if only market forces remain in effect. Unlike the above theories, theories of cumulative causation have a medium-term dimension and are often described as "soft" theories of

development due to the lack of applied mathematical rigor. However, there are some similarities between the cumulative causal approach and endogenous growth theory (Petrakos et al., 2007).

Now, it is worth describing the most important theoretical models.

2.1.2.1 The Harrod-Domar Model

This model, which can be seen as a benchmark for what is now called neoclassical growth theory, aims to provide a theoretical framework for understanding global output growth and the persistence of geographic differences in per capita output. This model was developed by Harrod (1939) and Domar (1946) and technology is a fixed coefficient, so economic growth depends on three factors: capital (K), labor (L) and natural resources (R).

This model adopts the production function in form

$$Y = f(K, L, R) \quad (1)$$

where, labor L and natural resources R are the resource factors used to create increased productive capital K. It would simply mean that:

$$Y = f(K) \quad (2)$$

According to Harrod (1939, pp. 19-20.) and Domar (1946, pp. 137 et 146), the relationship between savings (S), investment (I), productive capital (K) and productive capacity (Y) is as follows: S is the source of investment (I); (I) produces a later period ΔK; and ΔK directly produces the ΔY of the given period.

Robert Solow (1956) criticized the Harrod-Domar model as a starting point for analyzing long-run problems with the usual short-run classical analysis and demonstrated why the Harrod-Domar model was not an attractive model to begin with.

2.1.2.2 The Solow Model

Robert Solow (1956, pp. 65-66) took all the assumptions made in the Harrod-Domar model, except for the assumption of fixed input shares, and extended the model by adding labor as a production factor, requiring separately diminishing returns to labor and capital and constant returns to scale for both factors, and finally introducing a time variable technological variables distinct from capital and labor. Based on these assumptions, in the long run per capita output converges to a steady state regardless of initial conditions, the only potential sources of growth being permanent exogenous increases in primary factors, such as population growth and exogenously given technological changes.

Furthermore, the long-term growth rate is not affected by the rate of saving or investment. An increase in the savings rate only has a level effect, the value of state capital per worker increases but not the growth effect. Growth is thus exogenous in the sense that the behavior of economic entities does not change the rate of growth in the equilibrium state of the economy. In Solow's model, as simple as the hypotheses are, the assumption of a constant rate of labor growth is not a good approximation of reality. The main problem is that the population grows exponentially and thus tends to infinity as time goes to infinity, which is obviously unrealistic.

This model adopts the production function in the following form:

$$Y_t = K_t^{\alpha}(A_t L_t)^{1-\alpha}, 0<\alpha<1, \quad (3)$$

where, Y_t represents the flow of output, A_t technology, K_t gross fixed capital formation, and L_t labor.

According to David Romer (1996, p. 6), in Solow's model, the cumulation of physical capital increase cannot account for either output growth over time per capita, or the substantial geographical differences in output per capita. This simply means that capital and labor are not determinants of economic growth. The Solow model convincingly shows that growth is not derived from capital or labor but from technological progress. However, the model does not explain what generates

technological progress. In other words, it identifies what can potentially cause growth, but because it considers technology to be random or exogenous, it essentially fails to model the very cause of the economic growth it identifies. This is essentially why the model is only a starting point for analyzing the determinants of economic growth. If one is trying to explore what causes and sustains long-term growth, one must go beyond this model.

Later, in his publication on the perspectives on growth theory (1994), Solow provides a reflective overview and critique of the developments in growth theory since the mid-20th century. It is an important work that not only reviews the state of growth theory at the time but also provides a thoughtful critique of newer developments in the field. It serves as a bridge between the classical and modern approaches to understanding economic growth, highlighting both the strengths and limitations of each.

2.1.2.3 The Ramsey-Cass-Koopmans Model

The Ramsey-Cass-Koopmans model is a foundational model in macroeconomics, often used to analyze optimal economic growth. It extends the earlier work of Ramsey (1928) and was developed further by Cass (1965) and Koopmans (1965).

This model adopts the production function in the following form:

$$Y = AK^{\alpha}L^{1-\alpha}, \tag{4}$$

where Y is output, A is technology, K is capital, L is labor and is a constant positive fraction. This production function can be written in intensive form as

$$y = Ak^{\alpha} \tag{5}$$

where $y = \frac{Y}{L}$, A is a constant representing total factor productivity (TFP) and $k = \frac{K}{L}$, while the natural logarithm gives us

$$ln\, y = ln\, A + \alpha\, ln\, k \tag{6}$$

where y represents output (such as GDP or total production); A is a constant representing total factor productivity (TFP), which captures the effect of factors like technology, education, or efficiency on output; k is the capital input (such as machines, buildings, or infrastructure); α is the output elasticity of capital, representing the percentage change in output resulting from a 1% change in capital.

This means that output growth is driven by exogenous technical change and capital accumulation. Although this model is like the Solow model in that it fails to model technological change, it attributes growth not only to technological change but also to capital accumulation. Therefore, this model does not reduce the importance of capital like the Solow model but increases it to the same level as technological progress.

2.1.2.4 The Diamond Model

In both the Ramsey (1928) and Solow (1956) models, savings are assumed to be exogenous and thus never modelled. According to these models, a change in the saving rate leads to only a temporary change in output. The actual factors that affect the savings were not mentioned. This is the so-called Diamond model of overlapping generations (OLG), which models savings as a function of the real interest rate.

In the context of Diamond's (1965, p. 1131) OLG model, the equation

$$s_t = s(\omega_t, r_{t+1}) \tag{7}$$

where savings rate s_t is a function of two key variables:

- ω_t: This represents the wage income of individuals in period t; and
- r_{t+1}: This is the interest rate or the return on savings from period t to period $t + 1$.

Basically, the wage income **(ω_t),** in Diamond's model, individuals earn wage income during their working years (the first period of life) and decide how much of this income to consume and how much to save for retirement (the second period of

life). The higher the wage income, the more individuals can potentially save. When it comes to the interest rate (r_{t+1}), it determines how much the savings will grow by the time individuals retire. A higher interest rate provides a stronger incentive to save, as the returns on savings are greater.

2.1.2.5 Endogenous models

Endogenous growth theory was developed in response to the omissions and shortcomings of the neoclassical Solow's growth model. It is a modern theory that explains the long-term growth rate of the economy based on endogenous factors versus the exogenous factors of the neoclassical growth theory.

Endogenous growth models emphasize technological progress resulting from the rate of investment, the size of capital stock, and the stock of human capital based on several assumptions: (i) there are many firms in the market, (ii) knowledge or technological progress is a competitive good, (iii) increasing returns to range of all factors together and a constant return to a single factor, at least for one, (iv) technological progress comes from things people do, (v) it means that technological progress is based on the creation of new ideas, (v) many individuals and companies have market power and profits from their discoveries. Below are presented the most important models.

Arrow (1962) introduced the concept of learning by viewing it as endogenous to the growth process. His hypothesis was that new capital goods at any given moment incorporate whatever knowledge is available from accumulated experience, but once built up, their productive deficiencies cannot be changed by subsequent learning.

Arrow's model in simplified form can be written as

$$Y_i = A(K)\, F(K_i, L_i) \tag{8}$$

where Y_i denotes the output of firm i, K_i represents its capital stock, L_i denotes its labor stock, K without index denotes the aggregate capital stock and A is the technology factor. He showed that if the labor supply is kept constant, growth will

eventually stop because very little is socially invested and produced. Therefore, Arrow did not explain that his model can lead to permanent endogenous growth.

In his first paper on endogenous growth, Romer (1986) introduced a variant of Arrow's model known as learning by investment. It assumes the creation of knowledge as a by-product of investment.

It takes knowledge as an input to a production function in the following form

$$Y = A(R)\, F(R_i, K_i, L_i) \qquad (9)$$

where Y is the aggregated output, A is the public stock of knowledge from research and development R, R_i is the summary of results from the research and development expenditure of firm i; and K_i and L_i are the capital and labor stocks of firm i. In all its inputs R_i, K_i and L_i, it assumes a homogeneous degree one function F and treats R_i as a competitive good.

Romer took three key elements in his model, namely (i) externalities, (ii) increased returns to the production of final goods, and (iii) diminished returns to the production of new knowledge. According to Romer (1986, p. 1015), it is the spillover from a firm's research efforts that leads to the creation of new knowledge by other firms. In other words, a firm's new research technology immediately spills over into the entire economy. Moreover, a company that invests in research technologies will not be the sole beneficiary of the increase in knowledge. Other firms are also using new knowledge due to insufficient patent protection and increasing their production.

Lucas (1988, p. 36) assumes that investment in education leads to the production of human capital, which is a decisive factor in the growth process. It distinguishes between internal effects of human capital, in which an individual worker who participates in training becomes more productive, and external effects, which spill over and increase the productivity of capital and other workers in the

economy. Investments in human capital rather than physical capital, which have spillover effects, raise the level of technology.

The production function thus takes the shape of

$$Y_i = A(K_i)(H_i)H^e \quad (10)$$

where A is the technical coefficient, K_i and H_i are the inputs of physical and human capital used by firms to produce goods Y_i. The variable H is the average level of human capital in the economy. The parameter e represents the strength of external influences of human capital on the productivity of each firm.

In this model, each firm faces constant returns to scale, while the economy as a whole is increasing. Furthermore, learning through work or on-the-job training and spillover effects relate to human capital.

Each firm benefits from the average level of human capital in the economy rather than from the aggregate of human capital. Therefore, not only the accumulated knowledge or experience of other companies, but also the average level of skills and knowledge in the economy are decisive for economic growth.

Here, technology is endogenously provided as a side effect of firms' investment decisions. Technology is considered a public good from the perspective of its users. Consequently, firms can be treated as price makers and there can be an equilibrium with many firms as in perfect competition.

Later, Romer (1990, p. 88) developed a model of endogenous technical change with a research sector specializing in the production of ideas. This sector uses human capital together with the existing stock of knowledge to generate ideas or new knowledge.

In this model, new knowledge enters the production process in three ways: (i) the new design is used in the intermediate industry to produce a new intermediate product, (ii) in the final industry, they produce the final product of labor, human

capital, and the available producer of durable goods, (iii) the new design increases the total stock of knowledge, which increases the productivity of the human capital employed in the research sector.

Romer's model can be explained using the following technological production function

$$\Delta A = F(K_A, H_A, A) \tag{11}$$

where ΔA is the emerging technology, K_A is the amount of capital invested in the production of the new design (or technology), H_A is the amount of human capital (labor) employed in the research and development of the new design, A is the existing technology designs, and F is the production function of the technology. Technology is endogenous here, when more human capital is used to research and develop new designs, then technology increases by a greater amount, i.e. A is greater.

Other models developed based on these models will be discussed in the following subsections.

2.1.3 Empirical literature on economic growth

Economic growth is a well-studied part of modern macroeconomics. Thus, before conducting a new investigation into this matter, it is necessary to conduct a comprehensive review of some of the most important empirical investigations that have been conducted to date. This review aims to provide first-hand information on some of the most important aspects and challenges encountered in modelling economic growth.

Empirical growth analysis was pioneered by Barro (1991) and Mankiw et al. (1992). A large amount of empirical literature on the determinants of economic growth in transition economies emerged in the 1990s and 2000s. Studies have

identified various microeconomic, structural and institutional factors of economic growth in transition economies in general.

This section attempts a concise overview of the most important previous empirical studies on the various determinants correlated with growth.

2.1.3.1 Foreign Direct Investments

There is a large body of literature on the relationship between foreign direct investment (FDI) and economic growth in both developed and developing countries with different empirical outputs, ranging from positive, negative and/or at least mixed effects. One of the main sources of variation in the results stems largely from the intermediation mechanism through which the effects of FDI spillovers on recipient countries are affected. Clearly, several factors such as the trade policy regime, the quality of human resources, the level of sophistication of the domestic financial sector have been collectively placed below the absorptive capacity of the host country. Additionally, more recently, institutional quality has been proposed to predispose the host country to reap the benefits of growth. The following studies have been examining FDI in detail: Blomstrom et al. (1992); Borensztein et al. (1998); Balasubramanyam et al. (1996); Alfaro et al. (2004); Durham (2004); and Ang (2008).

In summary, based on the above findings, two distinct sources of literature can be filtered out of the research efforts carried out so far, namely:

- significant positive impact of FDI on growth: Ndikumana and Verick (2008), Sylwester (2005) and Lumbila (2005); and
- significant negative impact of FDI on growth Dutt (1997); Fry (1993); Hermes and Lensink (2003).

The critical evaluation of the empirical results of both categories appears too direct, raising doubts that could be drawn from previous research findings. As a result, and more inventively, attention has been focused on the minimum absorptive capacity of the countries in question, which appears to be promising, albeit indirect,

as it supports the use of a multidimensional framework that controls for multiple intervening variables.

However, the realization of the importance of controlling other conditional variables in the FDI growth space has shifted subsequent research efforts to institutional quality given the current global impacts on growth. Specifically, the economic freedom of institutional factors and its role in economic growth was sharply focused. The category of empirical studies in this regard includes Ayal and Karras (1998); Heckelman and Stroup (2000); Carlsson and Lundstrom (2002). The basic argument of most studies is that the decision of potential investors to invest in a foreign market usually depends on the state of the country's economy and the presence of a well-coordinated institutional arrangement. A study by Bengoa and Sanchez-Robles (2003) examined the relationship between economic growth, foreign direct investment and economic freedom in 18 Latin American economies from the 1970s to the late 1990s. The results show that economies with a higher index have greater inflows of FDI have therefore higher growth rates.

Pourshahabi et al. (2011), examined the relationship between FDI, economic freedom and growth in Organization for Economic Co-operation and Development (OECD) countries for the period from 1997 to 2007, using panel data method to estimate two models. The objective of the models was to (i) investigate the factors that stimulate FDI, and (ii) to find the growth factors in OECD countries. In the first model human capital, market size, political stability and inflation were found to have a positive and substantial effect on stimulating FDI in the OECD economies. The effect of economic freedom on FDI in OECD countries was found to be positive, but not statistically significant. Results from the second model showed that FDI, economic freedom, government spending, public investment, and human capital lead to economic growth in these economies. However, inflation and foreign debt had a negative impact on GDP growth, but this negative impact was not statistically significant for inflation.

Empirical attempts to examine the tripartite relationship between FDI inflows, economic freedom and economic growth are still scarce. Most of the typically modest empirical trials have mostly been conducted at the country level, making it very difficult to extrapolate country-specific cases.

For several economists, namely Romer (1986), Lucas (1988) and Barro (1991), investments have an ability to stimulate economic growth, thus it is an important catalyzer for the economies. In the case of China, Tang et al. (2008) used quarterly time series to study the causal links between domestic investment and economic growth during the period from 1988 to 2003. Ghazali (2010) examined the causal link between domestic investment and economic growth in Pakistan (1981–2008) and confirmed that domestic investments in the private sector cause economic growth.

On the other hand, empirical studies also indicate causality between domestic investment and economic growth. For the case of Pakistan, Ullah et al. (2014) examined the interaction between domestic investment and economic growth for the period from 1976 to 2010 and results confirmed unidirectional causality. For the period 1970 – 2015, Bakari (2017b) found that in Japan domestic investment affects positively economic growth.

For the case of Malaysia for the period from 1970 to 2009, Lean and Tan (2011) used a three-variable model to investigate the links between domestic investment and economic growth. It was found that domestic investment has no effect on economic growth. Likewise, Bakari (2017a), for the case of Sudan during the period 1976–2015, proved that there is no association between investment and economic growth in the short and long run. Similarly, Bouchoucha and Bakari (2019) empiric study results on Tunisia show that domestic investment impacts negatively economic growth in the long run (1976 – 2017) using an applied cointegration analysis and ARDL model.

2.1.3.2 Human capital

In the context of the technological potential and potential competitive advantages of the region, the quality of human capital, which is mainly reflected in education, has been the subject of many studies that have analyzed the determinants of economic growth.

Balcerzak and Pietrzak (2015) used a Cobb-Douglas production function estimation approach to estimate changes in total factor productivity (TFP) in EU new members between 2000 – 2010 and then proposed its endogenization using dynamic panel modelling. Researchers were able to confirm the significant influence of the quality of human capital on the level of TFP in the new EU member states. In addition, Cuaresma et al. (2014) showed that from 1995 to 2005 certain regions of the new EU members grew more rapidly due to a more educated labor pool.

The role of investment in research and development (R&D) is also often considered in relation to competitive potential in line with knowledge economies (Bilas et al., 2016). Although R&D spending is commonly considered the most important investment in building a knowledge-based economy, empirical research shows that the impact of R&D on the growth process is very complex. As a result, the effective use of R&D expenditure depends on many institutional and to some extent social factors. The positive effect of R&D on growth is therefore not automatic (Balcerzak & Pietrzak, 2015).

Human capital can be measured in terms of the level of education and health. Barro (2001), in his study of 98 countries over the period 1960 – 1985, concluded that the growth rate of real GDP per capita is positively related to initial human capital. He later concluded that the faster a country grows, the higher its current level of human capital development because physical capital expands rapidly to match the high endowment of human capital. The country is also better equipped to acquire and adapt efficient technologies that have been developed in advanced countries (Barro, 1997, p. 16). This topic was further investigated by Sach and Warner (1997) and

Gallup et al. (1999) who agree that a well-developed workforce (education and health) is likely to be able to produce more from a given resource than less skilled workers.

Nelson and Phelps (1966) similarly suggest that a large labor force makes it easier for a country to absorb new products or ideas that have been discovered elsewhere. Romer (1990) states that quality workforce development creates new products or ideas that underlie technological progress. He also notes that countries with a large and well-developed workforce experience faster introduction of new goods and therefore tend to grow faster.

According to Barro (1991), initial values of human capital and GDP per capita are significant for subsequent growth rates and show positive relationships with physical investment and fertility. They further argues that countries with higher human capital also have lower fertility rates and higher investment-to-GDP ratios. In the endogenous growth models of Barro (1990) and Rebelo (1991), per capita growth and the investment ratio usually move together. Becker et al. (1990) report that higher levels of investment in human and physical capital lead to higher per capita growth. This is because well-developed human capital will lead to improved productivity and increased growth and investment rates.

Barro and Lee (1993) results were further influenced by Gallup et al. (1999) who find a positive relationship between initial levels of health and economic growth and conclude that improved health is a significant source of economic growth. However, after using the average total years of education of the adult population as their main measure of education, they cannot find a statistically significant relationship between initial levels of education and subsequent economic growth in their sample of countries.

Based on the results of Levine and Renelt (1992) and later Levine and Zervos (1993), countries that have more secondary school students experience greater growth than countries with lower secondary school enrolment rates. Sala-i-Martin (1997) also support the view that different measures of education have a positive relationship

with growth. Brunetti et al. (1998) noted that education, as measured by high school enrolment, is positively related to growth.

2.1.3.3 Social factors

Social factors are considered by Harrison and Huntington (2000) to be important determinants of economic growth when they relate people's behavior to aspects related to output growth: investment, consumption, savings and expectations related to economic issues. The relationship between economic growth and social determinants in Romania and other EU states was studied by Popa (2012), who identified factors that were positively correlated with production growth (life expectancy, years of schooling) and factors that had negative correlations with economic growth (unemployment rate, risk of poverty).

In recent years, people's values and attitudes have also been considered in relation to the institutional and social determinants of growth factors, which are much more difficult to capture. For example, factors such as trust and social support, which are often considered components of social capital, are also included in growth regression equations. Based on a survey of world values, Zak and Knack (2001) pointed out that trust is positively associated with important economic factors such as per capita income and GDP growth along with other standard determinants of economic performance. For example, a 7 percent increase in interpersonal trust was measured to increase investment as a share of GDP by 1 percent. Ambroziak et al. (2016) also econometrically confirmed the importance of such components of social or cooperative capital as trust, friendliness and fairness using a model based on a modified and extended Cobb-Douglas production function. These authors conducted research in 2006-2012 using a sample of 22 European countries. Research has confirmed that 1/6 of economic growth as measured by the rate of GDP growth can be attributed to the effects of increased co-operative capital.

2.1.3.4 Political factors

Government policies also play a very important role in determining where the economy is headed in the long run. For example, favorable public policies—including better law enforcement, less distortion of private markets, less unproductive government consumption, and greater public investment in high-return areas—lead to higher levels of real GDP per capita in the long run (Barro, 2013). Likewise, a greater willingness of the private sector to save increases in the standard of living in the long run. Favorable government policy settings and the choice of the private sector are essential for poor countries to grow rapidly.

Hall and Jones (1997) evidenced that differences in economic success rates across countries are mainly due to the institutions and government policies (or infrastructure) that frame the economic environment. Brunetti et al. (1998) proved that two factors through which policies can influence economic growth are efficiency and reliability. Efficiency reflects timely implementation of macroeconomic and microeconomic policies. On the other hand, the reliability of policies refers to the stability that surrounds their implementation.

Gallup et al. (1998) conclude that open economies are generally in a better position to absorb new technologies and new ideas from the rest of the world. They further concluded that these economies would have a greater division of labor processes that are more consistent with their comparative advantages and therefore grow faster. Gallup et al. (1998) measure this variable relative to GDP and average it over the period of their survey, as government savings support aggregate economic growth in two ways:

a) higher rate of government saving will induce more saving and therefore investment with a higher growth rate; and

b) higher government savings means proper overall macroeconomic management, which reduces risks for investors and increases

investment. They conclude that prudent government fiscal policy is associated with faster overall economic growth.

A third policy they examined is the composition of government spending, particularly the extent of government spending on health and education. They found a positive relationship between government spending on health and education (measured as a share of GDP) and per capita income growth.

Many studies examine the role of government fiscal surpluses and deficits in influencing economic growth. The general view is that high levels of government deficits are bad for growth. Fischer (1993) notes that large budget deficits and growth are negatively associated. In addition to other variables such as inflation and distorted foreign exchange markets, it emphasizes the importance of a stable and sustainable fiscal policy to achieve a stable macroeconomic framework. Easterly and Rebelo (1993) find a consistent negative relationship between growth and budget deficits.

Levine and Zervos (1993) find a negative relationship between government consumption to GDP and growth, albeit insignificant, as higher government savings, global integration, and better quality of institutions increase steady-state income. Barro (1991) proved that growth is inversely related to the share of government consumption in GDP, but insignificantly related to the share of public investment.

The fourth factor that has an impact on growth is political instability. It is generally believed that countries that experience more revolutions and upheavals grow more slowly than more stable countries. This view is strongly supported by Levine and Zervos (1993). However, Brunetti and Weder (1995) note that Thailand, which is characterized as a country of high political uncertainty, still has a strong institutional framework and the number of coups it has experienced has not affected the functioning of the country's business class.

Barro (1991) also notes that growth rate is positively related to measures of political stability and inversely related to compensation for market disruptions. It

finds measures of political instability indirectly related to growth and investment. Therefore, political science focused its explanation on political determinants (Lipset, 1959; Brunetti, 1997), economic sociology emphasized the importance of sociocultural factors (Granovetter, 1985; Knack & Keefer, 1997), institutional economics underlined the significant role of the institution (see Matthews, 1986; North, 1990; Jütting, 2003) and others clarify the role of geography (Gallup et al. 1999) and demography (Brander & Dowrick, 1994; Kalemli-Ozcan, 2002).

In relation to the intangible determinants of production, political factors are also analyzed as factors that can have an impact on economic growth. A study conducted for Central and Eastern European countries by Radu (2015) showed that economic growth was influenced by political certainty and stability and political freedom in 1990–2010.

2.1.3.5 Technology

Authors in the field of technological determinants perceive the impact on economic development as a motivator for their technology-oriented study. In most studies, the relationship between technology and the economy remains implicit.

As already mentioned, neoclassical models such as Solow (1956) considered technological change as an exogenous variable, i.e. long-term economic growth depended only on (exogenous) technological change. Later, Arrow (1962), endogenized technology by considering learning by doing as the engine of economic growth and found that long-term economic growth depends on population growth. Uzawa (1965), Phelps (1965), Conlisk (1967, 1969) and Shell (1967) addressed the impact of the development of new technologies and ideas on economic growth.

In the 1990s, newer types of growth models begin to emerge, where the technology factor is endogenized. It was pioneered by Romer (1990), followed by Grossman and Helpman (1991a, 1991b) and Aghion and Howitt (1992). All share the characteristic that the continued increase in the level of resources spent on the

development of new technologies leads to a continuous increase in economic growth. Jones (1995a, 1995b), on the other hand, concluded that although the number of R&D scientists in developed countries has increased significantly over the past 40 years, economic growth has hardly increased during that period.

On the other hand, it must be stated that technology and equipment are the output of the human mind and can only be produced by humans, i.e. the labor factor. Developing modern technology depends on people's innovative ideas and creativity. The significant combined impact of human capital and technology on economic growth in India was also examined by Banerjee and Roy (2014).

2.1.3.6 Financial system

The financial system has an impact beyond the level of economic growth in the country. One of the first researchers to deal with this matter is Gurley and Shaw (1967) who examined the development of the financial structure during economic growth. Her conclusions lead to the fact that financial development is a positive function of real wealth.

According to Levine (2005), financial development has a positive impact on economic growth through:

a) provision of information and allocation of capital;
b) monitoring businesses and applying corporate governance;
c) improving risk management;
d) polling savings; and
e) facilitating the exchange of goods and services.

He further concluded that one important function of the financial system is to assist capital flows from savers to the highest return on investment (Levine, 2005).

2.1.3.7 Inflation

Most authors prove that inflation has significant adverse effects on long-term economic growth. Fischer and Modigliani (1978) proved that inflation uncertainty discourages firms from long-term commitments, which increased relative price variability with an impact on their efficiency. Unpredictable and high inflation rates generally lead to poor business and household performance. Through cross-sectional and panel regression. Levine and Renelt (1992) argue that countries with high growth are also countries with lower inflation. Fischer (1993) proves that growth is negatively related to inflation.

While most authors consider growth and inflation to be inversely related to the implication that inflation is relatively costly, there are exceptions: in his comments on Fischer's (1991) estimates, Sala-i-Martin (1991) also reports a negligible link between growth and inflation.

Clark (1997) in a sample of 85 countries attempts to provide a summary of the effects of inflation on growth. He concluded that the theory provides little or no guidance for establishing the empirical relationship between growth and inflation. His conclusion follows from his finding that there is no consistent and significant relationship between growth and inflation in countries with low and moderate inflation rates. However, his study shows that investment rates and inflation volatility are inversely related in almost all samples of countries.

On the other hand, Levine and Zervos (1993) argue that very high inflation rates are associated with the breakdown of normal economic relations and lower economic growth. Thus, marginal changes in the mild rate of inflation may not be negatively associated with growth. However, he later argues that very high inflation over very long periods of time can cause people to become accustomed to inflation and thus lead them to develop various mechanisms to cope with inflation. According to them, this growth is unrelated to very high inflation (Levine & Zervos, 1993, pp. 428-430).

Jarrett and Selody (1982) examine the relationship between output and inflation in Canada in the 1960s and 1970s and prove that a reduction in inflation would cause an increase in the growth rate of labor productivity and thus GDP. Through cross-sectional and panel regression, Selody (1990) concluded that a fall in inflation increases labor productivity growth. Grimes (1990) uses time series data from 21 countries in the 1960s and 1980s and estimates that a 1 percentage point reduction in inflation increases output growth by 0.1 percentage point.

Cozier and Selody (1992) share the same opinion. Their results, based on data from 22 countries, suggest that the impact of inflation is economically large and statistically significant. Furthermore, it is concluded that a permanent reduction in inflation has an impact on economic growth and increased production.

Barro (1995) uses data on approximately 100 countries from 1960 – 1990 to assess the effect of inflation on economic performance. He concluded that if several country characteristics are held constant, the regression results suggest that an increase in average inflation of 10 percent per year reduces the growth rate of real GDP by 0.2 to 0.3 percent per year and reduces the investment-to-GDP ratio by 0.4 – 0.6 percent.

2.1.3.8 Natural resources

In the 1970s, economists began to systematically examine the growth effects of non-renewable natural resources within dynamic general equilibrium macroeconomic models. Solow (1974) and Stiglitz (1974) show, using an exogenous growth model, that sustained economic growth is possible if physical capital is replaced by exhaustible resources along the balanced growth path of the economy.

Sachs and Warner (1995) proved that abundance of natural resources need not be a categorical advantage. Resource-driven economies tend to grow less rapidly than resource-poor economies, as the negative relationship holds even after controlling for

variables considered important to economic growth, such as trade policy, investment rates, initial per capita income, government effectiveness, and other variables.

The impact of energy consumption on economic growth was investigated in the late 1970s by Kraft and Kraft (1978), but there are also many recent papers that reconsider the relationship between energy consumption and economic growth in different countries.

2.1.3.9 Geographic position

Despite being an important factor, not many studies have investigated it. Hall and Jones (1997), Gallup et al. (1998) and Sachs and Warner (1999) in their growth studies concluded that countries located in the tropics tend to grow more slowly than countries in more temperate climates.

Developing countries, which are largely dependent on the agricultural sector as their main source of export earnings, are often adversely affected by tropical climates that inhibit growth. Gallup et al. (1998) suggest that two possible reasons for this negative relationship may be as follows: (i) the presence of parasitic diseases in tropical countries; and (ii) the tropics have more fragile soils and more natural disasters, all of which hinder agricultural growth. The authors further note that a geographical barrier faced by many countries is access to major shipping lines and important export/import markets.

2.2 AGRICULTURE AND ECONOMIC GROWTH

Angola's first president after independence, António Agostinho Neto (1926 – 1979) once said that "*Agriculture is the basis, and industry is the development factor*"[1].

[1] In the original language: "A agricultura é a base e a indústria o factor de desenvolvimento".

In addition to empirical studies on the impact of the most diverse variables mentioned above on economic growth, many studies examined the contribution of the agriculture sector to economic growth.

The relationship between agriculture and economic growth has been studied for years to better understand the impact of one over the other. Systematically, it has been analyzed since the mid-1990s by Clark (1940) and Kuznets (1967) and since then many studies have followed. The main purpose of the research is to measure the impact of agriculture in economic growth, observe the relationship between agriculture and the rest of the economy, identify how agriculture can become a better determinant of growth and subsequently socio-economic development. One of the most important moments in this pursuit was when Lewis (1954) developed the idea of an economy with two sectors, one modern and capital intensive, and another traditional based on the idea of surplus labor in the agricultural sector absorbed by the industrial sector.

In the midst of various criticisms the two-sector model has been further developed and adopted by many researchers who considered agriculture as an important and vibrant economic sector with positive impact in economic growth, fueling the agricultural food and non-food value chains, namely Matsuyama (1992) showing a positive link in a closed economy but a negative link in an open economy; Steger (2000) trying to answer the questions on how subsistence consumption can influence the process of growth beyond this threshold and how does the requirement of subsistence consumption interact with other essential mechanisms of growth; Vollrath (2011) shows in a two-sector endogenous Malthusian model that labor intensity of agricultural production is the main determinant of output per capita, population density, and industrialization. Many analyses consider agriculture as a vibrant determinant of economic growth through solid production and consumption linkages for which a general equilibrium idea of Agricultural Demand Led-Industrialization (ADLI) was further expanded and adopted for several developing countries.

Subsistence agriculture is very characteristic in developing economies, but unable to respond to market needs in scale and quality, therefore unable to feed the value chains. Only a few empirical studies were produced to assess the strength or extent of the interrelationship between agriculture and other sectors of the economy and thus unable to serve as an engine of growth (Ferroni & Valdes, 1991).

Gardner's (2005) study shows that agricultural sector in general does not seem to be a main engine of GDP per capita growth, notwithstanding many studies, including the World Bank (2007) World Development Report, conclude that agriculture could be the main engine of growth in agriculture-based economies, whereas in transforming economies agriculture is more an instrument of rural development and to reduce rural poverty.

With several empirical studies on the impact of agriculture on economic growth, agriculture soon became fertile ground to test theories of endogenous growth (Barro & Sala-i-Martin, 2003; Botric, 2013). Hwa (1988) empirical research proved that agricultural potential without the industrial sector would be unprofitable since it needs technologies and inputs to reach its potential and be transformed to modern commercial-based agriculture. In addition, other researchers have explored multi-sectoral simulation models to evaluate the computing linkages between agriculture and overall economy at the aggregate level, tracing the vibrant interaction of exogenous changes in agricultural productivity with other sectors of the economy (Mundlak & Cavallo, 1982; Mundlak et al., 1989; Block & Timmer, 1994; Naanwaab & Yeboah, 2014).

In numerous studies the linkage between agricultural and non-agricultural growth are estimated and modelled at regional level using a regional Social Accounting Matrix (SAM) to investigate the impact of exogenous changes in agricultural productivity on incomes in non-agricultural households (Haggblade et al., 1989).

On the other hand, some empirical studies that investigate the causal relationship between agricultural production and economic growth provide contradictory findings. Some of them consider that the export of surplus resources from agriculture leads to a growth of the agricultural sector while others consider that increases in the other sectors performance have spillover effect on agriculture.

2.2.1 Empirical literature

For years, economic growth and development were always associated with industrialization. But modern economic thinking changed this paradigm, diverting from the Harrod-Domar model (Thorbecke, 1970, pp. 590-591) and the Lewis's famous two sector model types (Todaro & Smith, 2020, pp. 125-127).

Measuring the impact of agriculture on economic growth has shown to have positive but also negative impacts mostly for developing countries. Many studies were made to date to examine the impact of agricultural sector on growth, and controversial findings persist. Some studies use the Sollow-Swan neoclassical growth theory to measure the impact of agriculture on growth, some modern growth theories based on endogenous models.

Modern growth theories have been putting agriculture to the forefront of economic thinking, thus decreasing the pressure on the search for food, ensuring food security and speeding up the industrialization process. Agriculture and rural development play an important role in any country's development plans and innovation acts as a catalyzer to expand and enhance food production, shaping the new socio-economic trend (Todaro & Smith, 2020).

Mellor (2017) argued that (i) accelerated output growth through technological, institutional, and price incentive to raise the productivity of small farmers (p. 38), (ii) rising domestic demand for agricultural output (p. 159), and (iii) diversified, non-agricultural, labor-intensive rural development activities are fundamental for a sustainable economic development (p. 197).

Adegeye and Dittoh (1985, pp 165-172) argue that the stage of economic development of a country determines the increase agricultural output with an emphasis on farmers and people income. Their conclusion shows that developed economies with solid agricultural sector see an increase in export of crops, improving the quantity and levels of such export crops. For industrialized countries, agricultural output is vital in providing the needed quantity and quality of inputs to the agro-industries.

Johnston and Mellor (1961) see agriculture as an active sector in the economy by playing a central role in economic growth and boosting local production and consumption and increasing food and labor supply. Additionally, agriculture can help rationalize foreign exchange by reducing food and non-food agricultural imports and increasing food and non-food agricultural exports.

2.2.1.1 The literature on developed economies

The GDP of most developed countries shows that agricultural sector activity is residual due to few arable lands or farming conditions. Developed economies focus more on services and industrial sectors, producing more capital-intensive goods and providing high quality services. Economies with abundant labor force tend to produce more labor-intensive goods whereas capital abundant economies tend to produce more capital-intensive goods (Markusen, 2005). It must be acknowledged though that even in technology intensive agriculture still labor remains the main factor.

Many studies have been made focusing on the relationship between agricultural sector and economic growth in developed countries. Some other show bi-directional relationship between agriculture production and growth like the Katircioglu (2006) demonstrates the existence of a bi-directional in North Cyprus and the study, engaging the Granger causality test. Bakari and El Weriemmi (2022) studied the impact of agricultural investment on economic growth in France over the period from 1978 to 2020. Economic growth was estimated using an ARDL model and results indicate that in the short and long run agricultural investment has a positive impact

on economic growth. Another study was performed by Apostolidou et al. (2014) to identify the causal relationship that exists between agricultural value added per worker and GDP per capita in Europe, with special emphasis to the differences and similarities among Mediterranean and Northern countries. The study applied a linear cointegration method to examine long and short-run linkages while the impact of agricultural value added on economic growth was examined using the Granger causality tests. Results show a bi-directional relationship between agricultural value added and economic growth in most of the countries.

Some studies were also made at a micronational geographic unit aimed at identifying the main determinants of rural development.

2.2.1.2 The literature on developing economies

Over the years, several studies have been fueling controversial debates on the impact of agriculture on economic growth in developing countries. Only a few studies were made to assess a group of different economies, while most for specific developing economies.

A. Group of different economies

Gardner (2005) and Chebbi (2010) explored the impact of agricultural productivity on economic growth for different economies. Awokuse (2009) examines, for the period 1971 to 2006, the interaction between agricultural productivity and economic growth for Africa, Asia, and fifteen other developing countries. The interaction between variables is assessed using ARDL models and cointegration. The variables considered are real exports, agricultural value added per worker, real GDP per capita, population as proxy for labor and gross capital formation per worker as proxy for capital. Results show that agriculture is the most important determinant of economic development and investment into the agricultural sector by both the private and public sectors are vital.

Mohamud et al. (2023) examined the relationship between agriculture and economic growth in Somalia over the period from 1980 to 2020, employing the ARDL model. The results revealed a positive relationship between the agriculture and economic growth in Somalia.

Awokuse and Xie (2015) worked on 9 developing economies and the results show that for some countries agriculture is a determinant of economic growth with different intensity, while for other countries results demonstrate that agricultural development is dependent on a vibrant economy. An ARDL model and cointegration tests were applied to find out the empirical relationship among variables. Zhang (2001) observed 11 economies in Latin America and East Asia with a strong causal Granger relationship between FDI in the agricultural sector and economic growth.

Furthermore, Awan (2014) observed the impact of agriculture productivity on economic growth in 7 economies and compared their experience with 7 advanced countries, using a two-sector model methodology to assess the economic behavior of variables. Results show negative effects on the economic growth in the selected emerging economies due to low agriculture productivity in the emerging economies and the income gap between emerging and advanced countries.

Other empirical studies find a correlation between agriculture and economic growth, but results do not indicate causality in either direction. Bravo-Ortega and Lederman (2005) prove that in developing economies an increase in agricultural sector GDP raises non-agricultural sector GDP, however a reverse relationship does not occur. They re-estimate the effect of agricultural growth on the total economic growth using panel data tools such as Granger causality tests for the period 1960 – 2000. Tiffin and Irz (2006) used Granger causality tests in the panel data to observe the direction of causality between agricultural value added per worker and GDP per capita in 85 economies and address the problem of endogeneity. The results revealed a clear causality between agricultural value added and GDP in developing

economies, whereas for developed economies results are not clear except from economies with solid presence of agriculture in the GDP.

However, the main challenge in assessing cross-country findings consists on the different socio-economic realities of the countries involved, which makes it harder to determine a best practice approach on the general relationship between agricultural and aggregate economic growth. Researchers have tried to establish a solid linkage between agriculture and other sectors of the economy in different developing economies but due to cross-countries realities, these linkages differ from one country to another. According to Matsuyama (1992), openness of an economy to international trade is vital for the relation between agricultural sector growth and economic growth. De Janvry and Sadoulet (2009) assessed the linkage between agricultural growth and poverty reduction and evidenced that 1 percent of agricultural sector growth have an effect of 0.45 percent on economic growth in China from 1980 to 2001.

Chenery and Syrquin (1975), a probable solution for the problem of cross-country studies is the combinatorial analysis of cross-section and time-series data. Stern (1996) assessed the relationship between the average rate of economic growth and the average rate of agricultural sector growth for developing countries. Results prove that before 1980 there is statistically significant and positive relationship. A positive linkage between the average rate of growth and agriculture's share of GDP was also confirmed by Echevarria (1997) who investigated sectoral composition associated with economic growth in 62 countries, for the period 1970 – 1987. Timmer (2002) assessed 65 developing economies for the period 1960 – 1985 and proved a positive relationship between agricultural GDP growth and non-agricultural GDP growth using a panel data approach. Other approaches were used to examine the correlation between agriculture and economic growth like the case of Self and Grabowski (2007) who proved positive relationship between average growth of real GDP per capita and different measures of agricultural productivity using a cross-section of countries for the period 1960 – 1995.

All studies found a strong relationship between agriculture and economic growth and identified agriculture as an important development transmission channel with spillover effects over other sectors.

B. Specific African Economies

In the case of the African economies, with substantially better farming conditions providing comparative advantages in agricultural products, most studies examined the link between the agricultural sector and economic growth or on the link between agricultural trade and economic growth. Very few studies examined the link between agricultural investments and economic growth.

Nevertheless, researchers agree that agriculture has an essential effect on economic growth of the developing countries implicated in the studies, namely Msuya (2007) on Tanzania, Oyakhilomen and Zibah (2014) on Nigeria, Odetola and Etumnu (2013) on Nigeria, Izuchukwu (2011) on Nigeria, Sertoğlu et al. (2017) on Nigeria, and Moussa (2018) on Benin.

For the case of the Tunisian economy, Matahir (2012) took a different stand using time series Johansen cointegration on his study on the role of agriculture on economic growth and how it affects other sectors in the economy. The study results show positive impact, recommending policy makers to see agricultural sector as pivotal tool when analyzing inter-sectoral growth policies. When addressing the impact of investment agriculture on the agricultural output, Badibanga and Ulimwengu (2020) explore the impact of agricultural investment on economic growth and poverty reduction in the Democratic Republic of Congo (DRC). The authors develop and utilize a two-sector economic growth model to analyze the optimal allocation of investments between the agricultural and non-agricultural sectors to maximize overall economic growth and reduce poverty.

Phiri et al. (2020) examined the agriculture sector in Zambia as determinant of economic sustainability for the period from 1983 to 2017. An ARDL model was applied and prove that agriculture the impact of agriculture on economic growth in

Zambia was substantial in both the short and long-run. Sanyang (2018) also analyzed the impact of agriculture on economic growth in Gambia, using an ECM and ARDL model to estimate the economic growth and found a significant positive effect of agriculture on economic growth in both the short- run and long-run.

Furthermore, Runganga and Mhaka (2021) assessed the impact of agriculture on economic growth in Zimbabwe using the ARDL estimation technique for the period from 1970 to 2018. Results show that agricultural production has a positive impact on economic growth in the short run, and no impact in the long run.

Bakari and Abdelhafidh (2018) investigates the relationship between agricultural investment and economic growth in Tunisia. The authors employ an ARDL cointegration approach to analyze how different components of agricultural investment influence the long-term and short-term economic growth of the country.

Many theoretical and empirical studies have also analyzed the correlation between financial credit and agricultural sector growth. Some have found positive impact, while others negative, but the literature's general conclusion is that strong financial systems increase credit activity and, subsequently, lead to economic growth. For instance, Akram et al. (2008) proved a positive effect of agricultural sector credit on agricultural sector growth in Pakistan with an elasticity of agricultural credit in relation to poverty of –0.35 percent and -0.27 percent in the short term and long term, respectively. Caetano João and Castro (2023) examined the degree of elasticity between two variables, namely, agricultural credit and agricultural growth, in Angola in the period 2003 – 2022 using the ARDL model. Results showed that the impact of agricultural credit on the growth of the agricultural sector was positive and statistically significant.

C. Other Specific Developing Economies

Most show positive impact like the Yao (2000) and Xuezhen et al. (2010) research on the impact of agriculture on economic growth in the case of China and it was found that agriculture is important for China's growth.

In the case of other developing economies, the impact of agricultural sector on economic growth in Pakistan was investigated by Raza et al. (2012), Awan and Vashma (2014), and Awan and Alam (2015), respectively. Furthermore, many other studies were developed like Uddin (2015) on Bangladesh, Jatuporn et al. (2011) on Thailand. Awan and Vashma (2014) assessed the relationship between agricultural economic development and GDP for the period from 1980 to 2010 in Pakistan, using cointegration and VEC model. Results show statistically significant data and a positive relationship between agricultural growth and GDP growth.

Using a different estimation technique, Awan and Alam (2015) investigate the impact of agriculture productivity on economic growth during the period from 1972 to 2012 using an ARDL model. Results show a positive correlation between economic growth and the agricultural sector.

Other studies assessed the contribution of agricultural investments on the agricultural sector and its impact on economic growth and some other on the contribution of agricultural exports on economic growth. In the case of Pakistan, Chandio et al. (2019) observed the impact of foreign direct investments in the agricultural sector and consequently on economic growth during the period 1991 – 2013. An ARDL model was applied with a positive impact.

Gemmel et al. (2000) examine the significance of cross-sectoral linkages for agricultural sector growth in Malaysia and results show that an increase of industrial output causes negative agricultural sector growth in the short-run and a positive agricultural sector growth in the long-run. On the other side, agricultural sector growth does not have an impact on the other sectors of the economy. Samini and Khyareh (2012) used annual time-series data for the period 1970-2009 to assess the relationship between agricultural sector growth and economic growth of Iran and prove that there is short-run and long-run linkage between agriculture value added and real GDP per capita. On the contrary, real GDP *per capita* causes agricultural

value to be added only in the short run. Authors used multivariate Granger causality tests based on the ARDL and error correction model estimates.

3. BACKGROUND INFORMATION

3.1 AGRICULTURE AND ITS CONTRIBUTION TO THE WORLD ECONOMY

From the beginning of civilization, crop production and livestock has always been one of the most important economic activities. It is the source of most of the food for humans and animals, as well as for most materials needed to produce many industrial products, including textiles and fertilizers.

Around 13,000 years ago, the so called "Neolithic Revolution" helped humankind to understand that food could be domesticated. The process of crop domestication made agriculture a more sustainable lifestyle. Agriculture allowed people to settle, without having to live a nomadic life in search of food. Soon, farmers were able to be more efficient, producing more food than they consumed, allowing the development of other sectors, complementary to the agricultural sector, including commerce who served as a competition and development catalyzer. It was after the first agricultural revolution that the planet's inhabitants began to change their habits, their lives and their social dynamics. The shift to agriculture is believed to have occurred independently in several parts of the world where many civilizations impacted the world (Pringle, 1998, pp. 1446-1447).

It is also worth to note that, besides the "Neolithic Revolution", many other events triggered a substantial increase not only in the quantity and quality of agricultural goods, but especially its productivity. This increase was not only a result of the employment of more workforce and expansion of arable land, but fundamentally from the proliferation of existing technological innovations. The transition in agriculture from human power to animal power ended and technological advances were the leading comparative advantages.

Other stress moments took advantage of the propagation of technological innovation to boost agricultural production, especially devastating wars such as American Civil War in the 1860s and the World Wars (I & II) in the first half of the

20th century. An increase in domestic and external demands, as well as productivity gains, greater use of limestone and fertilizers or improved crop varieties, completely transformed the agricultural sector. Its solid linkages with the industrial sector, especially informing farmers about new agricultural technologies through agricultural fairs and exhibitions accelerated the evolution process.

Animal production greater than crop production is generally an indicator of developed agriculture. In modern agriculture, a large part of crop production is destined for animal production. Crop production and livestock depends on many factors, including the environment, climate and water availability, as well as economic factors such as market size and consumption habits. Therefore, farmers' crop decisions affect market prices and production costs.

Agriculture plays an important role in government policy, including grants (net subsidies/incentives) for whether or not certain crops are produced.

According to FAOSTAT[2], in 2022, world agricultural land was 5.3 billion hectares, including temporary and permanent crops, meadows and pastures. Agricultural products play an important role in countries' food security and global trade. The trade in food and other agricultural products in bulk has been associated, since the 19th century, with the development of refrigeration equipment, as well as the development of rail and river/sea transport, due to the capacity to transport enormous quantities.

The economic context in which agriculture operates is changing rapidly, driven by population growth, urbanization, changing diets, information, and communication technologies (ICT), and broader technological change. Collectively, these factors are altering the way in which food is produced, processed, and sold - albeit at different speeds both across and within markets in developed, developing and

[2] FAO: FAOSTAT, Land Use Data, online: https://www.fao.org/faostat/en/#data/RL, 24/05/2024.

least developed countries. The same processes driving the emergence of global value chains in other sectors are also at work in the agrifood sector, notably technological change, transport and logistics innovation and the penetration of global agribusiness companies into local markets, through both direct contract relationships and investments.

According to FAOSTAT (FAOa), the share of agriculture to the world's GDP is 4.3 percent. The problem remains the recording of true agricultural value added, as a substantial part of production in countries with underdeveloped agriculture remains informal, hence not registered. Within the scope of the world average, there are therefore substantial regional differences between developed and developing countries.

Changes in food retailing are leading to greater involvement of the private sector in agriculture and a focus on developing and improving agriculture value chains. Initially motivated by export market opportunities, value chains are also extending their reach into domestic markets as retail markets evolve to meet the needs of urban consumers.

The latest data from the World Bank's World Development Indicators, shows that, as of 2023, approximately 3.4 billion people live in rural areas, out of which 70 percent (2.4 billion) still rely on agriculture as the main source of income and employment. Agricultural development is one of the fastest ways to achieve poverty reduction: growth in the agricultural sector could be more effective at reducing poverty than growth in other sectors. Harnessing value chain development is an opportunity for poverty reduction and rural development.

In recent years, participation in agricultural value chains has become a major vector of integration into the global trading system, contributing to both export growth and diversification. Value chains are the link between trade and agricultural development as well as food security. They have also become an important channel of socio-economic upgrading, with suppliers in developing countries potentially

benefiting from significant transfers of all kinds (from capital to knowledge and technology) from lead firms. However, barriers facing firms in developing countries create challenges for them to connect to agrifood value chains. The main obstacles can be classified in four categories, namely (i) business environment: trade facilitation, access to finance, corruption, investment and tax incentives; (ii) capacity building: operational cost, ability to meet quality and safety standards, availability of skills in the labor force; and (iii) infrastructure: quality infrastructure, including energy, water and transport infrastructure.

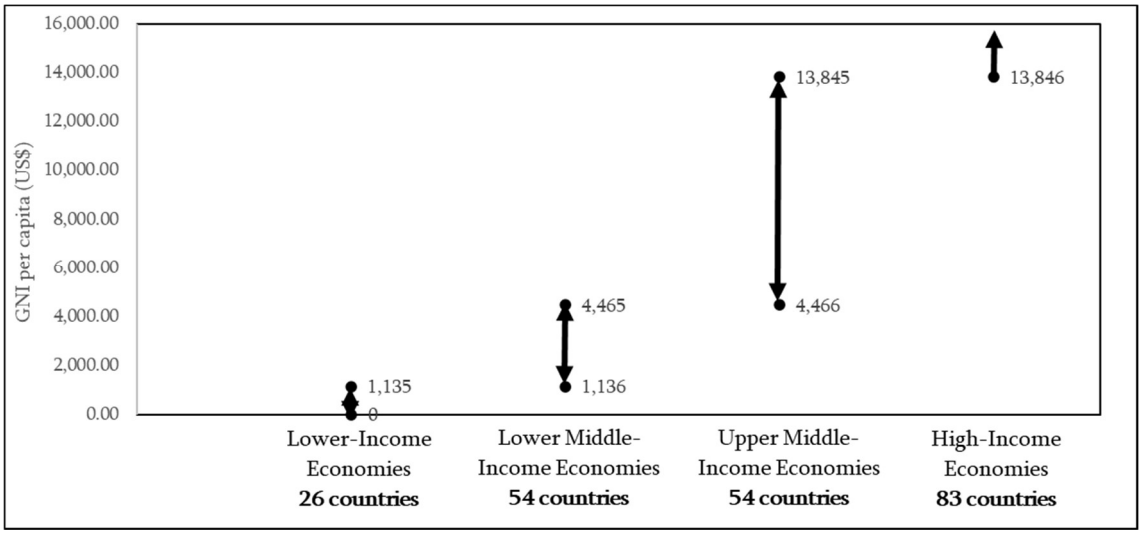
Based on FAOSTAT data (FAO, 2022, p. 3), 866 million people are employed in agriculture, forestry and fishing, out of which, approximately 250 million are in jobs related to food supply, trade and transportation. Among countries, there are large differences in the role that agriculture plays in the economy. In some developing countries like Nepal, 90 percent of the population cultivates land. On the other hand, in developed countries, such as the group of most industrialized countries in the world (G8), only around 2 to 3 percent of the workforce works in agriculture.

In developing countries, a considerable amount of labor in agriculture is in subsistence agriculture, where only some production reaches the market. In some developing countries, for instance in Africa, home to ethnolinguistic group Khoisan, hunting and gathering remains the main activity. On the other hand, in developed countries, agricultural activity is mainly related to the exploitation of soil for economic purposes, that is, commercial-based agriculture, playing a vital role in the global economy, generating foreign exchange, fighting against inflation, contributing for rural development and food security.

This work uses the World Bank 2024 country classification based on per-capita gross national income (GNI). According to World Bank, in 2023, 26 economies were classified as low-income economies (LIE) with a GNI per capita of US$ 1,135 or less; 54 as lower middle-income economies (LMIE) with a GNI per capita between $ 1,136 and US$ 4,465; 54 as upper middle-income economies (UMIE) with a GNI per capita

between US$ 4,466 and US$ 13,845; and 83 as high-income economies (HIE) with a GNI per capita of US$ 13,846 or more. Graph 1 below reflects this classification.

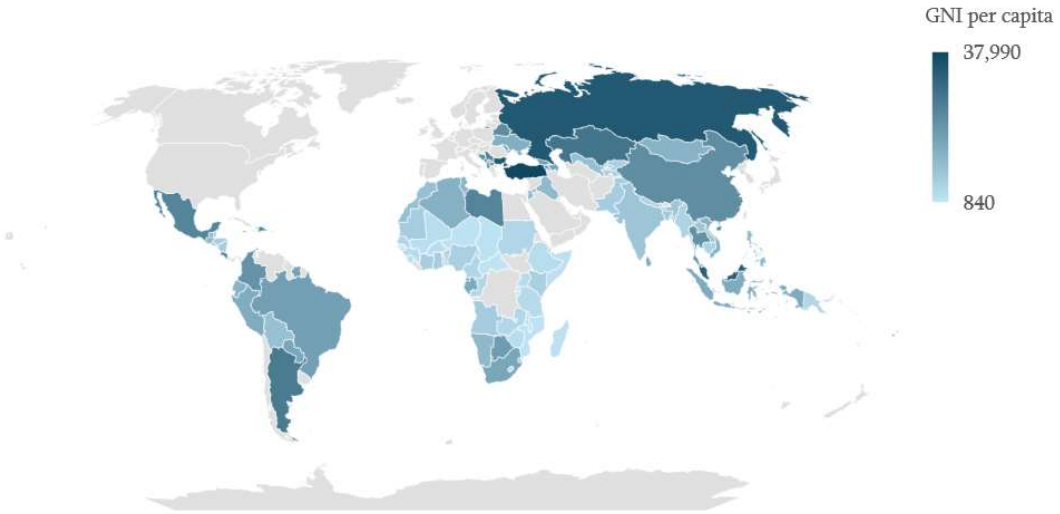
Graph 1: World Bank country classification, 2024



Source: Author's illustration based on World Bank, online: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups,

High-income economies with specific exceptions represent developed economies and other emerging and developing economies. Africa has most countries classified as LIE as shown in figure 1.

Figure 1: GNI per capita of Emerging Markets and Developed Economies, 2022



Source: World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 08/04/2024

3.1.1 Agriculture in developed economies

Agriculture in developed countries is practiced intensively, using pesticides, fertilizers, improved soil correction and conservation techniques and mechanized agricultural exploitation, which is not very labor intensive. High productivity generates production on a scale that satisfies the domestic market, and surpluses are destined for international markets. A failure in the harvest of a certain product in developed countries (mainly the United States and Europe) has an immediate impact on the global supply of agricultural goods in world trade and on their stock exchange prices.

With the agribusiness revolution in the 20th century after the World War II, developed countries, especially the group of the 7 most industrialized countries (G7), began to use more and more machinery on agricultural farms, using cutting-edge technology and chemical inputs and better soil rationalization. This allowed a substantial increase in productivity in plant and animal production.

To strengthen the sector and guarantee rural development, developed countries have developed a set of agricultural policies with large profit margins and multiple benefits. Storage infrastructures allow agricultural goods to be sold at times when prices are on the rise, thus ensuring greater profitability. The main objective of agricultural policies is protectionism, causing goods imported from developing countries to be subject to tariff and non-tariff barriers when entering their markets. This ensures that after being subjected to these trade barriers, imported products are less competitive. In addition to trade barriers, mainly technical barriers to trade, developed countries, in the implementation of their trade policies, subsidize the production of their agricultural goods with bank financing at subsidized interest rates for the purchase of fertilizers, pesticides, machinery, exemption from certain taxes, among others. This practice allows these subsidies to be decisive in creating the cost structure and consequently in the final cost of agricultural goods.

The trade policies of developed countries thus aim to protect the most vulnerable economic sectors of a country with production or price subsidies, increasing their competitiveness and creating difficulties for developing countries, especially the least advanced ones. These are monetary subsidies to producers along the value chain of agricultural goods with the aim of reducing the final price of the products, thus allowing greater competitiveness in the international market.

An example of these policy measures are the protection measures that exist when importing sugar or milk to Europe or even processed oranges or biofuels to the United States. The World Trade Organization (WTO), created to regulate practices harmful to international trade, brought a series of legal cooperation instruments to combat protectionism and promote international trade. However, developed countries have been defending neoliberal ideals with minimal State intervention, which makes it difficult for developing countries to obtain advantageous market access conditions.

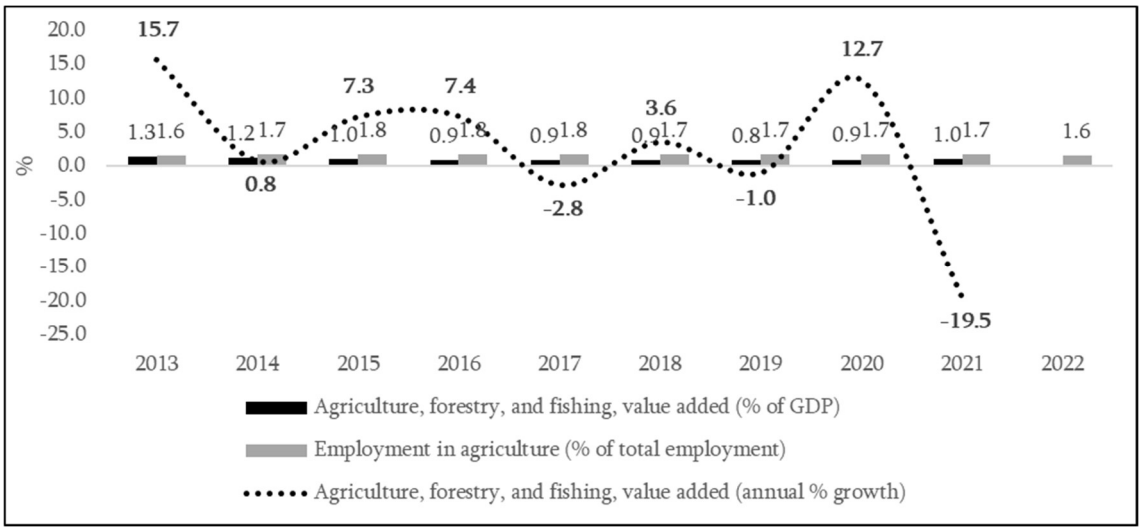
Several rounds of WTO negotiations took place before and after its creation in 1995, currently in the Doha Round that began in 2001, with two main themes without a practical solution: agricultural subsidies and trade facilitation. Agriculture is the most relevant and controversial issue, since, for developing countries, around ¾ of the population depends on agriculture as a source of income.

3.1.1.1 United States

The United States (US) is one of the top food producers and takes the lead on several crop and livestock production (Caetano Joao & Caetano Joao, 2018, p. 28). Its agricultural sector benefits from various incentives that help ensure greater competitiveness in the sector and make the country the largest producer of agri-food goods in the world. The production of agri-food goods exploits the country's agricultural potential (zoning, water resources, climate) using intensive mechanization, intermodal transport network (roads, railways, waterways, air) and storage infrastructures. The sector is of vital importance to the United States'

government, representing approximately 1 percent of GDP and 1.6 percent of total employment, as stated in the graph 2 below.

Graph 2: United States' main macro agricultural indicators, 2022

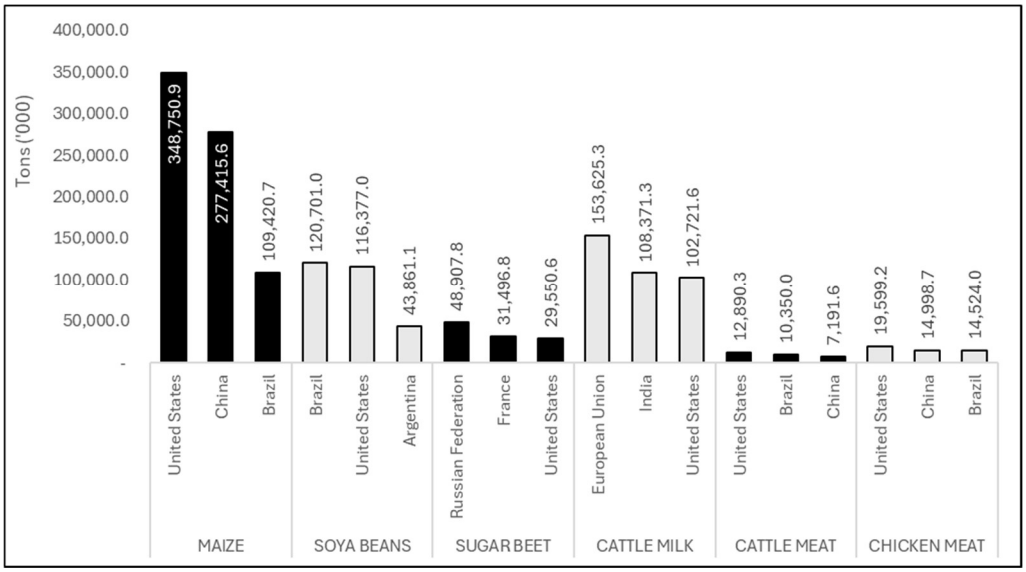


Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 27/03/2024

The United States agricultural policy is anchored in the "Farm Bill", a multi-year legal document that governs a series of agricultural and food programs. It is a transversal and periodic policy approach to plant and animal production. This diploma was developed in the 1930s and is normally renewed every five years, with 18 versions having already existed.

As shown in the figure below, the United States leads or is between first three world producers of different crops and livestock products. The United States is the larger producer of maize and cattle and chicken meat, whereas in soyabeans, sugar beet it ranks second and third respectively.

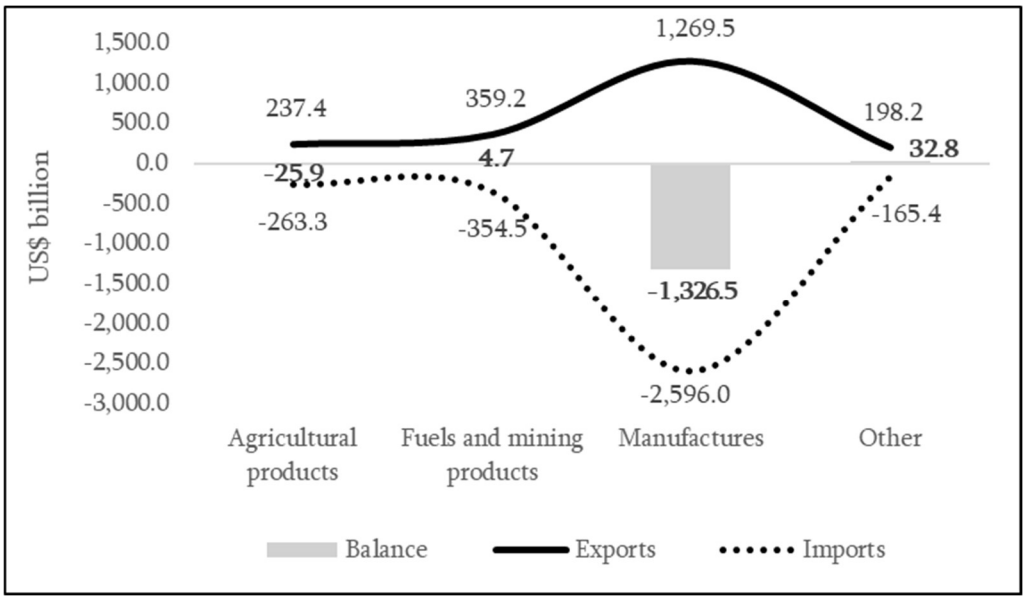
Graph 3: United States leading position in crops and livestock production, 2022



Source: Author's illustration based on FAOSTAT, online: https://www.fao.org/faostat/en/#data, 27/03/2024.

According to the WTO, the United States' trade in goods' volume in 2022 accounted for US$ 5.4 billion, out of which US$ 2.1 billion in exports and US$ 3.3 billion in imports. The main exported and imported commodity group are manufactured goods with US$ 1,269.5 billion and US$ 1,326.5 billion, respectively, as shown in graph 4 bellow.

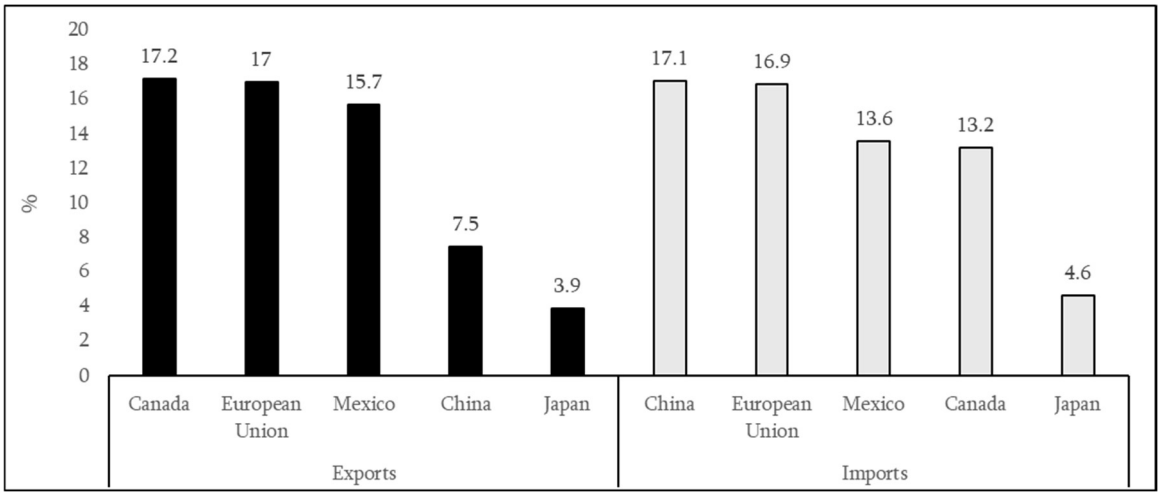
Graph 4: United States' main commodity group trade balance, 2021



Source: Author's illustration based on WTO Trade Profiles, online: https://www.wto.org/english/res_e/statis_e/daily_update_e/trade_profiles/US_e.pdf, 19/03/2024

The main destination for US exports is Canada, followed by the European Union, Mexico, China, and Japan. On the other hand, the main importing partner is China, followed by the European Union, Mexico, Canada, and Japan, as shown in the graph 5 below.

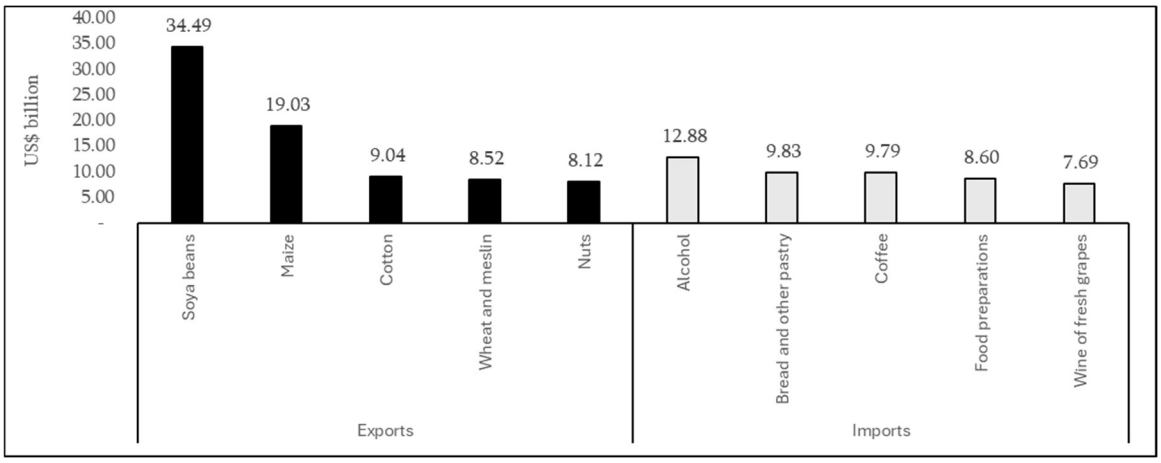
Graph 5: Main US trading partners by destination and origin, 2022



Source: Author's illustration based on WTO Trade Profiles, https://www.wto.org/english/res_e/statis_e/daily_update_e/trade_profiles/US_e.pdf, 19/03/2024

The most exported agricultural product from the United States is soya beans, followed by corn, cotton, wheat and walnuts. On the other hand, the most imported agricultural products are alcoholic beverages, bread and other pastry products, coffee, a variety of food preparation products and wine.

Graph 6: Top exported and imported US agricultural goods, 2022



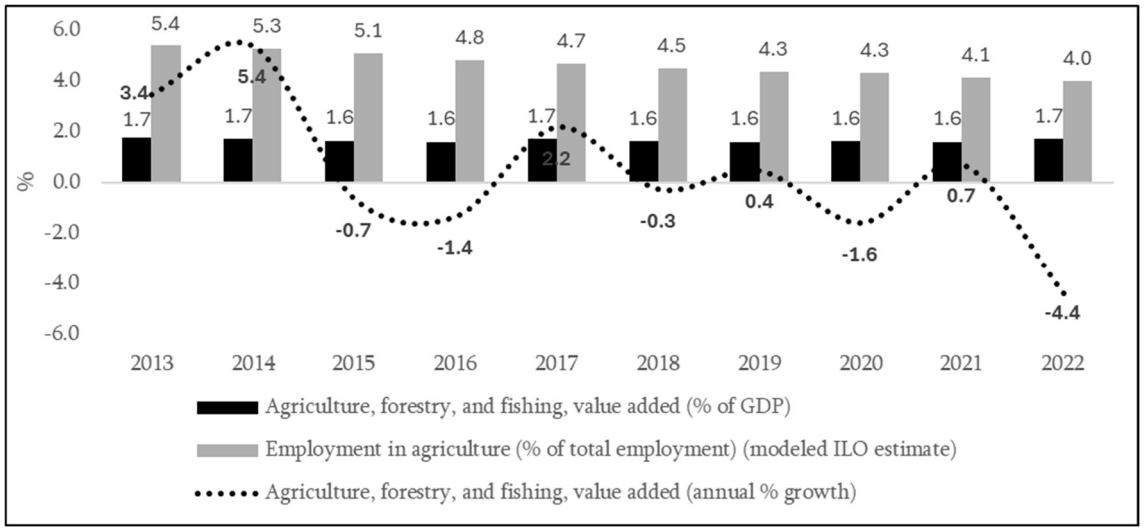
Source: Author's illustration based on WTO Trade Profiles, https://www.wto.org/english/res_e/statis_e/daily_update_e/trade_profiles/US_e.pdf, 19/03/2024

3.1.1.2 European Union

Europe's agrarian economy is based on continuous innovation in processes and procedures, high technological and technical development, as well as intense mechanization of production. European agriculture is characterized by the performance of the countries that make up the European Union (EU), composed of 27 countries.

In 2022, the EU agricultural sector represented an insignificant share of the EU's economic activity with 1.7 percent and with a negative growth rate of 4.4 percent. On the other hand, more than in the United States, agriculture is responsible for 4 percent of overall employment in the European Union, even though it has been decreasing in the last 10 years (5.4 percent in 2013), as shown in the figure below.

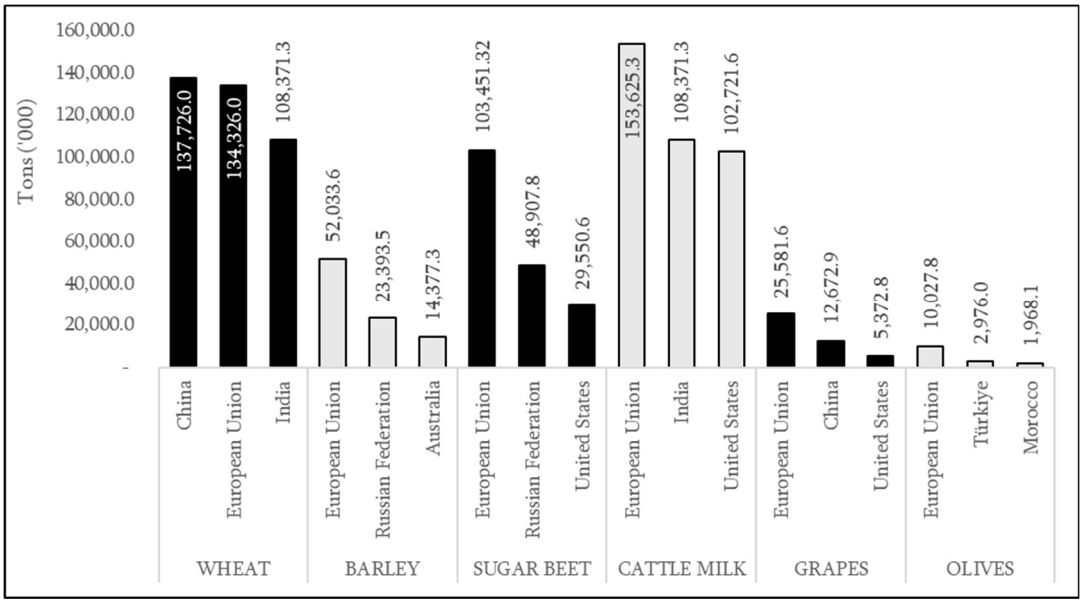
Graph 7: European Union main macro agricultural indicators, 2022



Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 27/03/2024

The Common Agricultural Policy (CAP) of the European Union is the main policy driver for the agricultural sector performance. It emphasizes specialization in regions with certain comparative advantages, anchored in a solid agribusiness value chain with a strong system of commercial networks. Agriculture is heavily subsidized by the CAP with the aim of satisfying the European Union's common market and its surpluses cause distortions to international trade.

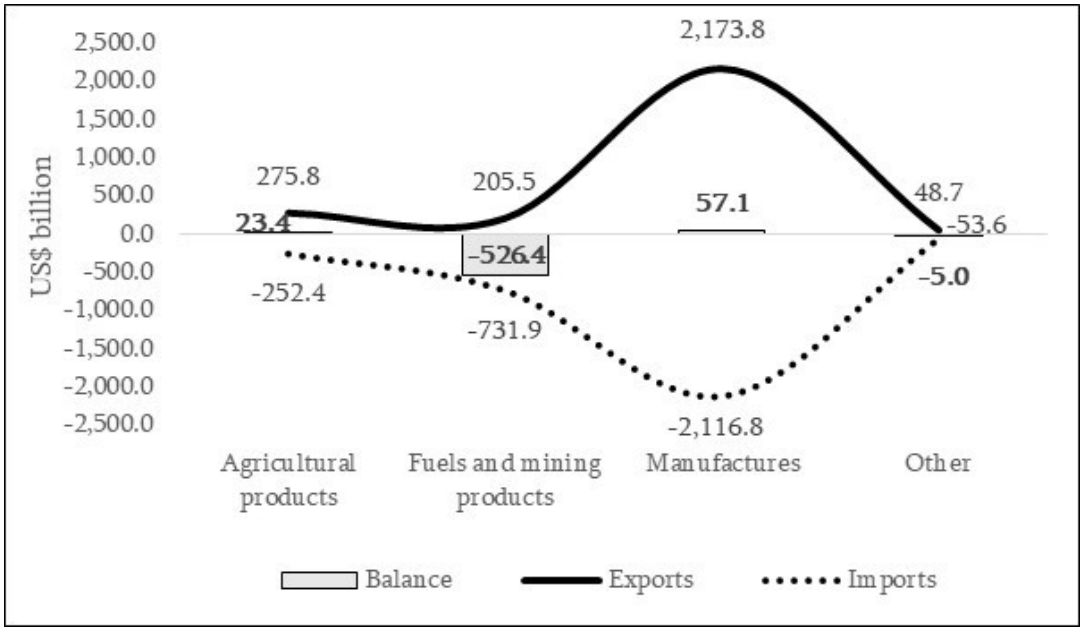
Graph 8: European Union leading production in crops and livestock, 2022



Source: Author's illustration based on FAOSTAT, online: https://www.fao.org/faostat/en/#data, 27/03/2024.

In 2022, the European Union recorded a negative trade in goods' balance of US$ 450.1 billion. Nevertheless, in the same year, this economic bloc was a net exporter of agricultural products with a positive agricultural trade balance of US$ 23.4 billion, as shown in graph 9 below.

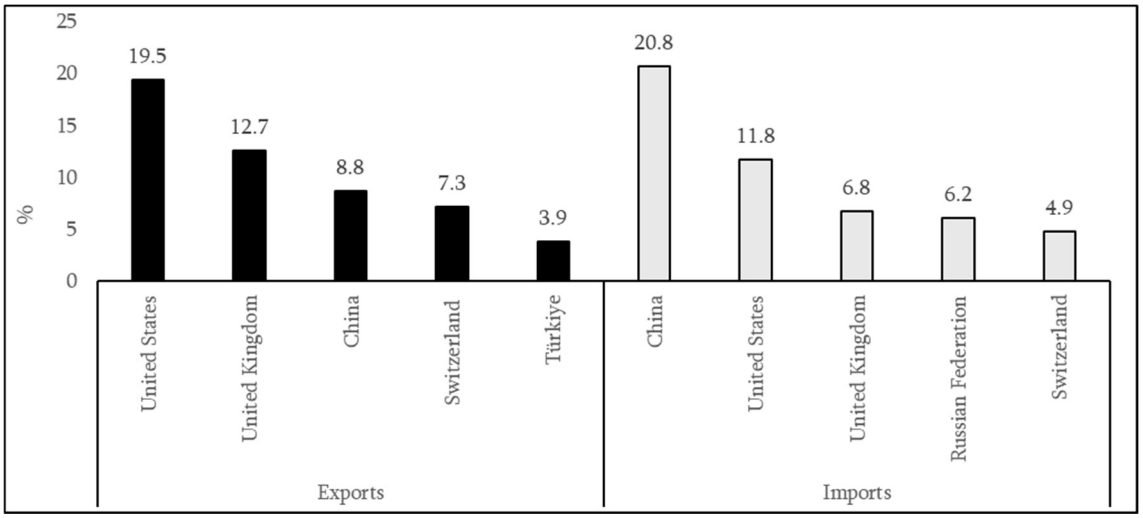
Graph 9: European Union main commodity group trade balance, 2022



Source: Author's illustration based on WTO Trade Profiles, online: https://www.wto.org/english/res_e/statis_e/daily_update_e/trade_profiles/US_e.pdf, 19/03/2024

The main destination for EU exports is the United States, followed by the United Kingdom, China, Switzerland, and Türkiye. On the other hand, the main importing partner of the European Union is China, followed by the United States, United Kingdom, Russian Federation, and Switzerland, as shown in the graph 10.

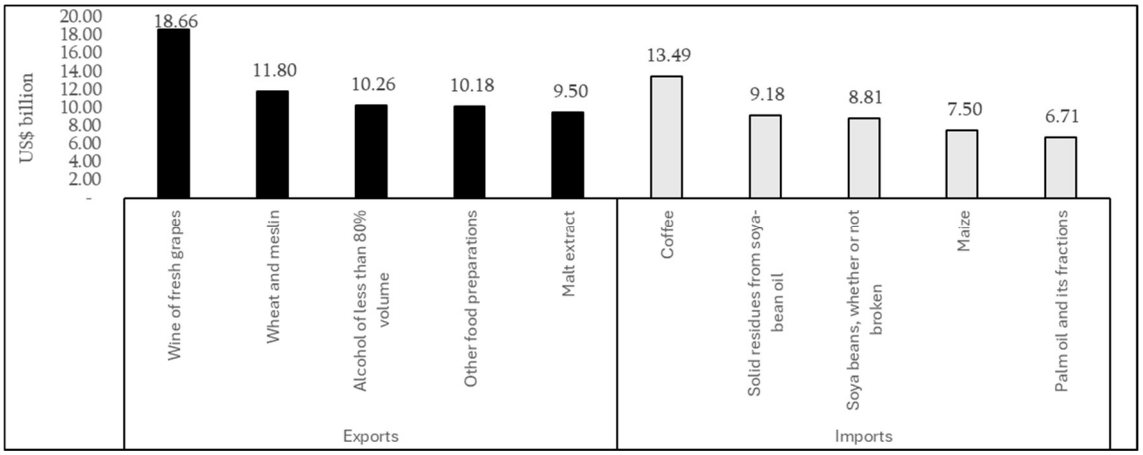
Graph 10: Main EU trading partners by destination and origin, 2022



Source: Author's illustration based on WTO Trade Profiles, https://www.wto.org/english/res_e/statis_e/daily_update_e/trade_profiles/US_e.pdf, 19/03/2024

The most exported European Union agricultural goods is wine of fresh grapes, followed by wheat, alcohol, other food preparation, and malt extract. On the other hand, the most imported agricultural product is alcoholic beverages, bread and other pastry products, coffee, various foods and wine.

Graph 11: Top exported and imported EU agricultural goods, 2022



Source: Author's illustration based on WTO Trade Profiles, online: https://www.wto.org/english/res_e/statis_e/daily_update_e/trade_profiles/US_e.pdf, 19/03/2024

The European Union has been one of the main importers of basic products from developing countries, especially Africa, thus boosting the growth of this sector within the scope of the multilateral trade system. Since the creation of the WTO, imports of agricultural goods from developing countries to the European Union have recorded steady growth, with an average annual growth rate of 5 percent between 1996 and 2001.

3.1.2 Agriculture in emerging markets and developing economies

The characteristics of agriculture in most the emerging markets and developing economies (EMDE) are subsistence agriculture, limited use of technology, manual-based labor, poor soil management, transhumant animal raising, and weak linkages to value chains or external markets.

Smallholder farming or small-scale farming, supports an estimated 500 million families worldwide, producing subsistence food but also some cash crops for which they create season work opportunities. Its productivity is very limited as their production factors are limited, producing on poor soils, facing cyclical droughts and relying on rainfall for as the only irrigation source.

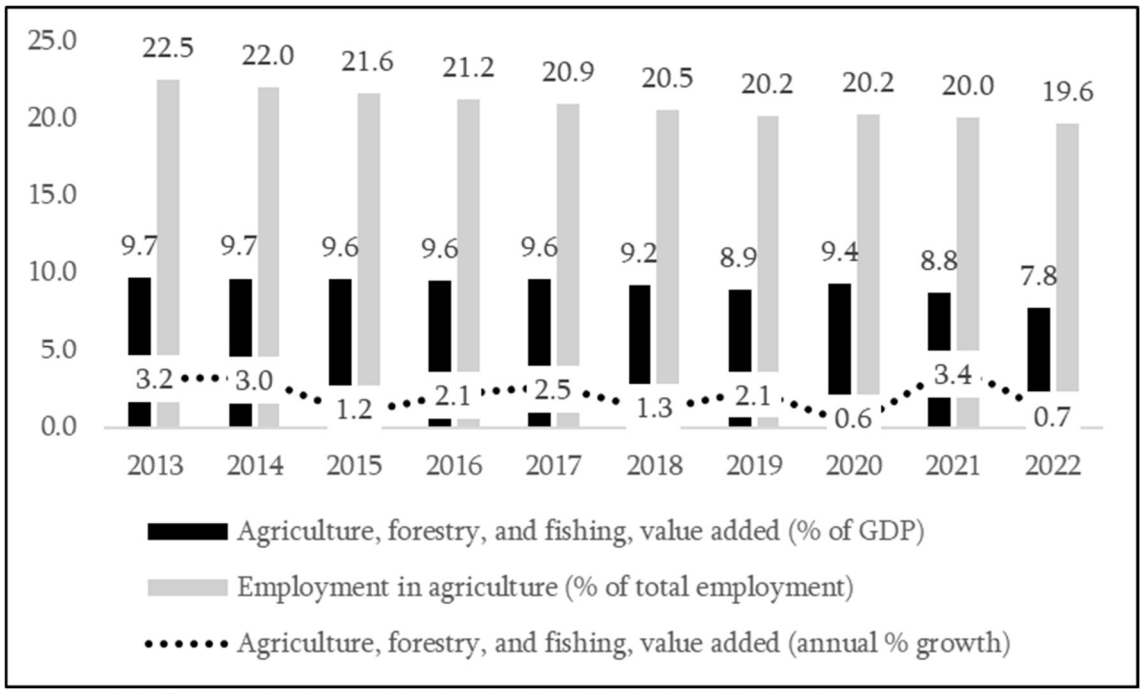
Basic crops, mainly maize, wheat, rice and some specific local crops such as cassava and sweet potatoes, represent most of the food produced by families in the rural areas. The unavailability of stocking infrastructure limits their negotiating power, hence forcing them to sale crops in season at a very low price. This practice hinders their capacity to create capital and efficiently fight against poverty.

Livestock is also an important source of living in many EMDE countries. In agriculturally difficult regions, households use livestock as the most important instrument to build capital, such as cows, goats, sheep and camels. According to FAO Statistical Database (FAOSTAT, online on 25/06/2024), more than 500 million people worldwide practice pastoralism. Additionally, communities develop their activity widely dispersed across large areas far from population centers.

The agricultural sector in EMDE has always been at the center of people's livelihoods, raising incomes and reducing hunger and poverty, hence transforming people's lives. Nowadays, many challenges are increasing every day because of human action on earth, especially extreme weather caused by climate change, affecting mostly countries in EMDE.

Agriculture in EMDE, especially in Africa, has now become more challenging for the billions of small-scale farmers (typically on less than five hectares) and pastoralist families who rely on agriculture as the main source of food. On the other hand, GFCF created new frontiers for agricultural activity introducing cutting-edge technology with flexible financial products and instruments, spurring unique opportunities for inclusive agriculture-led growth.

Graph 12: EMDE main macro agricultural indicators, 2022



Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 08/04/2024

Many challenges lay ahead emerging and developing economies when it comes to unlock the development potential of agriculture, but the major one is the ability to guarantee a sustainable and smooth growth of the sector, processing primary goods

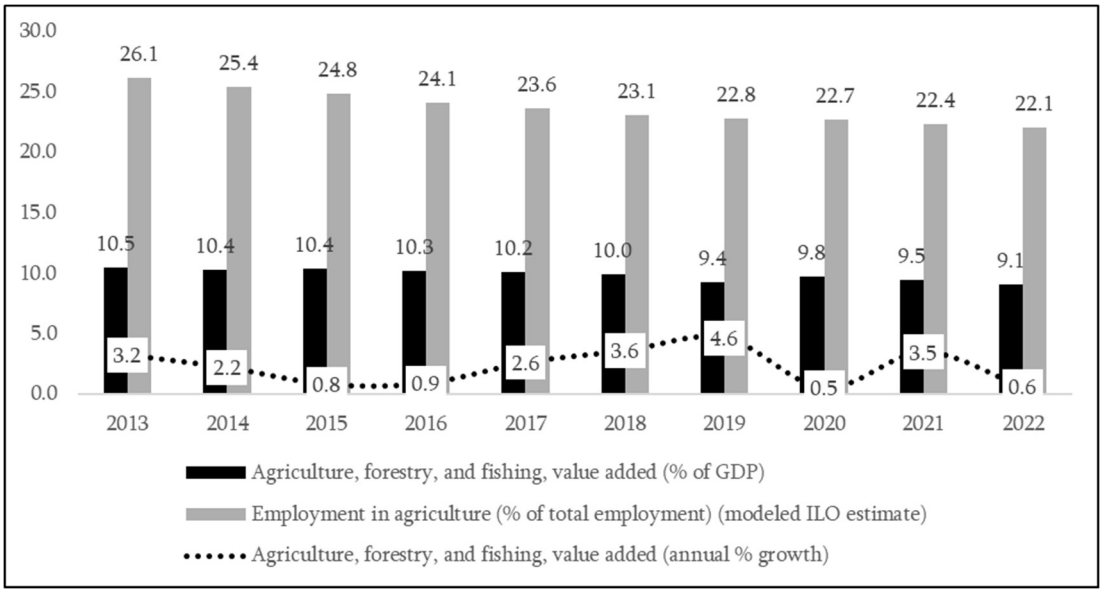
and progress into a more industrial-based economy. This would create sustainable demand for agricultural goods, hence increase in output and productivity to stabilize prices for the entire agri-business value chain and urban areas. Sustainable production would enable smallholders to build capital and be more poverty resilient.

Agricultural sector activity and its contribution to growth and development is different from one region to another based on its importance for growth and food security. Some regions are agricultural-based economies, some are more transformative and are already taking advantage of its value chain.

3.1.2.1 South and East Asia & Middle East and North Africa

In the South and East Asia (SEA) & Middle East and North Africa (MENA) macroregion, agriculture today does not play a substantial role for economic growth, with an average share of approximately 9.1 percent of GDP, 0.6 percent of annual growth rate and 22.1 percent of total employment, as shown in the graph 13 below.

Graph 13: SEA & MENA main macro agricultural indicators, 2022

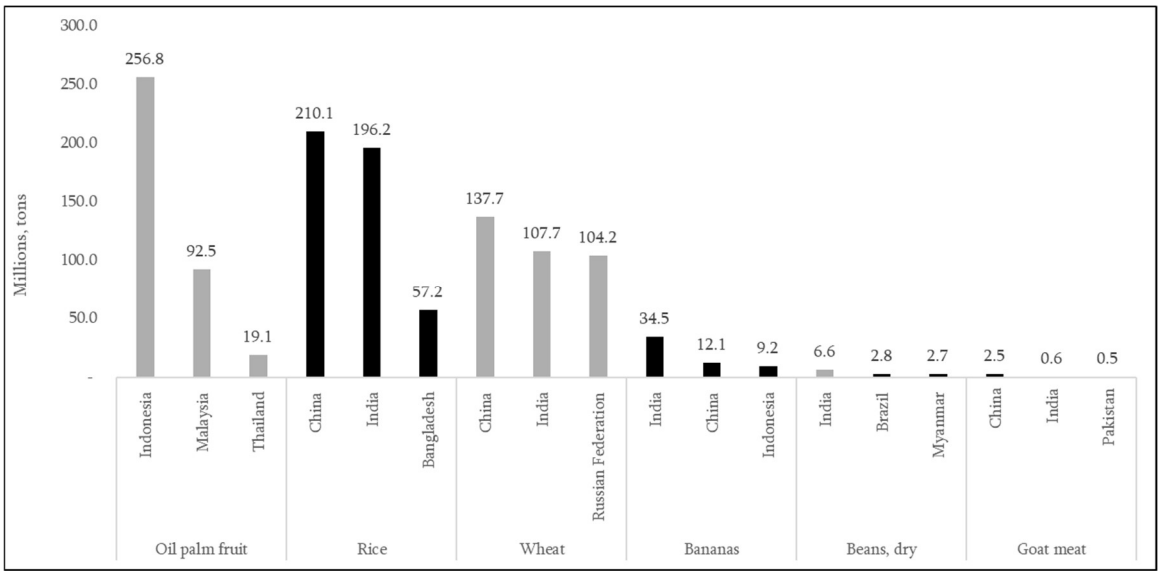


Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 10/04/2024

This group, led by China, but also India, Indonesia, Morocco, and many other, has approximately 3 billion rural inhabitants. Agriculture is critical to this group of countries, both economically and socially. Here, workers in the agricultural sector typically do so as independent small-scale farmers or pastoralists for subsistence purposes.

As shown in the figure below, in 2022, the SEA & MENA countries are in leading position as major world producers of different crops and livestock products, namely oil palm fruit, rice, wheat, bananas, beans and goat meat.

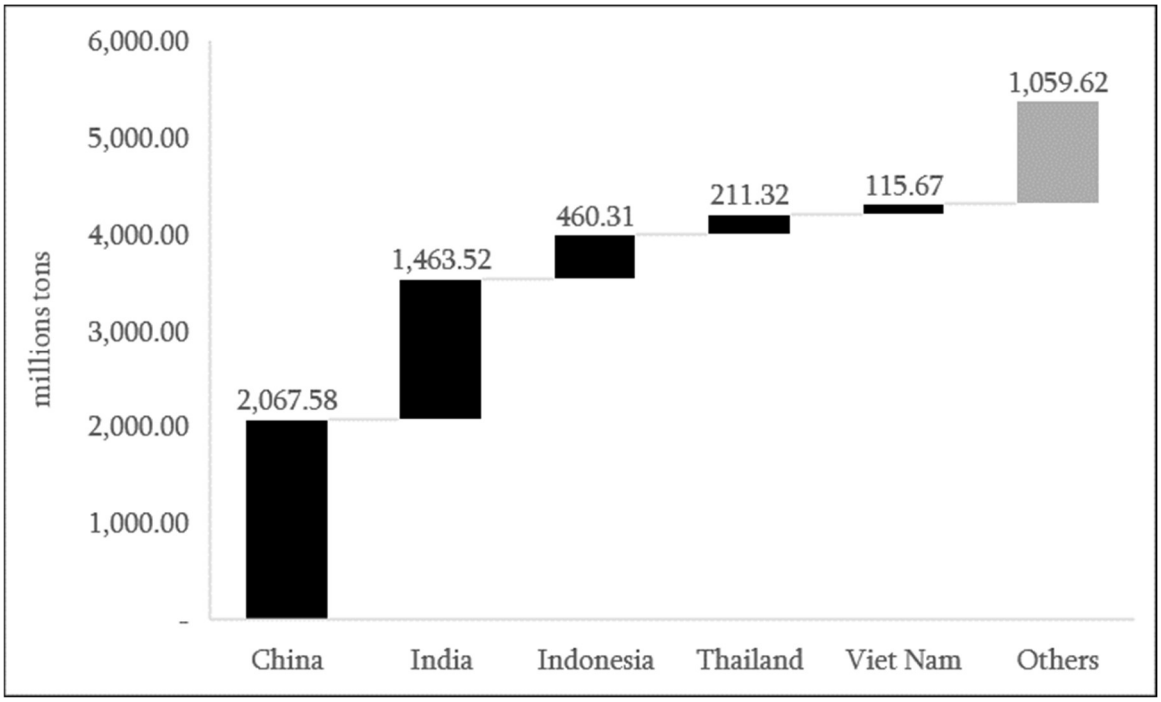
Graph 14: SEA & MENA leading position in crops and livestock production, 2022



Source: Author's illustration based on FAOSTAT, online: https://www.fao.org/faostat/en/#data, 27/03/2024.

In 2022, according to FAOTAT data displayed in graph 14, the largest crops and livestock producer was China, followed by India, Indonesia, Thailand and Viet Nam.

Graph 15: Major crop and livestock producers in SEA & MENA, 2022



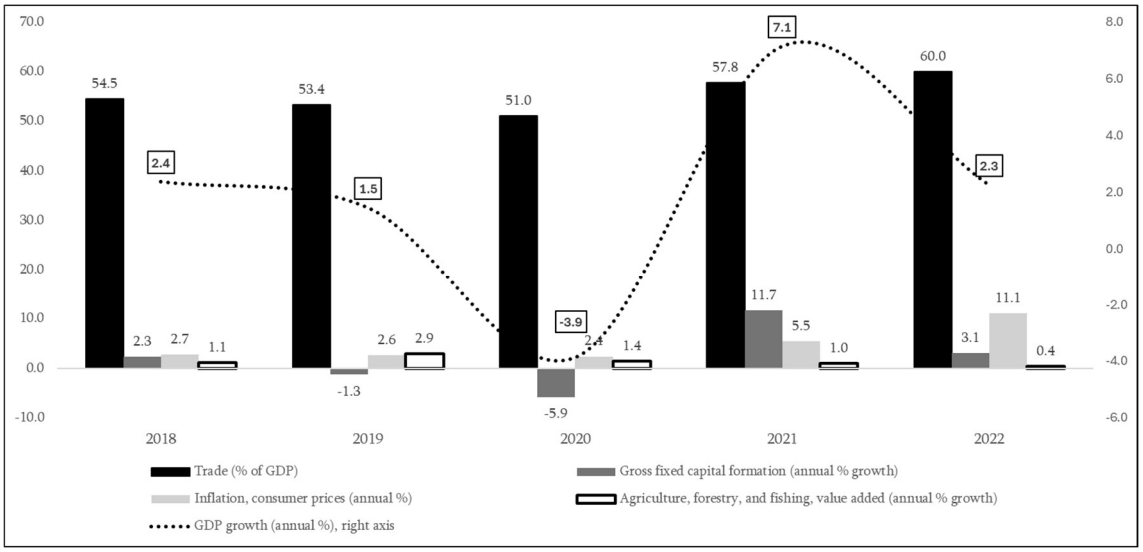
Source: Author's illustration based on FAOSTAT, online: https://www.fao.org/faostat/en/#data, 27/03/2024.

3.1.2.2 Latin America and the Caribbean & Central Asia

This macro region composed of Latin America and the Caribbean (LAC) states as well as Central Asia (CA) states is a diverse region, but similar in agricultural practices.

Fifty five percent of poverty in the LAC & CA macroregion is in the urban areas, but the agribusiness value chain is very developed, especially the food processing industry, accounting for almost one third of GDP. As shown in the graph 16 below, this macro region is a very open economy. In 2022 trade represented 60 percent of GDP, GDP growth stood at 2.3 percent and agricultural sector growth 0.4 percent.

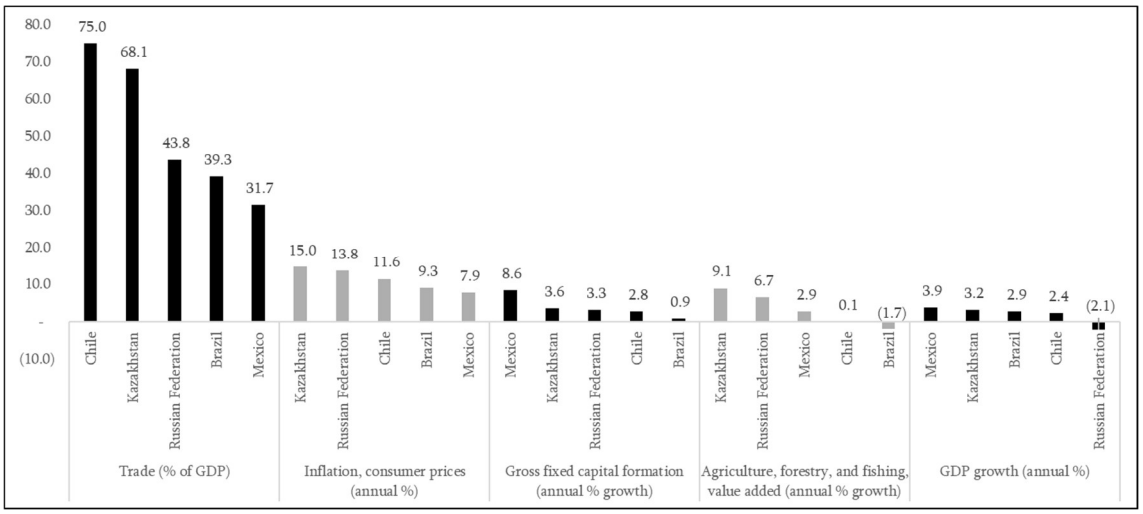
Graph 16: LAC & CA macro indicators, 2022



Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 10/04/2024

Five economies work as important anchors for the region, namely Brazil, Mexico, Chile, Russian Federation and Kazakhstan leading. As shown in the figure below, in 2022, Mexico was the most vibrant with the 3.9 percent of economic growth and 8.6 annual growth in GFCF, while Chile the most opened economy with trade representing 75 percent of its GDP.

Graph 17: LAC & CA country macro indicators, 2022



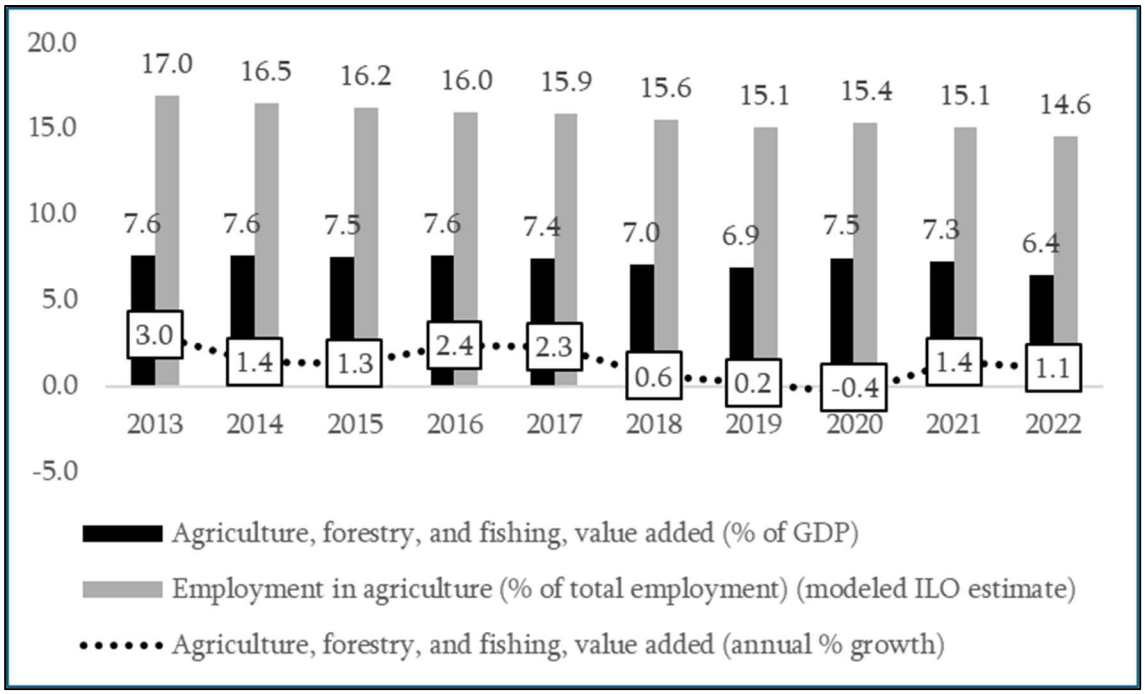
Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 10/04/2024

This macro region is characterized by agriculture good practices with lots of creativity, to overcome challenges and build resilience to face climate change. Production imbalances are well managed, avoiding therefore high price volatility.

But despite good agricultural sector performance, economic growth is, however, lagging other regions of the world, impacted mostly by geopolitical challenges, shaking commodity prices to which they depend on. However, most countries, with a few exceptions, have managed inflation below two digits with favourable impact on the interest rates and financing to real economy, including agricultural sector. Countries with better economic performance are

Latin America and the Caribbean & Central Asia macroregion is characterized as agriculture of urbanized countries. The agricultural sector, in 2022, contributed on average with 6.4 percent, 1.1 percent of annual growth rate and 14.6 percent of total employment, as shown in the graph 18 below.

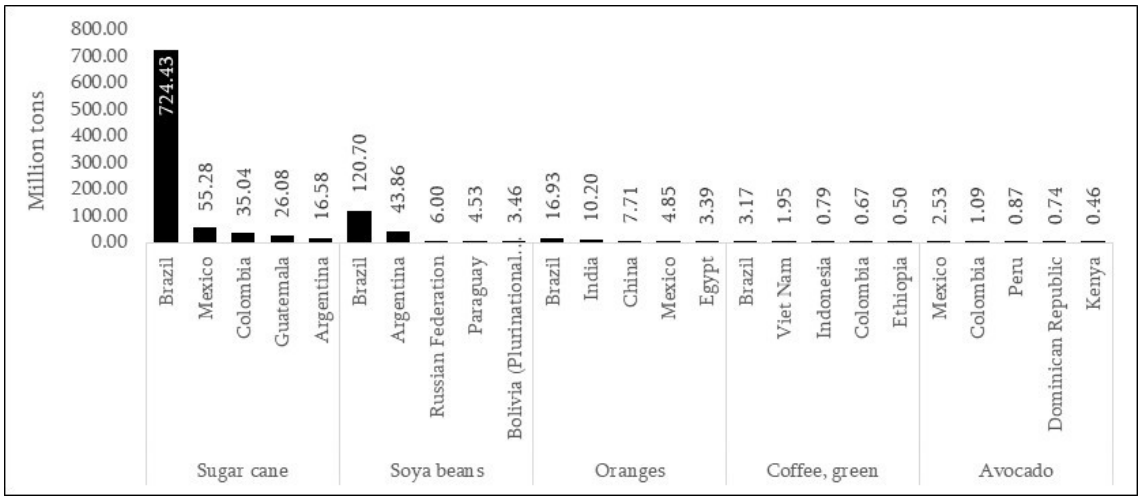
Graph 18: LAC & CA agricultural indicators, 2022



Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 14/04/2024

As shown in the figure below, in 2022, the LAC & CA comparative advantage in crops and livestock production is related to its climate conditions, especially fruits and cash crops. Brazil is worldwide dominant in much of the crops, namely sugar cane, soya beans, coffee and oranges. Mexico takes the lead in the avocado production.

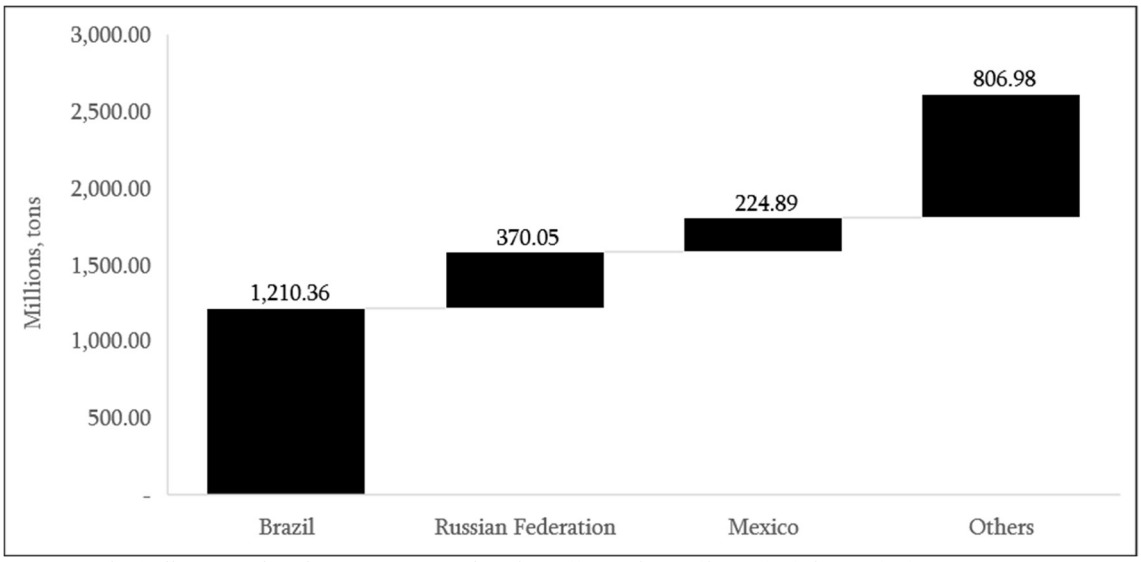
Graph 19: LAC & CA leading position in crops and livestock production, 2022



Source: Author's illustration based on FAOSTAT, online: https://www.fao.org/faostat/en/#data, 30/03/2024.

Finally, Brazil is the largest contributor to the food security in this macro region with more than 1,2 billion tons of crops and livestock production, followed by the Russian Federation with 370 million tons and Mexico with 224.8 million tons.

Graph 20: Major agriculture producers in LAC & CA, 2022



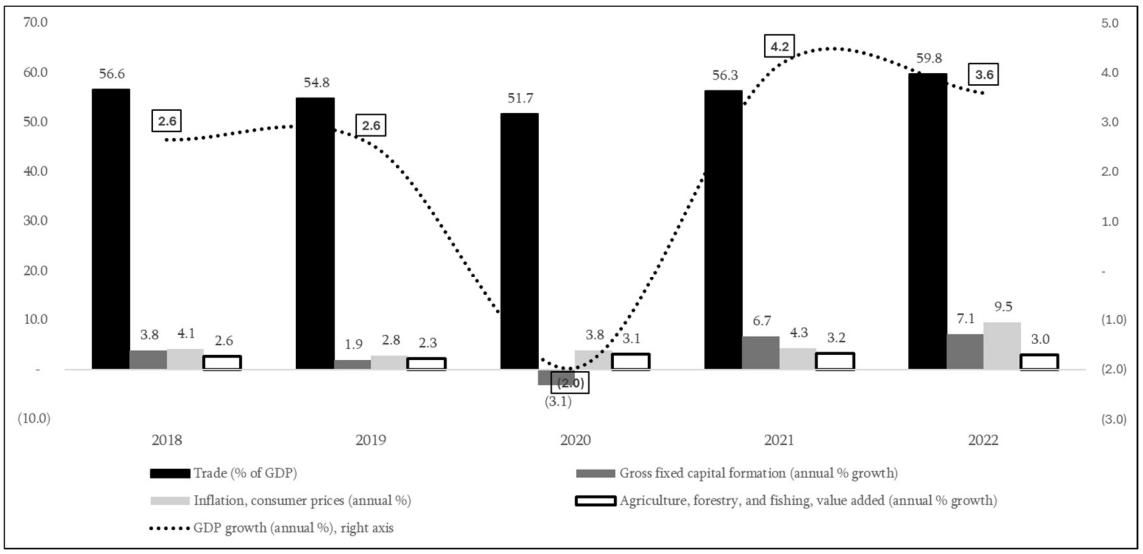
Source: Author's illustration based on FAOSTAT, online: https://www.fao.org/faostat/en/#data, 30/03/2024.

3.1.2.3 Sub-Saharan Africa

Sub-Saharan Africa (SSA) is a tremendously diverse macroregion rich in natural resources, composed of 49 countries (33 of which are least developed countries – LDC), a population of 1.2 billion. The development stage of the countries involved is very diverse and their development needs differ from one country to another. While some have already consolidated their political system and are benefiting of solid FDI inflows, other are conflict affected or fragile states.

According to the World Bank 2022 data shown in the graph 21, Sub-Saharan African economy is a trade-based economy with a share in GDP of approximately 60 percent and with an agricultural sector annual growth rate of 3 percent. With an annual growth rate of 3.6 percent in 2022, the Sub-Saharan Africa's economic growth in the last decade has in general been above the world average. For 2024 and 2025, the World Economic Outlook (WEO) of the International Monetary Fund (IMF) projects an annual growth rate of 3.8 and 4.0, respectively.

Graph 21: Sub-Saharan Africa macro indicators, 2022



Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 19/04/2024

Different crisis, including the COVID-19 pandemic, conflicts, military coups, or climate-related issues as well as population growth above economic growth rate, as

well as infrastructure availability have been affecting Sub-Saharan Africa's economic growth, forcing governments to face fiscal and monetary challenges such as debt distress and local currency depreciation. SSA's largest economies, such as Nigeria and South Africa, are also performing below average growth which is affecting neighboring economies.

The usage of human and natural resources (oil, gas, and minerals) below its potential is struggling to provide an opportunity to improve the fiscal and debt sustainability of Sub-Saharan Africa countries.

Almost half the Sub-Saharan Africa's population is young and up to 12 million youth enter the labor market every year. However, the speed of creating productive formal jobs is about four times slower.

In much of Sub-Saharan Africa, agriculture is a strong option for spurring growth, overcoming poverty, and enhancing food security. Agricultural productivity growth is vital for stimulating growth in other parts of the economy. But accelerated growth requires a sharp productivity increase in smallholder farming combined with more effective support to the millions coping as subsistence farmers, many of them in remote areas. Recent improved performance holds promise, and this Report identifies many emerging successes that can be scaled up.

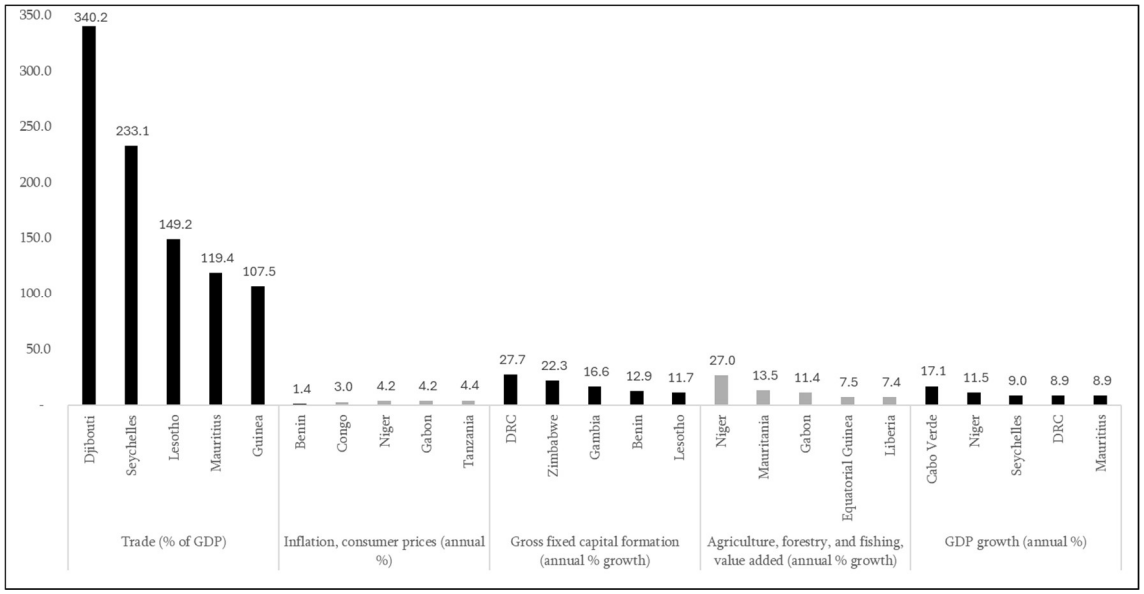
Agriculture productivity in Sub-Saharan Africa differs substantially from LAC & CA or East and South Asia & Middle East and North Africa. Diverse agriculture ecologic conditions create different farming ecosystems and food habits. For example, the most important staple foods in Sub-Saharan Africa are bananas or plantains, cassava and its leaves, corn, millet, rice, sorghum, sweet potatoes and its leaves, wheat, yams, and all respective value chain processed products. Most of these staple foods were chose due to its resilience to the absence of holistic irrigation systems, hence depend substantially on the quantity and frequence of the rain. Even though this macro-region is responsible for almost 10 percent of world's overall fresh water, , only less than 6 percent of the arable land in Sub-Saharan macro-region is irrigated (FAO

2023). This practice adds more farming risks than in other macro-regions mentioned above.

Many realities drive crops and livestock production in Sub-Saharan Africa. The first group of countries are small and landlocked countries. Most of them are small and the population density creates even more challenges to achieve economies of scale. On the other hand, almost 45 percent of SSA's population lives in landlocked countries, facing higher transport costs when compared to coastal countries, which reduces the competitiveness of products from the countries involved. The second group are conflict-affected countries with substantial negative impacts on growth, especially on agricultural and rural development. Internally displaced people (IDP) tend to reach urban areas seeking for refuge. This creates vast distances and low population density in rural areas which increases costs on trade, infrastructure, and many other services.

In 2022, Sub-Saharan Africa proved to be a very diverse macro-region. Graph 22 below shows that while some economies remained very open like Djibouti and islands or landlocked states (Seychelles, Mauritius or Lesotho), other show solid monetary policy management with controlled inflation like Benin, Congo and Niger. Niger is also a champion agriculture, forestry and fisheries annual growth, followed by Mauritius and Gabon. In this same year, Cabo Verde, Niger and Seychelles where the three most vibrant economies, with 17.1, 11.5 and 9 percent, respectively.

Graph 22: SSA country macro indicators, 2022



Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 20/04/2024

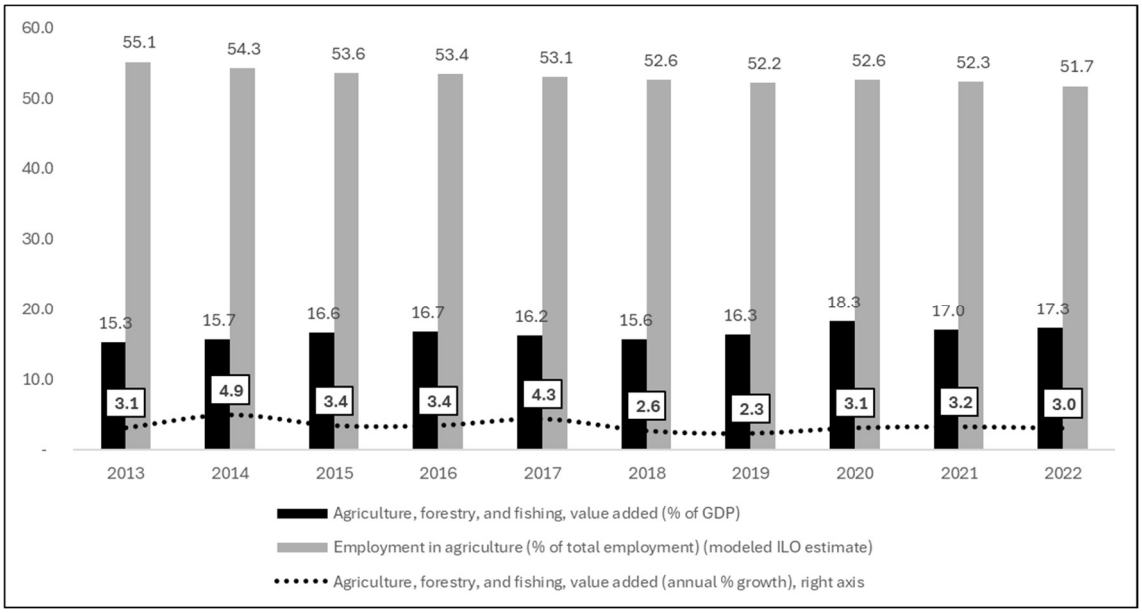
Regional economic integration processes, especially preferential or free trade areas of different regional economic communities, have been serving as a catalyst for agricultural sector development. It provides a concrete and phase-out mechanism to implement agricultural policy commitments vis-à-vis agri-food products.

Sub-Saharan Africa, including the poorest countries, is waking up from its food import dependency and is adjusting its policies to be a game changer, that is, attain food security and become net food exporter. Some governments enhanced their macroeconomic management and together with their international partners (donors and international organizations) have made agriculture a higher priority, allocating more of their financial resources towards a green (food) revolution.

This focused approach and solid government strategic and sectorial commitments are showing some results. As shown in graph 22 below, agricultural economic growth in Sub-Saharan Africa has accelerated in the five years from 2.6 percent in 2018 to 3.0 percent in 2022. Consequently, in the Sub-Saharan Africa macroregion, agriculture is a major employer with more than 50 percent of job

availability. On the other hand, the agricultural sector remains anchored with low productivity with its 17.3 percent average share to the GDP.

Graph 23: SSA agricultural indicators, 2022

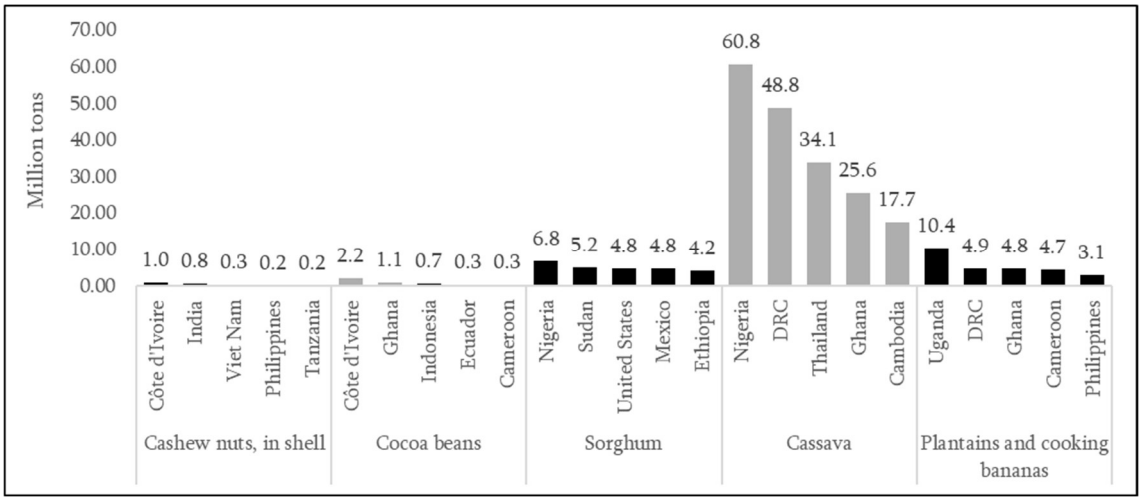


Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 20/04/2024

Agriculture remains critical to household food security, however, due to scarce agriculture value chains, poor smallholder farmers are unable to take advantage of the food market, particularly in inaccessible areas. The overall goal for agriculture-based countries of Sub-Saharan Africa is to secure sustained agricultural growth above population growth rate to reduce poverty and improve food security.

Graph 24 below shows that, in 2022, Sub-Saharan Africa is leading worldwide in some specific crops and livestock production, most of it involved in international trade transactions such as cocoa and cashew nuts. Nigeria and Côte d'Ivoire are by far the largest contributors.

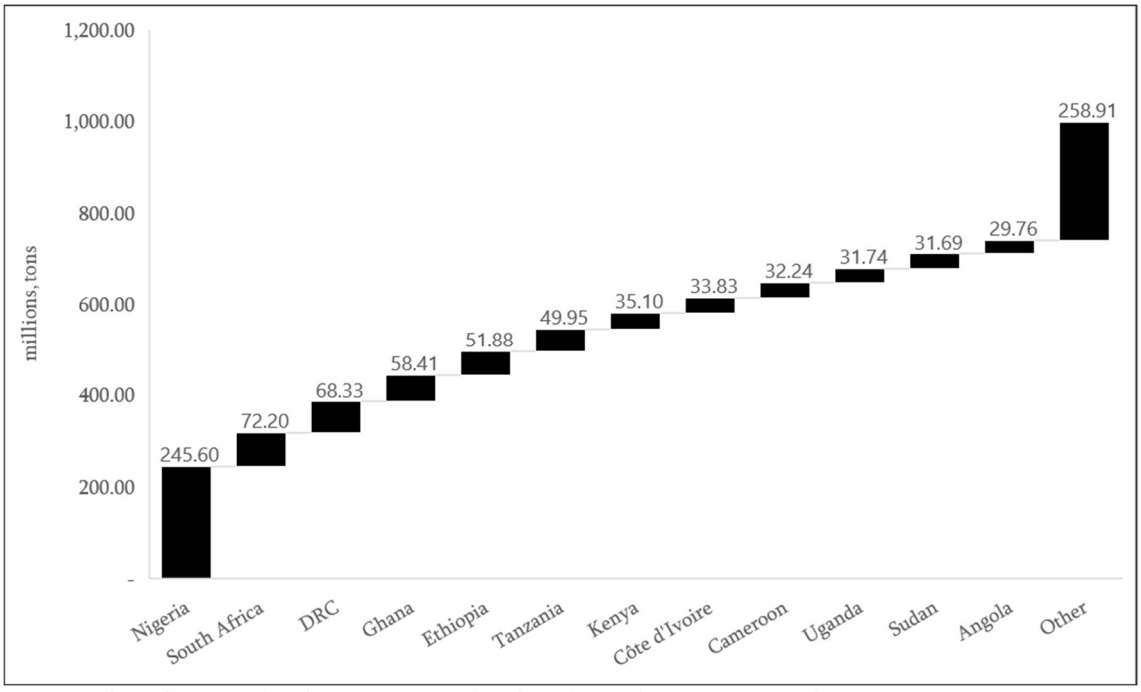
Graph 24: SSA leading position in crops and livestock production, 2022



Source: Author's illustration based on FAOSTAT, online: https://www.fao.org/faostat/en/#data, 31/03/2024.

In 2022, based on FAO database displayed in graph 25, the largest agricultural producer in Sub-Saharan Africa was Nigeria, followed by South Africa and Democratic Republic of Congo.

Graph 25: Major agriculture producers in SSA, 2022



Source: Author's illustration based on FAOSTAT, online: https://www.fao.org/faostat/en/#data, 31/03/2024.

3.2 ECONOMIC DEVELOPMENT OF ANGOLA

Angola occupies an area of 1,246,700 square kilometers and has a population of approximately 35 million inhabitants. The country is located on the southwest coast of Sub-Saharan Africa, limited to the west by the Atlantic Ocean, to the north by the Republic of Congo, to the north and northeast by the Democratic Republic of Congo (DRC), to the east by Zambia, and to the south by Namibia.

Its territory is extremely diverse made of a coastal strip of 1,650 kilometers bordering the Atlantic Ocean to the hinterland with a central plateau (1,520 – 1,830 meters high), savannas, rainforest (Mayombe) and desert (Namib Desert) and its climate varies according to climate zones, going from tropical, moderate tropical, sub-tropical and arid zones. In the north, the provinces of Cabinda and Zaire have a humid tropical climate.

The zone from provinces of Luanda to Benguela as well as the east part of the country there is a moderate tropical climate and in the central plateau prevails a dry climate. In the southwest, especially south of Namibe province, prevails a desert climate. The average temperature in Angola is 22 degrees centigrade and it has two agricultural seasons, one cold and dry from May to September and the other warm and rainy from October to Abril. Temperatures vary from the coast (warmer) to the hinterland (cooler).

Angola is rich in valuable natural resources such as oil, natural gas, diamonds, and has an extensive network of waterways. The country is the second largest oil producer in sub-Saharan Africa with approximately 1,1 million barrels per day, and diamond, being between the three largest producers in Sub-Saharan Africa.

The Portuguese discovered today's territory of Angola in the late 15th century on their way to India for better spices' trading conditions. Soon, the Portuguese and the Congo Kingdom, and lately the Ngola Kingdom, swapped the brotherhood relations and engaged in trade activities. The slave trade became the most dominant economic activity aiming at to feed the Brazilian labor market until the late 19th

century with severe impacts on the socio-economic development of the territory. The Portuguese were the only colonial power governing today's territory of Angola with a slight interruption from 1641 to 1648, when the territory fell under Dutch control. After the Berlin Conference in 1884-1885, Angola started to be systematically and "effectively occupied" and lately, ate the beginning of the 20th century, became a colony of the Portuguese Empire (Kevlihan, 2008, p 47).

In a relatively short period of time, the Portuguese implemented an efficient administration of the territory, unlocking the economic potential given the existent comparative advantages. The much-needed capacity building was secured by a massive Portuguese immigration, with a strong business orientation, and segregation policies (without the right to citizenship) towards the local African population enabled the use of local slave labor force. and that of an.

During colonial era, the smallholder farmers engaged in small-scale agriculture, mostly producing products required by the colonizer (coffee, corn, sisal), paying taxes and fees of various types, and often forced, by economic circumstances and/or administrative pressure, to accept poorly paid jobs. At that time, Angola became the 4th largest coffee producer and the 2nd in Africa.

The colonization period in Angola was based on exploitation of local communities and deprived them from right to self-determination, bringing and fermenting a feeling of revolt. Consequently, many nationalist movements sprung up like mushrooms after rain.

The liberation struggle started in 1961 and, with the aid of the eastern European countries and Cuba, but also western countries in 1975 Angola became independent from Portuguese administration. After independence, Angola plunged into a long lasting and devastating civil war, from 1975 to 2002, embodying partially the Cold War at the time, that is, one movement supported by eastern European countries and Cuba and the other by western countries. In 2002, a peace agreement was signed between both parties, and both armies were merged to form a single army.

Today, Angola is the second largest oil producer in Sub-Saharan Africa, after Nigeria. The country holds abundant untapped oil and gas resources and currently produces approximately 1 million oil barrels per day (mbpd). The oil industry is systemic in the country's economy and accounts for almost 25 percent of its GDP, but 60 percent of its revenues and 90 percent of its exports. The remaining 75 percent of its GDP is 60 to 70 percent informal with little impact on the public revenues.

3.2.1 Economic policy and performance

Angola is currently one of the most dynamic Sub-Saharan African economies, backed substantially by the extractive sector, mainly oil, gas and diamonds. But, in the last decade, the local government has been designing and implementing economic policies to diversify the economy to other sectors, namely the agribusiness value chain.

Nevertheless, the Angolan economic model is still facing many challenges. The efforts undertaken to reduce dependence on the extractive sector is still not sufficient to build the country's resilience during extractives' price shocks. Additionally, the economic policies put in place still need to mature to secure a more inclusive growth.

There are therefore many social, economic and financial issues, which call for a profound paradigm shift to ignite a more robust economic development, transforming potential wealth into real wealth.

A. REAL SECTOR

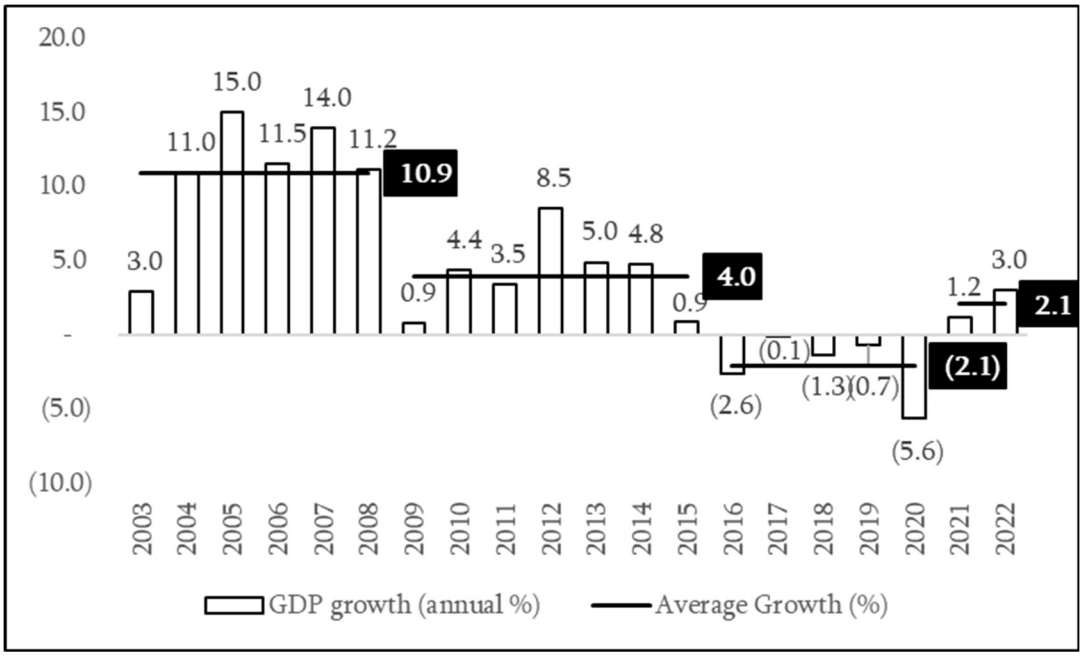
In recent years, Angola has experienced several major developments, which have profoundly affected not only its economic but also financial model. The first was the impact of the oil price shock that started in mid-2014 until 2015, which put on proof the country's economic and financial stance of the last decade. In this first moment, the country has paid a high price for its extreme dependency on hydrocarbons, which led to a long 5-year (2016-2020) period of macroeconomic

instability, deteriorated later by the COVID-19 pandemic. During that period of recession, macroeconomic indicators have deteriorated, widening budgetary and external account deficits, which led to an increase in public debt. This performance brought a significant depreciation of the local currency and, consequently, high inflation.

The other significant moment was political change which occurred with the succession of José Eduardo dos Santos who ruled for 38 years, from 1979 and 2017, by his successor, João Lourenço. The new president sent signals of paradigm shift by implementing measures to consolidate the democratic state and rule law, and fight against corruption and impunity. The consolidation of power with a better government communication brought a new economic moment ending the long recession period and starting a new period of economic growth from 2021.

As shown in graph 26 below, after the end of the civil war in 2002, from 2003 to 2008, Angola's economic growth had been exceptional: it exceeded in average 10 percent. This growth was mainly fueled by the country's oil production, reaching 1.6 mbpd in average. During this period, Angola became the second largest oil producer in Africa behind Nigeria. From 2009 to 2015, affected by the world’s economic and financial crisis in 2009, its production increased but was not capable to counterbalance the non-oil sector performance, representing around 60 percent of GDP.

Graph 26: Angola's economic growth rates

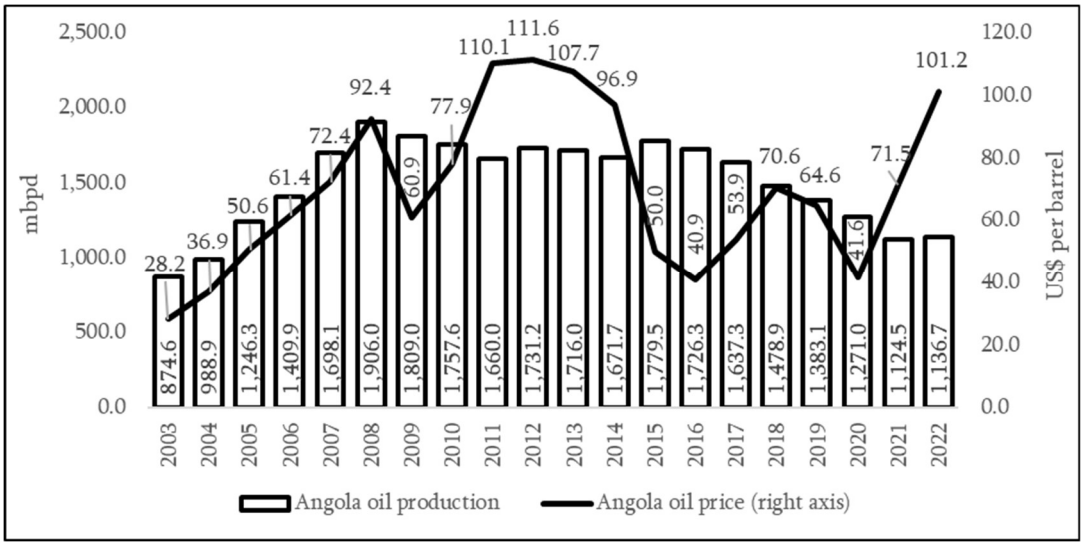


Source: Author's illustration based on World Bank, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, 30/04/2024

The oil sector at that time represented almost 40 percent of GDP and 90 percent of the country's export earnings. The average growth rate during this period stood at 4 percent. During the period 2016 to 2020, the Angolan oil price, influenced by **B**rent crude as a global benchmark for oil prices, dropped to US$ 54 per barrel. During this period, most oil international companies based in Angola were operating below their break-even threshold. This development discouraged production in the fields in production, as well as future investments in research and prospecting.

As shown in the graph 27 above, the last period, starting from 2021 onwards, is considered a new chapter of the Angolan economy as it reflects the end of the 5-years economic recession and the beginning of a joint government, private sector, civil society, and international partners' efforts for a solid and continued diversification of the economy. This represents the foundation of the new Angolan economic model. The reforms initiated by the government of Joao Lourenço, with the support of the IMF (2018-2021), have enabled the government to collect the dividends of the reforms carried out since 2017.

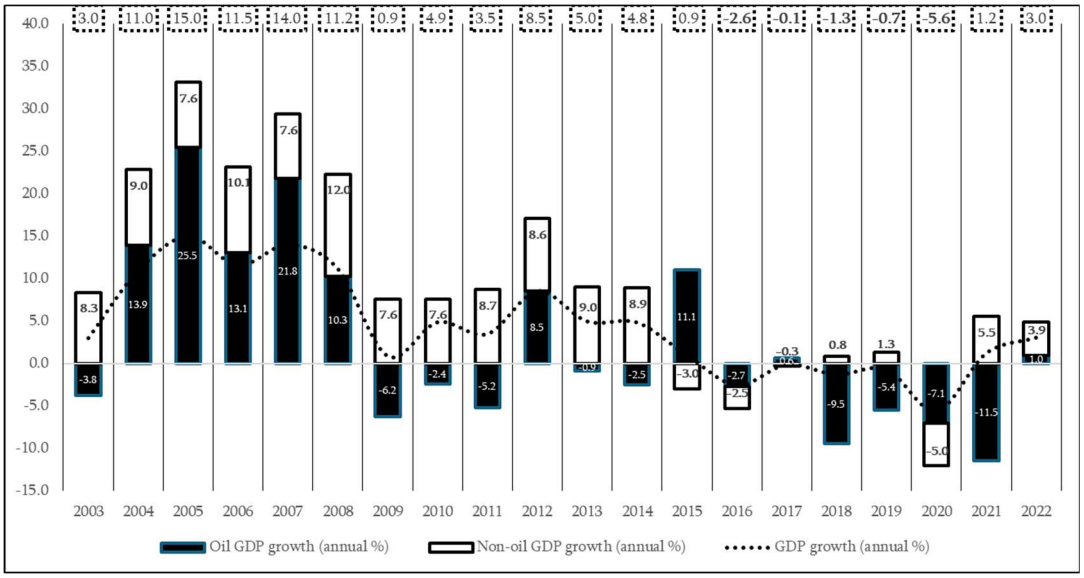
Graph 27: Angola's oil sector: price and production



Source: Author's illustration based on Ministry of Finance of Angola, online: https://minfin.gov.ao/macroeconomia/contas-nacionais%28PIB%29, 05/05/2024

Graph 28 shows the non-oil sector becoming a solid determinant of growth in Angola, with the strength to counterbalance the negative performance of the oil sector in 2021. This year was also marked by comfortable external and budgetary surpluses. They relate as much to improving the business climate and the fight against corruption as to measures aimed at increasing the share of non-oil revenues, controlling public spending and making the exchange rate more flexible.

Graph 28: Oil and non-oil GDP growth rates in Angola

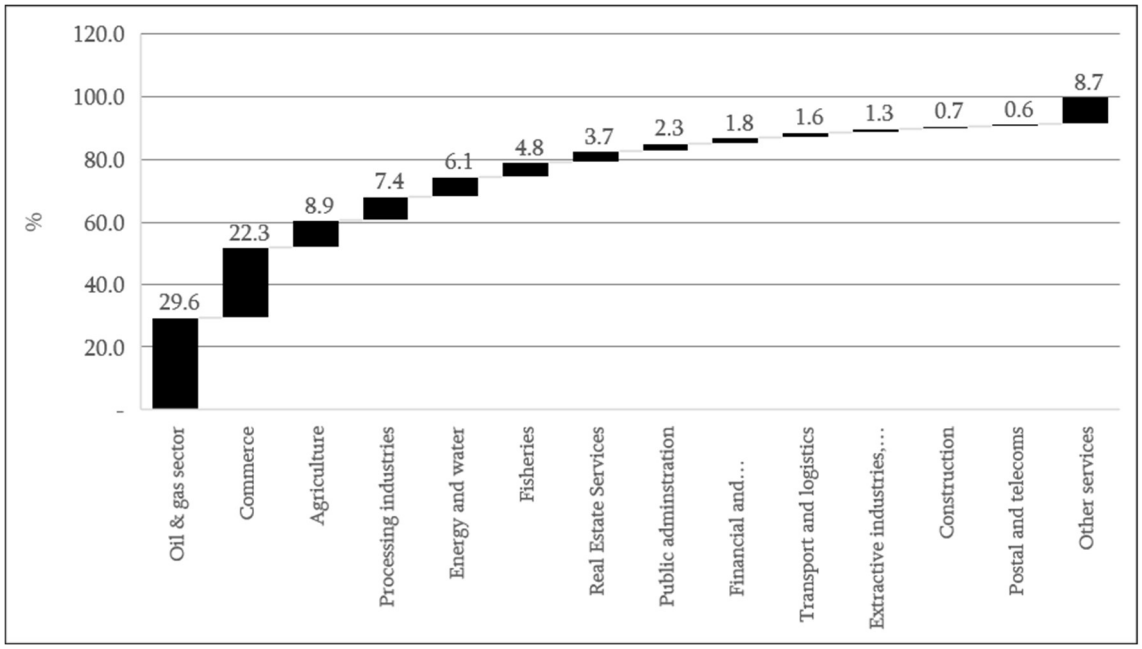


Source: Author's illustration based on https://www.ine.gov.ao/inicio/estatisticas, 30/04/2024

Besides, the oil sector is also rich in other natural resources such as diamonds, iron, copper, manganese, uranium, and phosphates. Taking advantage of its rich natural resources, Angola has become a huge construction site after the civil war, aiming at rebuilding the country's infrastructures with commercial loans guaranteed mainly by oil supplies. This construction boom has attracted the know-how from many migrants from all over the world, especially Brazilians, Portuguese and Chinese.

If the absence of economic diversification is a primary obstacle to economic and human development (the hydrocarbon sector employs less than 10 percent of formal sector workers), the absence of ambitious public policy constitutes an equally important obstacle.

Graph 29: Sectorial contribution to GDP in Angola, 2022



Source: Author's illustration based on https://www.ine.gov.ao/inicio/estatisticas, 30/04/2024

The Angolan economic model is still directly or indirectly dependent on the oil & gas sector, both for fiscal and external sectors (see graph 29 above). This contribution of the oil sector in the economy has been decreasing over the years with the fall in prices which has been discouraging oil companies from further production.

Oil production dropped from 1.8 mbpd in 2015 to 1.2 mbpd in 2021, representing 30 percent in that same year.

With this dependency on the oil sector, also called Angola's "Dutch disease", economic growth is extremely fragile and there is a call for a more robust, quick and disruptive performance of the non-oil sector. According to the Long-Term Strategy "Angola 2050" as growth prospects until 2050 are uncertain with high risks due to declining production in the oil sector due to lack of significant investments from international oil companies. By 2050, the oil sector share of GDP should be below 5 percent, which should shake with all sectors of the economy.

But the challenges to economic diversification are substantial, mainly due to the low level of capacity building in productive jobs which affects competitiveness of the country. Angola is yet to develop growth drivers to unlock potential growth and make it more resilient to exogenous shocks.

The initiatives taken by the authorities to respond to these economic diversification challenges are still to mature, including efforts towards changing corruption perception and easing the business climate. Many initiatives were implemented under the 2018 to 2022 National Development Plan (NDP), but some are worth mentioning, namely:

(i) PRODESI (Production Support, Export Diversification and Import Substitution Program)

This program aims at i) enhancing Angola's business environment, ii) increasing national production, iii) reducing imported goods in which Angola has comparative advantages, iv) increasing exports of surplus and competitive national products, v) diversify sources of foreign exchange away from the oil sector and iv) attracting more foreign direct investments. Its results were contagious, as it was able create a narrative on the fundamentals of the drivers of the economy with focus on the building value chains. There was a need to ignite the economy by creating all possible segments of the value chain with solid links. Before PRODESI only less than

50 agribusiness projects per year were financed but from 2020 to 2022 more than 1,400 agriculture and food processing projects were financed, which affect the performance of the sectors involved (agriculture, processing industry, transportation, commerce) and helped building and strengthening value chain segments. The financing approach carried out was to finance mainly scale-up projects, minimizing tough risks and reaching quick development impact results.

(ii) PREI (Formalization of the Informal Economy Program)

This program aims to contribute to a more appropriate structuring of the labor market and the creation of fairer competitive conditions, in particular by encouraging the regularization of economic activity. According to data on PREI, it has formalized more than 250,000 informal market operators, out of which 50,000 got trained and more than 5,000 had access to microcredit. This program brought a different perspective on how the government sees the informal economy not as the grey economy as a result of criminal activities but as segment of the economy to be sterilized with capacity building to better access the financing market, especially microcredit. On the other hand, access to capacity building and micro-credit is subject to social security registration and tax identification designed for micro economic operators. Additionally, the sustainability of the program was anchored on the linkage with other up and downstream programs. On the up-stream side is the Social Protection Strengthening Program "Kwenda", financed by the World Bank, where cash transfers are transformed into production inputs, mainly in agriculture. On the downstream side PRODESI was adjusted to capture the best formalization experiences with scalable projects to be financed.

(iii) PROPRIV (Privatization Program)

This government program was created for the privatization and reprivatization of (i) public companies (either held directly by the State or by other public entities) and (ii) other public assets. According to the Institute of Management of State Assets and Holdings (IGAPE), PROPRIV had identified 166 companies directly or indirectly

held by the Angola State to be privatized. By 2023, 103 had already been privatized for a price of more than US$ 1 billion, out of which 40 industrial units, 16 food-processing units and 7 agricultural units. Privatized assets had been paralyzed for more than 5 years and are now boosting the economy.

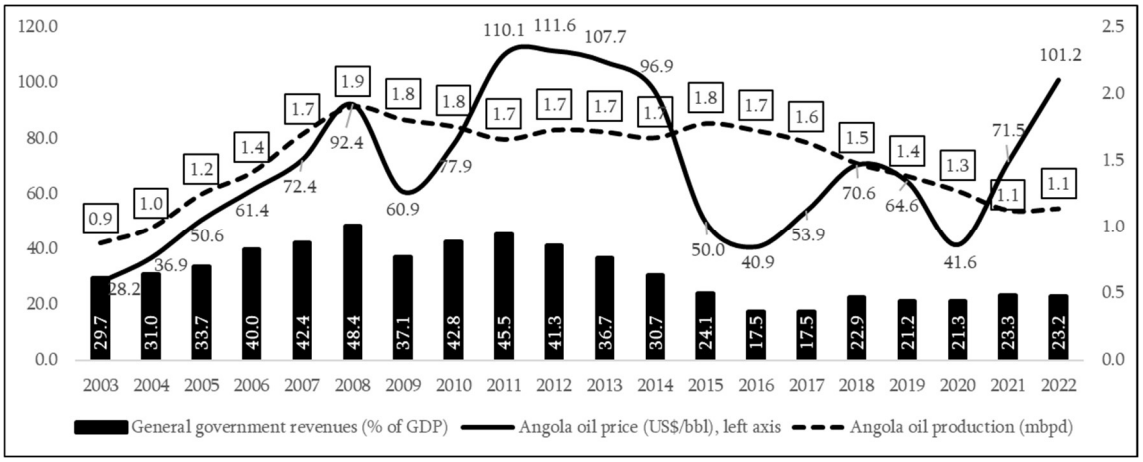
B. FISCAL SECTOR

The severe drop in international oil prices in 2014 has had a substantial effect on fiscal revenues, dropping from 36 percent of GDP in 2013 to 17 percent in 2016. The consequences of this fiscal stance on the budget performance were enormous, especially to extend or maintain public infrastructures with impact on social and economic government commitments.

This challenging fiscal performance was promptly tackled by the government with some specific measures. From the expenditure side, in 2020 a legal framework on the steering, management and reform of public enterprises was approved with the objective of privatizing State's assets and shares through PROPRIV. As mentioned above, a total of 195 assets had been listed for privatization and later adjusted to 166 assets, out of which 106 had already been privatized for a price of over US$ 1 billion.

From the revenue side, as shown in graph 30 below, the state budget is very dependent on oil revenues. Oil revenues rely on quantities produced and on the international price per barrel on international markets.

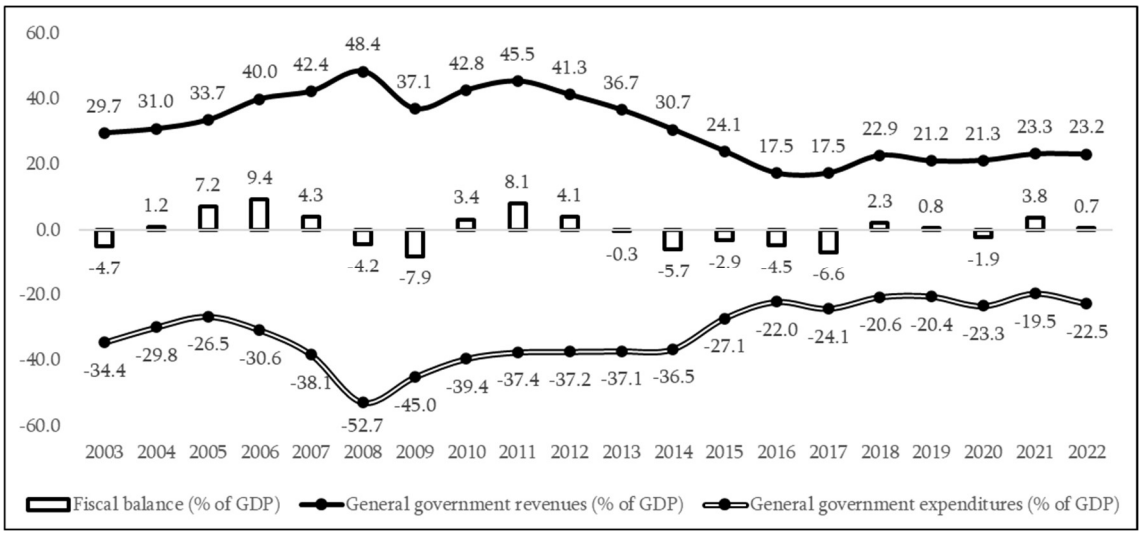
Graph 30: Determinants of fiscal oil revenues in Angola



Source: Author's illustration based on MINFIN, online: https://minfin.gov.ao/macroeconomia/contas-nacionais%28PIB%29, 05/05/2024; and
IMF WEO, online: https://www.imf.org/en/Publications/WEO/weo-database/2024/April, 02/05/2024 (general government revenues)

The excessive dependency on the oil sector with very timid economic diversification with diversified tax base made the fiscal policy very challenging. The sharp drop on oil prices from mid-2014 to 2016 led to fiscal expenditures contractions which provoked consecutive budget deficits from 2014 to 2017, as shown in the figure below.

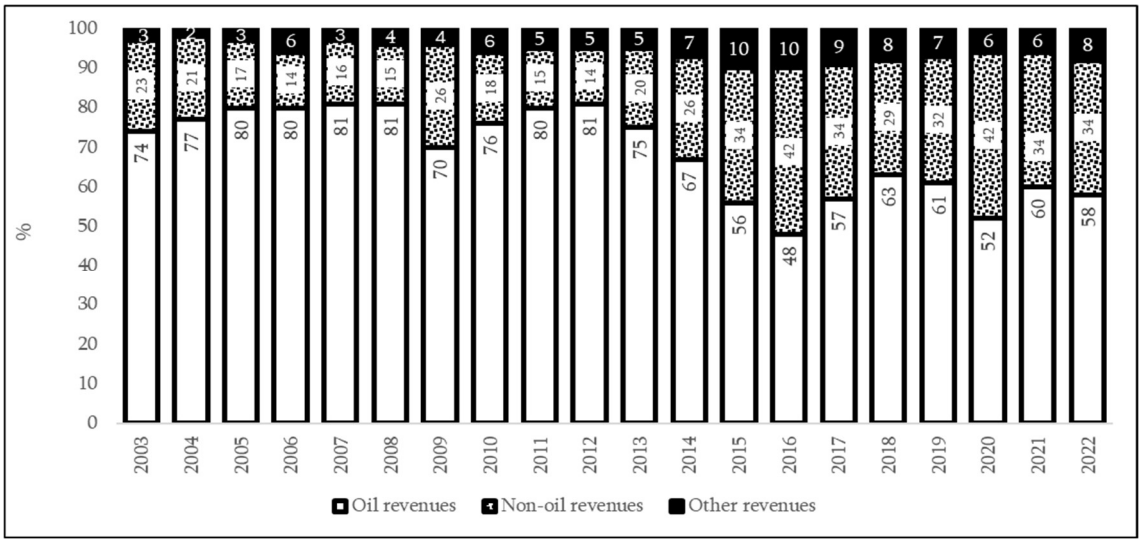
Graph 31: Angola government fiscal balance



Source: Author's illustration based on IMF WEO, online: https://www.imf.org/en/Publications/WEO/weo-database/2024/April, 02/05/2024

In 2012, according to graph 32 below, oil revenues represented more than 80 percent of government revenues which had a discouraging effect on broadening the tax base or deepening economic diversification efforts. However, when confronting graph 31 above, the increasing relative contribution of non-oil revenues to the overall revenue pool is a result of the decrease in the oil revenues rather than an increase of the share of non-oil revenues. Challenges related to the revenue collection capacity remain, notwithstanding the government efforts to overcome this concern.

Graph 32: Structure of government revenues in Angola



Source: Author's illustration based on MINFIN, online: https://minfin.gov.ao/macroeconomia/contas-nacionais%28PIB%29, 05/05/2024

In 2018, the IMF approved a three-year agreement with Angola under the Expanded Financing Program (EFF), in the amount of US$ 3.7 billion to support the country's economic reform program. The agreement was conceived to support the Angolan government to restore macroeconomic imbalances, especially with fiscal and external accounts, as well as create the enabling environment for a private sector-led economic diversification. Matters as budgetary consolidation, debt sustainability, monetary policy management to reduce inflation, exchange rate flexibility and economic competitiveness were some of the conditionalities before disbursement.

The reforms undertaken during the EFF program allowed to structurally improve Angola's fiscal position, by returning of budget surpluses in 2018 and 2019,

improving expenditure control and strengthening tax mobilization policies and procedures. From the revenue side, the Angolan government has introduced the value-added tax (VAT) in 2019, as well as a set of policy measures aimed at broadening the tax base and improving tax collection. From the expenditure side, measures undertaken contracted the level of expenditure. Effort was put on rationalizing budget spending with clear development impact and clearance of the stock of arrears as well as implementing more transparent public contracting procedures.

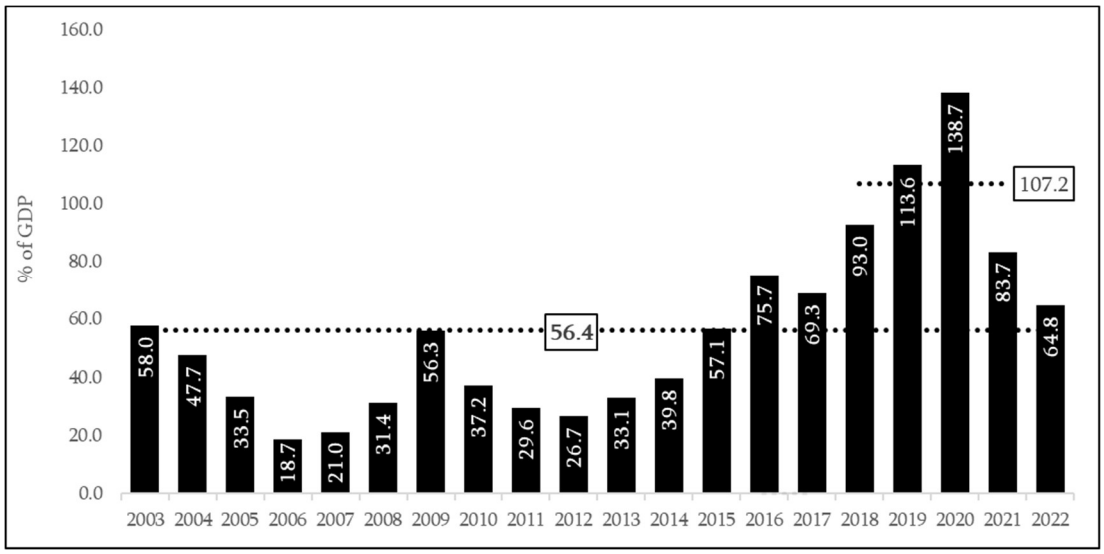
In Angola, the fiscal surplus averaged 0.3 percent of GDP from 2003 to 2022, being the worst period from 2014 to 2017 when it averaged -4.9 percent. When compared to its peers in Sub-Saharan Africa in 2022, Angola is substantially above average of -4.5 percent of GDP. The fiscal balance in Angola in 2022 was 0.7 percent of GDP (surplus).

Fiscal imbalances have consequences on the debt level and together with the magnitude of the GDP is determined the debt-to-GDP ratio, one of the most used macroeconomic indicators for accessing particular country's ability to pay back its debts, thus affecting the country borrowing costs and government bond yields when accessing the financial markets.

Public debt in Angola from 2003 to 2022 averaged 56.4 percent of GDP, but the worst performance was from 2018 to 2021, when it reached in average 107.2 percent of GDP. In 2022, Angola's public debt was 66.7 percent of GDP which was close to the limits set by the Public Finance Sustainability Law. In 2020, Angola faced one of its biggest challenges when oil prices fell to below US$20 per barrel, and the local currency (Kwanza) depreciated against US dollars reaching a record Kz 650/US$, which decrease the GDP and consequently deteriorated the debt-to-GDP ratio to its highest level ever of 138.7 percent. In 2022, Angola's debt situation has improved substantially, to the extent that public debt decreased to 64.6 percent of GDP, close to its legal limits. Angola’s Public Finance Sustainability Law approved in 2020

establishes the level of indebtedness by limiting the ratio of the debt-to-GDP, to a value equal to or less than 60 percent.

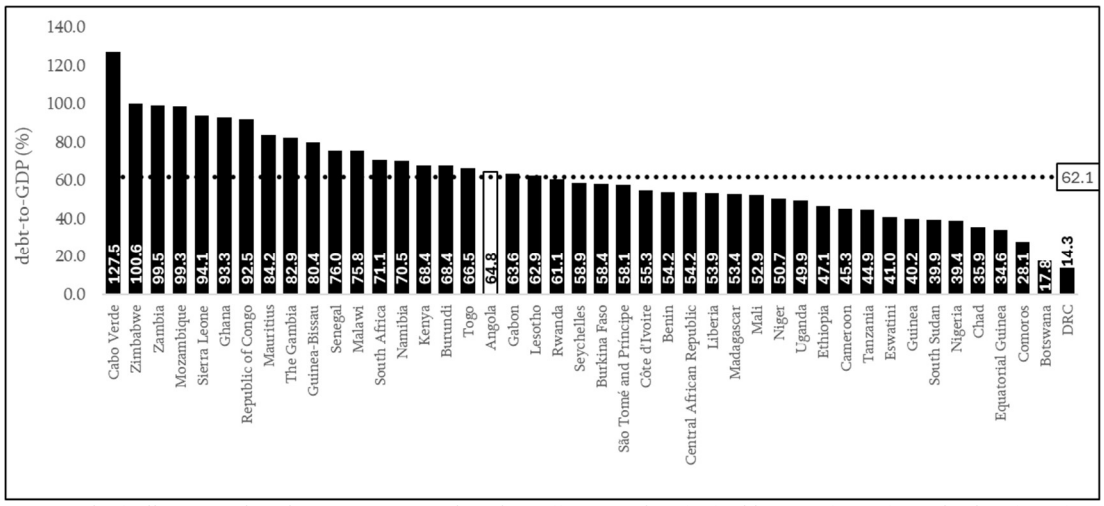
Graph 33: General government gross debt



Source: Author's illustration based on IMF WEO, online: https://www.imf.org/en/Publications/WEO/weo-database/2024/April, 02/05/2024

As shown already above in graph 33, Angola's external debt levels have increased significantly during this period, driven by borrowing to finance infrastructure projects and budget deficits. The country has faced challenges in managing its external debt burden and ensuring debt sustainability. When compared to its peers in Sub-Saharan Africa, Angola is positioned on average as shown in graph 34 below.

Graph 34: Debt-to-GDP ratio in Sub-Saharan Africa

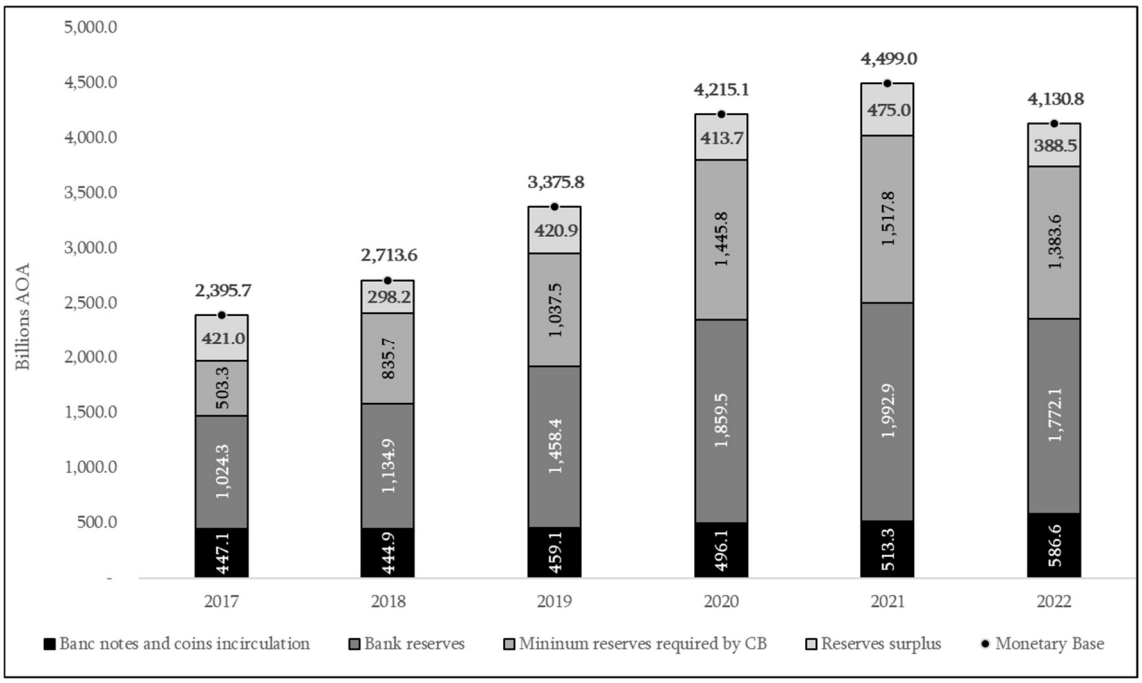


Source: Author's illustration based on IMF WEO, online: https://www.imf.org/en/Publications/WEO/weo-database/2024/April, 02/05/2024

C. MONETARY SECTOR

The monetary sector is managed by monetary policy. Angola's monetary policy is aimed at containing inflation, with adverse effect on its economy and ability to meet its debt obligations. The Angola National Bank (BNA) continues tightening the monetary policy stance with the objective of neutralizing the impact of hard currencies' revenues from the oil sector on the local currency to finance the State budget. To support exchange rate policy, the central bank increases its base rate to enable market interest rates to rise to a level that would impact the monetary base, namely the reserve money and broad money. However, limiting the expansion of the monetary to prevent inflation has been mammoth task over the last 5 years as shown in graph 35 below.

Graph 35: Monetary base behavior in Angola



Source: Author's illustration based on BNA, online: https://bna.ao/#/pt/estatisticas/estatisticas-monetarias-financeiras/nova-serie, 09/05/2024.

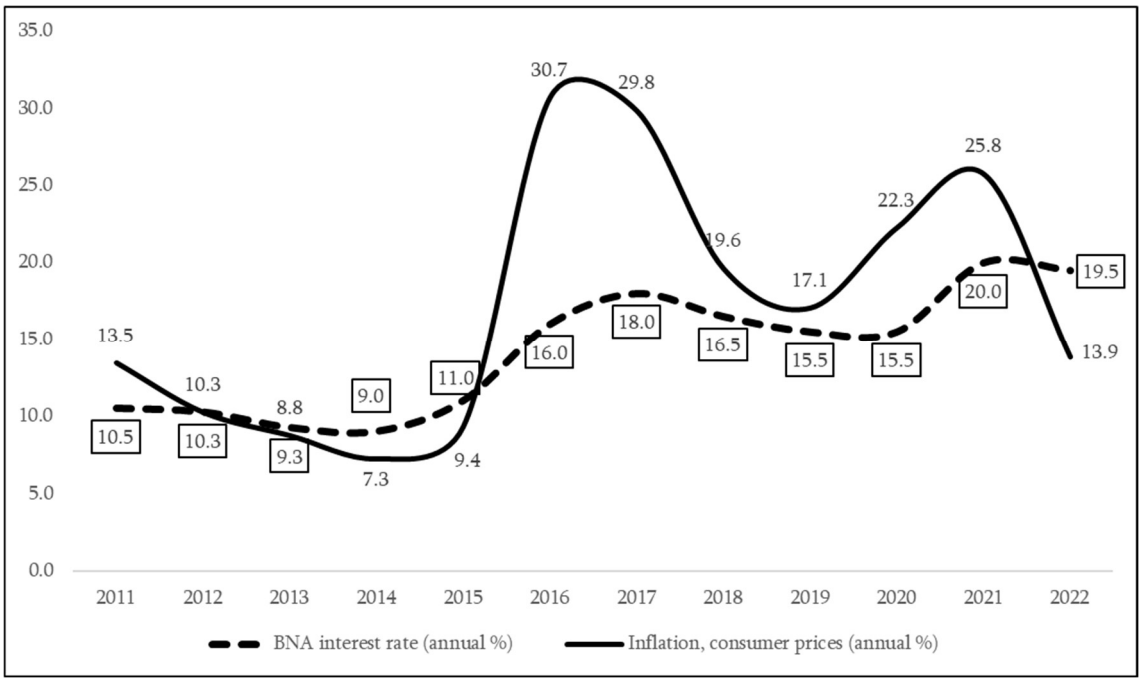
In Angola, over the period, the determinants of inflation had been local currency depreciation against hard currencies (mainly US dollar and Euro), limited

supply of goods in the economy as almost 90 percent of consumer goods are imported and, in some cases, import of inflation from supplying countries.

In a nutshell, the Angolan monetary sector from 2003 to 2022, has undergone significant changes and challenges. Some key characteristics and developments during this period are worth mentioning.

First, dependence on oil exports has had significant impact on the country's monetary sector. Fluctuations in oil prices have affected government revenues and foreign exchange reserves, influencing monetary policy decisions. Secondly, in the field of the monetary policy management and oversight of the production and distribution of the Angolan currency, the Central Bank of Angola, despite huge informality affecting liquidity management, was able to record some success in influencing inflation behavior and stabilize the exchange rate. During this period, as seen in the graph 36 below, the central bank had to adjust interest rates and reserve requirements to address inflationary behavior, however with the start of the crisis in 2015 it spurred inflation to highest rate in the last 20 years to 30.7 percent.

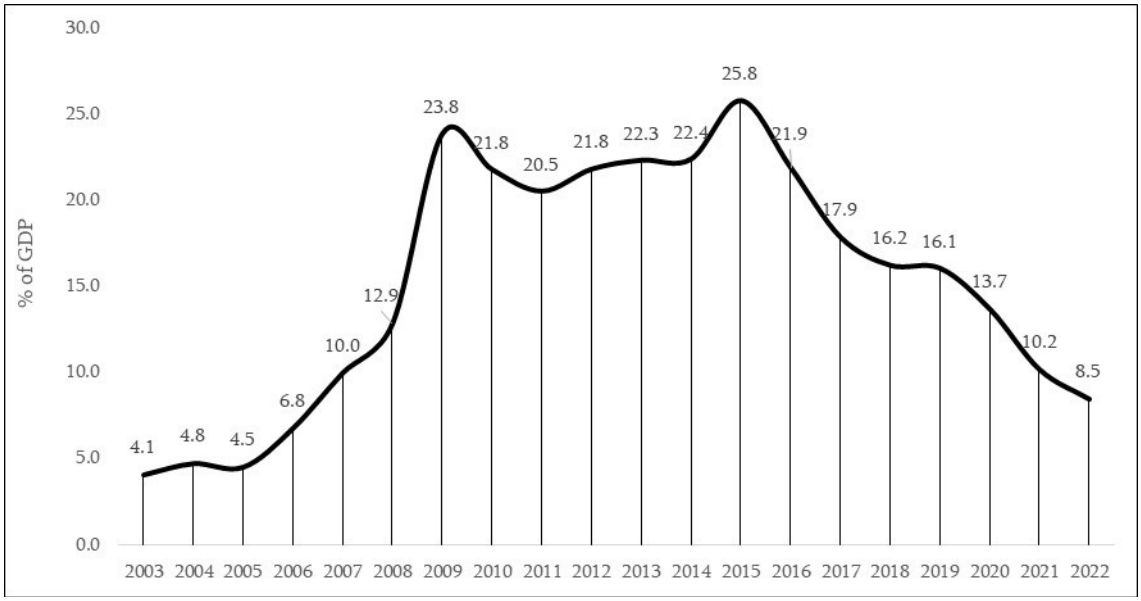
Graph 36: BNA interest rates and inflation behavior



Source: Author's illustration based on BNA, online: https://bna.ao/#/pt/estatisticas/estatisticas-monetarias-financeiras/nova-serie, 09/05/2024.

Thirdly, in the field of financial inclusion, efforts have been made to expand banking services to rural areas and promote digital financial services and increase access to financial market for the population. However, at the height of Angola's economic and financial crisis from 2015 onwards, because of the sudden drop in the oil price on the international markets, the Government began to face serious challenges in being able to balance its fiscal accounts and execute the general State budget. As a result, commercial banks began to make their financial resources available to finance the State at the expense of financing the economy, that is, private economic operators. Figure 37 shows that credit to the real sector fell from 25.8 percent of GDP in 2015 to 8.5 percent of GDP in 2022.

Graph 37: Credit to real sector in Angola



Source: Author's illustration based on BNA, online: https://bna.ao/#/pt/estatisticas/estatisticas-monetarias-financeiras/nova-serie, 09/05/2024.

Nevertheless, the monetary sector was pivotal in supporting diversification efforts and financing the real sector from 2009 to 2016. During this period, the Angolan banking sector had witnessed significant developments and transformations, namely (i) expansion and modernization with an exponential increase of banks and financial institutions, offering a wider range of products and services to customers, (ii) regulatory reforms characterized by regulatory reforms to enhance the stability and

transparency of the banking sector, (iii) financial inclusion with initiatives to expand banking services to underserved populations with some access to credit, (iv) FDI attraction with the participation of international banks and financial institutions in the Angolan market, bringing expertise, technology, and best practices to the sector, (v) better use of technologies for risk management gains, and (vi) adoption of technology and innovation which transformed the Angolan banking sector through digital banking services, mobile payments, and fintech solutions, improving efficiency, convenience, and access to financial services for customers.

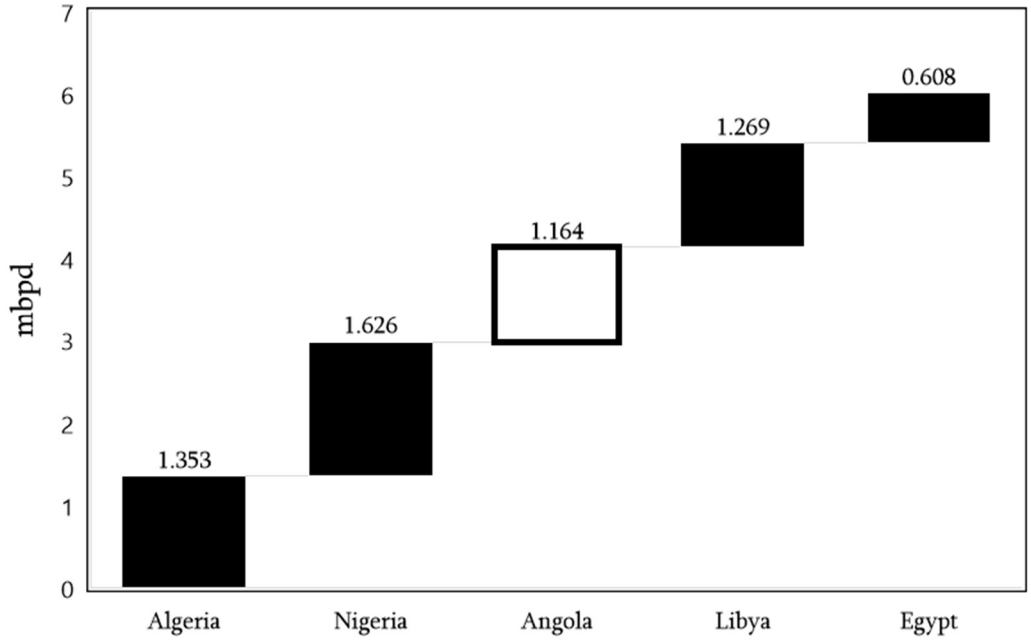
Efforts to promote non-oil sectors, improve governance, and attract foreign investment have aimed to strengthen the country's economic resilience and reduce vulnerabilities in the monetary sector. But, despite all these developments, the Angolan banking sector has faced challenges such as high non-performing loans, currency volatility, economic uncertainties, as well as very bureaucratic and reluctant to finance the real sector, especially in the agribusiness sector.

D. EXTERNAL SECTOR

Similarly, as the economic model, the weight of the extractive sector (predominantly oil, gas and diamonds) in Angola's external accounts is substantial, representing around 95 percent of the country's exports.

The systemic significance of the extractive sector in Angola has been, to some extent, limiting the diversification of the economic model. In 2021, as shown in graph 38 below, Angola ranked third as Sub-Saharan largest oil producer.

Graph 38: Oil (mbpd) production in SSA, 2021

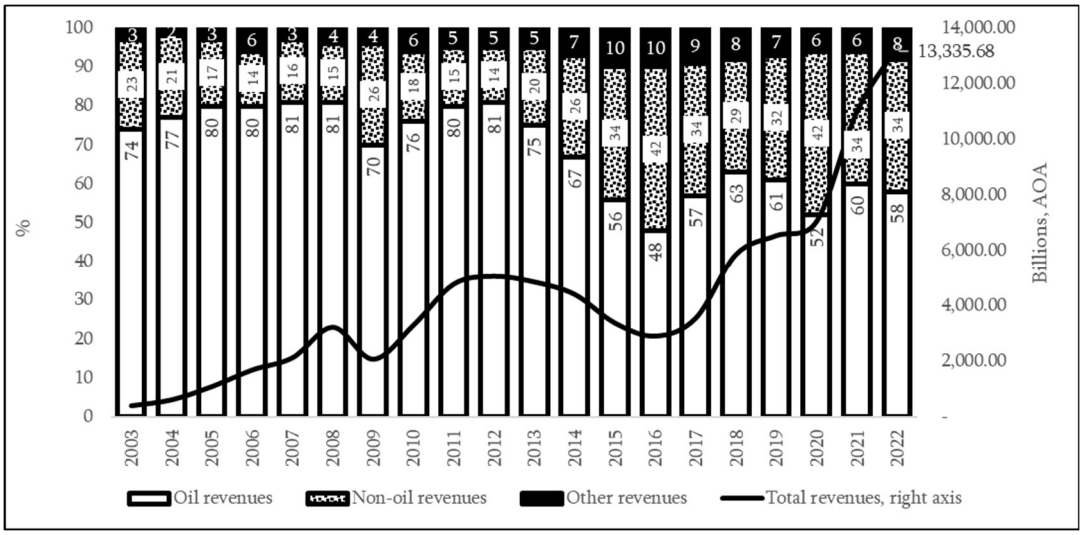


Source: Author's illustration based on BP (2022) Statistical Review of World Energy (71st edition).

Angola's external sector has been experiencing several significant developments and challenges. There are some key developments that can characterize Angola's external sector.

First, oil exports have traditionally been a major source of revenue for the country. Fluctuations in global oil prices have had a significant impact on Angola's external sector in the last 20 years. As already mentioned above, the country's economy is vulnerable to oil price volatility, as evidenced by the oil price crash in 2014-2016, which led to a severe economic downturn in Angola.

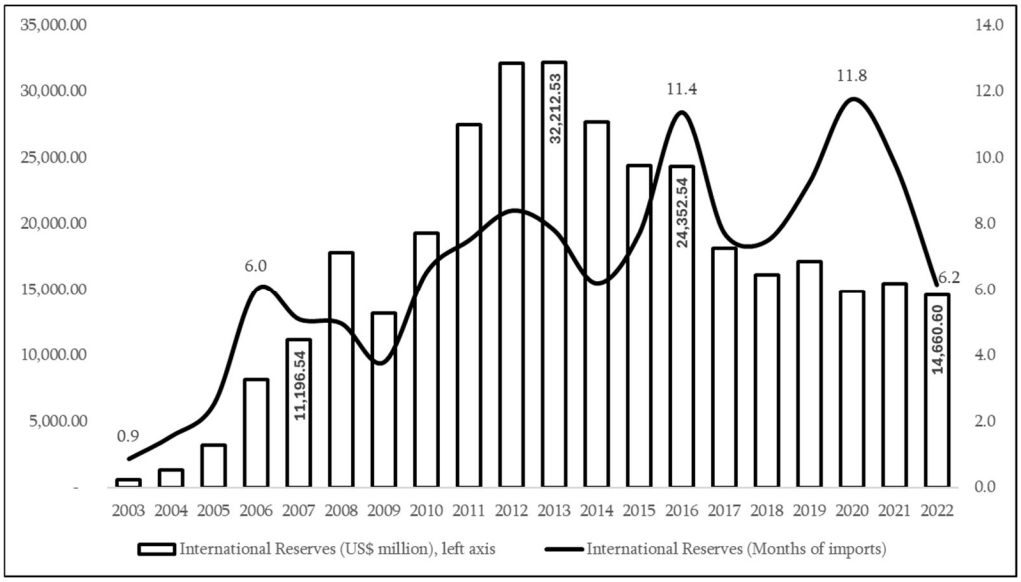
Graph 39: Angola total government revenues and its structure



Source: Author's illustration based on MINFIN, online: https://minfin.gov.ao/macroeconomia/contas-nacionais%28PIB%29, 05/05/2024

Oil revenues are also the major contributor to the foreign exchange reserves. Angola's foreign exchange reserves have been under pressure due to the volatility in oil prices and the impact of external shocks on the economy. The country has faced challenges in maintaining adequate foreign exchange reserves to support its import needs and stabilize its currency, the Angolan kwanza. As shown in graph 40, foreign exchange (FX) reserves dropped from US$ 32.2 billion to US$ 14.6 billion.

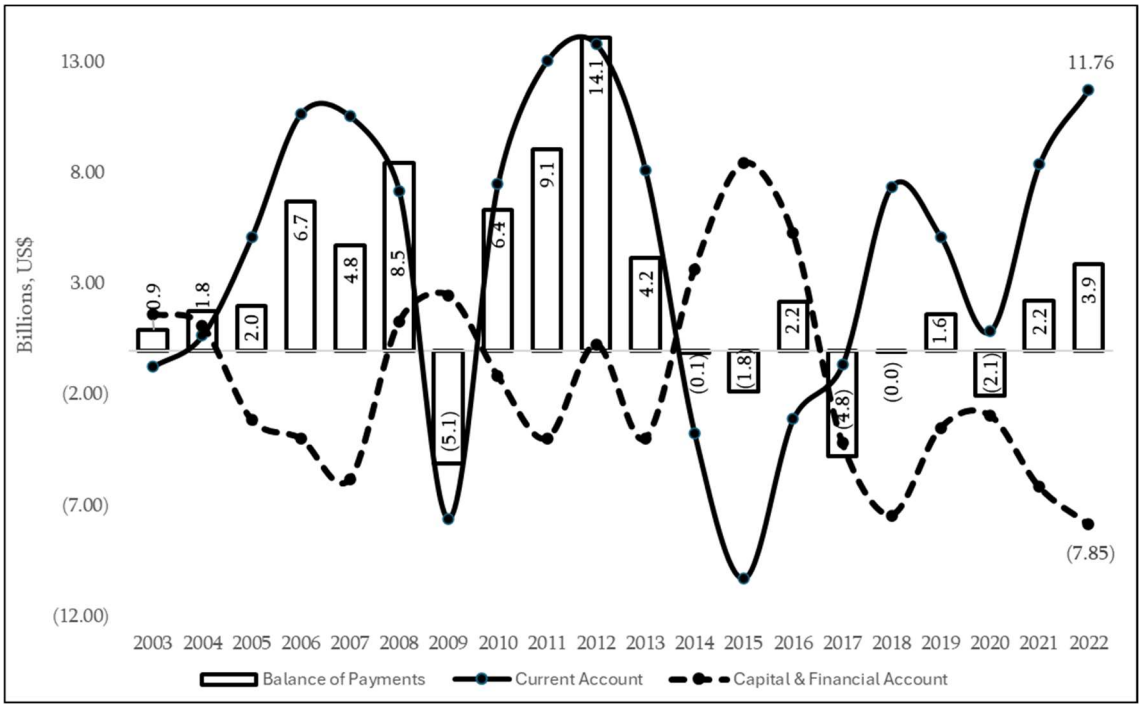
Graph 40: Angola FX reserves and month of imports coverage



Source: Author's illustration based on BNA, online: https://bna.ao/#/pt/estatisticas/estatisticas-externas/dados-anuais, 13/05/2024.

Fluctuations in global oil prices have a significant impact on Angola's balance of payments (BoP). When oil prices are high, Angola tends to have a surplus in its balance of payments due to increased export revenues. Conversely, when oil prices are low, Angola may experience deficits in its balance of payments. The current account of the BoP has been the main driver of BoP surpluses in the last 20 years (graph 41).

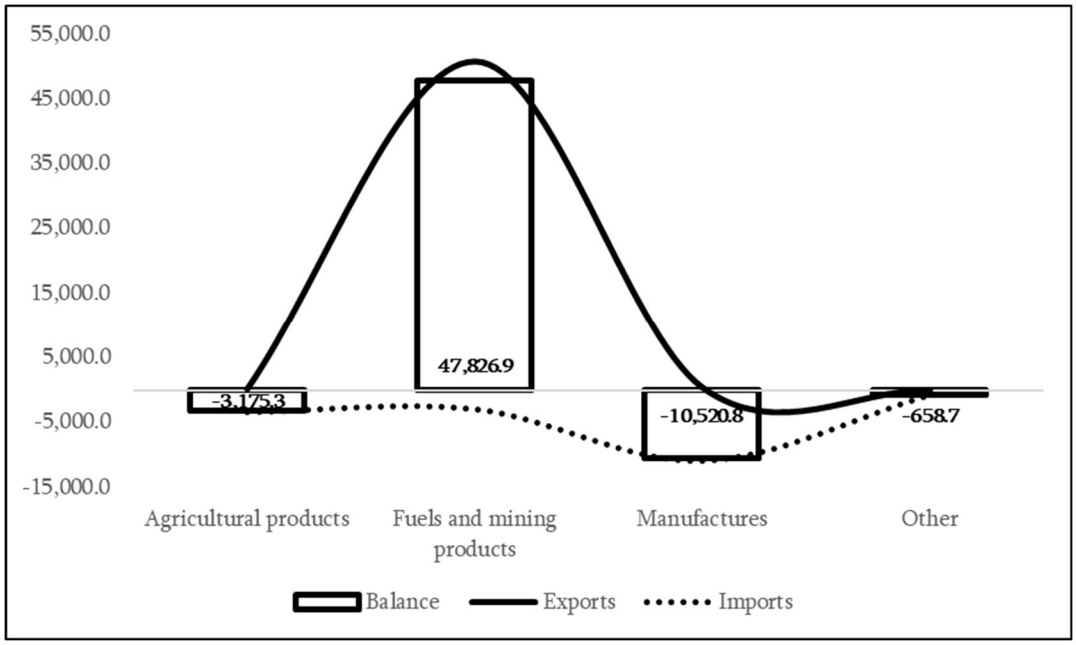
Graph 41: Angola BoP



Source: Author's illustration based on BNA, online: https://bna.ao/#/pt/estatisticas/estatisticas-externas/dados-anuais, 13/05/2024.

Apart from oil, Angola also exports diamonds and other commodities. Imports consist mainly of machinery, equipment, and consumer goods. But it is important to note that Angola has been making efforts to diversify its economy away from oil dependency and to promote non-oil sectors such as agriculture, manufacturing, and services. Graph 42 below shows the main commodity group trade balance, where the extractives sector export remains dominant.

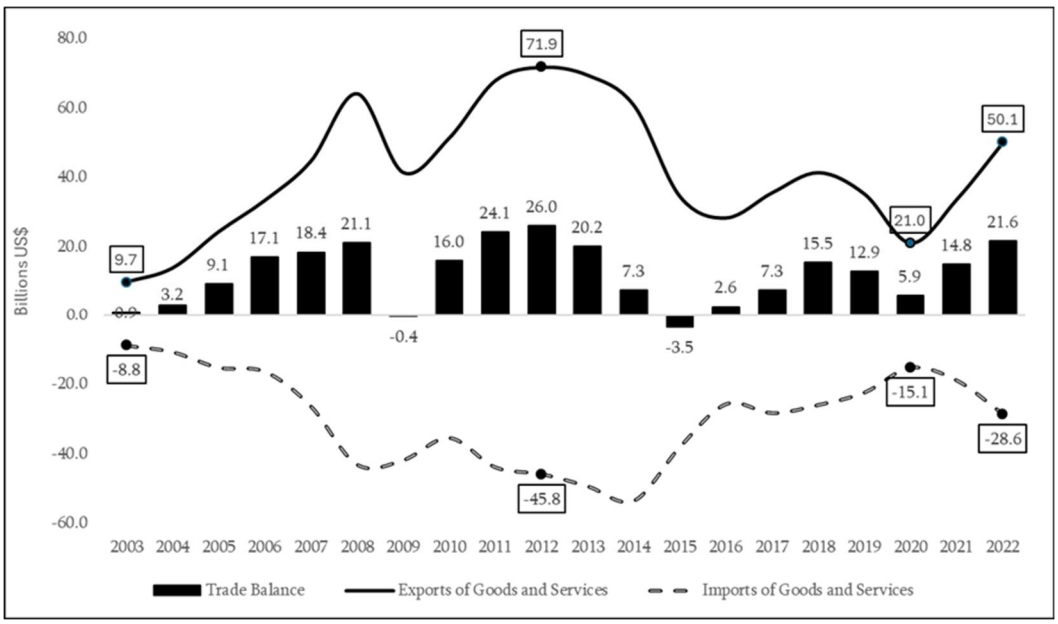
Graph 42: Angola main commodity group trade balance, 2022



Source: Author's illustration based on WTO Trade Profiles, online: https://www.wto.org/english/res_e/statis_e/daily_update_e/trade_profiles/US_e.pdf, 19/03/2024

On the trade profile, as shown in the graph 43 below, Angola has run a trade surplus due to its oil exports, but the country has also faced challenges in diversifying its exports and reducing its reliance on oil. Non-oil exports have not grown significantly during the last 20 years, which has limited its ability to balance its trade.

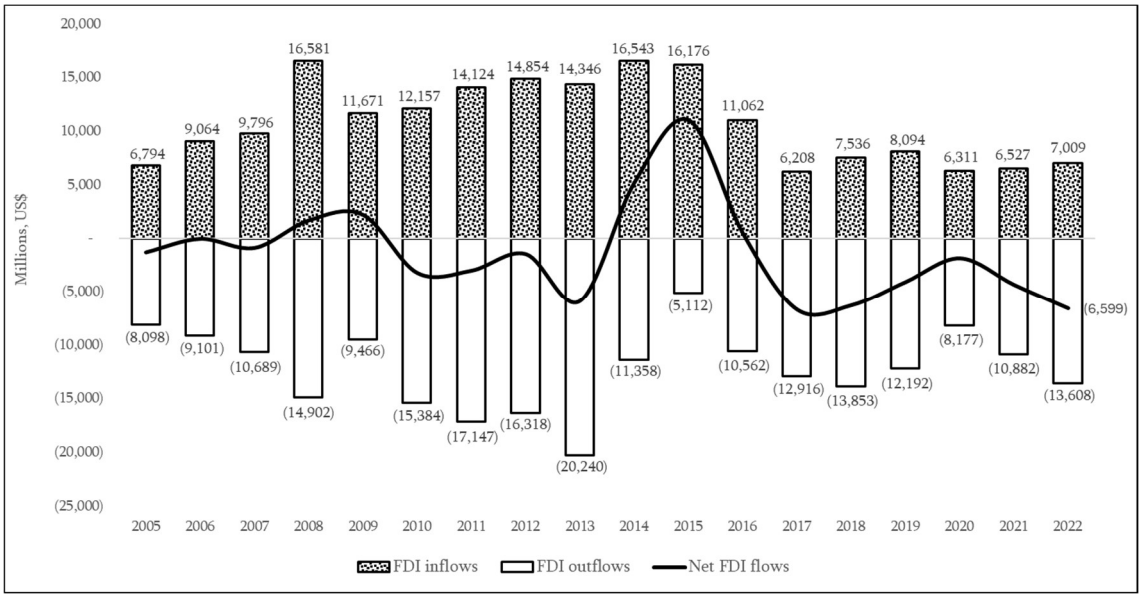
Graph 43: Angola trade balance



Source: Author's illustration based on BNA, online: https://bna.ao/#/pt/estatisticas/estatisticas-externas, 03/05/2024.

An important BoP engine is the foreign direct investment (FDI) as shown in graph 44. Angola has attracted significant foreign direct investments, particularly in the oil sector and food processing projects. However, the country has still challenges in attracting diversified FDI inflows to counterbalance capital account outflows and promoting investment in non-oil sectors, especially primary sector, to reduce its dependence on oil revenues.

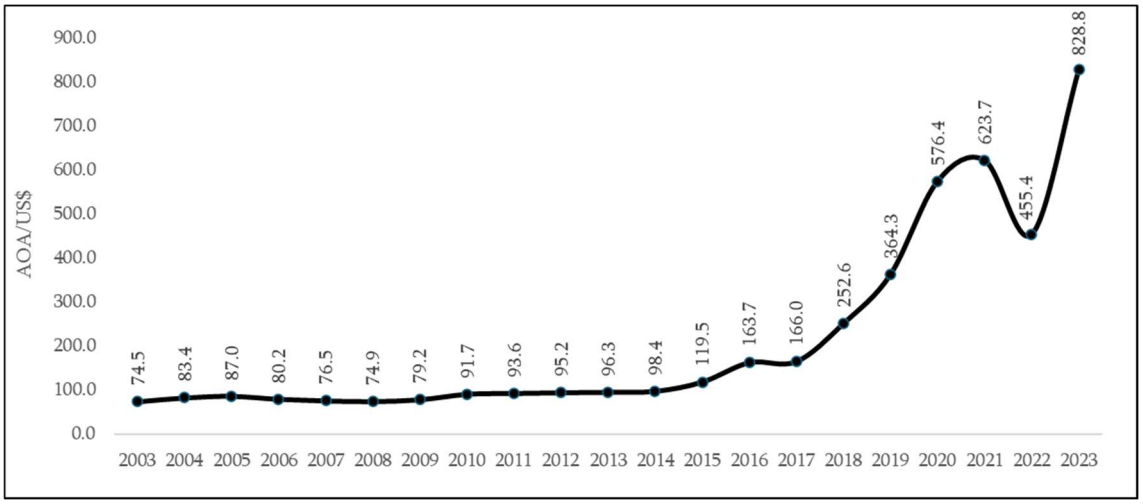
Graph 44: Angola FDI net flows



Source: Author's illustration based on BNA, online: https://bna.ao/#/pt/estatisticas/estatisticas-externas, 03/05/2024.

On the exchange rate volatility, the Angolan kwanza has experienced significant volatility against major currencies, reflecting the challenges in the external sector and the impact of external shocks on the economy. The government has implemented various exchange rate policies to stabilize the currency and manage inflation, including a floating exchange rate system implemented in 2019, but challenges persist.

Graph 45: Kwanza volatility against US dollar



Source: Author's illustration based on BNA, online: https://bna.ao/#/pt/estatisticas/estatisticas-externas, 03/05/2024.

In summary, Angola's external sector from 2003 to 2022 has been characterized by its heavy dependence on oil exports, challenges in diversifying the economy, managing foreign exchange reserves, attracting diversified FDI inflows, and managing external debt levels. The country has made efforts to address these challenges through economic reforms and diversification initiatives, but more work is needed to create a more resilient and sustainable external sector for a better doing business environment.

3.2.1.1 Contribution of the agricultural sector to the Angolan economy

Angola has, undoubtedly, one of the greatest agricultural potentials in Africa, considering the country's water resources, favorable climate and available arable land. This potential is, however, largely unexploited, with only 5.9 million hectares cultivated in the 2020-2021 season, out of 35 million hectares of arable land (MINAGRIF, 2022). Angola's agricultural production is unable to satisfy the demand for agricultural goods, and Angola still imports more than half of its food needs. In Angola, agriculture remains a significant source of employment, particularly in rural areas, where, according to MINAGRIF (2022), it supports the livelihoods of 1.8 million smallholder farmer families.

A. AGRICULTURAL PERFORMANCE

The first Portuguese presence in today's Angola was characterized by an economy essentially based on barter trade of numerous goods and later a massive slave trade, ending only with the effective abolition of slavery in Brazil at the end of the 19th century. The end of the slave trade was crucial to boost endogenous growth efforts, exploring and transforming Angola's economic potential.

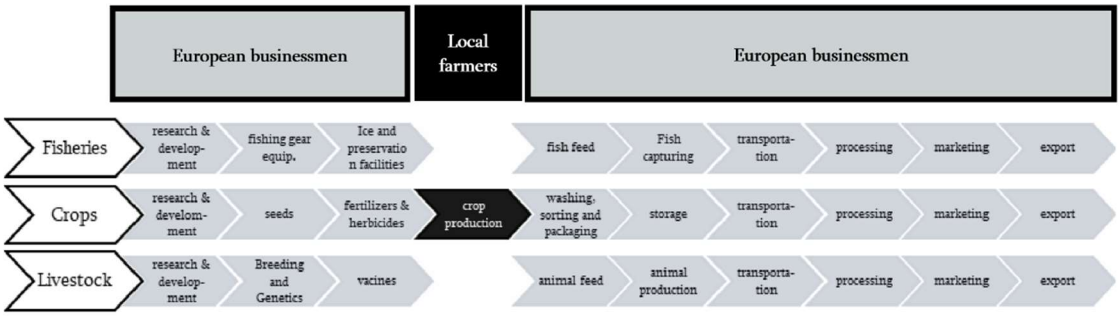
After the Berlin Conference (1884-1885) started the colonial period (Meijer & Birmingham, 2004, p. 11). This period was marked by the progressive exploratory missions to secure as much territory as possible for the new province, population of the acquired territories with Portuguese coming from Portugal and market creation initiatives. These initiatives aimed at boosting value chain segments with the objective to elevate the colonial province Angola into a export-led economy, heavily dependent on foreign markets. Angola was transformed by the Portuguese and other European businessmen and became an export-oriented market. Before the independence in 1975, Angola was one of Africa's major producer and exporter of cotton, coffee, corn, banana, tobacco, sugar cane, and sisal (Dilolwa, 2000, p. 156).

Coffee was the main cash crop. The development of coffee in Angola started in the 1830s but its commercial production only started in in the 1930s. By 1970, Angola was 2nd largest exporter in Africa, after Côte d'Ivoire, and the 4th largest in the world after Brazil and Colombia with a share of 6.1 percent of world exports (Caetano João, 2005, p. 113). Coffee was the main development catalyzer before the independence and their traders were the capital holders and major economic operators.

Food processing helped build the agricultural value chains, build capital for development and allowed the territory to be self-sufficient in most processed goods. Angola was considered one of Africa's largest food exporters, but the majority of the workforce employed was poorly paid or the price for crops did not allow Angolans to build capital and escape from the poverty cycle.

However, the contribution of local farmers to the overall agricultural value chain was limited. As shown in figure 2 below, local smallholder farmers were mostly involved the primary production, and European businessmen secured the rest of the value chain segments, including the exports. This experience did not bring locals capacity building or skills to develop other segments of the value chain, hence after liberation from the Portuguese left and the civil war has ended, local found difficult to revive the golden era of the agricultural sector in Angola.

Figure 2: Angolan agriculture value chain before the independence



Source: Author's illustration.

After the independence in 1975, Angola plunged into a long-lasting civil war. Subsequently, agricultural activity became risky with no adequate policies or financing available. Additionally, the Marxist-Leninist political regime adopted prohibited private sector activity, which affected severely the production of food and other agricultural goods.

Soon, the scarcity of food skyrocketed the inflation, and the government was forced to import (before 1992) or to grant import concession licenses for economic operators, inverting the flow of the agricultural value chain. Angola quickly started to substitute local production of food and agricultural production with imports mostly from eastern European and LAC countries. The result was that smallholder farmers were no longer producing commercial quantities as they were no longer feeding a value chain and produced mainly for subsistence. Only small amounts of agricultural

products were sold, and the objective was to have better purchasing power to buy processed food or other capital goods, hence shaping the new rural economy.

In 2002, after 47 years of civil war, most value chains were discontinued. There was an urgent need to clear the territory from landmines with the support of many international partners in order open extensive areas of land for economic activity, especially agricultural development. Livestock also holds strong potential in Angola, with a vast natural habitat for grazing and water resources throughout the country.

The needs for war reconstruction were enormous and billions of financial capital was needed. The extractive sector, namely oil and diamonds, quickly became the main sources of hard currency to import all necessary needs, including food and agricultural goods. Angola attracted many extractive sector investors and soon became the second largest oil producer in Sub-Saharan Africa, providing hard currency to rebuild the country and to back up bilateral commercial loans. There was little appetite from the financial system to de-risk agricultural projects, the economy was led by imports, covering 90 percent of consumer needs, and, until 2015, there was a dual currency market, one formal, the Kwanza, and one informal, the US dollar.

After the second elections in 2008, the country realized the need to build the real sector by creating a market with sound value chains to accelerate its diversification efforts. At that time, many pro-market government institutions were created, among them the Ministry of Economy, Angolan Active Venture Capital Fund (FACRA), Credit Guarantee Fund (FGC), Angolan Debt and Securities Exchange (BODIVA), Institute for the Public Business Sector (ISEP), Institute for Micro, Small and Medium Enterprises (INAPEM), and Angolan Development Bank (BDA).

These institutions helped create instruments to build a market economy, however not only officers and business lacked capacity building to ignite the economy, but also the business environment was not appropriate. Consequently, many good initiatives resulted in non-performing loans and many projects failed.

These episodes resulted in a backlash from the financial institutions. In the last decade, credit access in Angola for the agricultural sector has historically been limited as seen in graph 37 above, with smallholder farmers and agribusiness companies facing challenges in accessing affordable financing.

Only with the 2015 financial and economic crisis, there was a new push to finance the productive sector, especially agribusiness activities. This was a result of the difficult access to foreign exchange as central bank foreign reserves had been severely depleted from US$ 32 billion in 2014 to US$ 15 billion in 2020 (see graph 40). Consequently, in 2020, with the lockdown caused by the COVID pandemic, the government decided to speed up the diversification efforts by financing the productive sector and the banking sector followed with greater financing to the economy.

Since 2020, the Angolan government and financial institutions have been working to improve access to credit for the agricultural sector in recent years with some specific actions, namely:

a) Government initiatives: The Angolan government has implemented various initiatives to improve access to credit for farmers and agribusinesses. These initiatives include the establishment of agricultural credit lines with subsidized interest rates and loan guarantees to support agricultural activities; and

b) Financial institutions: Commercial banks and microfinance institutions in Angola are increasingly recognizing the potential of the agricultural sector and are expanding their lending activities to support agricultural projects. Some financial institutions have developed specialized financial instruments and products tailored to the needs of farmers and agribusinesses.

c) Informal credit sources: In rural areas where formal financial services are limited, farmers often rely on informal credit sources such as savings groups, moneylenders, and input suppliers for financing their

agricultural activities. While these sources can provide short-term liquidity, they often come with high interest rates and limited consumer protection.

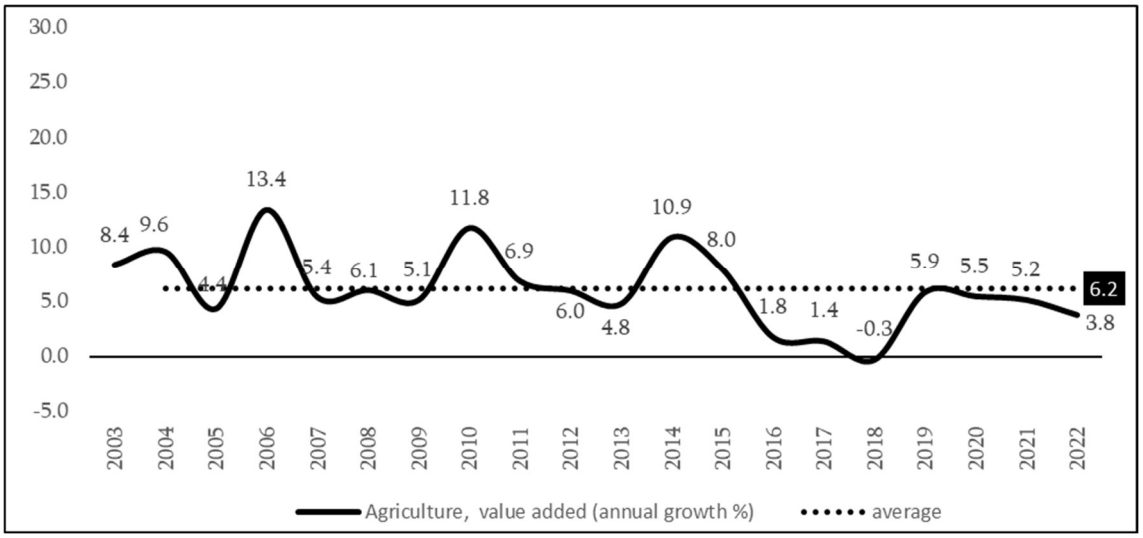
d) Capacity building: Efforts are being made to enhance financial literacy among farmers and agribusiness owners to improve their understanding of financial products and services. Capacity-building initiatives aim to empower farmers to make informed decisions about borrowing and managing credit effectively. On the other hand, the financial banking secto is also developing massive capacity building activities for their personnel to better understand, analyze and derisk agricultural projects.

While progress has been made in improving access to credit for agriculture in Angola, there is still room for further development. Other challenges include high interest rates, collateral requirements, limited financial literacy among farmers, and the perception of agriculture as a high-risk sector by financial institutions. Continued efforts to address the challenges in the credit landscape, enhance financial inclusion, and promote sustainable financing mechanisms will be crucial to supporting the growth and development of the agricultural sector in the country.

On the other hand, the lack of commercial credit with limited access to foreign exchange makes it difficult for companies to import agricultural machinery and inputs, creating significant obstacles to private sector agricultural development. Strong pent-up demand exists for these important imports as companies try to establish and expand their agricultural production capacity.

With all these efforts with policy alignment and private sector response, in recent years, the contribution of agriculture to the Angolan economy has grown rapidly, leading to an increase in the share of agriculture in the GDP from 5.8 percent to 8.9 percent of GDP from 2011 to 2022. In 2002, agricultural value added grew 3.8 percent but in the last 20 years growth averaged 6.2 percent, as shown in graph 46 below. Local production of agricultural goods accounts for less than 30 percent of its needs and the rest is imported.

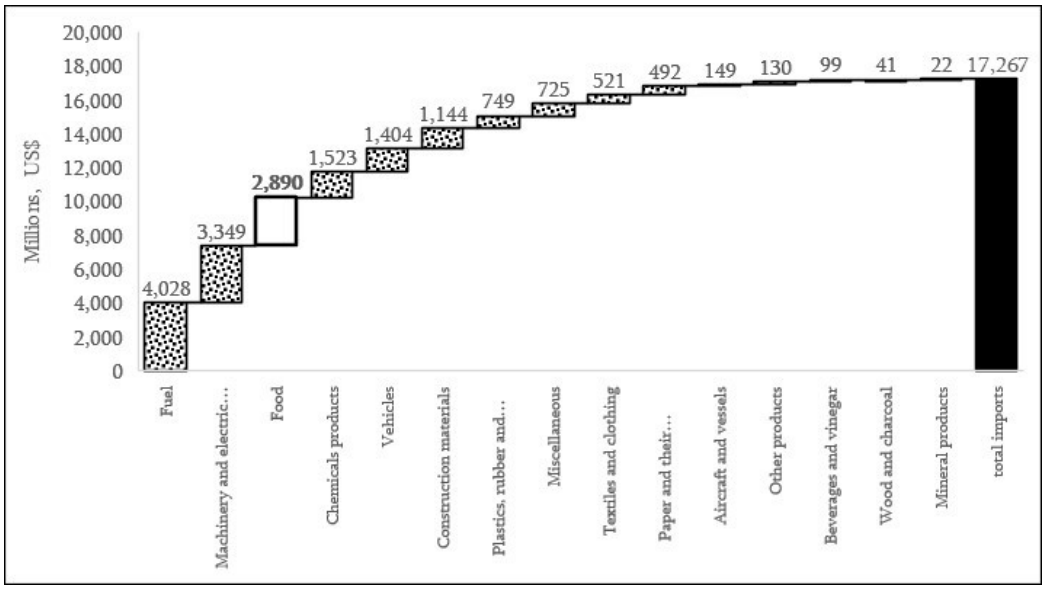
Graph 46: Agricultural value-added growth



Source: Author's illustration based on INE, 2024.

Notwithstanding these efforts, in 2022, Angola imported food worth almost US$ 2.8 billion from different geographies. Four products were responsible for almost US$ 1 billion, namely wheat and wheat flour, poultry, rice and cooking oil. In this year, the three largest suppliers of food and agricultural products were the EU, Brazil and the United States, accounting for more than half of Angola's imports. Food is the third most imported item in the country's trade balance as seen in graph 47.

Graph 47: Imports of goods in Angola, 2022



Source: Author's illustration based on BNA, online: https://bna.ao/#/pt/estatisticas/estatisticas-externas, 03/05/2024.

Currently, Angola's main agricultural crops include cassava, corn, beans, potatoes, sweet potatoes, soy, bananas, coffee, rice, vegetables, and fruits. Domestic agricultural production capacity does not meet local demand. The most fertile regions are in the highlands and valleys. The rainy season is from October to May, which is considered the prime season for vegetable cultivation. Tomatoes are grown during the dry season (June to September). Greenhouses and irrigation expand the growing seasons, but these technologies are not widely used in Angola.

According to MINAGRIF (2022), roots and tubers dominated the crop production in 2022, reaching almost 13 million tons, representing more than 52 percent of total production. Fruits followed with approximately 6 million tons, followed by cereals, with around 3.2 million tons. Horticultural crops accounted for around 2 million tons, while pulses and oilseed crops contributed around 622,000 tons.

Cereals covered 53 percent of the country's total sown area of 5.97 million hectares, with corn contributing 97 percent to the production of this category,

producing 1.18 tons per hectare. Root and tuber crops occupied around 22 percent of the total sown area, with cassava being the main crop in this category.

Poultry production has increased slightly over the last 3 years but was affected by an insufficient supply of feed and chemicals as well as long periods of drought in some Angolan provinces. Most chicken products in the market are currently imported to meet demand. Angola's livestock farming is located primarily in the southern part of the country and is based on natural pasture grazing. Beef is the second largest agricultural product after cassava. Other livestock, such as goats, pigs and chicken are raised mainly by small-scale farmers as subsistence food sources. Since last year, the Government of Angola has been conducting a pilot livestock census with technical support from the Food and Agriculture Organization of the United Nations (UNFAO) and with World Bank funding. According to the Cooperative of Cattle Producers of Southern Angola (CGSA), an industry association based in Lubango, Huíla province, the cattle population is approximately 3.5 million head, nationwide.

B. PHYSIOGRAPHY

Angola is composed of 18 provinces and has a surface area of 1,246,700 km^2 and is located on the west coast of the Southern African sub-region. The country is bordered by the Atlantic Ocean in the West, the Democratic Republic of Congo and the Congo Republic in the North, Namibia in the South, and Zambia in the East. Its population is approximately 35 million people, but according to Angola's NDP (2023, p. 24) the population growth is around 3 percent a year, i.e. around 1 million Angolans are born every year.

Angola is blessed with abundant water resources with more than 100 rivers and more than 40 water basins. The country has vast arable land resources, with an estimated 35 million hectares suitable for agriculture. However, only a small fraction is currently under cultivation due to limited infrastructure, landmine contamination from the civil war, and insufficient investment.

Most agriculture in Angola depends on pluviosity and is subsistence-based, with smallholder farmers making up most of the agricultural workforce as mechanization is low but expanding. Since colonial era, Angola's agricultural lands have been distributed at different altitudes and thus also in different climatic levels from the coast up to 2,000 masl. which made it possible to grow a wide variety of cash crops in Angola (Caetano Joao, 2005, p. 111).

Figure 3: Map of Angola (Physical)

Source: https://www.worldometers.info/maps/angola-map/

As seen in figure 3 above, Angola's physiography is characterized by diverse landscapes that range from coastal plains to highlands and mountains, which contribute to the country's varied climate and ecological zones, namely:

a) Coastal Plains: The coastal plains stretch along the Atlantic Ocean from the northern border with the Democratic Republic of Congo to the southern border with Namibia. These plains are generally low-lying

and flat, with elevations ranging from sea level to about 200 meters. The region is characterized by sandy soils and occasional salt flats. The coastal region experiences a tropical climate with two distinct seasons: a rainy season and a dry season, also called Cacimbo [Kasimbu]. The Benguela Current, which flows along the coast, has a cooling effect on the coastal climate, making it more arid than the interior.

b) Central Plateau: The central plateau, known as the Planalto Central, is the dominant feature of Angola's physiography, covering much of the central and southern parts of the country. Elevations here range from 1,000 to 2,000 meters above sea level (Kyle, 1997, p. 7). It is composed of ancient crystalline rocks and has a gently rolling landscape, interspersed with higher peaks and ridges. The central plateau has a subtropical climate, with more rainfall than the coastal areas. This region is crucial for agriculture, as it is more fertile and has better water availability.

c) Highlands and Mountains: Angola's highlands are concentrated in the central and northern regions, with notable mountain ranges including the Chela Mountain (Serra da Chela) and the Moco Mount (Morro do Moco). The highest point in Angola is Mount Moco, which reaches an elevation of 2,620 masl. These highlands contribute to the diverse microclimates within the country. The highlands are important for biodiversity, with unique flora and fauna. They are also a source of many of Angola's rivers.

d) River Systems: Angola's physiography is marked by several major rivers, including the Cuanza, Cunene, and Cubango rivers. These rivers play a vital role in the country's hydrology and are crucial for agriculture and hydroelectric power generation. The country is divided into several drainage basins, with most rivers flowing toward the

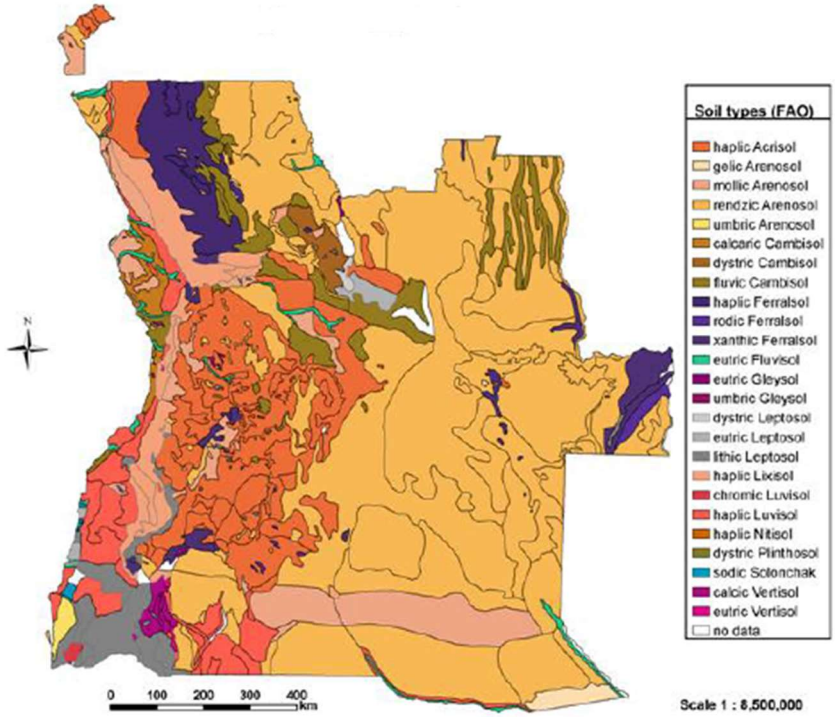
Atlantic Ocean, except for some that drain into the interior basins of southern Africa (Kyle, 1997, p. 7).

e) Deserts: In the southwest, Angola has a portion of the Namib Desert, which extends into Namibia. This desert region is arid, with sparse vegetation and extreme temperatures. The southeastern part of Angola is part of the Kalahari Basin, which is characterized by semi-arid conditions and sandy soils (Preetz et al., 2009, p. 7).

f) Biodiversity and Ecology: Angola's physiography supports a variety of ecological zones, from coastal mangroves and savannas to tropical rainforests and montane forests in the highlands. The diverse landscapes make Angola a biodiversity hotspot, with several endemic species of plants and animals. The highlands and forested areas are particularly rich in biodiversity.

Angola's physiography is marked by a complex and varied landscape that influences its climate, ecology, and human settlement patterns (Caetano Joao, 2006, p. 92). The country's coastal plains, central plateau, highlands, and river systems create a rich mosaic of environments, each with its own unique characteristics and challenges. This diversity is a significant asset but also presents challenges for development, particularly in terms of infrastructure and agriculture.

Figure 4: Soil types of Angola



Source: Preetz et al., 2009, p. 7.

C. AGRICULTURAL CHALLENGES

The economic recession in Angola from 2016 to 2020 had a negative impact on fiscal revenues, which affected government economic diversification efforts, including government support for smallholder farmers to boost agricultural production. Limited access to foreign exchange for government imports of seeds, fertilizers, and other agricultural inputs has been directly impacting government programs to support farmers.

While Angola's agricultural sector has the potential to contribute significantly to the country's economy and food security, it faces other challenges limiting its growth and productivity that need to be addressed to unlock this potential, namely:

a) Dependency on oil revenues: Angola's economy has been heavily reliant on oil revenues, which has led to underinvestment in the agricultural sector. This has resulted in limited modernization, poor infrastructure, and inadequate support for smallholder farmers;

b) Subsistence farming: A significant portion of Angola's agricultural activities is subsistence farming, where farmers produce mainly for their own consumption rather than for commercial purposes. This limits the sector's potential for generating income and improving food security;

c) Limited mechanization and technology adoption: The agricultural sector in Angola is characterized by low levels of mechanization and technology adoption. This hinders productivity and efficiency, leading to low yields and limited agricultural output;

d) Land mines: land mines left from the civil war pose a significant threat, particularly in rural areas, restricting access to agricultural land;

e) Infrastructure challenges: Angola's agricultural sector faces infrastructure challenges, including poor transportation networks, inadequate storage facilities, and limited access to markets. These challenges restrict farmers' ability to effectively market their produce and access inputs;

f) Land tenure issues: Land tenure issues, such as unclear land rights and land disputes, are prevalent in Angola. This hampers investment in the sector and leads to underutilization of agricultural land; and

g) Climate variability: Angola's agricultural sector is vulnerable to climate variability, including droughts and floods, which can have a significant impact on agricultural production and food security.

Addressing these issues is key to improving the sector's performance and sustainability.

D. PERSPECTIVES

According to the Ministry of Economy and Planning (MEP, 2023a), the actual Angola National Development Plan (2023-2027) pointed food security as one of the two development pillars, alongside human capital. The agricultural activity, including agricultural value chain development, is seen as the main engines of economic diversification with the objective to build domestic food production capacity.

Angola's agricultural industry comprises of both public and private economic operators. Several large agro-industry companies are owned by private sector operators, mostly held by foreigners such as Portuguese, Chinese, Brazilian or Israeli investors either independently or through joint ventures with the Angolan partners. But Government economic policies with subsidized credit interest rates have been crowding in Angolan businesspersons and who are following the paths of foreign companies in agribusiness.

On the other side, Angola efforts are leading to build and consolidate agricultural value chains with regional markets such as Southern African Development Community (SADC) and Economic Community of Central African States (ECCAS), which could enhance food security and boost exports. Despite the challenges, agriculture plays a crucial role in ensuring food security in Angola, particularly in rural communities.

4. RESEARCH STRUCTURE AND METHODOLOGY

4.1 DATA SOURCES, ESTIMATION PERIOD AND ECONOMETRIC TOOL

The data used to estimate the time series in the present study were extracted from United Nations specialized agencies, namely the World Bank – WB (World Development Indicators), IMF WEO, FAOSTAT, as well as from Angolan statistical system, namely Angola Statistical Office (INE), Ministry of Finance (MINFIN), MINAGRIF and BNA. The time series data are annual, covering the period from 1993 to 2022, a total of 30 observations. According to Narayan (2005) and Wolde-Rufael (2010), ARDL models are applicable to small sample size ranging from 30 to 80 observations.

For the estimation exercise, STATA 14.2 econometric tool was used.

4.2 DETERMINATION OF VARIABLES

The determination of the appropriate variables for the econometric model involved a combination of theoretical assumptions, empirical evidence, data availability and statistical techniques based on the definition of the research question and literature review.

Data was collected for five variables, namely gross domestic product (GDP), as a proxy for annual economic growth, inflation rate (INF, annual change), gross fixed capital formation (GFCF, annual growth) as a proxy for investments, agriculture value added (AgrVA, annual growth) as a proxy for agriculture and fisheries performance and trade openness as proxy for trade volume (TO, annual growth). The dependent variable (Y) is GDP, whereas the independent or explanatory variables (X) are INF, GFCF, AgrVA and TO. All the economic variables are taken as annual growth percentage, except INF where the variable is expressed in annual change rate. Table 1 below provides the details and rationale for choosing the variables.

Table 1: Summary of dependent and independent variables used in the model

Variables	Definition	Measurement	Source	Expected relationship
GDP	Gross Domestic Product as measure for economic growth. Total values of goods and services produced domestically in the economy in a year	Annual growth (%)	WDI	Dependent
INF	Inflation, consumer prices. Annual GDP growth rate implicit deflator.	Annual change (%)	WDI	Negative
GFCF	Gross fixed capital formation as a proxy for investments. Additions to the fixed assets of the economy plus net changes in the level of inventories.	Annual growth (%)	IMF	Positive
AgrVA	Agricultural value-added growth rate as a proxy for agricultural real growth.	Annual growth (%)	FAO/INE	Positive
TO	Trade openness or trade volume. Total values of goods and services imported and exported in the economy in a year.	Annual growth (%)	BNA	Positive

Source: Author's illustration.

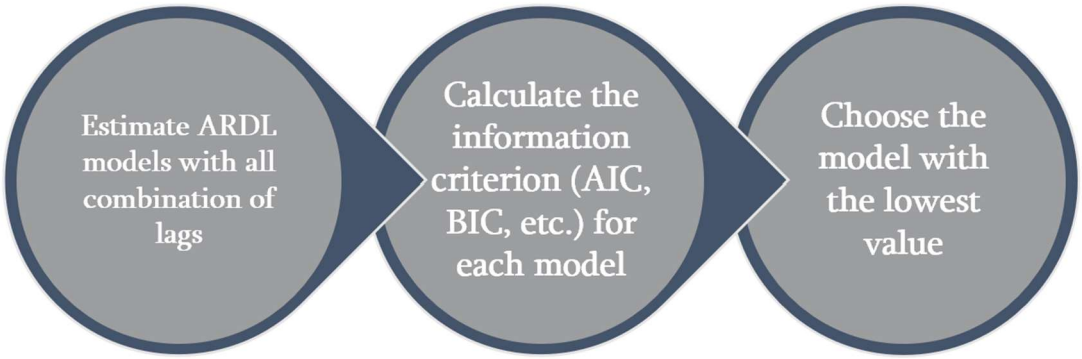
4.3 OPTIMAL LAG SELECTION

Optimal lag selection in ARDL models is essential for capturing the true dynamics of the data, ensuring valid inference, and achieving reliable predictions. Lags need to be clearly selected for every variable to avoid the presence of a serial correlation in the residual, hence avoiding spurious results. A combination of statistical criteria, economic theory, and practical considerations is needed to determine the appropriate lag structure for specific application.

While there are different criteria used for lag selection (Akaike Information Criterion – AIC, Bayesian Information Criterion – BIC, Hannan–Quinn Information Criterion – HQC, and the Schwarz Information Criterion – SIC and many other).

The procedure to select the appropriate lag length is explained in figure 5.

Figure 5: Procedure for selecting optimal lag length



Source: Author's illustration.

As this research is using the STATA 14.2 software, the *varsoc* command will be used to run different lag lengths and based on the results evaluate the information criterion to be used (AIC, BIC, HQC or SIC).

4.4 RESEARCH METHODOLOGY AND MODEL DESIGN

The objective of this study is to examine the impact of agriculture on Angola's economic growth, through robust methods, and using the ARDL econometric model. To verify the degree of the relationship between the variables in the model, the hypotheses below were set as follows:

H_0: Agriculture has no impact on economic growth in Angola; and

H_a: Agriculture has an impact on economic growth in Angola.

4.4.1 Unit root and stationarity tests

Stationarity is a crucial property in time series analysis because many statistical modeling techniques, such as Autoregressive Integrated Moving Average (ARIMA) models, assume that the time series is stationary. A stationary time series has statistical properties, such as mean and variance, that do not change over time.

While stationarity tests consider as null hypothesis (H_0) that the series is stationary and unit root tests consider the H_0 that the series possesses a unit root,

meaning that it is not stationary. If time series data are non-stationary and have a unit root, running a regression on them can lead to spurious results, meaning that the regression may show significant relationships between variables where none exist. This can lead to misleading conclusions.

The two most used unit root tests are the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) test.

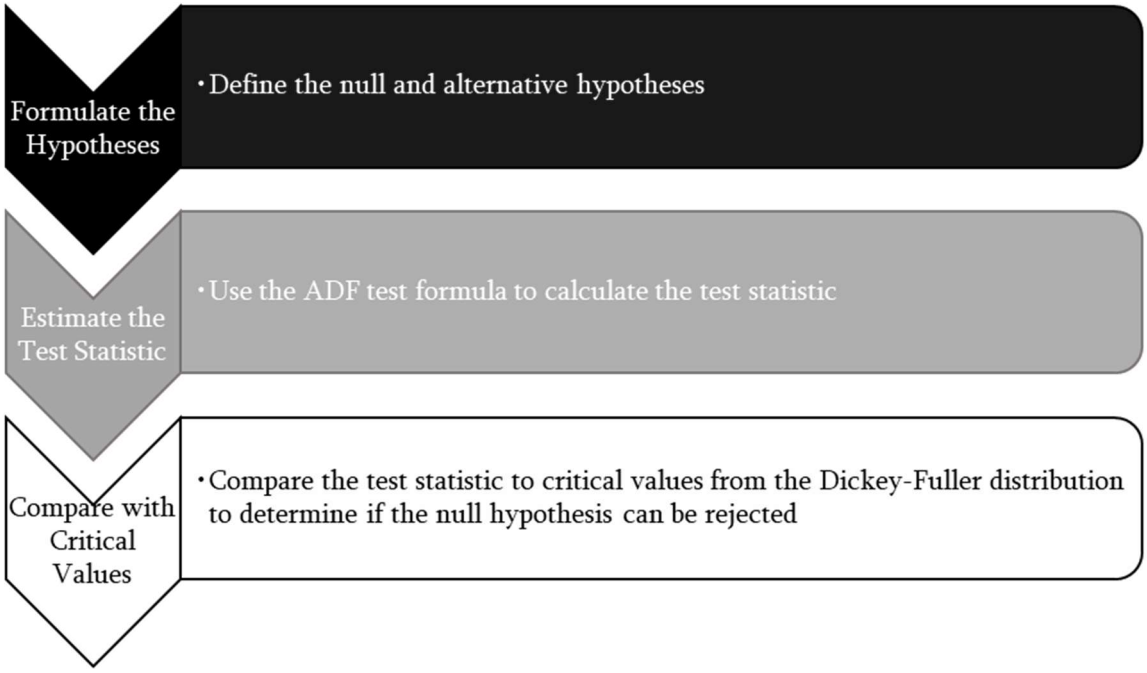
4.4.1.1 ADF test

The Augmented Dickey Fuller (1981) test is an enhancement to the standard Dickey Fuller test (1979), limited as it tests for a unit root in a simple autoregressive model. The study used the ADF test as it represents an improvement of the standard test, including lagged differences of the series to account for higher-order serial correlation.

Furthermore, it was used to determine modeling accuracy, parameter estimation, forecasting reliability, trends and seasonality and hypothesis testing. The ADF test allows for hypothesis testing on the time series data. The null hypothesis of the ADF test is that the time series has a unit root (i.e., non-stationary). By rejecting the null hypothesis, we conclude that the time series is stationary. If the data is non-stationary, the model's predictions can be unreliable or inaccurate. The ADF test helps identifying if a time series needs to be differenced or transformed to achieve stationarity.

The procedure used to access if the time series have a unit root followed the steps illustrated below:

Figure 5: Procedure to perform the ADF test



Source: Author's illustration.

The ADF test equations to examine for the presence of a unit root in a time series is as follows (Nkoro & Uko, 2016, p. 72):

$$\Delta Y_t = \alpha_0 + p_1 Y_{t-1} + \sum_{i=1}^{k} \alpha_i \, \Delta Y_{t-i} + \varepsilon_t \qquad (12)$$

where ΔY_t represents the change in the dependent variable at time t; α_0 the constant term (intercept); $p_1 Y_{t-1}$ the lagged level of the dependent variable; $\sum_{i=1}^{k} \alpha_i \, \Delta Y_{t-i}$ the sum of the lagged differences of the dependent variable, capturing the short-run dynamics; and ε_t is the error term (white noise).

4.4.1.2 Phillips-Perron test

The Peter Phillips and Pierre Perron (1988) developed the so-called Phillips-Perron (PP) test and quickly became another complementary statistical tool used for testing the presence of a unit root in time series. The PP test is an extension of the Dickey-Fuller (DF) test, providing improvements by addressing some of the DF test's limitations. While the DF test assumes homoscedastic (constant variance) errors, the

PP test allows for more general forms of heteroscedasticity and serial correlation in the error term, making it more robust in practical applications.

Additionally, the PP test adjusts the DF test statistics to account for serial correlation and heteroscedasticity in the error term without the need to specify a lag length for these serial correlations. This flexibility can provide more reliable results in the presence of complex error structures.

This study will apply the standard form of the Phillips-Perron (1988, p. 338) test equation as follows:

$$y_t = \alpha + \beta t + \rho y_{t-1} + \varepsilon_t \quad (13)$$

where, y_t is the variable being tested with a time trend, α a constant (intercept), βt the optional time trend, ρy_{t-1} represents the lag of the dependent variable to test for stationarity and ε_t the error term.

Similarly, as the ADF test, the PP test helps in hypothesis testing where the null hypothesis is that the time series contains a unit root, against the alternative that it does not contain a unit root.

4.5 THE ECONOMETRIC ARDL MODEL

Econometric models used for running regressions are selected based on the type of data (time series, cross-sectional, panel) and the specific characteristics of the economic relationships being studied. Some of the most common models used are:

a) ordinary least squares (OLS), one of the simplest and most widely used econometric models due to its intuitive interpretation and straightforward implementation;

b) Generalized Least Squares (GLS), providing more efficient estimators when OLS assumptions are violated;

c) Vector Autoregression (VAR), employed in time series analysis when multiple variables are interdependent. It models the joint behavior of the system, allowing each variable to be a function of its own lags and the lags of all other variables in the system; and

d) Autoregressive Distributed Lag (ARDL), popular for time series data because they can be used to analyze both short-term and long-term relationships between variables, even when they are integrated of different orders (e.g., I(0) and I(1)).

For the complexity of this econometric exercise, this research has chosen the ARDL model. The selection of the ARDL model for this research over other econometric models to estimate the relationship between dependent and independent variables, relies, as stated above, on its ability to handle both short- and long-run dynamics, as well as (i) flexibility with order of integration; (ii) ease of implementation and interpretation; (iii) lag selection flexibility; and (iv) incorporation of an error correction mechanism (ECM).

4.5.1 Long-run model

The ARDL model was presented by Pesaran and Shin (1995), improved by the authors in 1997 and 1999, and later expanded by Pesaran et al. (2001) to assess the long-run relationship (cointegration) among variables. The authors demonstrate that with an ARDL representation it is possible to identify cointegration relationships in a system formed by variables that are all I(1) – non-stationary and differenced, all I(0) – stationary, or a mixture of stationary and non-stationary (differenced) variables. This is another considerable advantage when compared to the cointegration method developed by Johansen (1988) or even the FMOLS estimator, as both assume that all variables in the system are non-stationary.

The dynamics of the relationship between GDP and INF, GFCF, AgrVA, and TO is analyzed using the ARDL model considering the assumption of exogeneity of the independent variables (INF, GFCF, AgrVA and TO).

The general equation of the model is described below:

GDP = f (INF, GFCF, AgrVA, TO) (14)

where *GDP* represents gross domestic product annual growth rate and is a function of inflation annual change rate (*INF*), gross fixed capital formation growth rate (*GFCF*), agricultural value-added growth rate (AgrVA), trade volume growth rate (TO).

To assess the long-run relationship (cointegration) among variables using the ARDL model, the following equation will be applied (Nkoro & Uko, 2016, p. 84):

$$Y_t = \alpha_0 + \sum_{i=1}^{p1} \beta_{\mathrm{i}} Y_{t-i} + \sum_{\mathrm{j}=1}^{p2} \beta_j X_{1,t-j} + \sum_{\mathrm{k}=1}^{p3} \beta_k X_{2,t-k} + \sum_{\mathrm{l}=1}^{p4} \beta_l X_{3,t-l} + \sum_{\mathrm{m}=1}^{p5} \beta_m X_{4,t-m} + \varepsilon_t \quad (15)$$

where Y_t is the dependent variable; $X_{1-4,t}$ are the independent variables; α_0 the intercept term; $\beta_{\mathrm{i}} - m$ are the long-run coefficients; $p1 - 5$ the number of lags for each variable; and ε_t the error term.

Equation 16 shows the adjusted equation with the model variables:

$$GDP_t = \alpha_0 + \sum_{i=1}^{p1} \beta_{\mathrm{i}} GDP_{t-i} + \sum_{\mathrm{j}=1}^{p2} \beta_j INF_{t-j} + \sum_{\mathrm{k}=1}^{p3} \beta_k GFCF_{t-k} + \sum_{\mathrm{l}=1}^{p4} \beta_l AgrVA_{t-l} + \sum_{\mathrm{m}=1}^{p5} \beta_m TO_{t-m} + \varepsilon_t \quad (16)$$

This ARDL model should facilitate analysis and interpretation of the relationships between dependent and independent variables, aiming to gain valuable insights into the impact of independent variables on the economic growth in Angola.

4.5.2 Short-run Dynamics and Error Correction Model

For the short-run model, variables need to be in 1st differences and stationary. The error correction term is introduced in the model, which is that of the long-term regression but lagged from a period as seen in equations 17 and 18 below.

$$\varepsilon_{t-1} = X_t - \beta_0 - \beta_1 M_{t-1} \quad (17)$$

$$\Delta X_t = \beta_0 + \beta_1 \Delta M_t + \beta_2 \varepsilon_{t-1} + v_t \quad (18)$$

where ΔX_t represents the change in the dependent variable X_t between two time periods. The difference operator (Δ) typically indicates a first difference; β_0 is the intercept term or constant; ΔM_t is the change in the independent variable M_t and β_1 is the coefficient that measures the effect of this change on the dependent variable X_t; $\beta_2 \varepsilon_{t-1}$ is the key term in ECM, ε_{t-1} represents the lagged error correction term and β_2 represents the speed of adjustment toward long-run equilibrium.

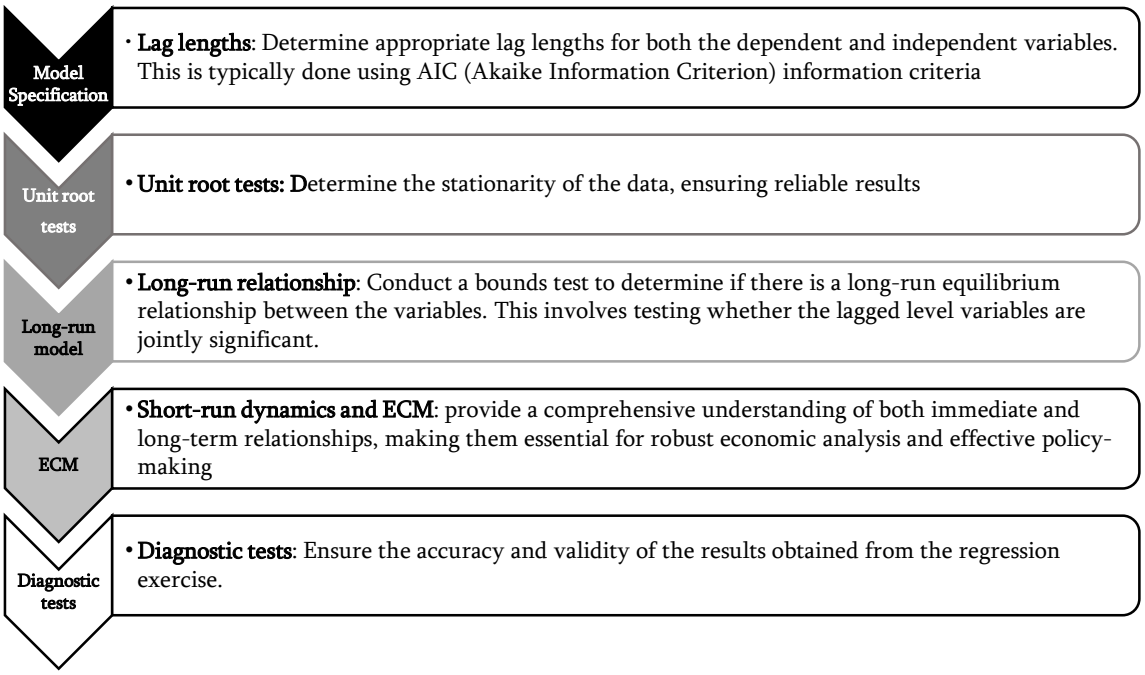
A negative ECT coefficient suggests that if the system is out of equilibrium (i.e., if there's a deviation from the long-run relationship), the dependent variable will adjust back to equilibrium. The greater the absolute value of the ECT, the faster the adjustment. A value close to zero indicates slow adjustment, while a value closer to -1 indicates a rapid return to equilibrium. The time it takes for the system to return to equilibrium can be approximated using the ECT coefficient and expressed as follows (Lebo & Kraft, 2017, p. 8):

$$T = \frac{1}{\beta} \quad (19)$$

where T is the time it takes to adjust after the shock; 1 the unit of time; and β the ECT coefficient.

Figure 6 below describes the procedure that will be used to estimate long run and short run relationship using the ARDL model.

Figure 6: Procedure to perform the ARDL model



Source: author's illustration.

4.6 DIAGNOSTIC TESTS

Diagnostic tests are crucial in the application of ARDL models because they ensure the reliability and validity of the model's results. Some of the main reasons are fundamentally to (i) ensure correct model specification, (ii) check model assumptions, namely linearity, homoscedasticity and normality of residuals, (iii) verify autocorrelation in the residuals, or (iv) detect multicollinearity by identifying high correlations among predictors that could affect the model's reliability.

4.6.1 Normality

While the assumption of normally distributed residuals is not strictly necessary for the estimation of ARDL models, it is important for several reasons related to the validity and reliability of the statistical inferences derived from the model.

There are several tests for normality, each with its own specific approach and equations. There are three commonly used normality tests, namely (i) the Jarque-Bera test, the Shapiro-Wilk test, and the Kolmogorov-Smirnov test.

For this research only the Jarque-Bera (1980) test will be applied as it assesses whether the sample data have skewness and kurtosis matching a normal distribution.

The Jarque-Bera test statistic equations 20 and 21 are expressed as follows:

$$JB = T\left[\frac{(Skew)^2}{6} + \frac{(Kurt-3)^2}{24}\right] \quad (20)$$

$$JB = \frac{n}{6}\left(S^2 + \frac{(K-3)^2}{4}\right) \quad (21)$$

where JB is the Jarque-Bera test statistic; n the sample size; S the skewness of the data (a measure of asymmetry); K the kurtosis of the data (a measure of how heavy or light the tails of the distribution are compared to a normal distribution); and $(K-3)$ reflects that the kurtosis of a normal distribution is 3, so the Jarque-Bera test measures how much the observed kurtosis deviates from 3.

The null hypothesis for the Jarque-Bera test is that the skewness and kurtosis of the data are equal to those of a normal distribution. In other words, if the *p*-value associated with the Jarque-Bera test is greater than a chosen significance level (e.g., 0.05), then the null hypothesis is not rejected, indicating that the data is normally distributed. Conversely, if the *p*-value is less than the significance level, the null hypothesis is rejected, suggesting that the data significantly deviates from a normal distribution.

4.6.2 Multicollinearity

Multicollinearity occurs in regression analysis when two or more predictor variables are highly correlated, making it difficult to isolate the individual effect of each predictor on the dependent variable. One way to diagnose multicollinearity is

through the Variance Inflation Factor (VIF). VIF measures how much the variance of an estimated regression coefficient increases if model predictors are correlated. A higher VIF indicates higher multicollinearity, and it assumes the following equation 22:

$$VIF = \frac{1}{1-R_j^2} \quad (22)$$

where, R_j^2 is the R^2 value obtained by regressing the *j*-th predictor on all other predictors.

Table 2: Interpretation of VIF values

VIF	Interpretation
1	No correlation between the *j*-th predictor and any other predictor. Multicollinearity is not a concern.
1 < VIF < 5	Moderate correlation, generally acceptable. Multicollinearity is not likely to be problematic.
5 ≤ VIF < 10	High correlation, it indicates potential multicollinearity. Investigate further to understand the source and consider remedial actions.
VIF ≥ 10	Very high correlation, serious multicollinearity issue. Strongly consider taking steps to address it.

Source: Author's illustration.

4.6.3 Autocorrelation

Autocorrelation tests are crucial because autocorrelation can significantly impact the reliability and validity of the model's estimates and inferences, leading to unreliable hypothesis tests (*t*-tests and *F*-tests) and confidence intervals. This can result in incorrect conclusions regarding the significance of the explanatory variables. By identifying and correcting for autocorrelation, more efficient and unbiased estimators can be achieved, improving the overall quality of the model.

Among common autocorrelation tests are (i) the Durbin-Watson (DW) Test, (ii) the Breusch-Godfrey (BG) Test, and (iii) the Ljung-Box Test.

For the purpose of this research, only the Breusch-Godfrey (1978 et 1978) test will be performed. It is used to detect the presence of autocorrelation in the residuals of a regression model, particularly when dealing with higher-order autocorrelation, and it allows testing for lagged values of dependent variables. Additionally, the Breusch-Godfrey test is less sensitive to the assumption that residuals are normally distributed, and it allows to test for serial correlation through a number of lags besides just one lag.

The output of the Breusch-Godfrey test will typically include the test statistic, the degrees of freedom, and the *p*-value, namely:

a) Test Statistic**:** the BG test statistic follows a chi^2 distribution. For large sample sizes, it can also be approximated by an F-statistic;

b) Degrees of freedom (df): the degrees of freedom for the chi^2 distribution are equal to the number of lagged residuals included in the test; and

c) *P*-value**:** the *p*-value indicates the probability of observing the test statistic under the null hypothesis that there is no autocorrelation.

The auxiliary regression model is expressed in the equation 22 below:

$$\hat{u}_t = \alpha_0 + \alpha_1 x_{1t} + \alpha_2 x_{2t} + \cdots + \rho_1 \hat{u}_{t-1} + \rho_2 \hat{u}_{t-2} + \cdots + \rho_p \hat{u}_{t-p} + \varepsilon_t \quad (23)$$

where $\hat{u}_t$ are the residuals from the original model; α_i the regression coefficients; x_{it} independent variables at time *t*; $\hat{u}_{t-i}$ the lagged residuals; ρ_i the number of restrictions imposed by H_0, and ε_t is the white noise error term in the auxiliary regression that satisfies all the classical assumptions.

For interpretation, the decision rule follows the following procedure:

a) Null hypothesis (H_0): there is no autocorrelation up to the specified order;

b) Alternative hypothesis (H_a): there is autocorrelation up to the specified order;

c) Significance level (α): for the purpose of this study, the significance level is 0.05.

d) Interpret the p-value:

- If *p*-value < α: reject the null hypothesis. There is evidence of autocorrelation; and
- If *p*-value ≥ α: fail to reject the null hypothesis. There is no evidence of autocorrelation.

4.6.4 Heteroscedasticity

The heteroscedasticity test in econometric models is multifaceted, largely because heteroscedasticity can significantly impact the reliability and validity of the model's estimates and inferences. Additionally, detecting heteroscedasticity can provide insights into potential misspecifications in the model, such as omitted variables, incorrect functional forms, or the need for a transformation of variables. Addressing these issues can improve the overall model specification and performance, making the models more useful for empirical analysis and policymakers. The most common tests for heteroscedasticity are the Breusch-Pagan test and the White test.

For this research only the White test will be performed as it is more general and does not assume a specific form for the heteroscedasticity. White's test for heteroscedasticity examines whether the variance of the residuals from a regression model depends on the values of the independent variables.

For the hypothesis and decision rule, the following assumptions are considered:

- Null hypothesis (H_0): residuals are homoscedastic, that is, constant variance of residuals; and

- Alternative hypothesis (H_a): residuals are heteroscedastic, that is, variance of residuals depends on the independent variables.

The White test equation (1980, p. 824) assumes the following form:

$$\hat{u}^2 = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \cdots + \alpha_k X_k + \beta_1 X_1^2 + \beta_2 X_2^2 + \cdots \beta_k X_k^2 + \gamma_1 (X_1 \cdot X_2) + \cdots + \varepsilon \quad (24)$$

where $\hat{u}^2$ is the squared residual from the original regression; α_0, α_1, α_2, …, β_1, β_2,…, γ_1 the coefficients to be estimated in the auxiliary regression; X_1, X_2, …, X_k the original independent variables; X_i^2 the squares of the independent variables; $(X_1 \cdot X_2)$ the cross-products of the independent variables; ε the error term or residuals.

4.6.5 Stability

Stability tests in ARDL models are essential for ensuring the reliability, robustness, and validity of the estimated relationships over time. By identifying and addressing any instability or structural breaks, these tests enhance the model's predictive accuracy and provide more reliable insights for policy analysis, forecasting, and understanding economic and financial dynamics.

This research will be performing the Cumulative Sum (CUSUM) test. It checks for parameter stability by examining the cumulative sum of recursive residuals. If the plot of the CUSUM statistic stays within the critical bounds, the model is stable.

4.7 GRANGER CAUSALITY

It was developed by British economist Clive Granger (1969) and quickly became an important concept when working with ARDL models because it helps in understanding the direction of causality between dependent and independent variables. Its importance in the context of ARDL models are numerous, namely (i) it helps identifying the direction of influence between variables, (ii) enhancing

forecasting and policy analysis, (iii) ECM specification, that is, the Granger causality tests inform the construction of the ECM derived from the ARDL model, (iv) handling endogeneity in the sense that Granger causality test helps in identifying potential endogeneity issues, and (v) it helps understanding structural relationships by provides insights into the structural relationships between variables. This understanding is crucial when interpreting the coefficients and dynamics in an ARDL model.

The basic idea is to test whether past values of X help to predict Y, and vice versa. When testing if X Granger-causes Y, the basic equation below is applied:

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \sum_{j=1}^{q} \beta_j X_{t-j} + \varepsilon_t \quad (25)$$

where, Y_t is the dependent variable, X_t is the independent variable whose past values are being tested for predictive power, α_0 is the intercept, α_i are the coefficients for the lagged values of Y, β_j are the coefficients for the lagged values of X, ε_t is the error term, p and q are the maximum lags for Y and X, respectively.

The hypotheses testing in this approach are:

(i) Null hypothesis (H_0): X does not Granger-cause Y. This means all $\beta_j = 0$

(ii) Alternative hypothesis (H_a): X Granger-causes Y. This means at least one $\beta_j \neq 0$.

For this research the equation is adjusted to:

$$GDP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i GDP_{t-i} + \sum_{j=1}^{q} \beta_j AgrVA_{t-j} + \varepsilon_t \quad (26)$$

On the other hand, when testing if Y Granger-causes X, the basic equation below is applied:

$$X_t = \gamma_0 + \sum_{i=1}^{p} \gamma_i X_{t-i} + \sum_{j=1}^{q} \delta_j Y_{t-j} + \eta_t \quad (27)$$

where, X_t is the dependent variable, Y_t is the independent variable whose past values are being tested for predictive power, γ_0 is the intercept, γ_i are the coefficients

for the lagged values of X, δ_j are the coefficients for the lagged values of Y, η_t is the error term, p and q are the maximum lags for X and Y, respectively.

The hypotheses testing in this approach are:

(i) Null hypothesis (H_0): Y does not Granger-cause X. This means all $\delta_j = 0$

(ii) Alternative hypothesis (H_a): Y Granger-causes X. This means at least one $\delta_j \neq 0$.

For this research the equation is adjusted to:

$$AgrVA_t = \gamma_0 + \sum_{i=1}^{p} \gamma_i AgrVA_{t-i} + \sum_{j=1}^{q} \delta_j GDP_{t-j} + \eta_t \quad (28)$$

where $AgrVA_t$ represents the agricultural value-added at time t, the dependent variable being explained by its own past values and by past values of GDP; γ_0 the constant term or intercept; $\sum_{i=1}^{p} \gamma_i AgrVA_{t-i}$ the autoregressive component, where $AgrVA_{t-i}$ represents the lagged values of agricultural value added, showing how past values of agriculture value added influence current values; $\sum_{j=1}^{q} \delta_j GDP_{t-j}$ the distributed lag component, where GDP_{t-j} represents the lagged values of GDP, capturing how past GDP values impact agricultural value added; and η_t the error term or disturbance, accounting for other factors not included in the model that may affect agricultural value added.

The other respective variances of the basic equations to examine Granger causality on both ways between other independent variables (INF, GFCF and TO) and the dependent variable (GDP) are adjusted accordingly.

5. DATA ANALYSIS, RESULTS AND DISCUSSION

Chapter 4 aimed at creating a solid foundation and framework for a suitable empirical analysis of the time series with the description of a diversity of econometric models and statistical techniques subject to the research.

This chapter aims at providing various econometric estimations and results from the application of approaches and methods described to determine if the purpose of the research was achieved or not.

5.1 PRIMARY EMPIRICAL DATA ANALYSIS

Primary analysis is a vital step in econometric modeling, as it lays the foundations for building accurate and reliable models. By thoroughly examining the data and its properties, primary analysis provides preliminary insurance that models and statistical techniques are well-specified, robust, and capable of providing valid inferences. This step helps in identifying and addressing potential issues early on, ultimately leading to more credible and trustworthy results in econometric analysis.

5.1.1 Performance analysis of variables

This study has identified five variables, one dependent (GDP growth) and four independents (inflation, gross fixed capital formation, agricultural value added and trade openness). This analysis over the selected period is important to examine trends and to complete before running stationarity and unity roots tests as it may assist in selecting a suitable model for analysis of the long-run estimation.

5.1.1.1 GDP growth

Angola's GDP from 1993 to 2022 has been characterized by fluctuations due to various factors such as changes in oil prices, economic policies, and external economic conditions. There are seven important moments shown in graph 48 that could characterize the Angolan economy from 1993 to 2022, namely:

(i) **1993-2003 – Unstable economy**. This period was for Angola's economy a period of high volatility, with the war, oil dependency, and inflation heavily impacting GDP. After the war's conclusion in 2002, economic prospects began to improve, with GDP growth primarily driven by the expanding oil sector.

(ii) **2003-2008 – Rapid Growth Period**: During this period, Angola experienced rapid economic growth primarily driven by the oil sector. High global oil prices and increased production boosted GDP significantly. Following the end of the civil war in 2002, Angola embarked on massive reconstruction projects, further stimulating economic growth. GDP growth rates were remarkably high, in average 10.9 percent.

(iii) 2009 – Global Financial Crisis: The global financial crisis led to a sharp drop in oil prices, negatively impacting Angola's GDP growth. The average growth rate slowed down but remained positive at 0.8 percent due to ongoing reconstruction efforts and government spending.

(iv) **2010-2014: Recovery and continued growth:** Oil prices recovered, and Angola's GDP growth stabilized, though at lower rates compared to the pre-crisis boom. The government made attempts to diversify the economy, investing in agriculture, mining, and infrastructure, though the economy remained heavily dependent on oil. Average GDP growth rate for the period stood at 5,2 percent.

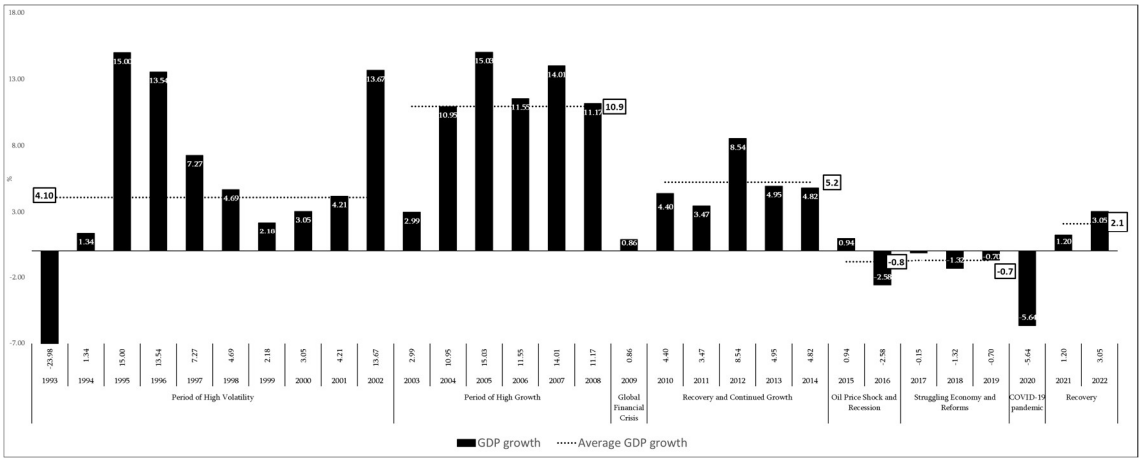
(v) **2015-2016 – Oil price shock and recession:** A significant drop in global oil prices led to economic contraction. Angola entered a recession, with GDP contracting in 2016. The decline in oil revenues resulted in fiscal deficits, leading to increased public debt and economic instability. Average GDP growth rate for the period stood at -0.8 percent.

(vi) **2017-2019 – Struggling economy and reforms:** Under President João Lourenço, Angola undertook economic reforms aimed at stabilizing the economy, reducing dependency on oil, and improving the business environment. Angola sought assistance from the International Monetary Fund (IMF), which provided support through an Extended Fund Facility program. GDP growth remained sluggish as the country struggled with high inflation, currency depreciation, and debt burdens. Average GDP growth rate for the period stood at -0.7 percent.

(vii) **2020 – COVID-19 pandemic**: The COVID-19 pandemic severely affected Angola's economy, exacerbating existing challenges. The global economic slowdown and reduced oil demand led to further GDP contraction. GDP growth rate stood at -5.6 percent.

(viii) **2021-2022 – Gradual recovery and continued challenges:** Angola started to see signs of recovery as oil prices increased and global economic conditions improved. Continued efforts to diversify the economy showed gradual progress, with growth in sectors such as agriculture and manufacturing. Angola's heavy reliance on oil remains a significant challenge. Efforts to diversify the economy are crucial for sustainable growth. Average GDP growth rate for the period stood at 2.1 percent.

Graph 48: Angola's GDP performance

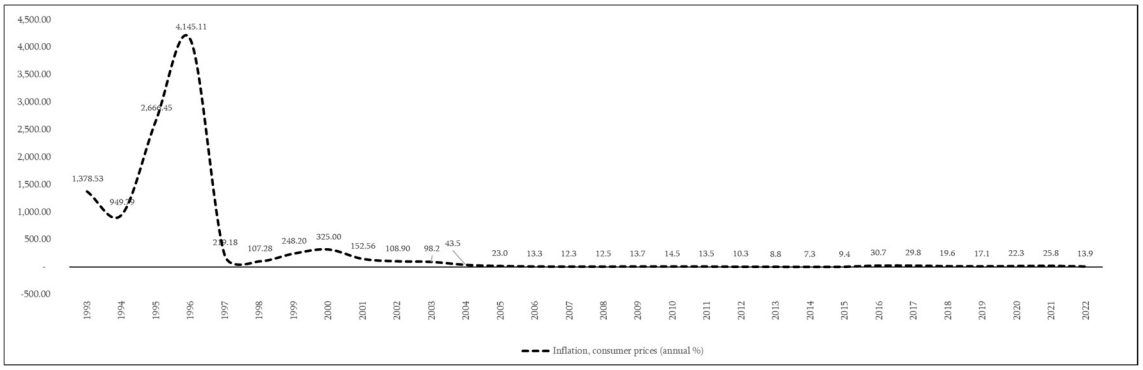


Source: Author's illustration based on World Bank data, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, (14 September 2024)

5.1.1.2 Inflation

As shown in graph 49, from 1993 to 2022, Angola's inflation rate experienced significant volatility, characterized by periods of moderation and severe spikes, especially during recession and COVID-19 pandemic (2016-2021). The country's heavy dependence on oil revenues, coupled with external economic shocks and currency depreciation, contributed to these inflationary trends. Efforts to stabilize the economy and implement structural reforms have helped to moderate inflation in recent years, though challenges remain.

Graph 49: Inflation behavior in Angola



Source: Author's illustration based on World Bank data, online: https://databank.worldbank.org/reports.aspx?source=world-development-indicators#, (14 September 2024)

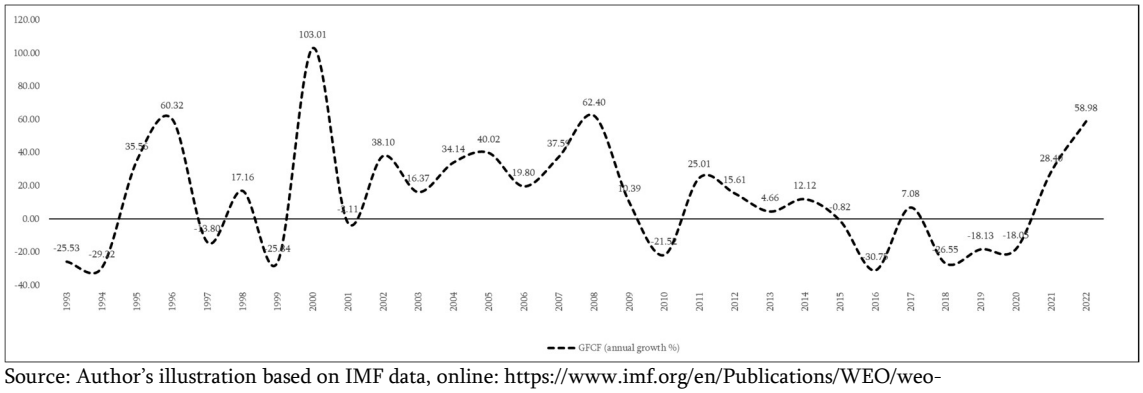
5.1.1.3 Gross fixed capital formation

From 1993 to 2022, gross fixed capital formation in Angola exhibited significant volatility, closely tied to oil revenue cycles and external economic conditions. The post-war reconstruction period saw high levels of investment, followed by slowdowns due to global financial crises and oil price collapses.

There are key influences of GFCF in Angola, namely (i) oil revenue dependency – fluctuations in global oil prices significantly influenced Angola's GFCF, with high prices boosting investment and low prices leading to cutbacks, (ii) economic diversification – efforts to diversify the economy impacted GFCF, with varying degrees of success in attracting investment to non-oil sectors, (iii) external shocks – the global financial crisis, oil price collapses, and the COVID-19 pandemic all had significant impacts on investment levels, and (iv) Government policies and reforms – Economic reforms and policies aimed at improving the investment climate, including structural adjustments and partnerships with international financial institutions, played crucial roles in shaping GFCF.

Graph 50 shows that, in recent years, with a focus on economic reform and diversification, GFCF is recovering gradually, particularly as the global economy and oil prices stabilized post-pandemic.

Graph 50: Angola's GFCF performance



Source: Author's illustration based on IMF data, online: https://www.imf.org/en/Publications/WEO/weo-database/2024/April/weo-report?c=614,&s=NGDPD,NID_NGDP,PCPIPCH,TM_RPCH,TX_RPCH,GGR,BCA,&sy=1991&ey=2022&ssm=0&scsm=1&scc=0&ssd=1&ssc=0&sic=0&sort=country&ds=.&br=1 (14 September 2024)

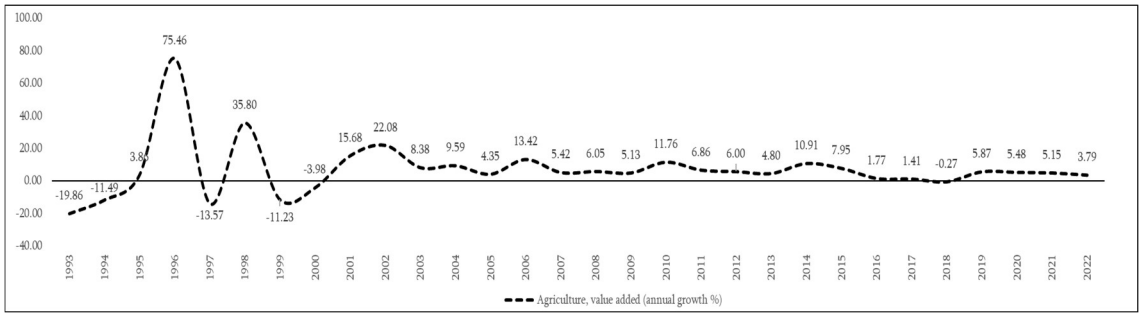
5.1.1.4 Agricultural value added

From 1993 to 2022, Angola's agricultural sector experienced gradual recovery and growth, marked by significant challenges and periodic setbacks. Efforts to rebuild and modernize agriculture following the civil war were met with mixed success, influenced by economic volatility, infrastructure deficits, and policy shifts. Recent years have shown a renewed focus on agricultural development as part of broader economic diversification efforts, with increasing emphasis on food security and resilience.

The key factors influencing agricultural performance is (i) post-war recovery – the legacy of the civil war continued to affect agricultural productivity, with ongoing challenges in landmine clearance and rural infrastructure rehabilitation, (ii) Government policies: Government initiatives and support programs played a crucial role in shaping agricultural performance, though effectiveness varied, (iii) economic volatility – Fluctuations in oil revenues and economic stability significantly impacted investment in agriculture and overall sector performance, (iv) climate and environmental factors – Variability in rainfall, periodic droughts, and other environmental factors affected crop yields and agricultural productivity, and (v) infrastructure and Access to Markets: Improvements in rural infrastructure and market access were essential for boosting productivity and integrating farmers into broader value chains.

Despite ongoing challenges, graph 51 shows that, in recent years (2019-2022), there have been positive developments in agricultural productivity and output, indicating a slow but steady path toward revitalizing the sector.

Graph 51: Angola's agricultural value-added performance



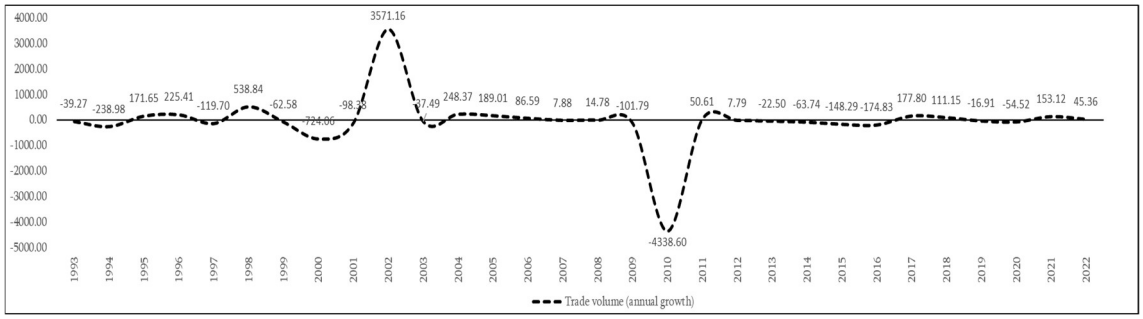
Source: Author's illustration based on FAO data, online: https://www.fao.org/faostat/en/#country/7 (14 September 2024).

5.1.1.5 Trade Openness

From 1993 to 2022, Angola's trade performance was characterized by significant dependence on oil exports, leading to periods of high trade surpluses during times of high oil prices (2010-2013) and trade deficits during oil price collapses (2014-2016). Economic reforms and diversification efforts in recent years aimed to stabilize and improve trade performance, with some progress observed in non-oil exports. As shown in graph 52, the COVID-19 pandemic in 2020 posed additional challenges with the most severe downturn of 37.1 percent, but recovery efforts and rising oil prices in the latter years showed signs of stabilization and improvement in trade dynamics.

There are key influences of trade openness in Angola, namely (i) oil dependency – Angola's trade performance has been heavily influenced by its reliance on oil exports, making it vulnerable to global oil price fluctuations, (ii) global economic conditions – global financial crises and pandemics significantly impacted trade volumes and revenues, (iii) economic reforms – Government policies and reforms aimed at economic diversification have played a crucial role in shaping trade performance, especially in the latter years, and (iv) currency fluctuations – depreciation of the Angolan kwanza affected import costs and trade balance, influencing overall trade dynamics.

Graph 52: Angola's trade openness performance



Source: Author's illustration based on BNA data, online: https://bna.ao/#/pt/estatisticas/estatisticas-externas/dados-anuais, (14 September 2024).

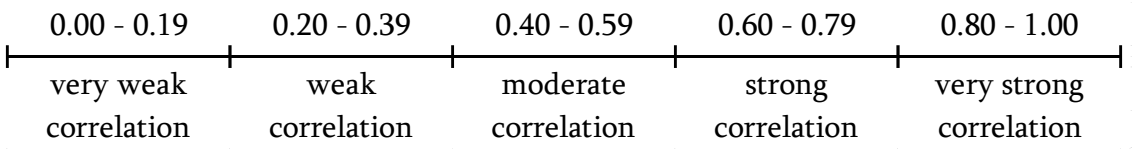
5.2 CORRELATION ANALYSIS RESULTS

Correlation analysis is a foundational tool in the modeling process. It helps in identifying relationships, selecting, and reducing variables, understanding data, and improving model diagnostics and interpretation. By leveraging correlation analysis, data scientists and analysts can build more accurate, efficient, and interpretable models.

Correlation analysis helps in selecting relevant features for a model by highlighting variables that have a strong relationship with the target variable. On the other hand, correlation analysis helps identify multicollinearity (high correlation) among independent variables, which can cause problems in regression models. Variables with high multicollinearity can be excluded or transformed. The most used correlation tool is the Pearson correlation coefficient measuring linear correlation between two continuous variables.

The Pearson correlation coefficient (r), illustrated in figure 8, measures the strength and direction of the linear relationship between two continuous variables. The value of r ranges from (–1) to (+1), that is, (+1) shows a perfect positive linear relationship, (0) shows no linear relationship and (–1) shows perfect negative linear relationship. The magnitude (absolute value) of the correlation coefficient indicates the strength of the linear relationship.

Figure 7: Correlation coefficient results



Source: Author's own illustration.

Additionally, to determine if the observed correlation is statistically significant, a hypothesis test is performed. The null hypothesis (H_0) states that there is no correlation between the variables ($r = 0$). A *p*-value was used to determine the significance as follows:

- *p*-value < α (e.g., 0.05): reject the null hypothesis. There is sufficient evidence to conclude that the correlation is significant.
- *p*-value ≥ α (e.g., 0.05): fail to reject the null hypothesis. There is insufficient evidence to conclude that the correlation is significant.

Table 3 shows the Pearson correlation coefficients between variables and level of significance. All variables have a positive correlation with GDP growth. With a coefficient of 0.4553, AgrVA has the strongest correlation with GDP growth, and its *p*-value of 0.0115 is statistically significant (0.0115 < 0.05). INF has the smallest coefficient with 0.1274, confirming the expectations of having a timid or inverse relation with growth as inflation results in currency depreciation and consequently exchange rate imbalance. On the other hand, it shows to be statistically insignificant as the *p*-value of 0.5023 is higher than 0.05 (5%), which means that there is insufficient evidence to conclude a meaningful relationship.

Table 3: Pearson correlation coefficients and level of significance (*)

	GDP	INF	GFCF	AgrVA	TO
GDP	1.0000				
INF	0.1274	1.0000			
	0.5023				
GFCF	0.4492	0.3281	1.0000		
	0.0128 *	0.0767			
AgrVA	0.4553	0.4876	0.4538	1.0000	
	0.0115 *	0.0063 *	0.0118 *		
TO	0.2784	0.0016	0.1515	0.3043	1.0000
	0.1363	0.9933	0.4243	0.1020	

Source: Author's computation using STATA 14.2

5.3 DESCRIPTIVE STATISTICS RESULTS

Descriptive statistics or summary statistics are an essential step in the modeling process, providing critical insights into the data's structure, quality, and characteristics. They lay the groundwork for more sophisticated analyses and model building, ensuring that the models developed are based on a thorough understanding of the underlying data. It is important as it reveals upfront if samples are normally distributed and if there are any outliers in the data.

Table 4 below describes descriptive statistics values for economic growth, inflation, gross fixed capital formation, agricultural value added and trade openness. It is worth noting that detailed analysis revealed that GDP mean, and median values are the lowest among variables with 4.2837 and 3.8400, respectively. Its standard deviation (st. dev.), that is, deviation of individual data points from the mean (average) is also the lowest with 7.7516 and the range of values goes from -23.9800 (minimum) to 15.0300 (maximum). Despite very high variance in the difference between

minimum and maximum values across all variables, GDP, followed by agricultural value added, have the smallest difference with 39.01 and 95.32, respectively. The TO skewness and kurtosis values of 4.5617 and 24.0801, respectively, show that values are asymmetrical (skewed) and with irregular distribution. The skewness and kurtosis values of other variables show less asymmetrical distribution, being the GDP the closest to 0.

Table 4: Descriptive statistics results

Variables	obs	Mean	Median	St. Dev	Min	Max	Diff.	Skewness	Kurtosis	Jar.-Bera
GDP	30	4.2837	3.8400	7.7516	-23.9800	15.0300	39.0100	-1.3773	7.0198	19.7893
INF	30	358.0083	24.3500	900.7366	7.2800	4145.1100	4137.8300	3.2191	12.7660	114.0226
GFCF	30	8.3410	6.3800	26.2496	-29.2200	103.0100	132.2300	1.6718	7.1160	23.4346
AgrVA	30	7.2190	5.4500	16.6132	-19.8600	75.4600	95.3200	2.3055	10.9549	70.4517
TO	30	115.8067	5.2600	678.5499	-724.0600	3571.1600	4295.2200	4.5617	24.0801	439.6706

Source: Author's computation using STATA 14.2.

5.4 OPTIMAL LAG SELECTION

According to the results of the information criterion (ANNEXURE C), the AIC criterion is found to be the most appropriate as it is the one with the least value. Results suggest that the most ideal lag for each variable of model ARDL is 1, 4, 2, 4, 0 for variables GDP, INF, GFCF, AgrVA and TO, respectively.

5.5 STATIONARITY AND UNIT ROOT TESTS RESULTS

As per the behavior of the variables in time displayed in line graphs above, showing a non-stable variance, the study found it necessary to assess if the variables are stationary. To examine the stationarity or existence of unit root in the time series, the ADF and PP tests were performed with the objective of determining the order of integration of each variable, that is, variation of variables over time.

5.5.1 ADF and PP unit root test results

With the optimal lags selected for each variable (Sub-Chapter 5.4), this study is employing a well know test, the ADF by Dickey & Fuller (1981), as well as the

Phillips Perron unit root test. The null hypothesis is that unit root exists in the specified variable(s), hence the variables are non- stationary.

Tables 5, 6 and 7 below show the results of the unit root tests.

Table 5: ADF and PP unit root tests with constant

Variables	Augmented Dickey Fuller			Phillips–Perron		
	t-Statistic Level	t-Statistic 1st Difference	Level of Integration	t-Statistic at Level	t-Statistic 1st Difference	Level of Integration
GDP	-2.191	-4.940	I(1) *	-5.010	-7.224	I(0) & I(1) *
INF	-2.703	-6.412	I(1) *	-2.834	-6.415	I(1) *
GFCF	-3.478	-7.736	I(0); I(1) *	-6.449	-12.532	I(0) & I(1) *
AgrVA	-5.023	-8.795	I(0); I(1) *	-7.237	-12.134	I(0) & I(1) *
TO	-3.490	-5.516	I(0); I(1) *	-5.519	-9.677	I(0) & I(1) *
Critical values	-3.736	-3.743	1% level*	-3.723	-3.730	1% level*
	-2.994	-2.997	5% level**	-2.989	-2.992	5% level**
	-2.628	-2.629	10% level***	-2.625	-2.626	10% level***

Source: Author's computation using STATA 14.2

Table 6: ADF and PP unit root tests with constant and trend

Variables	Augmented Dickey Fuller			Phillips–Perron		
	t-Statistic Level	t-Statistic 1st Difference	Level of Integration	t-Statistic at Level	t-Statistic 1st Difference	Level of Integration
GDP	-2.562	-4.702	I(1) *	-6.287	-6.719	I(0) & I(1) *
INF	-2.456	-8.828	I(1) *	-3.326	-6.295	I(0) & I(1) *
GFCF	-5.870	-7.415	I(0); I(1) *	-7.381	-12.427	I(1) *
AgrVA	-7.486	-8.546	I(0); I(1) *	-7.740	-12.033	I(0) & I(1) *
TO	-3.682	-5.395	I(0); I(1) *	-5.516	-9.477	I(1) *
Critical values	-3.736	-4.371	1% level*	-4.343	-4.352	1% level*
	-2.994	-3.596	5% level**	-3.584	-3.588	5% level**
	-2.628	-3.238	10% level***	-3.230	-3.233	10% level***

Source: Author's computation using STATA 14.2

Table 7: ADF and PP unit root tests with without constant and trend

Variables	Augmented Dickey Fuller			Phillips–Perron		
	t-Statistic Level	t-Statistic 1st Difference	Level of Integration	t-Statistic at Level	t-Statistic 1st Difference	Level of Integration
GDP	-1.780	-4.984	I(1) *	-3.643	-7.463	I(0) & I(1) *
INF	-2.925	-5.798	I(0); I(1) *	-2.746	-7.339	I(0) & I(1) *
GFCF	-2.587	-7.887	I(0); I(1) *	-5.667	-5.466	I(0) & I(1) *
AgrVA	-2.541	-8.870	I(0); I(1) *	-5.491	-7.034	I(0) & I(1) *
TO	-3.235	-5.640	I(0); I(1) *	-5.417	-5.161	I(0) & I(1) *
Critical values	-2.657	-2.658	1% level*	-2.654	-2.655	1% level*
	-1.950	-1.950	5% level**	-1.950	-1.950	5% level**
	-1.601	-1.600	10% level***	-1.602	-1.601	10% level***

Source: Author's computation using STATA 14.2

When testing for a stationary process around a non-zero constant mean with ADF and PP in table 5, results shows that GFCF, AgrVA and TO are all stationary at level, GDP is stationary at level with the PP test but stationary at 1st difference with ADF test and INF is only stationary at 1st difference in both tests (ADF &PP).

Slightly different results are seen when testing with trend and constant, accounting for a deterministic trend and checking if the series is stationary around this trend. AgrVA is the only variable stationary in both level and 1st difference.

Finally, when tested without a constant, assuming no drift and testing for pure stationarity around zero, all variables are stationary in both level and 1st differencing using ADF and PP tests, except GDP that is only stationary at 1st difference with ADF but in both using PP tests.

Based on the results, when tested for stationarity using a trend term, data did not show a deterministic trend and a non-zero intercept, which indicates that there not a clear time trend, and it does not follow a clear trajectory. When tested with a constant term, results show that data does not fluctuate around a constant mean and does not have a clear trend. Finally, when testing with non-constant term, results show that variables have a zero mean (i.e., they fluctuate around zero) and exhibit no deterministic trend.

In summarizing, the Augmented Dickey Fuller and the PP unit root test results indicate that variables GFCF, AgrVA and TO are mostly stationary at level (I(0)), using intercept, intercept and trend or no intercept and trend. On the other hand, GDP and INF are mostly stationary at 1st difference, hence integrated of order I(1). However, all variables became integrated of order I(1) in all possible test criteria.

The fact that GDP and INF are non-stationary at levels but stationary at first differences suggests that economic growth (GDP) and inflation (INF) may exhibit long-term trends. Shocks to these variables could have persistent effects, indicating that long-term factors significantly influence them. The stationary behavior of GFCF, AgrVA and TO should imply that these variables have more predictable patterns over time, which could mean that their impact on the economy is more immediate or short-run in nature, as opposed to long-run trends.

As variables are stationary of different order and none of order I(2), the Johansen cointegration test is not appropriate and the study will be performing the ARDL bounds test, proposed by Pesaran, et. al (2001) to examine if the variables are cointegrated.

5.6 ARDL BOUND TESTS RESULTS FOR COINTEGRATION

The ARDL bounds testing approach for cointegration, developed by Pesaran et al. (2001), is a powerful tool for analyzing the long-term relationships among time series variables. This approach is particularly flexible because it can be applied irrespective of whether the underlying regressors are purely I(0), purely I(1), or mutually cointegrated.

As seen in Sub Sub-Chapter 5.5.1, series are integrated of different orders, that is, with a combination of I(0) and I(1) series, hence the ARDL bounds test is applied on the level of the variables to determine whether the variables have a long-run cointegration. According to (Kalu et al, 2015), the null hypothesis of no cointegration is rejected if the F- statistic is higher than the upper bound critical value. On the other

hand, if the F- statistic is lower than the lower bound critical value, the null hypothesis of no cointegration is not rejected.

Figure 8: ARDL bounds testing

H_0: no cointegration

	accept if F < critical value for I(0) regressors				reject if F > critical value for I(1) regressors			
Significance level	L1	L1	L05	L05	L025	L025	L01	L01
	lower bound [I(0)]	upper bound [I(1)]	lower bound [I(0)]	upper bound [I(1)]	lower bound [I(0)]	upper bound [I(1)]	lower bound [I(0)]	upper bound [I(1)]
k_4	2.45	3.52	2.86	4.01	3.25	4.49	3.74	5.06
	F-statistic = 4.922							

Source: Author's computation using STATA 14.2

Since the F-statistic of 4.922 is greater than the upper bounds critical values (3.52, 4.01, 4.49) at all significance levels (2.5, 5 and 10 percent), except at 1 percent significance level (5.06), the null hypothesis of no cointegration is rejected. Figure 8 confirms that there is a cointegrating relationship between the variables in the long run at 5% significance level. So, the ARDL model will be retained.

5.7 ARDL MODEL ESTIMATION RESULTS

The research results in figure 9 demonstrate that variables GDP, INF, GFCF, AgrVA and TO are cointegrated and there is at least a long-run equilibrium relationship between them. The long and short-run models are therefore considered to be estimated.

5.7.1 Long-run relationship

With the existence of a long-run relationship between variables, the model will now quantify the effect of independent variables on the dependent variable, measuring the effect of explanatory variables on explained variable.

The ARDL long run regression results are shown in table 8 below.

Table 8: Long-run estimation results

Dependent Variable: GDP

Selected model: ARDL (1, 4, 2, 4, 0)				Sample: 1997 – 2022		
Number of obs	=	26		R-squared	=	0.8646
F(15, 10)	=	4.26		Adj R-squared	=	0.6614
Prob > F	=	0.0129		Root MSE	=	3.1434

Variables	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDP (L1)	–.1105448	.2600489	–0.43	0.680	–.6899698	.4688802
INF (--)	–.0744811	.0671779	–1.11	0.294	–.2241627	.0752005
INF (L1)	.0061723	.0070951	0.87	0.405	–.0096366	.0219813
INF (L2)	–.0027144	.005717	–0.47	0.645	–.0154526	.0100238
INF (L3)	.0021551	.0057472	0.37	0.716	–.0106504	.0149606
INF (L4)	–.0028874	.0099111	–0.29	0.777	–.0249708	.019196
GFCF (--)	.260681	.1110864	2.35	0.041	.0131649	.508197
GFCF (L1)	.0943287	.0974885	0.97	0.356	–.1228891	.3115466
GFCF (L2)	–.0503897	.087473	–0.58	0.577	–.2452917	.1445124
AgrVA (--)	.5231656	.2810496	1.86	0.092	–.1030519	1.149383
AgrVA (L1)	.4240959	.2498977	1.70	0.121	–.1327108	.9809027
AgrVA (L2)	.2270528	.1675906	1.35	0.205	–.1463624	.6004681
AgrVA (L3)	.3192587	.129282	2.47	0.033	.0312006	.6073169
AgrVA (L4)	.3249003	.1923665	1.69	0.122	–.103719	.7535195
TO	–.0001505	.0051783	–0.03	0.977	–.0116885	.0113876
_cons	–7.244381	3.340386	–2.17	0.055	–14.68723	.1984631

Source: Author's computation using STATA 14.2.

Regression results analysis presents an R^2 value of 0.8646, which indicates that 86.46 percent of the variation in GDP is explained by the independent variables INF, GFCF, AgrVA and TO in the model. The adjusted R^2 value of 0.6614 accounts for the number of variables in the model, suggesting that after penalizing for the number of predictors, around 66.14 percent of the variation in GDP is still explained.

The F-statistic of 4.26 tests the overall significance of the model. A probability (Prob > F) of 0.0129 means that the model is statistically significant at the 5 percent level, as this value is less than 0.05. Furthermore, the Root MSE value of 3.1434 represents the standard deviation of the residuals, indicating the model's prediction error.

When interpreting the coefficients of the variables involved, GDP (L1) coefficient of –0.1105 ($p = 0.680$), indicates that past GDP does not have a significant effect on current GDP, which may suggest a lack of persistence in economic growth in this context. The current inflation (INF) coefficient is also not significant ($p = 0.294$) but the lagged inflation terms (INF L1 to L4) also show no significant effects on GDP, with the highest *p*-value being 0.716 and the lowest 0.294. Most of the INF coefficients indicate a negative effect on GDP, as expected in Sub-Chapter 4.2 on the determination of the variables.

Similarly, the lagged gross fixed capital formation (GFCF L1 & L2) also do not show significant effects with *p*-value of 0.356 and 0.577, respectively. However, current GFCF and GFCF L1 show positive effect on GDP, especially current GFCF with a coefficient of 0.260681 and statistically significant *p*-value of 0.041, suggesting that an increase in GFCF positively affects GDP.

On the other hand, AgrVA has by large the most positive effect over GDP in current and all 4 lags. The largest coefficient is found in the current lag (0.5231656) but it is marginally significant with a *p*-value of 0.092. The lagged term AgrVA L3 is significant ($p = 0.033$), reinforcing that past agricultural performance positively affects GDP. Other lagged AgrVA terms do not show significant effects.

The trade openness (TO) coefficient of –0.0001505 shows a very small negative impact of trade openness on GDP and the highest *p*-value among variables (0.977) means the impact of trade openness is not statistically significant as well.

When examining the constant term (_cons), the negative coefficient (– 7.244381) reflects the intercept term, which is the expected value of GDP when all the independent variables are zero. The negative value implies that GDP would most probably be negative when other variables are absent. In addition to that, the *p*-value of 0.055 is almost significant at the 5 percent level, meaning the intercept term has a slight chance of being statistically relevant.

Overall, the model indicates that GFCF and certain lagged terms of AgrVA significantly contribute to explaining GDP fluctuations. Inflation, both current and lagged, as well as TO do not appear to have a meaningful impact on GDP.

5.7.2 Short-run relationship

Besides the long-run relationship, it is important to assess the responsiveness of the explained variable on the long-term changes in explanatory variables. Using the ECM the ARDL model can capture both short-run dynamics (through the differences Δ) and long-run equilibrium (through the error correction term) and results can provide a comprehensive and theoretically consistent framework for analyzing time series data.

Understanding the short-term relationship between independent variables and a dependent variable is crucial in econometric and time series analysis for their ability to provide immediate insights and predictive power, inform policy and business decisions, enhance model accuracy, and align with economic theories. By interpretating and accurately modeling these relationships, this research can better suggest policy measures and improve the robustness of the econometric model.

Table 9 below presents the regression results of the error correction model and its ECT estimating the speed at which the dependent variable dGDP (1st difference) returns to equilibrium after a change in variables dINF, dGFCF, dAgrVA and dTO in their 1st difference.

Table 9: Short-run dynamics and error correction model results

Dependent Variable: dGDP						
Selected model: ARDL (1, 4, 2, 4, 0)			Sample: 1998 – 2022			
Number of obs	=	25	R-squared	=	0.6957	
F(13, 11)	=	1.93	Adj R-squared	=	0.3361	
Prob > F	=	0.1401	Root MSE	=	4.0474	
Variables	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dGDP (L1)	.0023519	.2854678	0.01	0.994	–.6259586	.6306624
dINF (L1)	.0080467	.0058876	1.37	0.199	–.0049117	.021005
dINF (L2)	–.0036696	.0045577	–0.81	0.438	–.013701	.0063618
dINF (L3)	–.0013722	.0036919	–0.37	0.717	–.0094981	.0067536
dINF (L4)	–.005568	.0044847	–1.24	0.240	–.0154388	.0043027
dGFCF (L1)	–.0732744	.0966643	–0.76	0.464	–.2860311	.1394823
dGFCF (L2)	–.1018163	.0700228	–1.45	0.174	–.2559355	.0523029
dAgrVA (L1)	–.005955	.2648605	–0.02	0.982	–.5889089	.576999
dAgrVA (L2)	.3141319	.1927046	1.63	0.131	–.1100081	.7382719
dAgrVA (L3)	.2642865	.1466784	1.80	0.099	–.0585505	.5871236
dAgrVA (L4)	.1896218	.1633749	1.16	0.270	–.169964	.5492076
dTO	.0048409	.003352	1.44	0.177	–.0025367	.0122186
ECT	–.7702031	.5392338	–1.43	0.181	–1.957049	.4166424
_cons	–.3418246	.954606	–0.36	0.727	–2.442898	1.759249

Source: Author's computation using STATA 14.2

Based on the ARDL short-run dynamics and ECM results, the R^2 value of 0.6957 indicates that approximately 69.57 percent of the variation in dGDP (dependent variable) is explained by the independent variables (dINF, dGFCF, dAgrVA, dTO, and ECT). This suggests a moderately good fit.

Furthermore, the Adjusted R^2 value of 0.3361 demonstrates that after adjusting for the number of predictors, the explanatory power decreases to 33.61 percent, indicating that some independent variables may not significantly contribute to the explanation of the variation in dGDP.

When it comes to independent variables of the model, dINF (differenced inflation) shows a negative coefficient of –0.005568, suggesting that an increase in inflation is associated with a small decrease in GDP growth, but the *p*-value of 0.240

indicates that this effect is not statistically significant. Similarly, dGFCF (differenced gross fixed capital formation), the negative coefficient of –0.1018 implies that an increase in GFCF negatively impacts GDP growth, but again, the *p*-value of 0.174 indicates that it is not statistically significant (>0.05).

On the other hand, dAgrVA (differenced agricultural value added), the positive coefficient of 0.1896 indicates a positive relationship between agricultural value-added and GDP growth. However, this effect is also not statistically significant as the *p*-value of 0.270 is higher than the 5 percent significance level (0.05). The last variable, dTO (differenced trade openness), shows a positive coefficient of 0.0048409, suggesting that trade openness positively impacts GDP growth, but like the others, this is not statistically significant (*p*-value = 0.177).

Looking at the error correction term (ECT), indicating the speed of adjustment towards long-term equilibrium, the coefficient of –0.7702 suggests that approximately 77 percent of the disequilibrium from the previous period's shock is corrected in the current period. However, the *p*-value of 0.181 shows that this correction term is not statistically significant.

Nevertheless, the F-statistic (Prob > F) value of 0.1401 also shows that it is not statistically significant at the 5 percent significance level (0.05). This means that the overall regression is not significant, and the model in the short run may not explain the dependent variable sufficiently.

Finally, while the coefficients of the independent variables suggest some expected relationships (e.g., inflation has a negative impact on GDP, agricultural value-added contributes positively), none of the variables are statistically significant at common thresholds (e.g., *p*-value < 0.05). Additionally, the error correction term is not statistically significant, meaning the model does not provide clear evidence of a strong short-run relationship.

5.8 DIAGNOSTIC TESTS RESULTS

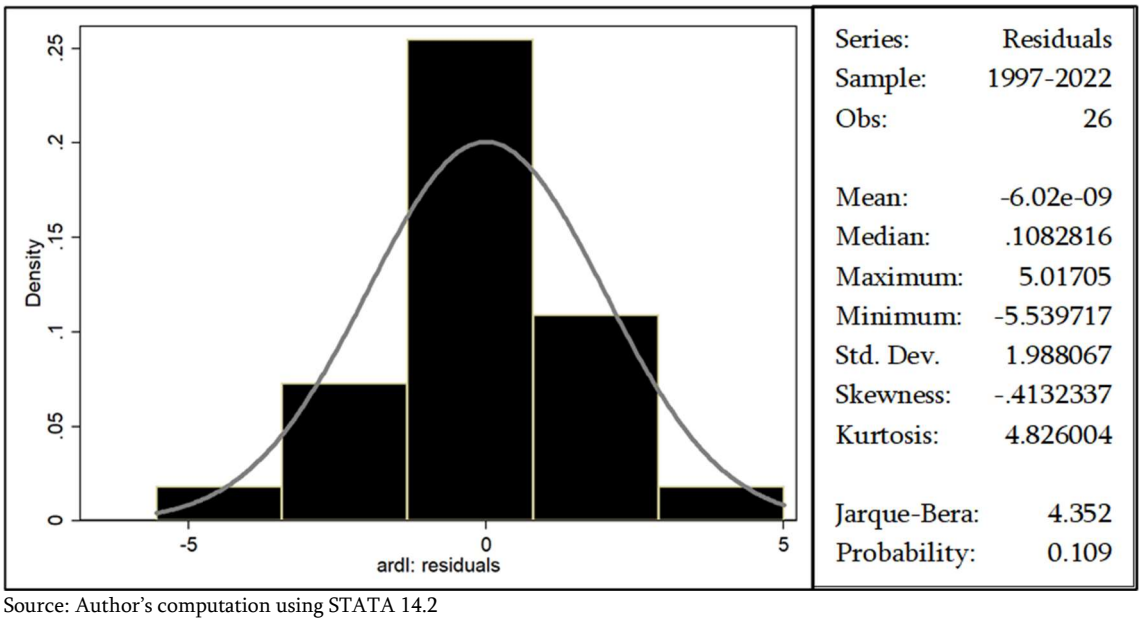
Diagnostic tests are essential after model estimation to ensure that the assumptions underpinning the model are valid, to detect any specification errors, and to improve the model's accuracy and reliability.

Following the methodology outlined in Sub-Chapter 4.6, diagnostic tests are performed through (i) normality, (ii) autocorrelation, (iii) heteroscedasticity and (iv) stability tests.

5.8.1 Normality tests

As per the methodology outlined in Sub Sub-Chapter 4.6.1, to check whether the residuals form the regression model are plausibly normally distributed, the Jarque-Bera test is applied to assess data skewness and kurtosis.

Graph 53: Normality test



Source: Author's computation using STATA 14.2

According to graph 53 above, the Jarque-Bera Statistic of 4.352 was calculated based on the skewness and kurtosis of the residuals and the higher this value, the greater the deviation from normality. The probability (*p*-value) represents the likelihood of observing a test statistic as extreme as the one calculated, assuming the

null hypothesis is true. The null hypothesis (H_0) is that the residuals are normally distributed. Consequently, since the *p*-value of 0.109 is greater than common significance levels like 0.05 or 0.01 (5 or 1 percent significance level), the null hypothesis is rejected. This means there is not enough evidence to say that the residuals deviate significantly from a normal distribution.

When interpretating data skewness (–0.413), the residuals are slightly negatively skewed, indicating a small leftward asymmetry. However, the skewness is close to zero, suggesting near symmetry. On the other hand, the kurtosis value of 4.826 is greater than 3, which indicates that the residuals have heavier tails than a normal distribution (i.e., more extreme values). However, this value is not excessively high.

This test result supports the adequacy of the model in terms of normally distributed residuals, which is a crucial assumption for many types of regression analyses.

5.8.2 Multicollinearity

Table 10 below shows test results on presence of multicollinearity, examining if predictors in the model are or not highly correlated with each other.

Table 10: Variance inflation factor results

Variable	VIF	1/VIF
AgrVA	1.67	0.599409
INF	1.38	0.723536
GFCF	1.29	0.777786
TO	1.14	0.877629
Mean VIF	1.37	

Source: Author's computation using STATA 14.2.

Results indicate that AgrVA (1.67), INF (1.38), GFCF (1.29), and TO (1.14) are all under 10, which is the conventional threshold for multicollinearity. A VIF below 10 suggests there is no significant multicollinearity in the data, meaning that the predictor variables are not highly correlated with each other.

The mean VIF of 1.37 ($\frac{1.67+1.38+1.29+1.14}{4}$) indicates low multicollinearity, implying that the predictors do not strongly correlate with each other and are not inflated due to multicollinearity. This suggests that the model is well-specified, and the individual contributions of AgrVA, INF, GFCF and TO can be interpreted with confidence.

Furthermore, the 1/VIF values represent tolerance, which indicates the proportion of the variance in the predictor variable that is not explained by the other predictors. Tolerance values closer to 1 suggest less multicollinearity. Since all values (ranging from 0.599 to 0.877) are comfortably above 0.1, multicollinearity is minimal.

5.8.3 Autocorrelation test

As per the methodology designed in Sub Sub-Chapter 4.6.3, for the presence of autocorrelation, this study has performed the Breusch and Godfrey test, as shown in table 11 below.

Table 11: Breusch-Godfrey test for autocorrelation

lags (p)	chi2	degrees of freedom	Prob > chi2
1	1.34	1	0.2471

Source: Author's computation using STATA 14.2.

Following the results from the Breusch-Godfrey test, the chi^2 value of 1.34 represents the test statistic for the Breusch-Godfrey test using 1 degree of freedom, which corresponds to the number of lags being tested for autocorrelation and the Prob > chi2 (0.2471) is the p-value associated with the test.

Since the *p*-value of 0.2471 is greater than the typical significance level of 0.05, the null hypothesis of no autocorrelation is rejected. This suggests that there is no evidence of autocorrelation in the residuals of the model at lag 1. This implies that in simpler terms, the residuals appear to be uncorrelated, indicating that the model does not exhibit signs of serial correlation at the first lag.

5.8.4 Heteroscedasticity

Based on heteroscedasticity test results using White's procedure to check if the error term is not correlated to one of explanatory variables in the model, as shown in table 12 below, data is found to be homoscedastic, hence the null hypothesis is not rejected. The null hypothesis is that the variance of the residuals is constant (i.e., there is no heteroscedasticity), and the alternative hypothesis is that the variance changes (heteroscedasticity exists).

Table 12: White's test for heteroscedasticity

chi2	df	Prob > chi2
25.00	26	0.519

Source: Author's computation using STATA 14.2.

Since the *p*-value of 0.519 is greater than the 0.05 significance level, the null hypothesis is not rejected. This means that there is no evidence to suggest the presence of heteroscedasticity in the regression model. In other words, the assumption of constant variance in the residuals appears to hold.

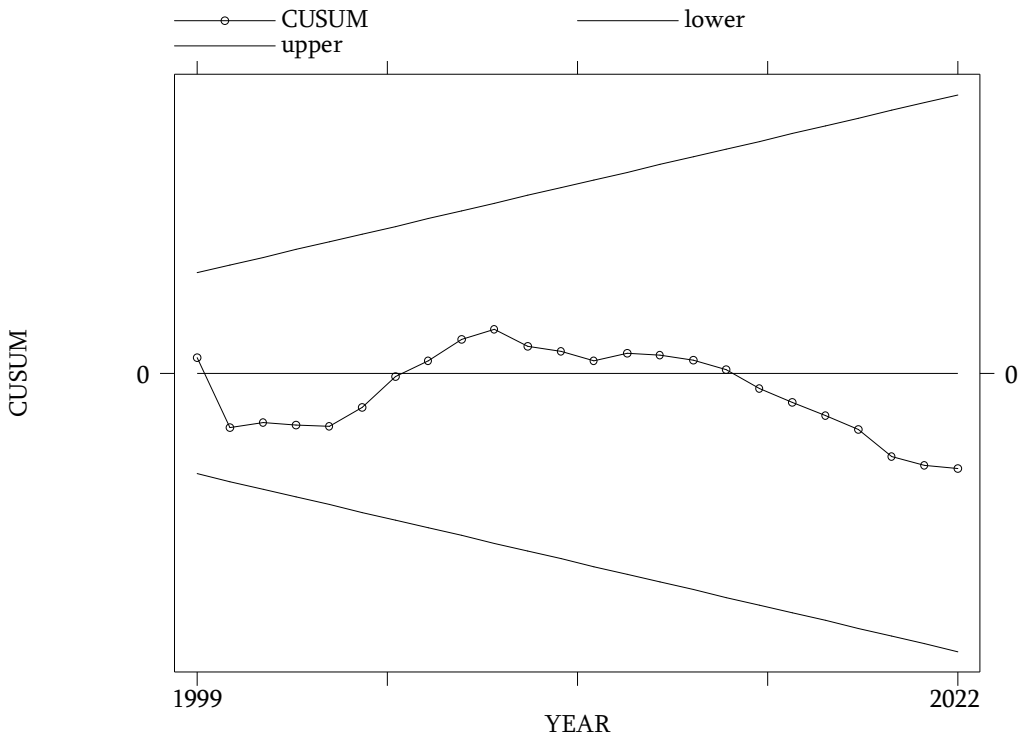
This result implies that the residuals' variance is consistent across observations, making the model reliable under the assumption of homoscedasticity.

5.8.5 Stability

As part of the data stability assessment of the model, the cumulative sum of recursive residuals (CUSUM) test was performed to avoid model misrepresentations.

Results show model stability as the CUSUM test results displayed in graph 54 is within the limits of 5 percent significance level.

Graph 54: CUSUM test results



Source: Author's computation using STATA 14.2.

The ARDL model is stable, and stability exists within the model parameters.

5.9 CAUSALITY RESULTS ANALYSIS

Further analysis was made using the Granger causality test for the variables of the estimated ARDL model to determine the existence of a causal relationship between explanatory and dependent variables. The null hypothesis (H_0) for causality assumes the absence of causality and the alternative (H_a) suggests that causality effect exists between both variables.

For this research, the significance level is 5 percent significance level (0.05), meaning that if *p*-values are greater than 5 percent, the null hypothesis is accepted, hence the variable involved do not Granger-cause the other variable. If the *p*-values

are smaller than 5 percent, the null hypothesis is rejected, hence variables involved Granger-cause other variables, meaning that they help predicting the behavior of other variables.

Table 13: Granger Causality Test

Null hypothesis	Equation	Excluded	chi2	df	Prob > chi2	Result
INF does not Granger-cause GDP	GDP	INF	.25126	2	0.882	Accept the null hypothesis
GDP Granger-cause INF	INF	GDP	12.677	2	0.002	Reject the null hypothesis
GFCF Granger-causes GDP	GDP	GFCF	7.5034	2	0.023	Reject the null hypothesis
GDP does not Granger-cause GFCF	GFCF	GDP	2.3588	2	0.307	Accept the null hypothesis
AgrVA does not Granger-cause GDP	GDP	AgrVA	1.9204	2	0.383	Accept the null hypothesis
GDP Granger-cause AgrVA	AgrVA	GDP	8.5052	2	0.014	Reject the null hypothesis
TO Granger-cause GDP	GDP	TO	7.878	2	0.019	Reject the null hypothesis
GDP does not Granger-cause TO	TO	GDP	.9022	2	0.637	Accept the null hypothesis

Source: Author's computation using STATA 14.2 results.

From the analysis of the results in table 13, it is possible to assess that the test statistic for GDP causing INF is 0.25126 with 2 degrees of freedom and a *p*-value of 0.882, indicating that changes in GDP do not Granger-cause changes in inflation at 0.05 significance level. On the other hand, the test statistic for INF causing GDP is 12.677 with 2 degrees of freedom and a *p*-value of 0.002, suggesting that changes in inflation Granger-cause changes in GDP at a 0.1 percent significance level, indicating a strong predictive power.

Similarly, the test statistic for GDP causing gross fixed capital formation is 7.5034 with 2 degrees of freedom and a *p*-value of 0.023, which indicates a significant causal effect from GDP to GFCF at the 5 percent level. However, the causality from GFCF to GDP is not significant, with a *p*-value of 0.307.

GDP causing AgrVA shows a *p*-value of 0.383, indicating no significant causality. Conversely, AgrVA causing GDP shows a significant result with a *p*-value of 0.014, suggesting AgrVA can predict GDP movements at the 5 percent level.

Finally, the causality from GDP to TO is significant with a *p*-value of 0.019, indicating a significant predictive power. The reverse causality from TO to GDP is not significant, with a *p*-value of 0.637.

Granger tests results suggest a mix of unidirectional and bidirectional causalities. Investments (GFCF), trade openness (TO), and GDP influence different variables, but inflation and agricultural value-added do not seem to significantly impact GDP, though GDP impacts both inflation and agriculture. These results offer important insights for policy, particularly regarding the roles of investment and trade in economic growth.

5.10 DISCUSSION

This sub-chapter discusses research findings of the implementation of the ARDL econometric model to assess the relationship between the dependent variable (economic growth) and independent variables (INF, GFCF, AgrVA and TO). Findings of this study are further compared to empirical findings of other studies.

Diagnostic tests were also conducted after the model estimation, namely normality, autocorrelation, heteroscedasticity and stability tests, confirming the precision of the model. The Jarque-Bera test confirmed the normal distribution of residuals, while the Breusch-Godfrey and White's tests showed the nonexistence of serial correlation and heteroscedasticity. Additionally, the stability of the model was assessed using the CUSUM test, and the model was found stable within the parameters. Finally, the Granger-causality test was performed to analyze the presence of a causal relationship between explanatory and dependent variables.

From the model point of view, the long run ARDL (1, 4, 2, 4, 0) model examines the impact of various lagged values of GDP, inflation, gross fixed capital formation, agricultural value-added, and trade openness on GDP. The lag structure captures both immediate and delayed effects of the explanatory variables on GDP. The objective of this research was to analyze the impact of agricultural value-added in economic growth in Angola and results address this concern. The structure of the long-run model has a good fit, with an R^2 of 86.46 percent, suggesting that the variables explain most of the variation in GDP. When examining the significance, although the overall model is significant (Prob > F is 0.0129), most of the individual

variables are not statistically significant at the conventional 5 percent level. This means that, despite the model being generally good, most of the individual predictors cannot be reliably said to affect GDP in this specific sample period.

Looking at the key long-run results of the long run model estimation model, the coefficient for GDP L1 is negative but not statistically significant (p = 0.680), suggesting that past GDP has little impact on current GDP. The coefficients for inflation are mostly not significant, with the first lag also being insignificant (p = 0.294), indicating that inflation may not have a strong effect on GDP in this context. From the GFCF perspective, the current period coefficient is significant (p = 0.041) and positive, implying that increases in GFCF positively impact GDP. Furthermore, AgrVA current and third lag coefficients are significant (p = 0.033 and p = 0.092, respectively), indicating a positive relationship with GDP, particularly with recent values. The TO coefficient is insignificant (p = 0.977), suggesting no impact on GDP and the constant term is –7.2444 with a p-value of 0.055, indicating that it is marginally significant. This may suggest a baseline effect on GDP that may warrant further investigation.

The economic significance of the coefficients is important. The presence of significant lags, such as the third lag for AgrVA, suggests a long-run equilibrium relationship, where agriculture influences GDP growth over a prolonged period. The significant lagged effect of agricultural value-added indicates that agricultural policies aimed at increasing productivity may take several years to show full effects. Therefore, long-term investment in agriculture could be crucial for sustained economic growth as a 1 percent increase in agricultural value-added is associated with a 0.319 percent increase in GDP after three years. This highlights the critical role of agriculture in driving long-term growth. These findings suggest targeted economic policies focusing on investment and agriculture could be beneficial for economic growth.

When interpreting the implications of non-significant coefficients, the non-significant impact of inflation (p > 0.05 across all lags) suggests that inflation does not

play a direct role in determining GDP in the short term. This could indicate a more complex relationship between inflation and economic growth, or the presence of other mitigating factors in the economy. However, non-significance should not be interpreted as the variable is unimportant. It may imply other relationships or that the effects are absorbed by other variables. For example, the insignificance of inflation may suggest that other factors, such as foreign exchange, external trade or global inflation trends might offset its impact on domestic GDP growth.

From the statistical significance perspective, the positive and statistically significant coefficient indicates that increases in GFCF are associated with increases in GDP. This suggests that investment in fixed capital is an important driver of economic growth, reinforcing the idea that enhancing capital investment could yield positive economic outcomes. The same could be confirmed form the AgrVA third lag results (coefficient: 0.3193; *p*-value: 0.033), suggesting that past agricultural performance positively influences GDP, implying that improvements in agricultural productivity can lead to increased economic growth over time. Finally, although marginally significant, the constant term (coefficient: –7.2444; *p*-value: 0.055) indicates a baseline effect on GDP, which may capture unobserved factors influencing GDP that are not included in the model.

Of all the variables, AgrVA shows the strongest positive relationship with GDP, although some of its statistical significance falls short the 5 percent significance level. This insignificance level might be related to the reliability of the data during the civil war in Angola (1993-2002), as GDP was affected by many exogenous factors not explained in the model related to a series of challenges in providing quality data showing inconsistent coverage, high volatility, permanent changes in economic relationships, existence of hyperinflation and informal markets, investment uncertainty, irregular seasonality with random shocks, policy uncertainties. From the descriptive statistics in table 4, showing high values in the standard deviation of variables, there is a high probability that times series data collected during the civil

war significantly disrupt the reliability of time series data for regression exercises, especially in economic contexts.

Therefore, notwithstanding the fact that the model shows a robust explanatory power, it should be interpreted with caution due to the limited sample size and potential omitted variable bias. Further analysis may include testing for additional variables or considering non-linear relationships.

The findings of the estimation using the ECM based on the ARDL (1, 4, 2, 4, 0) model specification reveled, though its R^2 value, that the model explains 69.57 percent of the variation in the dependent variable (dGDP), which indicates a decent fit. However, the adjusted R^2 is lower (33.61 percent), suggesting that some explanatory variables or lag structure may not significantly contribute to explaining the short-run changes in GDP. In addition, the F-statistic ($p = 0.1401$) indicates that, overall, the model is not statistically significant at conventional levels ($p < 0.05$), implying that the joint explanatory power of the regressors for short-term changes in GDP is not very strong.

When measuring the speed of adjustment back to long-run equilibrium after a short-run shock, the ECT coefficient (–0.7702) is found negative, as expected, which means the model is moving toward equilibrium in the long run. Following equation 19 in Sub Sub-Chapter 4.5.2, in practical terms, it takes approximately 1.3 years for the model to recover from short-term shocks (1/0.7702 = 1.298). But this adjustment is not statistically robust since the *p*-value (0.181) shows that the ECT is not statistically significant. The possible implications are that although the ECT has the expected negative sign, its lack of significance may imply weak long-run dynamics or that shocks to the system take longer to dissipate.

The ECM results suggest limited evidence of significant short-term drivers of GDP, apart from a marginal effect of agricultural value-added. The insignificant error correction term also highlights that deviations from long-run equilibrium are not quickly corrected, suggesting economic shocks may take time to dissipate.

Policymakers might focus on understanding why the model shows weak short-run dynamics, possibly exploring alternative variable specifications, lag lengths, or missing variables to better capture short-run impacts.

When analyzing the short-run dynamics, captured by the first differences of the independent variables (dINF, dGFCF, dAgrVA, dTO), none of the lagged differences of inflation (dINF) are statistically significant, with all p-values > 0.05. This suggests that in the short run, inflation does not have a notable effect on GDP growth. Furthermore, the first and second lags of GFCF also show no significant impact (p = 0.464 and p = 0.174, respectively), indicating that capital formation in the short run may not significantly contribute to changes in GDP. The same is also seen with TO, where its short-run coefficient is positive but not statistically significant (p = 0.177). This suggests that changes in trade openness do not have a significant immediate effect on GDP growth.

Short run dynamics in AgrVA show another perspective, as its third lag (dAgrVA L3) is marginally significant (p = 0.099), suggesting a positive short-run impact on GDP, though just outside the 5% significance level, suggesting that a 1-unit increase in agricultural value-added after three periods is associated with a 0.26-unit increase in GDP in the short run, though this is not fully conclusive given the p-value (0.099). This means that agriculture's effect on GDP in the short run may emerge after a lag of three periods but with limited statistical confidence.

In this model, only third lag of dAgrVA shows marginal statistical significance in impacting the GDP, emphasizing the importance of investment in agricultural productivity to foster economic growth. The non-significance of other variables suggests that not all factors have a meaningful influence on GDP in this context. Understanding the significance levels is crucial for making valid inferences about the relationships among variables, guiding economic policies effectively.

Agriculture value added is essential for Angola's economic growth. By diversifying the economy, creating jobs, enhancing food security, and promoting rural

development, the agricultural sector can significantly contribute to sustainable and inclusive economic growth. Addressing the challenges and implementing the right policies will be crucial in unlocking the full potential of agriculture in Angola.

Theoretically, several factors can contribute to a positive relationship between GDP and agriculture, particularly in economies where agriculture plays a significant role like Angola. Some of these factors are technological advancements, human capital development, agricultural investments and capital accumulation, government policies and institutional support, market access and trade, and other.

This positive relationship between GDP and agricultural output is aligned to growth theories listed in Sub Sub-Chapter 2.1.2, as according to the Harrod-Domar Model, growth is driven by investment. If investment is directed toward agriculture, it leads to an increase in agricultural productivity, which contributes to overall economic growth (GDP). Investment in agriculture, such as improving infrastructure or adopting advanced technologies, can lead to an increase in overall economic output. This boost in the agricultural sector leads to a rise in rural incomes, which stimulates demand for goods and services across other sectors, positively impacting GDP. The same could be explained by the Solow Model based on capital accumulation, labor force growth, and technological progress factors applied to the relationship between GDP and agriculture. The Solow Model emphasizes that capital accumulation is one of the key drivers of growth. In the context of agriculture, this means that investments in machinery, irrigation systems, improved seeds, fertilizers, and other productive inputs increase agricultural output. On the other hand, the endogenous growth model links economic growth to internal factors like human capital, innovation, and technological progress. In the context of agriculture, investments in education, research, and sustainable farming practices can drive agricultural productivity, which in turn positively influences GDP growth. This model emphasizes the importance of innovation-driven development in agriculture and suggests that policies promoting knowledge, R&D, and human capital in agriculture are key to achieving long-term economic growth.

From the empirical side, similar findings on the positive impact of agriculture on economic growth are found in Msuya (2007) on Tanzania, Izuchukwu (2011), Odetola et Etumnu (2013), Oyakhilomen and Zibah (2014), and Sertoğlu et al. (2017) on Nigeria, Moussa (2018) on Benin, Awokuse and Xie (2015) on Brazil, Chile, Mexico, China, Indonesia, Thailand, Kenya, South Africa, and Cameroon, Sanyang (2018) on Gambia, Runganga and Mhaka (2021) on Zimbabwe, Awan and Aslam (2015) on Pakistan, Phiri et al. (2020) on Zambia, Bakari and El Weriemmi (2022) on different Arab countries, and Bakari, S., & Abdelhafidh, S. (2018) on Tunisia.

Finally, from the diagnostic tests, that followed the estimation exercise, showed robustness of the model as residuals are normally distributed, there is no significant multicollinearity in the data, there is no evidence of autocorrelation in the residuals, there is no evidence of heteroscedasticity, and the cumulative sum of recursive residuals (CUSUM) revealed overall stability within the model parameters. Based on the Granger causality results, investment and trade openness are key short-run drivers of GDP growth. On the other hand, GDP influences inflation and agricultural value-added, suggesting that economic growth has important downstream effects on prices and sectoral performance, particularly agriculture. Policymakers should focus on enhancing investment and maintaining openness to trade, as these are significant contributors to economic performance in the short run.

6. CONCLUSIONS

6.1 SUMMARY CONCLUSIONS

This research has examined the impact of agricultural sector on economic growth in Angola using data from 1993 to 2022. When analyzing data, the ARDL bounds testing for cointegration approach was utilized. The ARDL bounds test was performed to assess if variables in the model have a long-run equilibrium relationship.

The ARDL (1, 4, 2, 4, 0) model results indicate that gross fixed capital formation (GFCF) has an immediate and significant positive effect on GDP, suggesting that investment in physical capital plays a crucial role in driving short-term economic growth. On the other hand, agricultural value-added (AgrVA) shows a delayed but significant effect on GDP, particularly at the third lag, indicating that the agricultural sector's contributions to growth manifest over time. None of the lags of inflation or trade openness are significant, suggesting these factors do not directly influence GDP in the periods studied. The overall high R^2 (0.8646) shows that the model fits the data well, but the significance of lagged variables highlights the need for long-term planning and sustained investment, especially in agriculture and capital formation, for continued economic growth.

From the ARDL long-run model results, we observe that GDP does not seem to be significantly influenced by its past values or inflation rates. Similarly trade openness does not appear to impact GDP significantly, which could indicate that other factors are at play in determining economic performance. On the other hand, current gross fixed capital formation, as a proxy for investments, exhibits a strong positive relationship with GDP growth. This suggests that fostering investment in fixed capital could be a crucial strategy for enhancing economic growth. Complementarily, the results suggest that agricultural value-added has both immediate and lagged positive impacts on GDP. However, the most significant effect occurs after a three-period lag, indicating that the impact of growth in the agricultural sector on GDP takes time to

materialize fully. The fact that the impact becomes significant only after three periods (with a positive coefficient of 0.3193) implies that agricultural activities contribute to economic growth, but the effects are delayed. Policymakers should recognize that investments or improvements in the agricultural sector may not yield immediate results, but they are crucial for sustained long-term economic growth.

The Error Correction Model (ECM) results provide insights into both short-term dynamics and long-run equilibrium adjustment for GDP. While the error correction term is negative, as expected, it is not statistically significant, suggesting that adjustments back to long-run equilibrium after a shock are not rapid or robust in this context. The short-run dynamics indicate that inflation, capital formation, and trade openness have no statistically significant impact on GDP in the short term. However, agricultural value-added shows a marginally significant positive effect after three periods, hinting that agriculture may play a delayed role in influencing short-run GDP growth. Overall, the model highlights weak short-term relationships and a slow adjustment to long-term equilibrium, which calls for further investigation into the underlying dynamics of GDP growth.

The diagnostic tests indicate that the model is robust and well-specified. The residuals are normally distributed, there is no significant multicollinearity, and the residuals show no evidence of autocorrelation or heteroscedasticity. Furthermore, the model demonstrates overall stability, as confirmed by the cumulative sum of recursive residuals (CUSUM) test.

In terms of economic relationships, the Granger causality results reveal that investment (GFCF) and trade openness (TO) are key short-run drivers of GDP growth. This suggests that policies targeting increased capital investment and maintaining or enhancing openness to trade are crucial for promoting economic growth.

On the other hand, the results show that GDP influences inflation and agricultural value-added (AgrVA), indicating that economic growth has significant downstream effects on prices and the agricultural sector. This highlights the

importance of monitoring inflation and supporting agricultural development as the economy expands.

In conclusion, the ARDL model provides valuable insights into the long run dynamics of GDP, particularly highlighting the importance of the agricultural performance, while in the short run the driver of economic growth is the gross fixed capital formation.

These results are consistent with other studies concluding that agricultural value added is crucial to ignite economic growth by providing food and non-food inputs for industrial goods and services.

Policy makers are therefore invited to consider the fact that according to short and long run coefficients, agriculture as a sector can become the engine of growth in Angola and play the stabilizer's role when securing food security especially for periods of socio-economic crisis.

According to Ministry of Economy and Planning of Angola (MEP), the Angola Long-Term Strategy "Angola 2050" (2023) projects the share of agriculture in GDP to double in the next 26 years from 8 percent actual share to 14 percent due to its potential. This may force some courageous and disruptive approaches to consolidate the whole agribusiness value chain, promoting the industrial sector and boost the employment opportunities in a Angola.

It must however be stressed that the relatively small sample size (30 observations) can lead to higher standard errors and statistically insignificant results. When tested for multicollinearity, to check if high correlation among independent variables (multicollinearity) are inflating standard errors and leading to statistically insignificant coefficients, values range from 1.14 to 1.67, with a mean VIF of 1.37. While TO shows the lowest VIF (1.14), indicating that it is relatively independent of the other variables in the model, AgrVA revealed the highest VIF at 1.67, suggesting it may have a slightly higher correlation with other variables than the others, but it's still far from concerning. With a mean VIF of 1.37, the model seems free from

significant multicollinearity issues, meaning that the coefficients of the independent variables are not inflated by their correlation with each other.

This can lead to a possible conclusion that statistically insignificant data does not necessarily imply that there is no effect. It means that there is not enough evidence to confirm an effect with the given data and model.

While the coefficients of the independent variables suggest some expected relationships (e.g., inflation has a negative impact on GDP, agricultural value-added contributes positively), most results show to be statistically significant at common thresholds (e.g., $p < 0.05$). Additionally, the error correction term is not statistically significant, meaning the model does not provide clear evidence of a strong short-run relationship. More data, refinement of variables, or considering alternative models might be necessary for stronger conclusions.

In summary, the ARDL model highlights the importance of both immediate and delayed effects of capital investment and agricultural value-added on GDP growth. Policymakers should prioritize long-term investment in agriculture and capital formation, as their effects are significant and sustained over multiple periods.

6.2 POLICY RECOMMENDATIONS

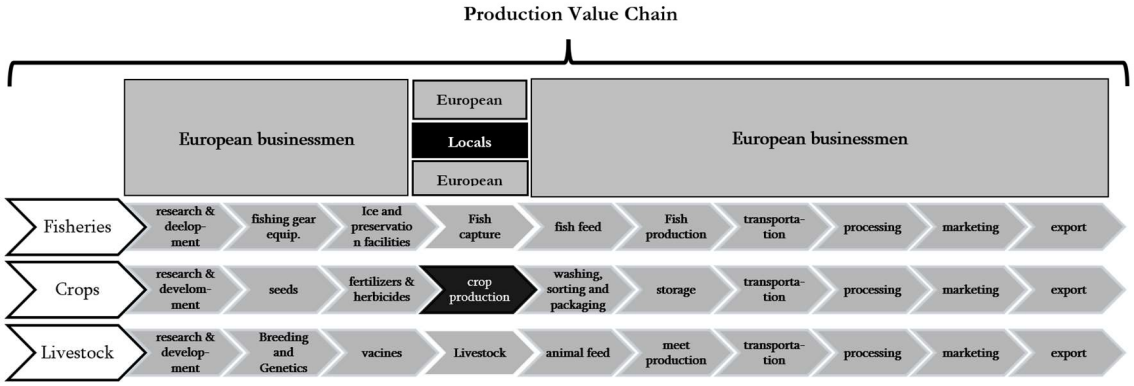
Based on the ARDL model outcomes, where agricultural performance is a vital driver of long-term economic growth in Angola, and in the short run, both agriculture and gross fixed capital formation (GFCF) are key drivers, several policy recommendations can be made to sustain and enhance economic growth. Since the agricultural sector takes time to affect GDP growth significantly, policymakers should ensure consistent extensionist support and investment in agriculture, knowing that the benefits will manifest in the medium to long term.

From the interpretation of the empirical results, aligned with the theories and other empirical studies, agricultural sector is, amongst tested variables, the most substantial determinant of growth for the Angolan economy. Enhancing agricultural

sector productivity in Angola to continue unlocking its diversification potential and take advantage of regional and international economic integration requires a multi-faceted approach with well-designed policy measures.

Looking at the practical side of the results, in Angola, as already mentioned in sub-subchapter 3.2.1.1 of this research and reinforced in the figure 9 below, between 1900 and 1961, the value chains in agriculture matured during the colonial period, supplying almost all consumption. In this process, foreign economic operators (Portuguese, Belgian, German, etc.) dominated all segments of the value chain, leaving local farmers only to participate in the primary production of goods segment.

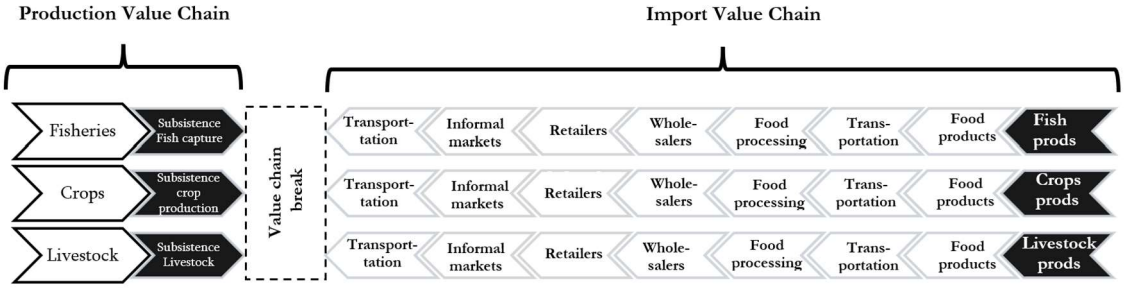
Figure 9: 1900 – 1961 Agribusiness Logistics in Angola



Source: Author's illustration.

Between 1961 and 2008 (figure 10 below), with the decolonization process and the presence of the civil war, the value chain was greatly sacrificed. With the departure of the European operators that dominated the segments of the value chain, they no longer demanded agricultural products, and the war made agriculture a risky activity, distancing commercial banking from agriculture. This process meant that farmers produced only for subsistence and the market was supplied by imports.

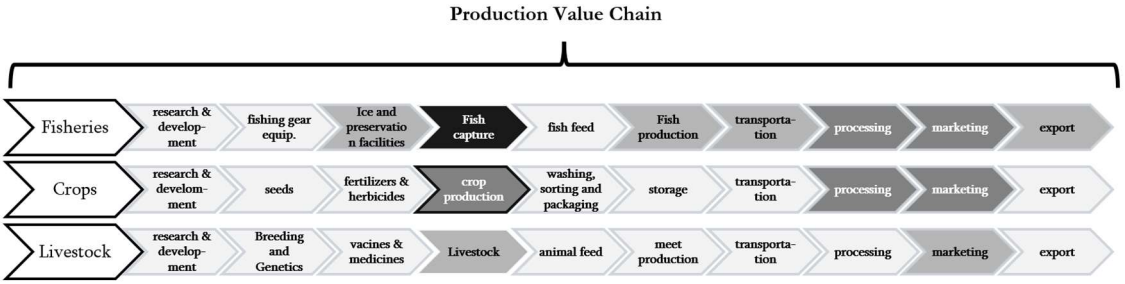
Figure 10: 1961 – 2008 Agribusiness Logistics in Angola



Source: Author's illustration.

Between 2008 and 2022 (figure 11 below), with the end of the civil war and numerous investments in infrastructure and implementation of economic policies to promote production, as well as some government participation in the re-establishment of segments of the most varied value chains with logistics centers, mechanization brigades, processing centers, transportation companies, venture capital funds, etc., albeit inefficiently, the agricultural sector began to gain ground. Today, with limited access to foreign exchange for importing goods in which Angola has comparative advantages, segments of the agricultural value chain are being gradually revived, exerting demand for agricultural products, bringing back the appetite of the banking and non-banking financial sector and reducing the need for imports.

Figure 11: 2008 – 2022 Agribusiness Logistics in Angola



Source: Author's illustration.

However, the process has been slow due to the entrepreneurial and technical capacity of economic operators and the financial appetite, as well as the almost non-existence of logistics centers distributed throughout areas of production density.

Logistics centers can serve as sales centers for instruments and inputs for producers, as well as purchasing farm produce at a fair price, encouraging production, adding value and feeding the value chain.

According to the current situation, few segments of the value chain are showing any degree of maturity. Figure 11 demonstrates that primary production is more mature than the other segments of the chain, not considering the processing and marketing segments developed by the import of agricultural goods. This explains the delays agriculture faces in impacting agriculture.

Based on these value chain challenges and on the ARDL bounds testing results from the study of the agricultural sector's impact on Angola's economic growth, several policy recommendations can be drawn to support sustained economic development, namely:

First. Increase Investment in Physical Capital (GFCF). Given that gross fixed capital formation (GFCF) has a significant positive impact on GDP in the short term, the Angolan government should prioritize public and private investments in infrastructure, machinery, and industrial capital. These investments create immediate economic returns by enhancing productivity and efficiency across sectors. Specifically, targeted investments in infrastructure (roads, energy, and telecommunications) will help support broader economic activities, including agriculture, manufacturing, and services.

Second. Long-Term Focus on Agricultural Development. The Angolan government should strengthen long-term investment in the agricultural sector to realize its delayed but significant impact on economic growth. This can include funding for modern farming techniques, irrigation systems, research and development (R&D), and extension services for farmers. The results show that agriculture has a delayed effect on GDP, implying that efforts made today may take time to materialize in economic growth. Policies should focus on

improving productivity, expanding value chains, and reducing post-harvest losses, which would allow the sector to contribute more consistently to economic growth over time.

Third. Develop Agricultural Value Chains. Angola should build capacity for processing and value addition in agriculture, especially for high-potential crops such as cassava, coffee, maize, and livestock. Increasing value addition within agriculture ensures that the sector contributes more effectively to GDP through agro-processing and manufacturing, which can generate jobs, increase exports, and reduce reliance on raw commodity exports.

Fourth. Support for Export Diversification. Though trade openness did not show a significant short-term effect on GDP, export diversification beyond oil can boost long-term economic stability. Strengthening non-oil export sectors, particularly agriculture, could help mitigate Angola's vulnerability to global oil price fluctuations. By diversifying exports, especially agricultural products, Angola can achieve a more balanced trade portfolio, stabilizing growth and reducing reliance on the extractive industry.

Fifth. Structural Reforms to Accelerate Equilibrium Adjustment. The Implementation of structural reforms aimed at improving the efficiency of institutions and markets is important to enable faster adjustments to economic shocks. This may include improving governance, reducing regulatory barriers, and increasing financial market accessibility. The ECM results indicate slow adjustment to long-run equilibrium, suggesting inefficiencies or structural barriers that prevent a rapid recovery after economic disruptions. Reforms in governance, investment climate, and market access can improve economic resilience.

Sixth. Enhance Agricultural Technology and Innovation. It is imperative to accelerate the promotion of the adoption of modern agricultural

technology and digital tools such as precision farming, big data analytics, and remote sensing to enhance agricultural productivity and sustainability. Technological adoption in agriculture can address the delayed effects of agricultural value-added on GDP, accelerating productivity growth and enabling better use of resources.

Seventh. Strengthen Rural Infrastructure and Access to Markets. Improvement of rural infrastructure, such as roads, storage facilities, and market access points is crucial to support agricultural productivity and reduce transaction costs for farmers. Enhanced rural infrastructure will facilitate market access, reduce post-harvest losses, and connect smallholder farmers to larger markets, boosting the overall contribution of agriculture to economic growth.

Eighth. Macroeconomic Stability and Inflation Control. Even though inflation did not show a direct impact on GDP, maintaining low and stable inflation rates is essential for investor confidence and long-term economic planning. Macroeconomic stability supports a conducive environment for both domestic and foreign investment. Policies aimed at controlling inflation through sound monetary and fiscal measures will be key to maintaining economic growth momentum.

Ninth. Continuous Monitoring and Policy Flexibility. Implementation of continuous monitoring mechanisms to assess the progress of agricultural and economic policies and remain flexible in policy adjustments based on changing conditions and external shocks. Angola faces external risks such as fluctuating commodity prices and climate change. A responsive policy environment that adjusts quickly to new information can better protect growth and development outcomes.

The findings of this research suggest that while Angola can achieve short-term economic gains through increased capital formation, the agricultural sector holds the key to sustained long-term growth. Strategic investments in agricultural productivity, infrastructure, and governance reforms, combined with export diversification, will help solidify Angola's economic growth trajectory over the coming decades. Addressing the slow adjustment to long-term equilibrium by streamlining economic governance and enhancing institutional efficiency will further boost Angola's economic resilience.

6.3 ACCOMPLISHMENT OF RESEARCH OBJECTIVES

The core objective of this study was to assess the impact of agriculture on economic growth in Angola, which was positive. Furthermore, this study addressed the following research questions:

(i) "*What is the trend in world agriculture, and its performance and challenges in Angola?*"

This question was addressed in chapter three on the status of agriculture and its contribution to the world economy. The main approach brought here was to demonstrate that global agricultural development is unequal in all dimensions, not only between developed and developing countries, but also between developing countries. Here the objective was to demonstrate a certain approximation of the levels of agrarian development between Latin America and the Caribbean. The chapter then provides a brief explanation of the state of the Angolan economy with a focus on the past and current performance of Angolan agriculture, including current potential and challenges.

(ii) "*What is the contribution of agriculture to Angola's GDP growth?*"

This research question is addressed in subchapter 5.1 related to primary empirical data analysis and where the performance of all variables, dependent (GDP) and independent (INF, GFCF, AgrVA and TO), are analyzed. The agricultural sector recorded a growth rate of over 6 percent in the period. In the last four years, it has registered positive growth of 5.1 percent, mainly as a result of the involvement of the banking financial sector with financial engineering aimed at financing the sector.

(iii) "*Is there a long or short run relationship between agriculture and economic growth?*"

Subchapter 5.7 on the findings of the ARDL model estimation shows existence, in the long and short run of positive relationship between AgrVA and GDP. Among other independent variables, AgrVA shows itself to be the major determinant of economic growth with a coefficient with coefficients spanning from 0.22 to 0.52, with statistical significance in the current year and delayed 3 periods (L3). For this year, a 1 percent increase in the AgrVA would result, ceteris paribus, in a 0.52 percent increase of GDP.

(iv) "*Is there a causal effect between GDP growth, inflation, gross fixed capital formation (GFCF), agricultural value added (AgrVA) and trade openness?*"

Causality analysis is tested in subchapter 5.9, where only INF and AgrVA Granger-cause GDP as the p-value assessed is smaller than the significance level of 5 percent. In all other senses, the null hypothesis is accepted.

(v) "*What policy measures could help enhance agricultural sector productivity in Angola to further unlock its diversification potential and take advantage of regional and international economic integration?*"

Possible policy measures are addressed in subchapter 6.2, where, by implementing these policy measures, Angola can significantly enhance its agricultural productivity, diversify its economy, and strengthen its position in regional and international markets. The combination of improved infrastructure, access to finance, technological advancements, education, market access, land reforms, sustainability practices, public-private partnerships, a supportive policy environment, climate adaptation strategies, as well as making appropriate use of the population dividend, especially youth, will create a robust and resilient agricultural sector.

6.4 LIMITATIONS OF THE RESEARCH

The main limitation of this study is that the data series is not sufficiently robust (long) to show more statistically significant results, especially when running the ARDL model 1, 4, 2, 4, 0, as some data were not available. The war in Angola, from liberation struggle to civil war lasted more than 40 years and institutional capacity in all angles was heavily compromised.

One more limitation of the study was the availability of separate statistics for life stock, agriculture, fisheries, and forestry which forced the study to adopt aggregated statistics as a proxy for agricultural value added.

It is worth noting that economic growth may also be affected by other variables other than those used in the regression exercise, such as infrastructure, including water and energy availability, and capacity building.

Finally, the study did not test for the presence of structural breaks as no major political changes (same political party governing the country) were evidenced during

the studied sample. Consequently, there may have been inexplicable or inconsistent results, hence minimizing the statistical noise that may have been present.

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ANNEXURES

ANNEXURE A: DATA SET

	Source				
	WDI	WDI	IMF	FAO/INE	BNA
Variables / Years	GDP (annual growth %)	INF (annual % change)	GFCF (annual growth %)	AgrVA (annual growth %)	TO (annual growth%)
1993	-23.98	1,378.53	-25.53	-19.86	-39.27
1994	1.34	949.79	-29.22	-11.49	-238.98
1995	15.00	2,666.45	35.56	3.86	171.65
1996	13.54	4,145.11	60.32	75.46	225.41
1997	7.27	219.18	-13.80	-13.57	-119.70
1998	4.69	107.28	17.16	35.80	538.84
1999	2.18	248.20	-25.84	-11.23	-62.58
2000	3.05	325.00	103.01	-3.98	-724.06
2001	4.21	152.56	-2.11	15.68	-98.38
2002	13.67	108.90	38.10	22.08	3571.16
2003	2.99	98.22	16.37	8.38	-37.49
2004	10.95	43.54	34.14	9.59	248.37
2005	15.03	22.95	40.02	4.35	189.01
2006	11.55	13.31	19.80	13.42	86.59
2007	14.01	12.25	37.59	5.42	7.88
2008	11.17	12.48	62.40	6.05	14.78
2009	0.86	13.73	10.39	5.13	-101.79
2010	4.40	14.47	-21.52	11.76	-4,338.60
2011	3.47	13.48	25.01	6.86	50.61
2012	8.54	10.28	15.61	6.00	7.79
2013	4.95	8.78	4.66	4.80	-22.50
2014	4.82	7.28	12.12	10.91	-63.74
2015	0.94	9.35	-0.82	7.95	-148.29
2016	-2.58	30.70	-30.75	1.77	-174.83
2017	-0.15	29.84	7.08	1.41	177.80
2018	-1.32	19.63	-26.55	-0.27	111.15
2019	-0.70	17.08	-18.13	5.87	-16.91
2020	-5.64	22.27	-18.05	5.48	-54.52
2021	1.20	25.75	28.40	5.15	153.12
2022	3.05	13.86	58.98	3.79	45.36

ANNEXURE B: CURRICULUM VITAE

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Education

2024 To be concluded	**Doctorate in Economics (PhD) – candidate** Czech University of Life Sciences, Faculty of Economics and Management, Czech Republic
2009	**Doctorate in African Studies (PhD)** Charles University in Prague, Faculty of Arts, Czech Republic
2007	**Master's in African Studies (MA)** Charles University in Prague, Faculty of Arts, Czech Republic
2006	**Master's in Economics (MSc)** Czech University of Life Sciences, Faculty of Economics and Management, Czech Republic
2004	**Master's in Portuguese Studies (MA)** Charles University in Prague, Faculty of Arts, Czech Republic

Professional Experience

2024 –	**Consultant to the Secretary of State for Treasury.** Ministry of Finance, Angola.
2021 – 2023	**Minister of Economy and Planning.** Ministry of Economy and Planning, Angola.
2020 – 2021	**Secretary of Estate for the Economy.** Ministry of Economy and Planning, Angola.
2019 – 2020	**Executive Director and Chief Financial Officer.** Angola Securities Exchange, Angola.
2016 – 2019	**Advisor to the Executive Director.** The World Bank Group, United States.
2015 – 2016	**Head of Department: International Economic Relations.** Ministry of Finance, Angola.
2013 - 2015	**Head of Department: Macroeconomic Policy and Management.** Ministry of Finance, Angola.

2007 – 2012	**Head of Division, International Economic Cooperation.** National Customs Service, Angola.
2011	**Officer: Trade and Customs.** Southern Africa Development Community (SADC), Botswana.
2004 – 2006	**Trade and Investment Manager.** AICEP, Portuguese Trade and Investment Agency, Czech Republic.
1996 – 2006	**Crew, Crew Trainer and Manager.** McDonald's, Czech Republic

Languages

Portuguese – Native

English, French, Spanish, Czech – Fluent

Publications

Caetano Joao, M., & De Castro, A. (2023). The Impact of Agricultural Credit on the Growth of the Agricultural Sector in Angola. Sustainability, 15(20), 14704.

Caetano Joao, A., & Caetano Joao, M. (2018). Economia Internacional, vol. 2: Centros, Regiões Blocos Económicos. Lito Tipo.

Caetano Joao, A., & Caetano Joao, M. (2018). Economia Internacional, vol. 1: Geografia Económica. Editando.

Caetano Joao, M. (2006). Ekonomie angolského zemědělství. Caetano Joao, M., Jelinek, P., Kni A. (eds.) Lusofonní Afrika 1975-2005 África Lusófona. Ústav mezinarodních vztahů.

Caetano Joao, M. (2005). Historie angolského zemědělství. Sborník příspěvků z doktorského semináře, 1. Czech University of Life Sciences, Faculty of Economics and Management.

Other Skills & Certifications

Microsoft Office (Word, Excel, PowerPoint, Visio).

Stata, econometrics software.

Accreditation Workshop for Customs Modernization Advisers, WCO Accreditation

ANNEXURE C: OPTIMAL LAG SELECTION

varsoc GDP

Selection-order criteria
Sample: 1997 - 2022 Number of obs = 26

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-80.2404				30.3083	6.24926	6.2632	6.29765
1	-74.6723	11.136*	1	0.001	21.3338*	5.89787*	5.92573*	5.99464*
2	-74.3146	.7154	1	0.398	22.4307	5.94727	5.98908	6.09244
3	-74.3131	.00292	1	0.957	24.2561	6.02408	6.07982	6.21764
4	-74.2707	.0847	1	0.771	26.1728	6.09775	6.16742	6.33969

Endogenous: GDP
Exogenous: _cons

varsoc INF

Selection-order criteria
Sample: 1997 - 2022 Number of obs = 26

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-151.898				7506.84	11.7614	11.7753	11.8098
1	-148.924	5.9481	1	0.015	6450.98	11.6096	11.6374	11.7063
2	-148.662	.52465	1	0.469	6832.59	11.6663	11.7081	11.8115
3	-143.672	9.9802	1	0.002	5033.94	11.3594	11.4151	11.5529
4	-124.45	38.443*	1	0.000	1242.25*	9.95771*	10.0274*	10.1997*

Endogenous: INF
Exogenous: _cons

varsoc GFCF

Selection-order criteria
Sample: 1997 - 2022 Number of obs = 26

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-118.626				580.67	9.20202	9.21596	9.25041*
1	-117.01	3.2323	1	0.072	553.939*	9.15463	9.1825*	9.2514
2	-116.007	2.0055	1	0.157	554.225	9.15441*	9.19622	9.29958
3	-115.969	.07667	1	0.782	597.632	9.22839	9.28413	9.42194
4	-114.584	2.7693	1	0.096	581.594	9.1988	9.26847	9.44074

Endogenous: GFCF
Exogenous: _cons

varsoc AgrVA

Selection-order criteria
Sample: 1997 - 2022 Number of obs = 26

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-94.8136				92.9848	7.37028	7.38421	7.41866
1	-89.86	9.9072	1	0.002	68.6197	7.06615	7.09402	7.16293
2	-88.1229	3.4741	1	0.062	64.8846	7.00945	7.05126*	7.15462*
3	-88.0598	.1262	1	0.722	69.8332	7.08152	7.13726	7.27508
4	-85.7941	4.5315*	1	0.033	63.5058*	6.98416*	7.05383	7.2261

Endogenous: AgrVA
Exogenous: _cons

varsoc TO

Selection-order criteria
Sample: 1997 - 2022 Number of obs = 26

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-207.665				547595*	16.0511*	16.0651*	16.0995*
1	-207.624	.08232	1	0.774	589668	16.1249	16.1528	16.2217
2	-206.796	1.6543	1	0.198	597996	16.1382	16.18	16.2833
3	-206.749	.09414	1	0.759	644398	16.2115	16.2672	16.405
4	-206.738	.02174	1	0.883	697003	16.2876	16.3572	16.5295

Endogenous: TO
Exogenous: _cons

ANNEXURE D: OPPONENT'S RECOMMENDATIONS

Dissertation: Impact of agriculture on economic growth in Angola
Author: PhDr. Ing. Mário Augusto Caetano João, PhD.
Opponent: Ing. Lenka Rumánková, Ph.D.

The dissertation is focused on examining the impact of agriculture on economic growth in Angola and contains six main chapters covering both theoretical and empirical parts.

Chapter 1: Introduction is focused on the dissertation background, statement of the problems, objectives, and research questions, and introduces the significance and structure of the dissertation. Chapter 2: Literature review introduces the theoretical concepts (models) of economic growth, and identifies the main factors affecting it, and introduces the scientific literature focused on agriculture and economic growth in developed and developing countries. Chapter 3: Background information provides the overview of the linkage between agriculture and economic growth and their indicators in developed and developing countries, emphasizing the situation in Angola. Chapter 4: Research structure and methodology describes the data and methodology used in the empirical part. Chapter 5: Data analysis, results, and discussion presents the results, their interpretation, and discussion. Chapter 6: Conclusions provides the summary conclusions, policy recommendations, the objectives discussion, and the research limitations. Besides these main chapters, the dissertation contains references, appendixes, a list of tables, figures, and abbreviations. The abstract, keywords, dedication, declaration, acknowledgment, and contents are also included.

The dissertation examines current and relevant topic. The main idea of the analysis of the impact of agriculture on economic growth in Angola and its utilization in the recommendations for policymakers can be appreciated. Also, the methodology selected can be considered as suitable. In conclusion, the opponent's recommendations were incorporated and thus, the revised dissertation can be recommended to submit for the final defense.

October 10th, 2024

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