

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics



Diploma Thesis

**The role of agriculture in economic performance of the
republic of Benin**

Bc. Krystel Camellia Olakou Bankole

© 2021 CZU Prague

DIPLOMA THESIS ASSIGNMENT

Bc. Krystel Camellia Olakou Bankole

Economics and Management
Economics and Management

Thesis title

The role of agriculture in economic performance of the Republic of Benin

Objectives of thesis

As a rule the performance of any economy is estimated from the point of view of reaching economic goals. These goals can be long-term, like sustainable growth and development, or short-term, such as resilience of an economy to sudden and unpredictable event (economic shocks) or economic stabilization in response to these shocks.

Since agriculture is one of the most important sectors in the economy of Benin, the development of this sector plays a seminal role in forming its GDP, the latter can be referred to as a measure of economic performance. Knowing how agriculture contributes to the GDP of Benin can help to understand what particular steps may be done to improve economic situation in the country.

The main aim of the present Master Thesis is to analyze the role of agriculture in economic performance of the Republic of Benin focusing on selected long-term and short-term economic goals that were to be achieved within the 30-year period from 1990 to 2019.

Methodology

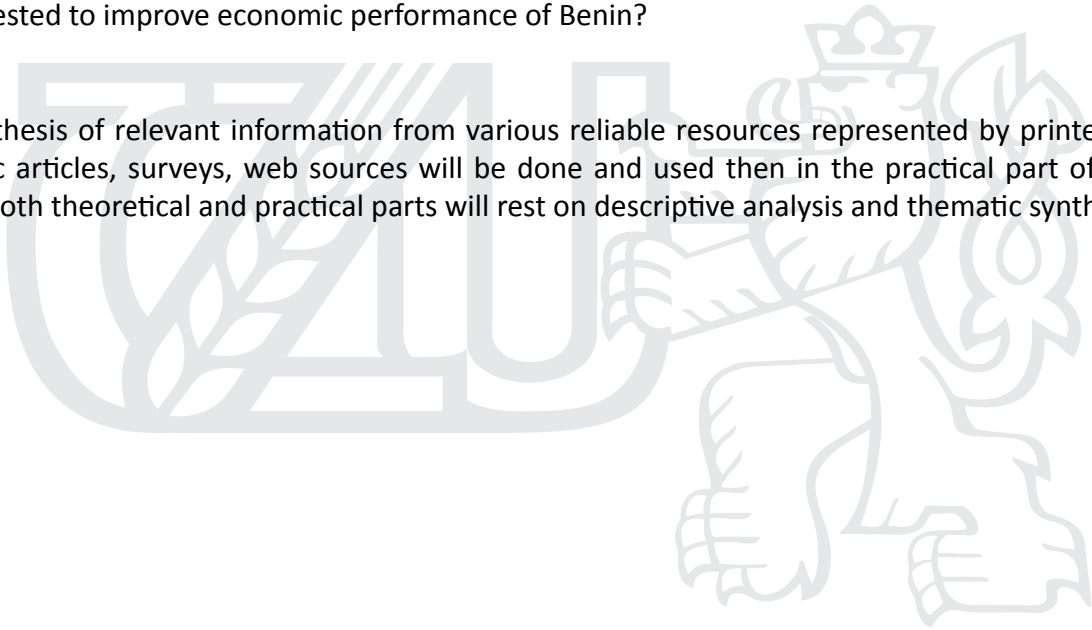
In order to get a better understanding of how the agriculture has been contributing to economic performance of Benin during the last 30 years (from 1990 – 2019) in terms of selected long-term and short-term economic goals, the following research questions will be raised and gradually answered:

1. What economic indicators are generally used to know how well an economy is performing against both long-term and short-term economic goals?
2. What is the current economic situation in the Republic of Benin (as per 2019) and its GDP dynamics since 1990 till 2019?
3. How is agriculture presented (to specify the agriculture's share of the overall Benin economy) and developed in The Republic of Benin over the specified time span?
4. What is the effect of agriculture on the GDP of Benin?
5. What long-term and short-term economic objectives have been defined in Benin since 1990?

6. Is there any positive dynamics in achieving these objectives? If not – what are the main reasons behind this?

7. By tracking selected macroeconomic indicators and assessing them what government interventions can be suggested to improve economic performance of Benin?

The synthesis of relevant information from various reliable resources represented by printed literature, scientific articles, surveys, web sources will be done and used then in the practical part of the Master thesis. Both theoretical and practical parts will rest on descriptive analysis and thematic synthesis.



The proposed extent of the thesis

60-80

Keywords

Benin, GDP, Agriculture, Economic performance

Recommended information sources

CLUNIES-ROSS, A. – FORSYTH, D. – HUQ, M. *Development economics*. London: McGraw-Hill, 2009. ISBN 978-0-07711453-4.

HEJKRLÍK, J. – ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE. INSTITUT TROPŮ A SUBTROPŮ. *Impact of the world trade liberalization on economic development and poverty alleviation in the Southern African development community (SADC)*. Dissertation thesis. Praha: 2008.

NAFZIGER, E W. *Economic development*. Cambridge ; New York: Cambridge University Press, 2012. ISBN 978-0-521-76548-0.

PERKINS, D H. – RADELET, S C. – LINDAUER, D L. *Economics of development*. New York: W.W. Norton & Co., 2006. ISBN 0393926524.

PFÄFFENZELLER, S. *Global commodity markets and development economics*. New York: Routledge, 2018. ISBN 9781138898257.

The World Bank Data. Retrived from <https://data.worldbank.org/country/benin>

TODARO, M P. – SMITH, S C. *Economic development*. Harlow: Addison-Wesley, 2011. ISBN 978-1-4082-8447-6.

Expected date of thesis defence

2020/21 SS – FEM

The Diploma Thesis Supervisor

Mgr. Elena Kuzmenko, Ph.D.

Supervising department

Department of Economics

Electronic approval: 27. 2. 2021

prof. Ing. Miroslav Svatoš, CSc.

Head of department

Electronic approval: 1. 3. 2021

Ing. Martin Pelikán, Ph.D.

Dean

Prague on 24. 03. 2021

Declaration

I declare that I have worked on my diploma thesis titled "The role of agriculture in economic performance of the republic of Benin" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break any copyrights.

In Prague, on 30th March 2021

Acknowledgement

I would like to thank my supervisor Mgr. Elena Kuzmenko, Ph.D. for her overall guidance, supports, useful and valuable advices, and I am very grateful to her extremely useful comments and assistance, during my work on this thesis.

The role of Agriculture in economic performance of the Republic of Benin

Abstract

This study analyses the role of agriculture in economic performance of the Republic of Benin focusing on selected long-term and short-term economic goals that were to be achieved within the 30-year period from 1990 to 2019. Benin agriculture is said to employ more than 70 percent of the country's population, and account on average from 1990 to 2019 for 28.42% of Benin GDP. To determine the effect of agriculture on the GDP of Benin, data collected from the World Bank from 1990 to 2019 were analysed using OLS. The result suggests that a 1% increase in a year-on-year (YoY) change in the value added by Agriculture leads on average to 0.28% growth in YoY value of GDP; a 1% increase in a YoY change in the value added by Exports of good and services leads on average to 0.03% growth in YoY value of GDP; a 1% increase in a YoY change in the value added by Services leads on average to 0.30% growth in YoY value of GDP; and a 1% increase in a YoY change in the value added by Industry leads on average to 0.07% growth in YoY value of GDP. Benin's services along with agriculture have approximately identical importance to the GDP, while industry and exports contributions are relatively low. The growth of agriculture is essential to the GDP growth of the Republic of Benin, and therefore essential to its economic performance.

Keywords: Benin, GDP, Agriculture, Economic performance

Úloha zemědělství v hospodářské výkonnosti Beninské republiky

Abstrakt

Tato studie analyzuje roli zemědělství v ekonomické výkonnosti Beninské republiky se zaměřením na vybrané dlouhodobé a krátkodobé ekonomické cíle, kterých mělo být dosaženo během 30 letého období od roku 1990 do roku 2019. V Beninu zemědělství údajně zaměstnává více než 70 procent populace země a v letech 1990 až 2019 představuje v průměru 28,42% beninského HDP. Za účelem stanovení podílu zemědělství na HDP Beninu byla data získaná od Světové banky od roku 1990 do roku 2019 analyzována pomocí OLS. Výsledky ukazují, že 1% meziroční nárůst přidané hodnoty v zemědělství vede v průměru k 0,28% meziročnímu růstu HDP; 1% meziroční nárůst přidané hodnoty vývozu zboží a služeb vede v průměru k 0,03% meziročnímu růstu HDP; 1% nárůst meziroční změny přidané hodnoty službami vede v průměru k 0,30% růstu meziroční hodnoty HDP; a 1% meziroční nárůst přidané hodnoty v průmyslu vede v průměru k 0,07% meziročnímu růstu hodnoty HDP. Beninovy služby spolu se zemědělstvím mají přibližně stejný význam jako HDP, zatímco příspěvky průmyslu a vývozu jsou relativně nízké. Růst zemědělství je zásadní pro růst HDP Beninské republiky, a proto zásadní pro její ekonomickou výkonnost.

Klíčová slova: Benin, HDP, zemědělství, Ekonomický výkon.

Table of content

1 Introduction	13
2 Objectives and Methodology	17
2.1 Objectives.....	17
2.2 Methodology	17
3 Literature Review.....	19
3.1 Agriculture.....	19
3.2 Gross Domestic Product.....	21
3.3 Previous studies on the relationship between Agriculture and GDP.....	24
4 Practical Part.....	30
4.1 Economic indicators of economic performance.....	30
4.2 An Overview of Benin Economy	30
4.2.1 Benin’s Economy	30
4.2.2 Resources of Benin	34
4.2.3 Benin’s industry and Finance.....	34
4.2.4 Trade in Benin.....	35
4.2.5 Benin’s transport	37
4.2.6 Administration and Social Conditions of Benin	38
4.2.7 Education	39
4.3 Agriculture in the Republic of Benin	39
4.4 Effect of agriculture on the GDP of Benin.....	48
4.4.1 Data and Methods	51
4.4.2 Regression analysis	56
4.5 Economic objectives.....	61
4.6 Dynamics in achieving economic objectives	63
4.6.1 Economic indicators.....	63
4.6.2 Current economic situation of Benin	64
5 Results and Discussion	70
6 Conclusion.....	74
7 References	77
8 Appendix	85

List of Figures

Figure 1: Share of labor force employed in agriculture, 2017.....	15
Figure 2: Agriculture value added per worker, 2017.....	16
Figure 3: Presentation of Benin.....	32
Figure 4: Benin’s Infographic.....	33
Figure 5: Benin’s major export destinations in 2016.....	36
Figure 6: Benin’s major import sources in 2016.....	37
Figure 7: Production of cotton in Benin in 2012.....	41

List of graphs

Graph 1: Cotton Production for West Africa’s Franc Zone.....	43
Graph 2: Cotton Yield for West Africa’s Franc Zone.....	44
Graph 3: Benin’s agriculture, forestry, and fishing, value added (constant 2010 US\$)....	46
Graph 4: Benin’s GDP compared to Agriculture, forestry, and fishing value added.....	50
Graph 5: Time series of all five variables.....	55
Graph 6: Benin’s exports of goods and services (constant 2010 US\$).....	66
Graph 7: Benin’s services value added (constant 2010 US\$).....	67
Graph 8: Benin’s industry (including construction), value added (constant 2010 US\$)....	67
Graph 9: Benin’s GDP (constant 2010 US\$).....	69

List of tables

Table 1: Computation of the average of Agriculture, forestry, and fishing value added (%GDP)	49
Table 2 : Unit root test results.....	54
Table 3: Summary statistic of variables.....	55
Table 4 : Correlation matrix.....	56
Table 5: OLS Estimates.....	57
Table 6: Autocorrelation test result.....	58
Table 7: Normality test result.....	59
Table 8: Heteroscedasticity test result.....	60

List of abbreviations

SOBETEX: Beninese Textiles Company SA (Société Beninoise de Textiles SA)	42
SITEX: Benin Textile Industries Society (Société Des Industries Textiles Du Bénin)	42
NERICA: New Rice for Africa.....	45
WARDA: West Africa Rice Development Association.....	45
BCEAO: Central Bank of West African States (Banque Centrale des États de l’Afrique de l’Ouest).....	68

1 Introduction

Though numerous sectors contribute to the growth of a country, a close attention must be paid to specific ones since their contribution to economic performance can be quite large. And each determinant of a country's economic performance contributes differently to the growth. Agriculture plays a fundamental role in terms of its contribution to the economic activities and performance of many countries. Thus, it is important to understand how the agricultural sector is developed in a country and its role in terms of economic performance, in order to propose a solution for the amelioration of the economic situation of the country. The Republic of Benin is a developing country situated in West Africa. The country being a developing country, several efforts must be made by its inhabitants for the betterment of its living conditions. It is a low-income, food-deficit country with an estimated population of 11.2 million, who are predominantly rural (World Food Programme, 2020). Having politically a stable democracy since 1990, with a socio-political environment that is amicable and contributory to business, the country nonetheless ranked 163 of 189 countries on the 2018 Human Development Index and development challenges, including food insecurity, malnutrition and gender inequalities. In Benin over 70 percent of the population are dependent on employment in the agricultural sector, which accounts for about 25 percent of the GDP (World Food Programme, 2020). In spite of that, productivity is low, farmlands are small, and since the 2008 crisis, food prices have kept rising which affects people's ability to buy food. For the purpose of supporting themselves, families are usually forced to sell crops at low prices and reduce the quantity and quality of food they consume, which further worsen food insecurity and malnutrition.

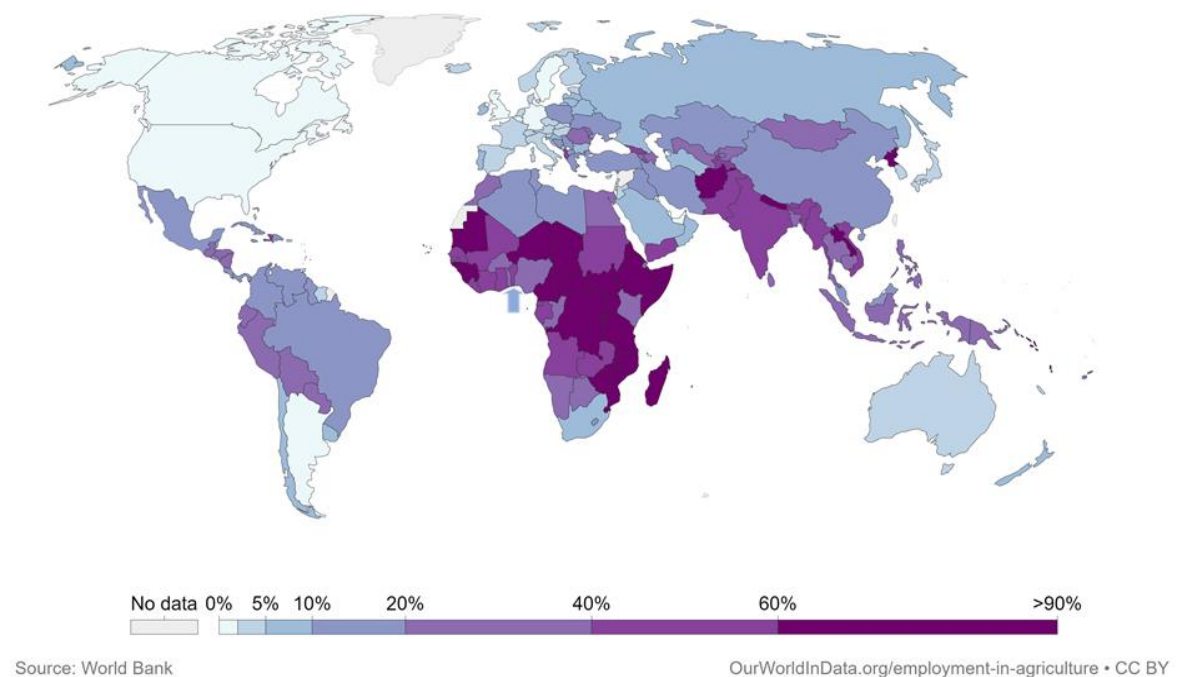
Food security being the most basic need for every population, it is more than necessary to determine and understand how it can possibly be achieved. Agricultural activities and agriculture in general are meant to provide food for the population of a nation, in order for them to meet their basic needs and have some food reserves for future needs and potential exportations. However, in several countries, mostly African, a major portion of the inhabitants find it difficult to meet their basic needs and are still suffering in abject poverty. A proper and better management of the agricultural sector and resources should improve agricultural yield, and therefore provide enough food for populations. In countries like Benin, due to the lack of motivation, and agricultural initiatives, agricultural activities

are not as prospective as they should be, knowing that the country has a substantial advantage thanks to its favorable climate, available natural and agricultural resources. Food insecurity remains a serious problem in Benin. A comprehensive food security and vulnerability analysis performed on the country in 2017 showed that 9.6 percent of the population was food insecure while chronic malnutrition, which prevents body growth and cognitive development with irrevocable consequences after the age of 2, affects 32 percent of young children (World Food Programme, 2020). For agriculture to further contribute to a better economic performance of Benin, the country's farmers need to be supported with appropriated infrastructures, farming inputs, better irrigation techniques, that would help solve the problem of reliance on rain; more workers should be trained to provide the proper education to farmers in the use of modern production techniques to help enhance the country's production capacity; and more research institutes need to be put in place to improve seedling production.

Agriculture can help reduce poverty, raise incomes, and improve food security for 80% of the world's poor, who live in rural areas and work mainly in farming (The World Bank, 2020). The World Bank Group is a leading financier of agriculture. According to the World Bank Group, Agricultural development is one of the most powerful tools in terms of ending extreme poverty, boosting shared prosperity, and feeding a projected 9.7 billion people by 2050. The growth of the agricultural sector is two to four times more effective in raising incomes in the midst of the poorest compared to other sectors. In 2016 analysis found that 65 percent of poor working adults made a living through agriculture. Agriculture is also essential to economic growth. In 2018, it accounted for 4 percent of global gross domestic product (GDP) and in certain developing countries, it can account for more than 25% of GDP (The World Bank, 2020). Moreover, employment in the agricultural sector has decreased to 54% in 2016 in the West African region due to the fact that young people are not motivated enough to participate in agriculture as occupation (Osabohien, "et al."2019). Despite the fact that agricultural performance has been declining globally, the sector dominates the West African economies (Clunies-Ross, Forsyth and Huq, 2009). Agriculture remains one of the major keys for generating employment and poverty reduction, especially in West Africa which accounts for more than 40% of the World's poverty (poverty rates are higher among rural households that are farmers and uneducated) (Food and Agriculture Organisation, 2017). The following map

shows the share of labor force employed in agriculture country by country. Three quarters of the labor force in a poor country like Madagascar are employed in agriculture and in rich countries like Germany or the UK it is only 1 in 100 is employed in agriculture (Roser, 2013). From the graph it can be observed that more than 40% of Benin labor force is employed in agriculture in 2017.

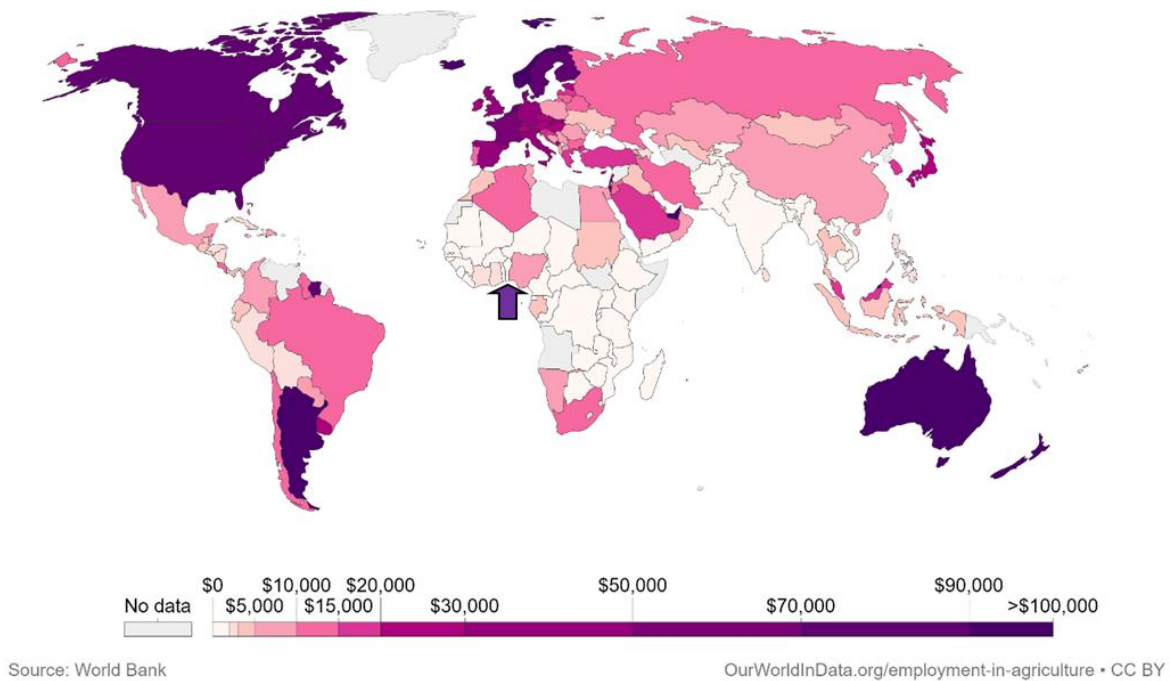
Figure 1: Share of labor force employed in agriculture, 2017



Source: Roser, 2013

In the following map the agriculture value added per worker (measured in 2010 constant US\$) has been mapped. Agriculture value added per worker is calculated as the total agricultural value added divided by the number of people employed in agriculture. On average, the map shows that highest rates of agricultural value added per worker are across Europe, North America and New Zealand; in 2017, several countries had a value added per worker of \$70,000; and in comparison, in most countries across Sub-Saharan Africa and South Asia, the value added per worker was typically less than \$1,000 in 2017 (Roser, 2013). This map shows that the republic of Benin is among the countries who have the value added per worker less than \$ 1000 in 2017.

Figure 2: Agriculture value added per worker, 2017



Source: Roser, 2013

Agriculture has great potential to provide an essential contribution to employment for the unemployed and lower poverty among rural farmers, because when people get employed in the sector, they earn a living that allows them to care for themselves and their families. Its development remains one of the major means for generating employment and reducing poverty in West Africa because improvement in agricultural development has the potential of reducing poverty by approximately 47.90% and 13.74% (Osabohien, “et al.”2019). The agricultural sector in developing countries contributes significantly to the overall growth of their economies, and unquestionably, agricultural development has special potentials for employment generation and poverty reduction (Clunies-Ross, Forsyth and Huq, 2009). Which is the reason why this study is being done on the relationship between agriculture and economic performance in order to give an empirical response to the role of the agricultural sector to the economic performance of the Republic of Benin. Thus, the role of agriculture in the economic performance of the Republic of Benin will be investigated in this study using data, information on Benin from 1990 to 2019 and time series analysis.

2 Objectives and Methodology

2.1 Objectives

As a rule the performance of any economy is estimated from the point of view of reaching economic goals. These goals can be long-term, like sustainable growth and development, or short-term, such as resilience of an economy to sudden and unpredictable events (economic shocks) or economic stabilization in response to these shocks. Since agriculture is one of the most important sectors in the economy of Benin, the development of this sector plays a seminal role in forming its GDP, the latter can be referred to as a measure of economic performance. Knowing how agriculture contributes to the GDP of Benin can help to understand what particular steps may be done to improve the economic situation in the country. The main aim of the present Master Thesis is to analyze the role of agriculture in economic performance of the Republic of Benin focusing on selected long-term and short-term economic goals that were to be achieved within the 30-year period from 1990 to 2019.

2.2 Methodology

In order to get a better understanding of how the agriculture has been contributing to economic performance of Benin during the last 30 years (from 1990 - 2019) in terms of selected long-term and short-term economic goals, the following research questions will be raised and gradually answered:

1. What economic indicators are generally used to know how well an economy is performing against both long-term and short-term economic goals?
2. What is the current economic situation in the Republic of Benin (as per 2019) and its GDP dynamics since 1990 till 2019?
3. How is agriculture presented (to specify the agriculture's share of the overall Benin economy) and developed in The Republic of Benin over the specified time span?
4. What is the effect of agriculture on the GDP of Benin?

5. What long-term and short-term economic objectives have been defined in Benin since 1990?
6. Is there any positive dynamics in achieving these objectives? If not - what are the main reasons behind this?
7. By tracking selected macroeconomic indicators and assessing them what government interventions can be suggested to improve economic performance of Benin?

The synthesis of relevant information from various reliable resources represented by printed literature, scientific articles, surveys, web sources will be done and used then in the practical part of the Master thesis. Both theoretical and practical parts will rest on descriptive analysis and thematic synthesis.

3 Literature Review

3.1 Agriculture

“Agriculture is the science, art, or occupation concerned with cultivating land, raising crops, and feeding, breeding, and raising livestock; farming” (Dictionary.com). “Agriculture is also defined as the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products” (Merriam-webster dictionary). “Agriculture is the systematic raising of useful plants and livestock under the management of man” (Rimando, 2004). “Agriculture is the growing of both plants and animals for human needs” (Abellanosa and Pava, 1987). “Agriculture is the deliberate effort to modify a portion of Earth's surface through the cultivation of crops and the raising of livestock for sustenance or economic gain” (Rubenstein, 2003) “Agriculture is the art and science of growing plants and other crops and raising animals for food, other human needs, or economic gain” (Danford School, 2020).

On the legal scope, according to the Art. 97 (d), Chapter I, Title II, of the Labour Code of the Philippines, “agriculture includes farming in all branches and, among other things, includes the cultivation and tillage of soil, dairying, the production, cultivation, growing and harvesting of any agricultural and horticultural commodities, the raising of livestock or poultry, and any practices performed by a farmer on a farm as an incident to or in conjunction with such farming operations, but does not include the manufacturing or processing of sugar, coconuts, abaca, tobacco, pineapple or other farm products.”

“Agriculture, Agricultural Enterprise or Agricultural Activity means the cultivation of the soil, planting of crops, growing of fruit trees, including the harvesting of such farm products, and other farm activities and practices performed by a farmer in conjunction with such farming operations done by persons whether natural or juridical” (As amended by R. A. 7881) (Republic Act No. 6657).

““Farming” or “agriculture” shall include farming in all of its branches and the cultivation and tillage of the soil, dairying, the production, cultivation, growing and harvesting of any agricultural, aquacultural, floricultural or horticultural commodities, the growing and harvesting of forest products upon forest land, the raising of livestock including horses, the keeping of horses as a commercial enterprise, the keeping and raising of poultry, swine, cattle and other domesticated animals used for food purposes, bees, fur-bearing animals, and any forestry or lumbering operations, performed by a farmer, who is hereby defined as one engaged in agriculture or farming as herein defined, or on a farm as an incident to or in conjunction with such farming operations, including preparations for market, delivery to storage or to market or to carriers for transportation to market” (The 192ND General Court of the Commonwealth of Massachusetts. Sec 1a).

In this study Agriculture value added will be used as an indicator for Agriculture. “The latest value for Agriculture, value added (constant 2010 US\$) in Benin was 2,179,103,000 as of 2018. Over the past 48 years, the value for this indicator has fluctuated between 2,179,103,000 in 2018 and 318,948,000 in 1975. Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3 or 4. Data are in constant 2010 U.S. dollars” (Index mundi, 2019).

3.2 Gross Domestic Product

“Gross Domestic Product (GDP) is the final value of the goods and services produced within the geographic boundaries of a country during a specified period of time, normally a year. GDP growth rate is an important indicator of the economic performance of a country” (The Economic Times, 2020). “It’s the total monetary value of everything produced within a country and is used as a measurement of a country’s economic status and growth” (Dictionary.com). “GDP is the total market values of goods and services produced by workers and capital within a nation's borders during a given period, usually 1 year” (The free dictionary). Duignan, (2017) defines “gross domestic product (GDP) as the total market value of the goods and services produced by a country’s economy during a specified period of time. It includes all final goods and services - that is, those that are produced by the economic agents located in that country regardless of their ownership and that are not resold in any form. It is used throughout the world as the main measure of output and economic activity. In economics, the final users of goods and services are divided into three main groups: households, businesses, and the government.”

“GDP per capita (also called GDP per person) is used as a measure of a country’s standard of living. A country with a higher level of GDP per capita is considered to be better off in economic terms than a country with a lower level. GDP differs from gross national product (GNP), which includes all final goods and services produced by resources owned by that country’s residents, whether located in the country or elsewhere. In 1991 the United States substituted GDP for GNP as its main measure of economic output” (Duignan, 2017).

Gross domestic product (GDP) can be measured using three different methods such as: Output Method, Expenditure Method and Income Method. Using the Output Method, GDP measures the monetary or market value of all the goods and services produced within the borders of the country (The Economic Times, 2020). In order to avoid a distorted measure of GDP due to price level changes, GDP at constant prices or real GDP is computed (The Economic Times, 2020). GDP (as per output method) is equal to Real GDP (GDP at constant prices) minus Taxes plus Subsidies.

$$\text{GDP (as per output method)} = \text{Real GDP} - \text{Taxes} + \text{Subsidies} \quad (1)$$

Using the Expenditure Method, GDP measures the total expenditure incurred by all entities on goods and services within the domestic boundaries of a country (The Economic Times, 2020).

$$\text{GDP (as per expenditure method)} = C + I + G + (X-IM) \quad (2)$$

Where C: Consumption expenditure, I: Investment expenditure, G: Government spending and (X-IM): Exports minus imports, that is, net exports (The Economic Times, 2020).

Using the Income Method, GDP measures the total income earned by the factors of production, that is, labour and capital within the domestic boundaries of a country (The Economic Times, 2020).

$$\text{GDP (as per income method)} = \text{GDP at factor cost} + \text{Taxes} - \text{Subsidies} \quad (3)$$

Those different components of GDP help discern the various factors and economic sectors included into them, so that how they contribute to the GDP can be determined. Finding the extent to which economic factors contribute to the GDP of a country helps to uncover the factors that really influence the economic growth of a country and to determine how much effort needs to be put into certain economic activities.

In addition, there are two fundamental ways of measuring GDP which are: nominal gross domestic product and real gross domestic product. The advantages of real compared to nominal GDP vary depending on how the final measure is being used and whether inflation is to be accounted for. To calculate nominal GDP, only current quantities are utilized at current year prices. Which is achieved by using a consumer price index of the country's basket of goods. Nominal GDP takes into account all the goods and services that are produced within a country's borders at their current prices (Masterclass, 2020). If, for example, the Republic of Benin produced only three products: cotton, pineapple and rice, nominal GDP would be calculated by first multiplying the quantity of each product produced by its current market price, and then adding the three results together. In order to calculate nominal GDP, it is first necessary to know the quantity of each product produced and the up-to-date average price for that product. Therefore,

$$\text{Nominal GDP} = (\text{Cotton quantity} \times \text{Cotton's current market price}) + (\text{Pineapple quantity} \times \text{Pineapple's current market price}) + (\text{Rice quantity} \times \text{Rice's current market price}) \quad (4)$$

Real gross domestic product, or real GDP, is a measure of a country's output in terms of the value of its goods and services, its investments, its government spending, and its exports (Masterclass, 2020). However, Real GDP takes nominal GDP and adjusts for inflation or deflation by comparing and converting prices to a specific base year's prices. By adjusting for price changes, the final number will reflect true increases or decreases in GDP due to fluctuation in prices. Real GDP is a more accurate representation of a country's economic activity. To calculate real GDP, nominal GDP for the deflator which is a price index used to measure inflation against a base year, must be calculated. The US Bureau of Economic Analysis calculates the GDP deflator for the US every year, and uses the year 2000 as the standard base year for prices and exchange rates, but the Bureau of Economic Analysis also includes several other base years for a quick look at the rise in inflation as far back as 1937 (Masterclass, 2020). Once both nominal GDP and the deflator are determined, the formula for calculating real GDP is as follows:

$$\text{Real GDP} = \text{Nominal GDP} / \text{Deflator} \quad (5)$$

“The GDP deflator is a measure of the change in the annual domestic production due to change in price rates in the economy and hence it is a measure of the change in nominal GDP and real GDP during a particular year calculated by dividing the Nominal GDP with the real GDP and multiplying the resultant with 100.” (Madhuri, T and Dheeraj V, 2020).

While nominal GDP by definition reflects inflation, real GDP uses a GDP deflator to adjust for inflation, which then reflects only the changes in real output; and since inflation is generally a positive number, a country's nominal GDP is generally higher than its real GDP (Masterclass, 2020). Nominal GDP is typically used by economists when comparing different quarters of output within the same year. However, when comparing GDP across more than one year, economists use real GDP because, by removing inflation from the equation, the comparison only shows the change in output volume between the years. Meaning that real GDP growth reflects a country's increased output and is not influenced

by inflation increasing price level. In this case the usage of real GDP in this study and during statistical time series analysis is justifiable since it reflects the change in real output.

3.3 Previous studies on the relationship between Agriculture and GDP

Agriculture is one of the most important sectors of the economy of a country, since it provides food to populations for them to meet their basic daily needs. Without food people can not survive and be productive. Agriculture also constitutes a dominant activity for some countries. The agricultural products are not only used and sold locally but also exported, in the form of agricultural Input or value-added products. Agriculture provides a significant number of jobs in agricultural countries. Thus, it is important to determine the structure of agriculture in a country, how it is managed, and how it contributes to the economic performance of the country. Several authors have studied the relationship between agriculture and the economic performance of different countries in order to determine the impact of agriculture on the economy in general and economic growth in particular.

Enu (2014) attempted to determine the impact of the agricultural sector on Ghana's economic growth, and the effect of the various sub- sectors of the agricultural sectors on Ghana's economic growth used time series (1996-2006) data on agriculture, service, industry and the various sub-sectors under agriculture, which includes forestry, fishery, crops/ livestock and cocoa. Enu's (2014) regression model was specified and OLS was employed to estimate the respective impact of agriculture, service and industry on GDP growth. At the end of the study, it was observed that agricultural output had a significantly positive impact on Ghana's growth as compared to the other sectors (agricultural output (0.354515); service output (0.283401); industrial sector (0.303257)). In addition, the study further analyzed the effect of the various sub sectors under the agricultural sector on GDP growth since the agricultural sector contributed more significantly to GDP, which led to the cocoa sub-sector being identified to be vital to economic growth and development in Ghana. It was thus suggested that the cocoa subsector should continue to be prioritized even with the discovery of oil, and that massive investments should be directed to the cocoa sub-sector of the agricultural sector for further economic expansion in Ghana.

Izuchukwu (2011) who analyzed the contribution of the Agricultural Sector to the Nigerian economic development, has collected a panel of data sourced from the statistical bulletin of the Central Bank of Nigeria and World Bank's development indicators, and has used multiple regression to analyze the data. The result indicated a positive relationship between Gross Domestic Product (GDP) vis a vis domestic saving, government expenditure on agriculture and foreign direct investment between the period of 1986-2007. The study also revealed that 81% of the variation in GDP could be explained by Domestic Savings, Government Expenditure and Foreign Direct Investment, and suggested that in order to improve the agricultural sector it is recommended that government provides more funding for agricultural universities in Nigeria to carry out researches on all areas of agricultural production, which will lead to more exports and improvement in the competitiveness of Nigeria agricultural production in international markets. For Izuchukwu (2011) the Central bank of Nigeria should also come up with a stable policy for loan disbursement to farmers at a reasonable interest payback, in order to help them expand their production capacity. It was proposed that: more extension workers should be trained to educate farmers in the use of modern production techniques to help boost the country's production capacity; the Nigerian's government should encourage the use of modern mechanized farm tools, and subsidize the prices of agro-chemical and fertilizer for farmers; more research institute should be established to improve seedling production, encourage the use of irrigation farming system and provision of storage facilities for seasonal products as means of improving the country's agricultural output; and that the government should encourage more exportation of agricultural output as this in turn will enhance external foreign exchange earnings and improve the competitiveness of Nigerian agricultural produce in the international markets.

On the other hand, Gardner (2005) using data from 85 countries during 1960-2001, has investigated the underlying factors in the growth of agriculture as a sector and of rural incomes in developing countries. From this study it was observed that the growth of agriculture as a sector is surprisingly independent of the growth of income per capita for those who work in that sector, and that either is necessary nor sufficient for the other. For Gardner (2005) the growth of agriculture as a sector is surprisingly independent of the growth of income per capita for those who work in that sector. The study concluded that

agricultural economics is in many circumstances not the key discipline in understanding the economics of rural income and poverty.

According to Matsuyama (1992) the role of agricultural productivity in economic development is addressed in a two-sector model of endogenous growth in which preferences are non-homothetic and the income elasticity of demand for the agricultural good is less than unitary, and the engine of growth is learning-by-doing in the manufacturing sector. For Matsuyama (1992) in the closed economy case, the model predicts a positive link between agricultural productivity and economic growth, while, for the small open economy case, it predicts a negative link. From this it is suggested that the openness of an economy should be an important factor when planning development strategy and predicting growth performance.

Phiri et al (2020) in an attempt to determine the role of agriculture in supporting the economy of Zambia, particularly, the effect of agriculture on economic growth have analysed data for the period 1983–2017 and the ARDL Bound. The ECM results obtained suggest that agriculture, manufacturing, services, and mining converge to an equilibrium and affect economic growth at the speed of adjustment of 90.6%, with the effect from agriculture, mining, and services being significant. It was observed that the impact of agriculture on economic growth was significant in both the short-run and long-run, with coefficient unit effects of 0.428 and 0.342, respectively; that effects are strong because more than two-thirds of the rural population rely on farming; and agriculture has stood as a catalyst for food security. From this study, it was recommended that, for a much more profound effect of agriculture, farmers must be supported with adequate infrastructure, accessibility to markets, farming inputs, better irrigation techniques, which would address the problem of reliance on rain, all of which were inconsistent in the last decade, and governments must ensure the institutionalization of food processing industries which add more value to the national income (Phiri et al, 2020).

According to Labintan and Ding (2012) under different reforms that occurred since 1961, Benin agricultural productivity has changed and decreased significantly after the country's agricultural liberalization in 1990. In an attempt to assess agricultural productivity and major driving factors in the republic of benin, Labintan and Ding (2012) used simple linear

regression to explore major driving factors that change and propose policies which will contribute to improve the country's agricultural productivity in the long term. The results obtained reveal that Agricultural land and rainfall had a positive effect on productivity while labor and government effectiveness had a negative effect; And agricultural research, extension and country openness do not have any significant effect. The study suggests that the government should manage efforts to improve agricultural labor management and develop effective actions to address agricultural productivity goals.

Tomšík et al.(2015) in order to analyze the main changes in area of GDP structure formation (agricultural, industrial and services sector) which have occurred in selected Sub-Saharan African countries during a twenty-year period, have compared GDP and GDP per capita in Sub-Saharan countries with the world GDP and GDP per capita. The comparative analysis was performed through logarithmic regression and elasticity analysis, and a special attention was devoted to the position of the agricultural sector in relation to the other sectors. The results indicate that while many Sub-Saharan countries have reached the modern type of economy with prevailing services in GDP composition, agriculture still dominates in most countries in terms of employment. For Tomšík et al.(2015) economically speaking, it is worth noting that the transformation process in Sub-Saharan Africa still has not reached the level of the global economic transformation.

Yetiz and Özden (2017) to investigate the causal relationship among GDP, agricultural, industrial and services sectors in Turkey for the period of 1968-2015, have employed Engle-Granger causality/block exogeneity Wald test, Impulse Response and Variance Decomposition analysis. The obtained results showed an unidirectional granger causality from agriculture to GDP and the other three sectors, while the agricultural sector is not influenced by the others.

Xuezhen, Shilei, and Feng (2010) for the purpose of determining the relationship between agriculture and economic development, performed econometric model analysis in the case of China for the year 1952-2007 showing that there has always been a positive relation between agricultural and economic growth, and discusses how agriculture makes a contribution to economy growth. They concluded that although the share of agriculture in GDP has declined significantly over time, the contribution of agricultural growth has

maintained an upward trend with the elimination of the price index and has made an important market, foreign exchange, factor (finance and labour), output contributions to nonagricultural growth; thus remains an irreplaceable driving force for economic growth; and economic growth strongly does not necessarily need a higher GDP growth rate in the agricultural sector. They propose that China should have strength to enter the stage of industry nurturing agriculture and that enhancing agricultural contributions needs to continue to encourage the transfer of rural labour, raise the level of consumption of rural residents, encourage export and increase farmers' income so that the national economy develops rapidly and orderly.

MOUSSA (2018) in his study on how agricultural sector contributes to the economic growth of Benin, has used time series data from 1970 to 2016 and co-integration method considering the order of integration, which led him to observe that the GDP per capita, agricultural value added, and the human development index have a long-run relationship; and that agricultural sector will have a significant impact on the economy in the long-run and ameliorate the living condition of population. For MOUSSA (2018), it has been always argued that agriculture contributes to the economic growth in Africa particularly in sub-Saharan African countries. Analysis results series exhibit a long-run causality and the absence of short-run causality. The study suggested that in the absence of resources like in Benin, it is necessary to make investment in the agricultural sector which contributes more to the economic growth and reduces poverty. MOUSSA (2018) also mentioned that it is urgent to specialize in the domain where there is comparative advantage like cotton and re-exporting sector, and that the domestic investment should be diversified not just concentrated in one domain like in cotton which generates a lot of currency.

Azra et al. (2013) have conducted a study to explore the relationship between Agriculture and Economic Growth in Pakistan using time series data to examine the causal relationship for the period 1981-2005. Azra et al. (2013) found that with Pakistan's, being an agricultural country, agricultural GDP plays an important role in growth of Pakistan's economy.

For Adenomon and Unit (2016) it is well reported in the literature that agriculture in Nigeria is a major sector of the economy, providing employment for about 70% of the

population. Here the relationship between agriculture and GDP in Nigeria using data from 1960 to 2014 was examined. The annual data for agriculture and GDP was extracted from CBN Statistical Bulletin. The ADF test revealed that agriculture and GDP variables are stationary at first difference, and evidence from bound testing and Johansen cointegration test revealed that agriculture and GDP variables are not cointegrated. And the evidence from the first difference revealed that 1% increase in the change of agriculture leads to about 90.86% increase in the change of GDP, and the paper recommends that with the fall in oil price, investment that will grow the agricultural sector should be encouraged so as to motivate economic growth.

For Anjum and Tarique (2017) poverty is an important concern for most of the developing countries, and both the agriculture and non-agriculture sectors play an important role in reducing poverty. But in the case of an agrarian economy like India, the contribution of agriculture in poverty reduction is dominant since the majority of poor people rely on this sector for their sustenance. Since it is always a tough job for policy makers to quantify the contribution made by each sector, Anjum and Tarique (2017) tried to find the relative impact of GDP growth of agriculture and non-agriculture sector on poverty reduction in India, by applying pooled regression analysis using panel data. The analyses reveal that the agricultural GDP per worker elasticity of poverty reduction is 0.85 against the 0.08 non-agricultural GDP per worker elasticity of poverty reduction. However, Anjum and Tarique (2017) suggested that the impact of agriculture on poverty reduction cannot be judged by focusing on this sector alone. Instead, balanced growth between agriculture and manufacturing is required to reap the maximum benefit of forward and backward linkages.

4 Practical Part

4.1 Economic indicators of economic performance

The performance of an economy is usually determined in terms of the achievement of economic objectives. These objectives can be long term, such as sustainable growth and development, or short term, such as the stabilization of the economy in response to sudden and unpredictable events, called economic shocks. To know how well an economy is performing against these objectives, economists utilize a wide range of economic indicators. Economic indicators measure macro-economic variables that directly or indirectly enable economists to judge whether economic performance has improved or worsened (Economics Online, 2021). Tracking these indicators is especially useful for policy makers, both in terms of assessing whether to intervene and whether the intervention has worked or not. Levels of real national income, spending, and output are useful indicators of economic performance. National income, output, and spending are three key variables that indicate whether an economy is growing, or in recession. Like many other indicators, income, output, and spending can also be measured in per capita (per head) terms (Economics Online, 2021). An economic indicator is simply any economic statistic, such as the unemployment rate, GDP, or the inflation rate, which indicate how well the economy is doing and how well the economy is going to do in the future (Moffatt, 2018). Real GDP will thus be employed as an indicator of economic performance, since it represents one of the most usual indicators used to track the health of a nation's economy. Also, GDP can be utilized by economists to determine whether an economy is growing or going through a recession.

4.2 An Overview of Benin Economy

4.2.1 Benin's Economy

Benin is named after the body of water on which it lies: the 'Bight of Benin'. The country was named Benin on November 30, 1975. Earlier it was known as Dahomey. The people of Benin are called Beninese. The capital region of the country and the area nearby was referred as 'Slave Coast' from as early as the 17th century. During the trans-Atlantic slave

trade, many slaves were shipped to the New World (Staff, Editorial, et al, 2020). The Republic of Benin is a developing country situated in West Africa which was a French colony that obtained its independence in 1960. Since independence, Benin's regular and developmental budgets have been dependent on external support, primarily from France and international organizations. This support has helped attenuate economic stagnation and has relatively ameliorated the low standard of living of the majority of the population. The regime that came to power, attempted from 1975 to restructure the economy along socialist principles and to disengage from dependence on France (Dov, 2017). During that period, most sectors of the economy were nationalized or otherwise turned over to government control, and economic relations were established with the Soviet Union and other socialist countries, as well as with Benin's neighbouring countries. By the early 1980s it was clear that even though the economy was restructured and, at least on paper, more efficient and diversified, and France's contribution to Benin's economy diminished, corruption persisted leading to an unimproved overall economic situation. The liberalization of the economy in the mid-1980s was also not successful in terms of producing positive results. After changes in the constitution and regime in the early 1990s were carried out, the remnants and slogans of Marxism were wrecked, and privatization of the economy initiated (Dov, 2017). Benin was the first country in the 1990s to make the transition from a dictatorship to a multiparty democracy. The following figure shows that Benin is a west African country bordered on the north by Burkina Faso and the Republic of Niger, on the East by the Federal Republic of Nigeria and on the West by the Republic of Togo. The country has a 121 km long coastline. 31.3% of the country's land area is under agriculture while 40% of it is under forest (Staff, Editorial, et al, 2020).

Figure 3: Presentation of Benin

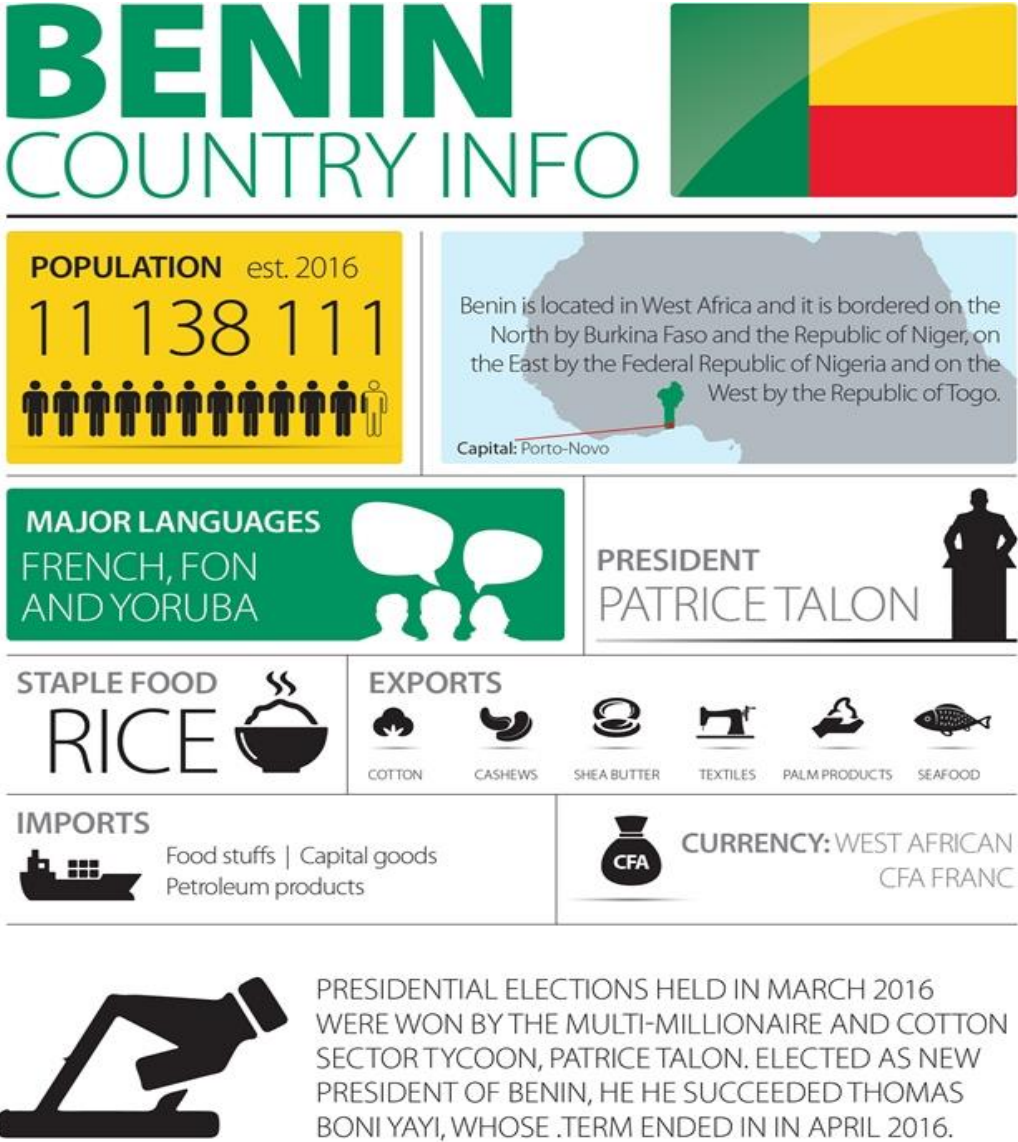


Source: Wathi, 1970

The Following figure is an infographic of the Republic of Benin. It shows that in 2016 the population of Benin was about 11138111 inhabitants; The major spoken languages of Benin are Fon, French and Yoruba; The actual President of the country is Patrice Talon; The multi-millionaire and cotton sector tycoon, Patrice Talon won the presidential elections held in March 2016 and succeeded Thomas Boni Yayi whose term ended in April 2016; The country's currency is the west African CFA Franc; Benin imports food stuffs, capital goods and petroleum and exports cotton, cashews, shea butter, textiles, palm products and seafood; And the country staple food is rice. The capital city of Benin is Porto-Novo. It is also known as Adjatche and Hogbonou. While being very poor, Benin is also one of the most politically stable countries in West Africa (Staff, Editorial, et al, 2020). Benin is a country dependent on subsistence agriculture. Cotton is the main commercial crop, accounting for about 45% of the country's foreign-exchange earnings (SolutionsTeam, 2016). The hydroelectric potential of the Mono River also forms Benin's border with Togo, and is being developed, along with the construction of dams for power generation and irrigation. Also, mineral reserves, notably of marble,

iron, and phosphate, have not been fully exploited, which also presents an opportunity for investment (Solutions Team, 2016).

Figure 4: Benin’s Infographic



Source: Solutions Team, 2016

4.2.2 Resources of Benin

The republic of Benin disposes of several resources. There are few stretches of tropical forest that remain in Benin, mostly in the southwest and central areas, containing mahogany, iroko, teak, samba, and other tropical hardwoods. The rivers and lagoons of Benin are rich in fish. Mineral deposits include iron ore both in the Atakora Mountains and northeast of Kandi, limestone deposits at Onigbolo, chromium ore and a little gold in the northwest near Natitingou, marble at Dadjo, an important deposit of pottery clay at Sakété, and ilmenite (a mineral source of titanium) near the coast. Offshore oil was discovered in 1968 in the Sémé field near Cotonou the economic capital city and has been exploited since 1982 (Dov, 2017). Even though the Republic of Benin is rich in natural resources and dispose of fertile soil, agriculture is not widely developed and not exploited enough. The agriculture in the republic of Benin has mostly been focused on the production of Cotton. About 70 percent of the working population depends on agriculture. Since the mid-1980s Benin has produced yams, cassava, corn (maize), millet, beans, and rice to achieve self-sufficiency in staple foods. Among cash crops, the formerly predominant palm product output reduced considerably in the 1980s, but cotton output rose (Dov, 2017). The output of Shea, peanuts, cocoa beans, and coffee also has increased. Livestock include cattle, sheep and goats, pigs, horses, and poultry. Considerable quantities of fish are caught annually in the lagoons and rivers, while coastal fishing produces a smaller, but growing, amount, and most of the fish is exported to Nigeria or Togo. Moreover, Shrimp and deep-sea fishing are developing, thanks to the use of modern vessels (Dov, 2017).

4.2.3 Benin's industry and Finance

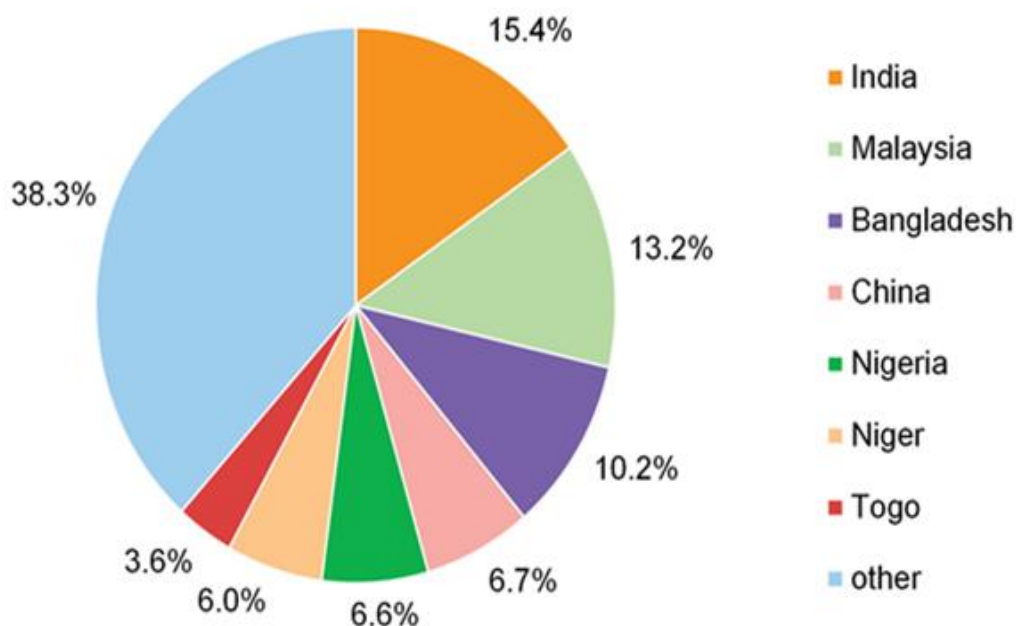
In the industrial sector, Benin has manufacturing plants and secondary industries which include several palm-oil-processing plants in Ahozon, Avrankou, Bohicon, Cotonou, Gbada, and Pobé; cement plants at Onigbolo and Pobé; several cotton-ginning facilities in the north; a textile mill at Parakou; a sugar refining complex at Savé; a soft-drink plant; a brewery; and two shrimp-processing plants. Furthermore, electricity is generated thermally by plants located at Bohicon, Parakou, Cotonou, and Porto-Novo and about half of Benin's demand for electricity is met by importing power from Ghana's Volta River Project at Akosombo. In 1988 operations commenced at the hydroelectric installation of the Mono River Dam, a joint venture between Benin and Togo on their common southern boundary

(Dov, 2017). Taking into consideration the financial sector, Benin's three state-owned banks liquidation took place in the late 1980s and early 1990s as part of economic privatization, and four private banks opened, including the Bank of Africa-Benin (Dov, 2017). Citizens of Benin began to transfer their savings from foreign banks to local ones. With the emergence of privatization, foreign aid and assistance grew, funding especially for developmental projects from the United States and the European Economic Community, which was later succeeded by the European Union, the latter of which also agreed to help pay the wages of civil servants. Also, France continues to provide financial assistance. The currency of Benin CFA (Communauté Financière Africaine) African Financial Community is fully guaranteed by and pegged to the French franc (Dov, 2017). However, many controversial discussions are made in relation with the currency topic. While many people want to keep the CFA currency, which signifies in a way staying financially dependent on France, others Benin and non-Benin citizens believe that it is best for a country to have its own currency in order to suppress this type of dependency. The current president of the Republic of Benin, Patrice Talon is also among those against the idea that the Republic of Benin does not have its own currency and is still dependent on France in this area. At the end of the year 2019 the president Patrice Talon shook the establishment table of France-Africa relations when he mentioned in an interview that the Francophone nations in West Africa want to take more control over their CFA franc currency and plan to move some of their reserves away from France (Signé, 2019). The discussion is still open on the CFA Currency topic and the expectation of the citizens of Francophone countries of West Africa is that the best decision is taken for the purpose of improving the economic situation of the concerned countries, while avoiding conflict with countries like France.

4.2.4 Trade in Benin

On the Trade side, Benin's export incomes rely mostly on agricultural products, such as cotton, palm oil, cocoa, and coffee, exported to countries like India, Malaysia, and Bangladesh. Informal trade across the border with Nigeria has also affected Benin's negative trade balance (Dov, 2017). From this pie chart, in 2016 15.4% of Benin export goes to India, 13.2% to Malaysia, 10.2% to Bangladesh, 6.7% to China, 6.6% to Nigeria, 6.0% to Niger, 3.6% to Togo, and 38.3% to other destinations.

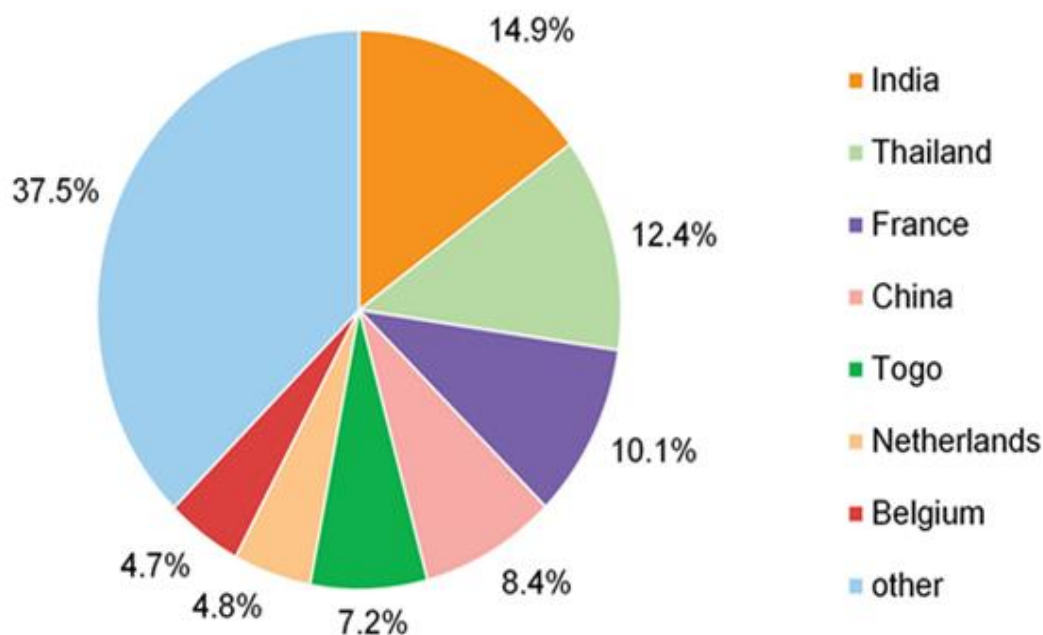
Figure 5: Benin’s major export destinations in 2016



Source: Dov, 2017

And one of Benin’s main, though underexploited, trade assets is the Deepwater port of Cotonou, which serves as a sea channel for the Republic of Niger and as a secondary port for Nigeria and thus has a potential to earn lucrative customs duties. If Republic of Benin was fully exploiting its autonomous port of Cotonou, by being more frequently an intermediary for Sahelian countries like Niger, Burkina Faso, and Mali; and even Nigeria, it would maximize its port revenue. Benin has traditionally imported various manufactured products, machinery, chemicals, beverages, and tobacco, as well as cereals. Benin imports from several countries including India, Thailand, and France (Dov, 2017). This chart shows that in 2016, 14.9% of Benin export comes from India, 12.4% from Thailand, 10,1% from France, 8.4% from China, 7.2% from Togo, 4.8% from Netherlands, 4,7% from Belgium, and 37.5% from other destinations.

Figure 6: Benin’s major import sources in 2016



Source: Dov, 2017

4.2.5 Benin’s transport

Speaking of transport, Benin suffers from the absence of secure and better-quality public transport and the inexistence of good practicable roads. There are two paved, mostly two-lane, road networks. One runs parallel to the coast of the Gulf of Guinea from the Togolese border, through Cotonou and near Porto-Novo, to the Nigerian border. And the other road runs north from Cotonou, near Abomey and Dassa, to Parakou in the north. Roads from Parakou to Niger’s border and from near Abomey to Burkina Faso’s border are unpaved and are barely passable in the rainy season. In addition to that, there is a railroad from Cotonou to Parakou, and another one parallel to the coast, which does not extend to either the Togolese or the Nigerian border (Dov, 2017). Interconnected coastal lagoons are navigable by small craft known as pirogues (canoes); and the Ouémé, Couffo, and Mono rivers are navigable by small boats for several dozen miles. The country’s only port called the Autonomous port of Cotonou is at Cotonou. The republic of Benin international airport in Cotonou links Benin with other countries of Africa and with Europe. However, there is limited domestic airline service (Dov, 2017).

4.2.6 Administration and Social Conditions of Benin

In terms of administration And Social Conditions Benin has experienced much political instability and unrest. It suffered through 12 years of unstable government, including several overturns, that started three years after independence. The regime of President Mathieu Kérékou, who came to power in a 1972 stroke, enjoyed almost two decades of delicate but unprecedented stability. The Marxist eloquence introduced in 1974 led to repressive military rule in the late 1970s, but this had largely faded away by the early 1980s (Dov, 2017). However, during this period, the Benin People's Revolutionary Party (PRPB) was the only legal political party. A National Revolutionary Assembly, elected by citizens, chose the president, who was also head of state. Benin was the first African country to make a post-Cold War transition away from Marxism-Leninism. In December 1989 Kérékou himself abandoned the Marxist-Leninist ideology that he had promoted in the mid-1970s and in December 1990 a new constitution was approved, guaranteeing human rights, freedom to organize political parties, the right to private property, and universal franchise. Under the 1990 constitution, Benin is a multiparty republic. The president, who is directly elected for no more than two consecutive five-year terms, serves as head of state and government. The president may be assisted by the prime minister, though the position is not required by the constitution and was vacant from May 1998–May 2011 and again from August 2013 (Dov, 2017). Legislative power is vested in the National Assembly, consisting of members who are directly elected to serve four-year terms. The constitution pledges for an independent judicial branch of government. Benin's judiciary is composed of the Constitutional Court, which is the highest court in constitutional-related affairs, the Supreme Court, which is the highest court for administrative and judicial matters, and the High Court of Justice, which hears cases against the president and other government officials in matters pertaining to crimes committed while in office and high treason. The Constitutional Court and Supreme Court are located in Cotonou the economical capital city, while the High Court of Justice is located in Porto-Novo the capital city of Benin (Dov, 2017).

4.2.7 Education

In the sector of education, the public education system has followed the French model since colonial times. A six-year primary school cycle (for children ages 6–11) is followed by six years of secondary education (ages 12–17). In the mid-1970s major amendments were introduced both to conform to the then-dominant Marxist-Leninist ideology and to drop French influence. The reforms failed as teachers, parents, and university-bound students objected to the lowering of standards, and the reforms were largely abandoned by the late 1980s. The University of Abomey-Calavi (previously known as the University of Dahomey from 1970 to 1975 and the National University of Benin from 1975 to 2001), located in Cotonou, was founded in 1970 (Dov, 2017). The university's student body has been, together with workers, the main political force in the country since the early 1980s. The University of Parakou was founded in 2001 (Dov, 2017). Since then, several schools and universities, both private and public have been created allowing a large portion of the population to have access to an education. However, the absence of Jobs is a serious problem for the inhabitants of Benin, causing a high rate of unemployment.

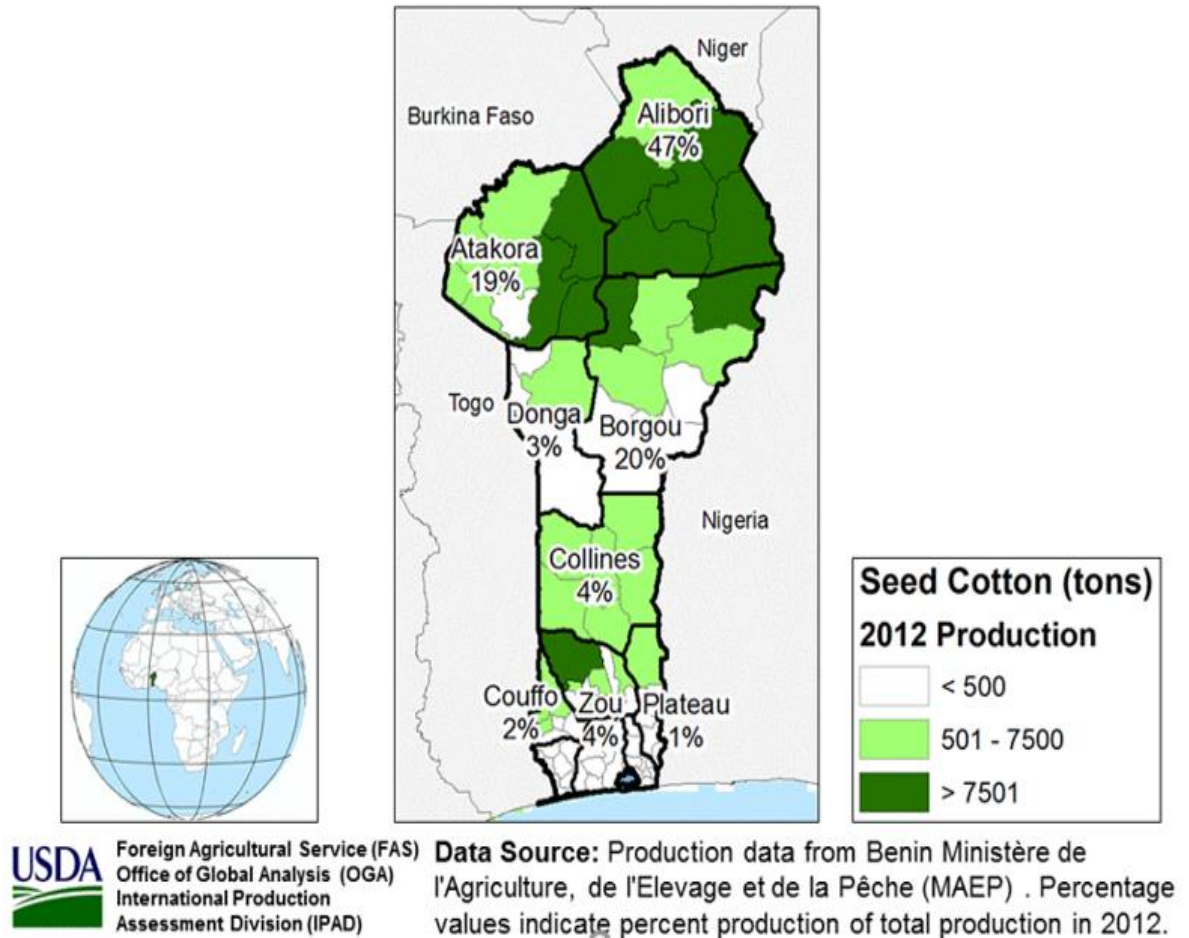
4.3 Agriculture in the Republic of Benin

Benin, previously known as Dahomey, is characterized by a great diversity of landscapes and ecosystems. Actually, the W Regional Park and Pendjari National Park, located in northern Benin, are two of the most protected and biodiverse semiarid grassland ecosystems in West Africa. The mountainous region of the northwest represents the water reservoir for the Republics of Benin and Niger. On the other hand, the central part of the country constitutes a large complex of plateaus covered by a mosaic of savannas, gallery forests, woodland, and cropland. Agriculture plays a fundamental role in Benin's economy, and Benin is one of Africa's largest cotton producers. The landscape is very distinct with massive palm groves dispersed across the fertile plateau of the Terre de Barre in the south. The coastal region is characterized by lagoons and marshes formed by the three main rivers of the country flowing into the coastal sandy barriers. Nokoué Lake is the largest lagoon that separates Benin's two largest cities, Cotonou and Porto-Novo (West Africa: Land Use and Land Cover Dynamics, 2020).

The mission and objective of the Benin Ministry of Agriculture are: To define policies relating to Agriculture, Breeding Fisheries, Forestry and Natural Resources, Agricultural Research, Rural Legislation, Rural fitting and Cleansing, Promotion of Rural Youths and Women Activities, Packaging of agricultural products and to other closely related sectors (Training, support and Consultancy, Preservation, Processing and training of Agricultural products) ; To follow up and coordinate the activities of other stakeholders involved in Agricultural and Rural sector; To create enabling conditions for enhancing agricultural incomes and the living conditions of populations by working out and implementing appropriate policies in order to: firstly further technical progress in Farming, Breeding, Fishery and Forestry, secondly facilitate the exploitation of Natural and halieutic resources up to levels that satisfy the country's needs and by abiding by ecological balances, and thirdly create a conducive environment and a legal, statutory and fiscal framework to facilitate investments in Agricultural and Rural sector (Benin Ministry of Agriculture, 2020).

Agriculture plays a substantial role in Benin's economy. More than 70 percent of Benin's population earn a living from agriculture. Most of them are subsistence farmers, growing crops on small family plots. However, poor infrastructure and flooding, which can wipe out harvests and seed stocks, are just a few of the challenges faced by Benin farmers. The insufficient production of rice has forced Benin to rely on imports to meet the rice demand. Just a small fraction of the country's available land that could be adapted for growing rice is being used by farmers. As a solution to this problem, the Government has made scaling up rice production a priority. Cotton being the most important Benin's cash crop, contributes approximately 35 percent to the country's export revenues and provides an income to roughly three million people (Food and Agricultural Organization, 2021). But cotton productivity and profitability have recently declined, in part due to poor management practices. These are some of the agricultural challenges that need to be addressed by the country's decision-makers. From the following Map of the Republic of Benin it can be noticed that the cotton production is widespread over a major part of the Beninese territory considering percent production of cotton in 2012.

Figure 7: Production of cotton in Benin in 2012



Source: Crop Explorer for Major Crop Regions - United States Department of Agriculture

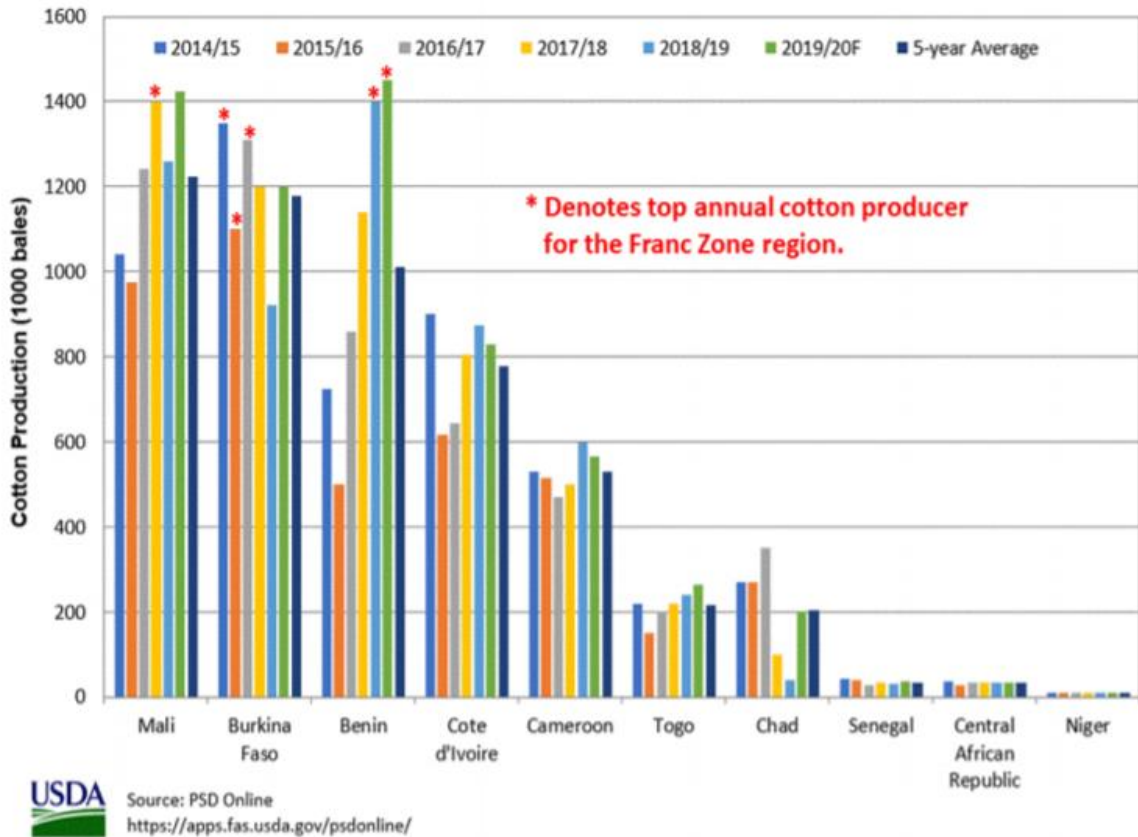
The Republic of Benin was once one of the strongest empires in West Africa. Maize, cowpeas, sorghum, millet, and cotton were the most extensively grown crops in Benin. Despite the fact that cotton used to be grown by almost one third of the farmers in Benin, it plays an important role in the rural economy. Its contribution to the GDP was estimated at around 10% and it accounts for over 70% of agricultural export value and about 98% of cotton fiber was exported and barely 1% is used for local consumption (Cotton Technical Assistance Programme for Africa, 2012). The downstream industry for spinning, knitting, weaving, colouring and confection is limited to only a few firms. Cotton in Benin is cultivated solely under rain-fed conditions. The leading cotton variety that is grown all over the country is STAM 18 A and the quality of cotton available in Benin is 29mm with a ginning out-turn of about 42-44% (Cotton Technical Assistance Programme for Africa, 2012). The majority of the cotton is cultivated in the northern parts of Benin, Principally in

Karimama, Malanville, Banikoara, Gogounou, Segbana, Sinande, Kalale, Bembereke, Nikki, N'Dali, Perere and Tchaourou.

The prime constraints of production are related to insect pest damage of bollworms and sucking pests, due to which the productivity and area are continuously declining. Training of farmers in the use of pesticides is often not adequate. Rain-fed organic cotton production began in Benin during the 1996-97 season and has increased significantly over the past twenty years. The organic cotton area grew from 500 hectares in 2005 to an estimated 1,800 hectares in 2008 (Cotton Technical Assistance Programme for Africa, 2012). The average yield is 400-450 kg/ha which is lower than local yields of 600-900 kg/ha. The factors that compensate for lower organic yields are: Firstly organic farmers do not have to pay back input credit loans; and secondly, they receive a price premium of 20% above the local conventional price.

Some processing units such as: SOBETEX created by a French private group; IDATEX created by a joint partnership between the Government of Benin and European investors; and SITEX set up by the government and merged into a joint partnership with Chinese investors in 2002, were set up in Benin (Cotton Technical Assistance Programme for Africa, 2012). The industry covers the entire value chain but the activity is regularly shrinking and processes less than 2% of the lint production (Cotton Technical Assistance Programme for Africa, 2012). The Cotton sector is also facing an increasing competition from imports and second-hand garments, high cost of energy and low productivity of labour. However, during the last few years cotton production in the Republic of Benin has improved and considerably increased thanks to a better management of the sector. Looking at the below Graph 1 and 2 showing cotton Production and yield for West Africa's Franc Zone, it can be seen that Benin is one of the largest producers of cotton in West Africa's Franc Zone Between 2014 and 2019.

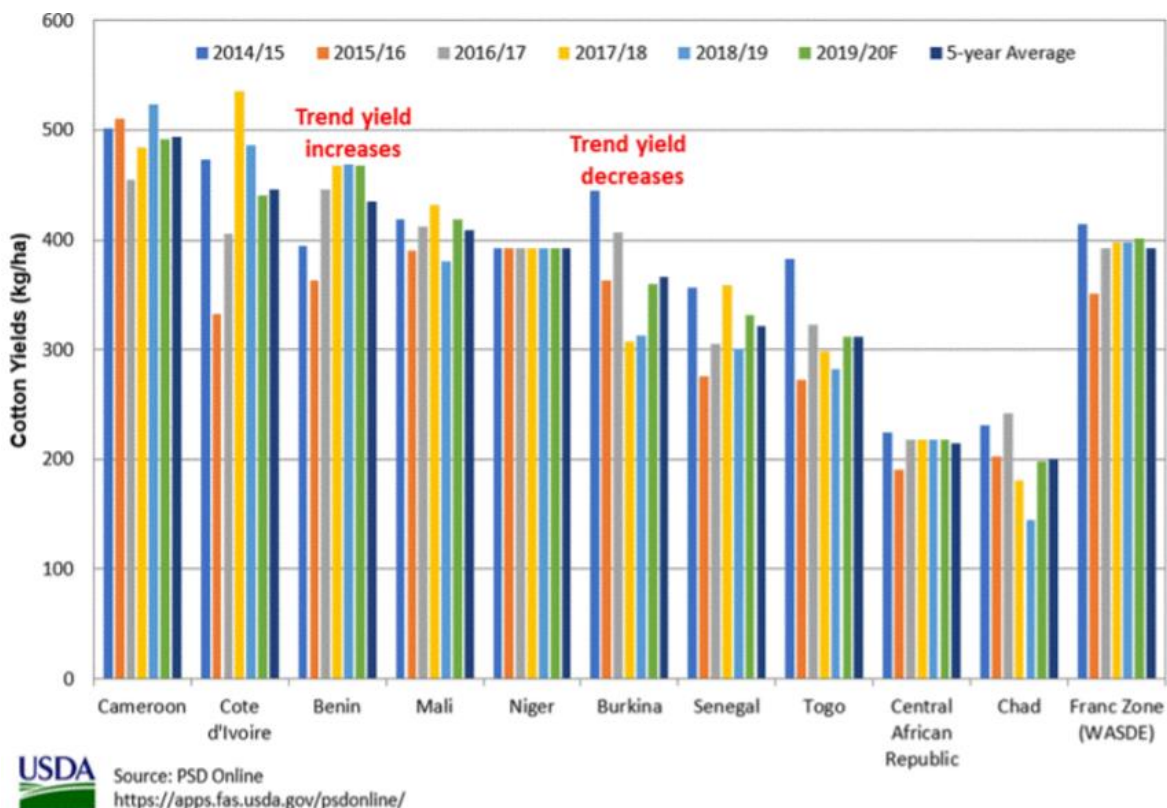
Graph 1: Cotton Production for West Africa’s Franc Zone



Source: United States Department of Agriculture, 2019

Graph 2 also shows that cotton has an increasing yield trend from 2015 to 2019 in Benin. Benin’s yield trend has increased during recent years after the government and private industry invested in modernizing the entire cotton supply chain and provided more timely supply of seed and fertilizer inputs (United States Department of Agriculture, 2019). Benin’s five-year average yield is 435 kg/ha which is also well above the five-year average yield of 393 kg/ha for the Franc Zone. The Republic of Benin produced 1,450 bales, and is followed by Mali’s 1,425 and Burkina Faso’s 1,200 bales. Before the ranking, the Republic of Benin was ranked third on the African continent behind Mali and Burkina Faso. The country was named the largest cotton producer for the African region for the 2019/2020 marketing year in July 2019 (Erezi, 2019).

Graph 2: Cotton Yield for West Africa’s Franc Zone



Source: United States Department of Agriculture, 2019

A consequence of cotton being the only cash crop available to small scale farmers is that the country's fertile land has suffered environmental degradation as a result of the emphasis on production of cotton for the export market, and because 90 per cent of all pesticides are used on cotton. The heavy use of agrochemicals has instigated widespread concern about the sustainability of the industry, which was particularly so between 1999 and 2000 following reintroduction of the pesticide Endosulfan, related to the banned DDT (Dichlorodiphenyltrichloroethane) which led to many farmers’ deaths. The damage to both human health and the environment has motivated the widespread introduction of organic farming methods which has almost doubled since 2003 (New agriculturist, 2008). Organizations such as the Pesticide Action Network, based in the UK, together with local partner OBEPAB (Organisation Béninoise pour la Promotion de l'Agriculture Biologique), Beninese Organization for the Promotion of Organic Agriculture, have trained local farmers, especially women in Integrated Pest Management (IPM) and organic cotton

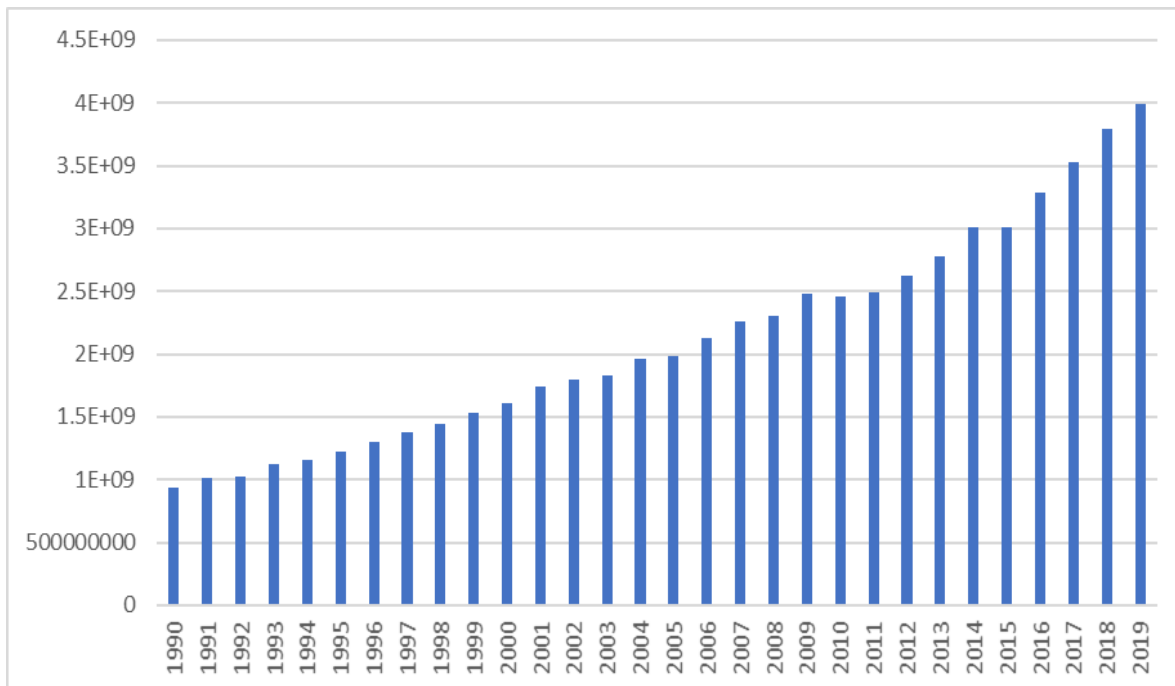
farming through Farmer Field Schools. IPM measures that aimed to reduce chemical pesticide use to a minimum, include improving soil fertility, recognizing disease, and encouraging natural enemies.

Benin's export market has developed to include other agricultural products. The production of shea nut butter, though more popular in Ghana, is an activity now strongly associated with women and reported to be, at times, a more important source of income than cotton. Shea nuts are a dominant in the local diet and their increasing use in the lucrative cosmetics industry is promoting interest in its export value. But the process of making shea butter is laborious and, in some seasons, may be unprofitable when the needed technologies are not being used. Since the mid-1980s Benin has increased production of yams, cassava, maize, peanuts, and pulses for the purpose of achieving food security. Rice production, principally upland varieties grown on dry land, has been boosted by the introduction of NERICA rice varieties by the Africa Rice Center (WARDA), which combine the hardiness of indigenous rice with the high yielding characteristics of Asian varieties, and they are said to produce 50 per cent more yield than local varieties without fertilizer use, and up to 200 per cent more with fertilizer application (New agriculturist, 2008).

Even though palm oil was a major cash crop in Benin during the 1980s, its cultivation was marginalized by the popularity of cotton. But now, following the growing interest in biofuels, palm oil production is increasing investment (New agriculturist, 2008). Also, the World Rainforest Movement has reported the allocation of 300,000-400,000 ha of land for palm oil production in humid southern Benin which, despite constituting only ten per cent of national territory, is home to 50 per cent of the country's population. This was put in place to promote the cultivation of palm oil for biofuel production on prime agricultural land and lead to competition with food crops. More than half of Benin's forest areas have been cleared or lost to bush fires. From the remaining forests, mahogany, iroko, teak, samba and other tropical hardwoods are used to make furniture and gifts for the tourist trade. Off-shore oil reserves uncovered in the 1960s have been largely exploited and imports now far exceed exports. Other natural resources include marble and limestone, together with small deposits of gold, but the mineral industry makes up a small component of the country's GDP, mostly because infrastructure is not developed. The lack of

infrastructure and investment means that even with large reserves of natural resources and a historic and thriving cotton industry, Benin has been unable to realize its economic potential. And food processing, shrimp and deep-sea fishing are only slowly developing as the private sector takes advantage of a new policy introduced by the government in 2001 to encourage investment (New agriculturist, 2008). It can be observed from the following graph that agriculture, forestry, and fishing value added has a positive increasing trend from 1990 to 2019. It has been rising throughout the years 1990-2019 without any drastic drop. Even though the agricultural sector in Benin encountered several problems, the agricultural output of Benin has been rising from 938555801.6 (constant 2010 US\$) in 1990 to 3986775451 (constant 2010 US\$) in 2019 (Appendix Table A).

Graph 3: Benin’s Agriculture, forestry, and fishing, value added (constant 2010 US\$)



Source: World Bank national accounts data, and OECD National Accounts data files, 2020

In Benin, the International Fund for Agricultural Development (IFAD) loans support the Government in reducing poverty and improving the livelihoods of poor rural people, and its activities target the most underprivileged households in rural areas. The approach of the International Fund for Agricultural Development (IFAD) is based on the use of local service providers to support communities. Its key activities include: The Improvement of access by small- and medium-sized rural operations to adapted financial services; The

Improvement of income for smallholder farmers and vegetable growers and ameliorate resilience to climate change through their integration into sustainable value chains for production, distribution and sale of flowers, rice, soya, pineapple, cassava, and maize; And to help farmer organizations and local associations take part in steering and managing economic development within their communes (Kabore, 2020).

World Bank's support in Benin for agriculture is channeled through two main operations namely the Agricultural Productivity and Diversification Project (PADA) and the West Africa Agricultural Productivity Project (WAAPP) (The World Bank, 2019). A support that has led to an increase in agricultural productivity, improved processing of agricultural products, and increased volume of exports with a positive impact on the income of those who have benefited from it. Moreover, 39% of women benefited from both projects out of a total of about one million direct beneficiaries. Benin as a low-income country that experiences serious challenges in developing its agricultural sector, which employs a large majority of the labor force, had a particularly modest growth in agriculture. In the country, the rural economy has been dominated by low-productivity agriculture where steady output growth has been followed by a deforestation rate of over twice that of the average Sub-Saharan region. Even though it offers the country the potential for sustainable growth and employment, agriculture in Benin is still heavily dependent on rainfall and an important commodity 'cotton' whose productivity has stayed modest over time. In the past, agricultural performance has not been enough to significantly help reduce poverty and its production systems were based on increasing cultivated areas and family labor, with limited use of improved inputs, production methods and agricultural equipment (The World Bank, 2019). In the following chapter, the effect of agriculture on GDP will be investigated for the purpose of understanding the relationship between agriculture and the GDP of the Republic of Benin, and further understanding the role of agriculture in economic performance of the country.

4.4 Effect of agriculture on the GDP of Benin

In most agricultural countries, agriculture plays an important role in economic activity. In those countries the agricultural sector employees most of the labour force and agricultural products account for a large portion of export. In economic terms Benin is heavily dependent on Nigeria and the vast majority of goods transhipped in the port of Cotonou involve business with Nigeria. Benin is also an important transit country for Niger, Burkina Faso and Mali. The trade at the Benin's ports is thus a centerpiece of the country's economy. The second important pillar of Benin's economy is agriculture. It contributes one third to gross national product (Federal Ministry for Economic Cooperation and Development, 2016). Benin is a country dependent on subsistence agriculture. In Benin more than 70 percent of the population earn a living from agriculture. Cotton is the main commercial crop, accounting for about 45% of the country's foreign-exchange earnings (SolutionsTeam, 2016). Benin is known for its production of cotton that represent approximately 35 percent to the country's export revenues and provide an income to roughly three million people (Food and Agricultural Organization, 2021). In addition agriculture accounts in 2019 for 26.87% of Benin GDP and 28.42% on average from 1990 to 2019 (Author's own excel computation, see the following table 1) (World Bank national accounts data, and OECD National Accounts data files, 2020).

Here “Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator” (World Bank national accounts data, and OECD National Accounts data files, 2020).

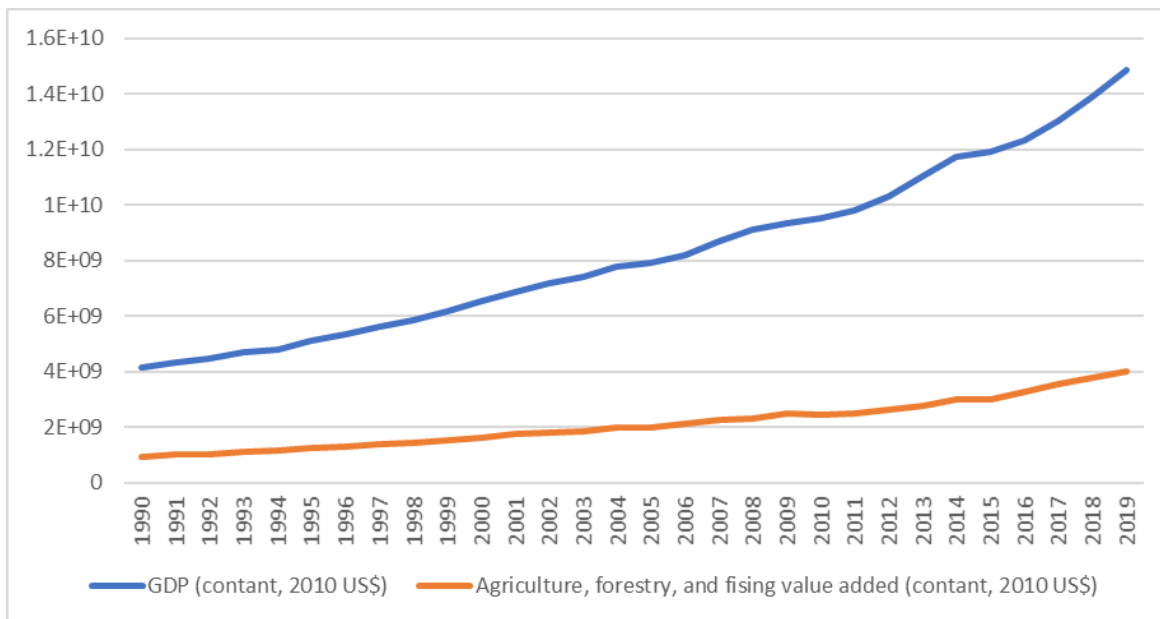
Table 1: Computation of the average of Agriculture, forestry, and fishing value added (%GDP)

Year	Agriculture value added (%GDP)
1990	34.65494536
1991	35.0437735
1992	33.94190414
1993	34.1194608
1994	32.29399457
1995	33.09015959
1996	35.70530039
1997	35.78193016
1998	36.57664979
1999	24.53433491
2000	23.54123399
2001	25.04816274
2002	25.38272928
2003	24.45398374
2004	26.52084928
2005	26.6894285
2006	26.63180343
2007	26.97108697
2008	26.82615619
2009	26.97895538
2010	25.8411355
2011	25.79700083
2012	25.76897583
2013	25.27540464
2014	25.61845297
2015	26.39208509
2016	27.7536355
2017	28.48901653
2018	28.08726564
2019	26.87580163
Average	28.42100515

Source: Author's own excel computation using World Bank national accounts data, and OECD National Accounts data files, 2020

Moreover, it can be observed from the following graph that both GDP (constant, 2010 US\$) and Agriculture forestry, and fishing value added (constant, 2010 US\$) have an increasing trend. From this it can be seen that there is a correlation between GDP (constant, 2010 US\$) and Agriculture, forestry, and fishing value added (constant, 2010 US\$) For the period from 1990 to 2019.

Graph 4: Benin’s GDP compared to Agriculture, forestry, and fishing value added



Source: World Bank national accounts data, and OECD National Accounts data files, 2020

Here the objective is to determine the effect of Agriculture, forestry, and fishing value added (constant, 2010 US\$) on the GDP (constant, 2010 US\$) of Benin. The correlation coefficient between this two variables is as follows: $\text{corr}(\text{GDP}, \text{Agriculture}) = 0.99835345$; and under the null hypothesis H_0 of no correlation: $t(28) = 92.0958$, with two-tailed p-value 0.0000 (Appendix Table B). GDP and Agriculture, forestry, and fishing value added are highly correlated. However correlation between two variables does not necessarily mean causation. The relationship between GDP and Agriculture, forestry, and fishing value added needs to be analysed on a deeper level. To complete the analysis of determining how Agriculture, forestry, and fishing value added affect GDP, it is necessary to construct a model that includes control variables. “A controlled variable is one which the researcher holds constant (controls) during an experiment. It is also known as a constant variable or simply as a "control." The control variable is not part of an experiment itself; it is neither

the independent nor dependent variable, but it is important because it can influence the results” (Anne Marie Helmenstine, 2020). Control variables are usually held constant during regression analysis to prevent them from affecting the relationship that is being studied. Here in order to analyse the effect of Agriculture, forestry, and fishing value added (constant, 2010 US\$) on GDP (constant, 2010 US\$), the following control variables: Exports of goods and services (constant 2010 US\$), Services, value added (constant 2010 US\$) and Industry (including construction), value added (constant 2010 US\$) will be used. Those control variables have been chosen because they can potentially influence the relationship between GDP and Agriculture, reason why they need to be kept constant while the analysis is being done.

4.4.1 Data and Methods

4.4.1.1 Data

Annual data were collected from the World Bank’s World Development Indicators for the period 1974 to 2019. The variables are GDP (constant, 2010 US\$), Agriculture, forestry, and fishing value added (constant, 2010 US\$), Exports of goods and services (constant 2010 US\$), Services, value added (constant 2010 US\$) and Industry (including construction), value added (constant 2010 US\$). These variables are defined as follows:

“GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars. Dollar figures for GDP are converted from domestic currencies using 2010 official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used” (World Bank national accounts data, and OECD National Accounts data files, 2020).

“Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a

sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Data are in constant 2010 U.S. dollars” (World Bank national accounts data, and OECD National Accounts data files, 2020).

“Services correspond to ISIC divisions 50-99. They include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The industrial origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3 or 4. Data are in constant 2010 U.S. dollars” (World Bank national accounts data, and OECD National Accounts data files, 2020).

“Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Data are in constant 2010 U.S. dollars” (World Bank national accounts data, and OECD National Accounts data files, 2020).

“Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government

services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments. Data are in constant 2010 U.S. dollars” (World Bank national accounts data, and OECD National Accounts data files, 2020).

4.4.1.2 Model

The formulation of the model in analytical form is as follows:

$$\mathbf{GDP = f (Agr, Ex, Serv, Ind)} \quad (6)$$

Where: GDP (constant 2010 US) as a function of Agriculture, forestry, and fishing, value added (constant 2010 US\$); Exports of good and services (constant 2010 US\$); Services value added (constant 2010 US\$); and Industry (including construction), value added (constant US\$).

4.4.1.3 Econometric Procedure

For the analysis of the data collected and presented into (Table A) of the appendix, an OLS regression will be carried out. In time series analysis, the first step is to conduct a stationary test to determine whether the variables have a unit root or not. Stationarity tests allow us to verify whether a series is stationary or not. A time series Y_t ($t=1,2,\dots$) is said to be stationary (in the weak sense) if its statistical properties do not vary with time (Mathematical expectation, variance, autocorrelation). There are two different approaches: stationarity tests such as the KPSS test that consider as null hypothesis H_0 that the series is stationary, and unit root tests, such as the Dickey-Fuller test and its augmented version, the augmented Dickey-Fuller test (ADF), or the Phillips-Perron test (PP), for which the null hypothesis is on the contrary that the series possesses a unit root and hence is not stationary (XLSTAT support center, 2020). In this study the augmented Dickey-Fuller test (ADF) will be utilized. The test is as follows:

H_0 = The series is not stationary = There is a unit root for the series

H_1 = The series is Stationary = There is no unit root for the series

$\alpha = 0,05$

Here, when p-value is lower than $\alpha = 0,05$ the null hypothesis is rejected, and it is concluded that there is no unit root for the series, and the series is Stationary. The

following table shows the result of the unit root test from lag 1 and using the level of variables and log differences of variables (Appendix Table C,D,E,F,G,H,I,J,K and L).

Table 2 : Unit root test results

Variables	GDP	Agroval	Exports	Services	Industry
Using level of variables	P-value = 1 Non-Stationary	P-value = 1 Non-Stationary	P-value = 0.9949 Non-Stationary	P-value = 0.9999 Non-Stationary	P-value = 0.9962 Non-Stationary
Using log difference of variables	P-value = 0.0062 Stationary	P-value = 0.006267 Stationary	P-value = 0.001458 Stationary	P-value = 0.000516 Stationary	P-value = 0.00291 Stationary

Source: Author's own computation form Gretl, 2021

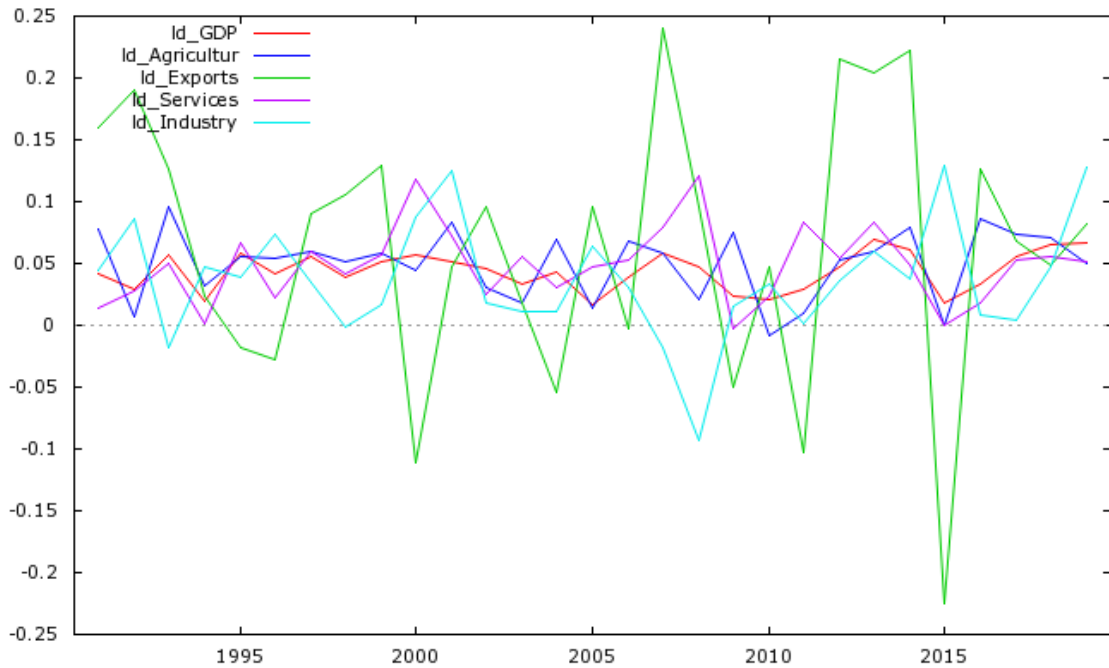
The time series of the five variables are not stationary when level of variables are used during the unit root test with lag 1. However, their time series are stationary when log differences are used during the test with lag 1. Each difference is a linear function of its own lagged differences and of lagged differences of each of the other variables in the system. Thanks to the results of the stationarity tests, the log differences of the initial variable were chosen to be used for the OLS regression analysis. The following table and graph presents the summary statistic and time series of the chosen variables.

Table 3: Summary statistic of variables.

Summary Statistics, using the observations 1990 - 2019 (missing values were skipped)				
Variable	MEAN	MEDIAN	MIN	MAX
ld_GDP	0.044001	0.045385	0.016987	0.069446
ld_Agricultur	0.049876	0.056067	-0.0083737	0.096463
ld_Exports	0.063571	0.082635	-0.22434	0.24086
ld_Services	0.048735	0.050855	-0.0034214	0.12136
ld_Industry	0.036596	0.034483	-0.093243	0.12916
Variable	S.D.	C.V.	SKEW	EXCSKURT
ld_GDP	0.015543	0.35325	-0.25367	-1.0399
ld_Agricultur	0.028158	0.56457	-0.48302	-0.78549
ld_Exports	0.10937	1.7204	-0.52186	0.11037
ld_Services	0.030967	0.63540	0.43445	0.093396
ld_Industry	0.047289	1.2922	-0.047005	0.90174

Source: Author's own computation form Gretl, 2021

Graph 5: Time series of all five variables.



Source: Author's own computation form Gretl, 2021

Secondly, the Multicollinearity test has been conducted. The correlation matrix is as follows:

Table 4 : Correlation matrix

Correlation Coefficients, using the observations 1990 - 2019					
5% critical value (two-tailed) = 0.3673 for n = 29					
ld_GDP	ld_Agriculture	ld_Exports	ld_Services	ld_Industry	
1	0.5708	0.3917	0.5741	-0.0314	ld_GDP
	1	0.2969	0.0095	-0.1022	ld_Agriculture
		1	0.1256	-0.2624	ld_Exports
			1	-0.2519	ld_Services
				1	ld_Industry

Source: Author’s own computation form Gretl, 2021

This correlation matrix shows that the control variables are not highly correlated with one another and with the independent variable. Thus, it can be concluded that there is no multicollinearity in the chosen model.

4.4.2 Regression analysis

From The OLS regression of Agriculture, forestry, and fishing value added (constant, 2010 US\$), Exports of goods and services (constant 2010 US\$), Services, value added (constant 2010 US\$) and Industry (including construction) on GDP (constant, 2010 US\$) the results obtained are present in table 5. From the OLS results, it can be seen that all P-values of both the independent variable Agriculture and the control variables Exports, Industry And Services are lower than the significant level $\alpha = 0.05$. It can be concluded that the estimated coefficients are all significant. Also, it is observed that: R-squared = 0.722353, which indicates that 72.22% of the variation in GDP is explained by the Agriculture, Exports, services and Industry. Generally, a higher R-squared indicates a better fit for the model. The following table shows the result obtained from the OLS regression.

Table 5: OLS Estimates

Model 1: OLS estimates using the 29 observations 1991-2019					
Dependent variable: ld_GDP					
VARIABLE	COEFFICIENT	STDERROR	T STAT	P-VALUE	
const	0.0101514	0.00487703	2.081	0.04823	**
ld_Agricultur	0.288652	0.0622379	4.638	0.00010	***
ld_Exports	0.0315258	0.0165505	1.905	0.06886	*
ld_Services	0.300941	0.0559366	5.380	0.00002	***
ld_Industry	0.0760135	0.0376555	2.019	0.05483	*

Mean of dependent variable = 0.0440005
 Standard deviation of dep. var. = 0.0155434
 Sum of squared residuals = 0.0018782
 Standard error of residuals = 0.00884637
 Unadjusted R-squared = 0.722353
 Adjusted R-squared = 0.676079
 F-statistic (4, 24) = 15.6102 (p-value < 0.00001)
 Durbin-Watson statistic = 1.78579
 First-order autocorrelation coeff. = 0.05609
 Log-likelihood = 98.6995
 Akaike information criterion (AIC) = -187.399
 Schwarz Bayesian criterion (BIC) = -180.562
 Hannan-Quinn criterion (HQC) = -185.258

Source: Author's own computation form Gretl, 2021

The formulation of the model in stochastic form is as follows:

$$\text{ld_GDP}_t = \beta_0 + \beta_1 \text{ld_Agricult}_t + \beta_2 \text{ld_Exports}_t + \beta_3 \text{ld_Services}_t + \beta_4 \text{ld_Industry}_t + e_t \quad (7)$$

Where: ld_GDP stands for the log difference of GDP (constant 2010 US\$); ld_Agriculture stands for the log difference of Agriculture, forestry, and fishing, value added (constant 2010 US\$); ld_Exports stands for the log difference of exports of good and services (constant 2010 US\$); ld_Services stands for the log difference of services value added (constant 2010 US\$) and ld_Industry stands for the log difference of industry (including construction), value added (constant US\$). β_0 to β_4 represent the coefficients and e_t represents the error term.

After running the OLS regression, a series of tests for the verification of the Linear Regression Model were done based on the result.

Firstly, the Autocorrelation test is as follows:

Hypothesis:

$H_0: \rho = 0 \rightarrow$ autocorrelation absence

$H_1: \rho \neq 0 \rightarrow$ autocorrelation presence

With significant level $\alpha = 0.05$

From the following result of the Breusch-Godfrey test for the first-order autocorrelation, it is observed that $p\text{-value} = 0.757 > 0.05$, the null hypothesis of autocorrelation absence is not rejected. There is no autocorrelation presence in the model.

Table 6 : Autocorrelation test result

Breusch-Godfrey test for first-order autocorrelation				
OLS estimates using the 28 observations 1992-2019				
Dependent variable: uhat				
VARIABLE	COEFFICIENT	STDERROR	T STAT	P-VALUE
const	0.000156111	0.00507353	0.031	0.97573
ld_Agricultur	0.00546187	0.0654896	0.083	0.93429
ld_Exports	0.00174147	0.0175118	0.099	0.92169
ld_Services	-0.00626856	0.0596955	-0.105	0.91732
ld_Industry	-0.00135595	0.0396872	-0.034	0.97305
uhat_1	0.0647977	0.232689	0.278	0.78325
Unadjusted R-squared = 0.00442795				
Test statistic: LMF = 0.097848,				
with p-value = $P(F(1,22) > 0.0978481) = 0.757$				
Alternative statistic: $TR^2 = 0.123983$,				
with p-value = $P(\text{Chi-square}(1) > 0.123983) = 0.725$				
Ljung-Box $Q' = 0.0806094$ with p-value = $P(\text{Chi-square}(1) > 0.0806094) = 0.776$				

Source: Author's own computation form Gretl, 2021

Secondly, normality test is as follows:

Hypothesis:

H₀: normality presence of random variable

H₁: normality absence of random variable

With significant level $\alpha = 0.05$

Table 7: Normality test result

```

Frequency distribution for uhat1, obs 1-30
number of bins = 7, mean = 3.88817e-018, sd = 0.00884637

      interval      midpt  frequency  rel.   cum.
      < -0.016564 -0.019403      1    3.45%  3.45% *
-0.016564 - -0.010888 -0.013726      2    6.90% 10.34% **
-0.010888 - -0.0052109 -0.0080493      3   10.34% 20.69% ***
-0.0052109 - 0.00046587-0.0023725      8   27.59% 48.28% *****
0.00046587 - 0.0061426 0.0033043     11   37.93% 86.21% *****
0.0061426 - 0.011819 0.0089810      1    3.45% 89.66% *
      >= 0.011819 0.014658      3   10.34% 100.00% ***

Missing observations = 1 ( 3.33%)

Test for null hypothesis of normal distribution:
Chi-square(2) = 0.886 with p-value 0.64224

```

Source: Author's own computation form Gretl, 2021

Here the p-value = 0.64224 > 0.05, thus the null Hypothesis of normality presence of random variable is not rejected. Sample data has been drawn from a normally distributed population (See normal distribution graph as Appendix Graph 1).

Thirdly, Heteroscedasticity is as follows:

Hypothesis:

H₀: Homoscedasticity

H₁: Heteroscedasticity

With significant level $\alpha = 0.05$

Table 8: Heteroscedasticity test result

White's test for heteroskedasticity				
OLS estimates using the 29 observations 1991-2019				
Dependent variable: uhat^2				
VARIABLE	COEFFICIENT	STDERROR	T STAT	P-VALUE
const	-0.000132651	0.000164997	-0.804	0.43486
ld_Agricultur	0.00136740	0.00284775	0.480	0.63852
ld_Exports	0.000615757	0.000737753	0.835	0.41794
ld_Services	0.00638532	0.00391991	1.629	0.12561
ld_Industry	0.00114058	0.00256144	0.445	0.66292
sq_ld_Agricul	0.0178129	0.0318957	0.558	0.58534
ld_Agr_ld_Exp	-0.00315880	0.0102387	-0.309	0.76223
ld_Agr_ld_Ser	-0.0855506	0.0474255	-1.804	0.09280 *
ld_Agr_ld_Ind	-0.00235688	0.0215546	-0.109	0.91448
sq_ld_Exports	-0.00341161	0.00235716	-1.447	0.16982
ld_Exp_ld_Ser	0.00768126	0.00763328	1.006	0.33136
ld_Exp_ld_Ind	-0.00910990	0.00743913	-1.225	0.24094
sq_ld_Service	-0.0275293	0.0233106	-1.181	0.25729
ld_Ser_ld_Ind	0.0158965	0.0205889	0.772	0.45290
sq_ld_Industr	0.00236994	0.0119076	0.199	0.84510
Unadjusted R-squared = 0.480338				
Test statistic: $TR^2 = 13.929792$,				
with p-value = $P(\text{Chi-square}(14) > 13.929792) = 0.454955$				

Source: Author's own computation form Gretl, 2021

This result shows that p-value = 0.454955 > 0.05, thus the null hypothesis is not rejected and it can be concluded that there is no heteroscedasticity in the Model. From the result of all the tests it can be concluded that the OLS coefficient estimates is BLUE (Best Linear Unbiased Estimate). The ordinary least squares (OLS) regression in this study produces unbiased estimates that have the smallest variance of all possible linear estimators. From the results of the regression, it is observed that a 1% increase in a year-on-year change in the value added by Agriculture leads on average to 0.28% growth in a year-on-year value of GDP; a 1% increase in a year-on-year change in the value added by Exports of good and services leads on average to 0.03% growth in a year-on-year value of GDP; a 1% increase in a year-on-year change in the value added by Services leads on average to 0.30% growth in a year-on-year value of GDP; and a 1% increase in a year-on-year change in the value added by Industry leads on average to 0.07% growth in a year-on-

year value of GDP. The result shows that services along with agriculture have approximately identical importance to the GDP. Industry and Exports contributions are in turn relatively low.

4.5 Economic objectives

Since 2016 the government has put in place an action programme that provides projects that aim to transform the social and economic conditions in Benin. The action programme aims to consolidate democracy, rule of law and good governance by strengthening the foundations of democracy and rule of law and improving governance; Initiate structural economic change by reforming the macroeconomic framework and maintaining stability, improving economic growth and improving educational performance; And to improve the living environment for the people by Improving basic social services and social protection, and promoting a balanced and sustainable development throughout the country. In order to make ‘agriculture the main driver of economic growth, wealth and job creation, the government goal was, and remains to establish seven regional hubs of agricultural development, and promote the development of high added-value sectors: pineapples, cashew nuts, cotton, maize, tapioca and rice. In support of large-scale agricultural investment, the government planned to set up research facilities specific to each sector, and vocational agricultural schools for each hub of agricultural development. Special emphasis is to also be placed on instruments and measures which promote private investment in the agricultural and rural sector. Among other things, 6,000 ha of arable land was planned to be created in the Ouémé Valley to encourage 2,500 young people to go into the farming business’(Government Action Programme 2016-2021).

Knowing that Benin is one of the countries with the most outstanding tourism potential in Africa it is unfortunate that in the country tourism accounts for only 0.7% of GDP. ‘The new government aims to transform the tourist industry into a growth sector that creates wealth and jobs and puts Benin firmly on the international map. To achieve this, Benin has numerous assets at its disposal, including the best wildlife and nature reserves in West Africa: the Pendjari and W parks. Vestiges and relics of the slave trade that will be used to

reconstruct the historic city of Ouidah, and the largest lake village in Africa (Ganvié) will also be redeveloped' (Government Action Programme 2016-2021).

The geographical position of Benin makes it a natural corridor linking several West African countries among which have Niger, Burkina Faso and Mali. 'To make the most of this strategic asset, the government will strengthen transport infrastructure to support economic growth and facilitate the development of exports. Special emphasis is planned to be placed on improving transport, logistics and trade infrastructure, notably by: Modernising and extending the Port of Cotonou; Upgrading the road network around the Port of Cotonou; Building a new international airport in Glo-Djigbé; Maintaining, modernising and extending the national road network over a planned 1,362 km Energy and Mines' (Government Action Programme 2016-2021).

'To establish a largely independent and competitive energy system and provide a reliable and high-quality electricity supply to factories and homes across Benin, the government is planning to modernise and expand the thermal sector. The development of renewable energy and the installation of solar farms with a total capacity of 95 MW are also among the measures planned to boost energy capacity in Benin. Lastly, the government believes that Benin must develop its mining capacities in order to fully exploit its subsoil potential. Craft industries The government action programme will boost the output from craft industries. It aims not only to build and expand the support infrastructure needed to develop the craft industry sector, but also to enhance the technical capabilities of craftspeople themselves' (Government Action Programme 2016-2021).

'The Benin government plans to use ICT (Information and Communication Technologies) as a catalyst for economic dynamism and national modernisation in order to quicken the pace of economic growth and social inclusion by 2021. The goal is to establish Benin in the medium term as a digital services hub for the whole of West Africa. This new strategy will be based notably on large-scale infrastructure development, the roll-out of high-speed Internet to 80% of the population, and efficiency improvements across the sector. As a result, the market will double in size and up to 90,000 direct jobs will be created in the ICT sector. These investment levels are expected to enable a minimum average growth rate of 6.5% over the President's five-year term in office. The measures are expected to enable the

creation of at least 500,000 direct and indirect jobs over the period. Focus: Impact of the programme 2015-2021' (Government Action Programme 2016-2021).

4.6 Dynamics in achieving economic objectives

4.6.1 Economic indicators

According to Theodora.com (2020), the GDP (purchasing power parity) in the Republic of Benin which was \$23.12 billion in 2015 grew to \$24.04 billion in 2016 and \$25.39 billion in 2017. Its GDP (official exchange rate) was \$9.246 billion in 2017. Its GDP real growth rate which was 2.1% in 2015 increased to 4% in 2016 and 5.6% in 2017. Benin's GDP per capita was \$2,200 in 2015, \$2,200 in 2016 and increased to \$2,300 in 2017. Its Gross national saving was 16.6% of GDP in 2015, 15.2% of GDP in 2016 and 17.3% of GDP in 2017. Its GDP composition, by sector of origin was: 26.1% for agriculture, 22.8% for industry and 51.1% for services in 2017. The Agricultural products of Benin are mostly cotton, corn, cassava, yams, beans, palm oil, peanuts and cashews. As previously mentioned, Benin has textiles, food processing, construction materials and cement industries. Its industrial production growth rate was 3% in 2017. Labor force was 3.662 million people in 2007 and the unemployment rate 1% in 2014. About 36.2% of the population was below the poverty line in 2011. In Benin the Budget was composed of: Revenues of 1.578 billion and expenditures of 2.152 billion in 2017. Taxes and other revenues represent 17.1% of GDP as of 2017. The country had a budget deficit of -6.2% (of GDP) as of 2017, and public debt of 49.7% of GDP in 2016 which decreased to 54.6% of GDP in 2017. Inflation rate (consumer prices) changed from -0.8% in 2016 to 0.1% in 2017. Exports which was \$1.588 billion in 2016 increased to \$1.974 billion in 2017. The exports partners of Benin were Bangladesh 18.1%, India 10.7%, Ukraine 9%, Niger 8.1%, China 7.7%, Nigeria 7.2%, Turkey 4% in 2017 and exports commodities cotton, cashews, shea butter, textiles, palm products, and seafood. Imports which was \$2.443 billion in 2016 increased to \$2.787 billion in 2017, and import commodities are foodstuffs, capital goods, petroleum products. Benin imports partners are Thailand 18.1%, India 15.9%, France 8.5%, China 7.5%, Togo 5.9%, Netherlands 4.3%, Belgium 4.3% as of 2017. Reserves of

foreign exchange and gold were worth \$57.5 million as of 31 December 2016 and \$698.9 million as of 31 December 2017. External debts which were \$2.476 billion on 31 December 2016 increased to \$2.804 billion on 31 December 2017. Exchange rates of African Financial Community francs (XOF) per US dollar was 494.42 in 2013, 591.45 in 2014, 593.01 in 2015, 593.01 in 2016 and 605.3 in 2017 (Theodora.com, 2020). Though growth slowed in 2017, as its close trade links to Nigeria exposing Benin to risks from unstable commodity prices, the market economy of Benin has experienced an uninterrupted growth for four years. Since cotton is a key export commodity, export earnings are significantly impacted by the price of cotton in the broader market. The economy started to collapse in 2017, due to the consumer price index falling 0.8% (Theodora.com, 2020).

4.6.2 Current economic situation of Benin

The government of Benin has been following an ambitious action plan to kick-start development through investments in infrastructure, education, agriculture, and governance since the introduction of President TALON's administration, which began in April 2016. Electricity generation, which has always been a limitation to Benin's economic growth, has increased and blackouts have been considerably reduced allowing businesses to be more productive. Private foreign direct investment is still small, while foreign aid accounts for a large proportion of investment in infrastructure projects. Also, Benin has appealed for international assistance to minimize piracy against commercial shipping in its territory and has used equipment from donors effectively against such piracy. This led to a significant dropped misappropriation at the Port of Cotonou, though the port is still struggling with effective implementation of the International Ship and Port Facility Security (ISPS) Code. Projects included in Benin's \$307 million Millennium Challenge Corporation (MCC) first compact (2006-11) were conceived to increase and promote investment, and private sector activity by improving key institutional and physical infrastructure. The four projects focused on access to land, access to financial services, access to justice, and access to markets; including modernization of the port of Cotonou, which is a crucial contributor to Benin's economy, with revenues projected to account for more than 40% of Benin's national budget (Theodora.com, 2020).

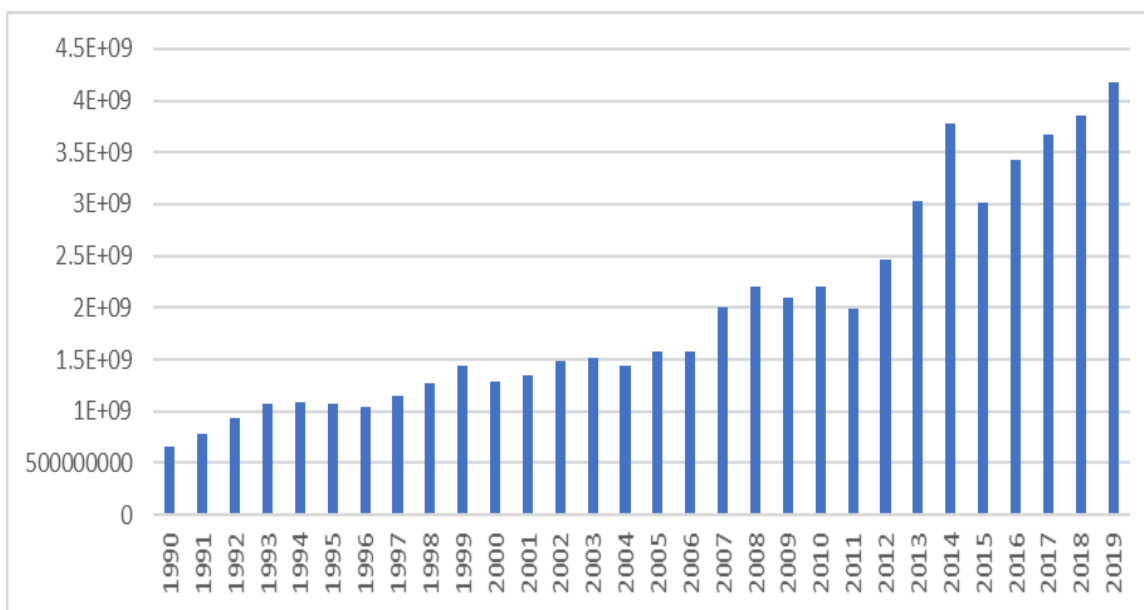
According to the World Bank (2020) Benin's economy highly depends on the informal re-export and transit trade with Nigeria estimated at approximately 20% of GDP, and on agriculture, notably cotton, which is the country's leading export product. In spite of the continuous, robust economic growth over the past two decades, poverty remains prevalent due to limited growth in per capita terms, which was only 1.5% on average during the period 2008–2018. The national headcount poverty rate was estimated at 40.1% in 2015 as against 49.5% in 2008 based on the international poverty threshold set at S\$1.90 per person per day in purchasing power parity (PPP) terms. For a lower poverty rate and more inclusive growth, greater economic diversification, more efficient public spending, and a more equitable geographical distribution of resources would pave the way. In a political context, Benin is a stable democracy, although there was some tension surrounding the legislative elections held on April 28, 2019. The government currently enjoys an absolute majority in Parliament (83 deputies). According to the party system reform approved by the National Assembly in 2018, several political parties and movements were merged to comply with the new Charter of political parties. Compared to over 200 parties prior to the reform, Benin now has around a dozen State-recognized parties.

Currently a global slowdown is expected due to the global pandemic of COVID-19. In Benin, the external transmission channels will play a significant role, mainly due to the slowdown in the Nigerian economy affected by the low price of oil, and the overall drop in raw material prices, especially cotton. Based on estimates from the International Monetary Fund (IMF), investors have already withdrawn S\$83 billion from emerging markets since the start of the COVID-19 crisis and capital outflows are likely to cause a serious drop in foreign direct investment (FDI) and to increased financing costs (World bank, 2020). The extent of the negative impact of COVID-19 on consumption and domestic investment will depend on contagion risk and the public policy choices made to combat the pandemic.

Before the negative impact of the spread of coronavirus everywhere in the world, Benin had recorded a solid GDP growth of 5.5% between 2016 and 2019 (World bank, 2020). However, the country's economic activity had gotten negatively affected by the decision of Nigeria to unilaterally close its land borders with its neighbors in August 2019. Even though the country tried to keep up with its activities, there was a slowdown of economic activity from 6.7 in 2018 to 6.4 in 2019, which represents a per capita growth of 3.5%.

Thanks to growth driven by agriculture due to the extensive cotton production, which increased by 18%, the supply side has improved. Industry and services have also contributed to the growth with the help of the increase in locally generated electricity with reference to the opening of a new power station. Consumer spending and private investment were the major contributors to the economic activities on the demand side, and inflation remained moderate at 0.9% in 2019 thanks to the enhancement of agricultural output in spite of the rise in fuel prices (World bank, 2020). The following graph shows exports of goods and services in Benin from 1990 to 2019. It can be observed from the graph that from 1990 to 2019, the export of Benin has been Increasing, with the lowest value 661898367.9 in (constant 2010 US\$) in 1990 and the highest value 4182533083 in (constant 2010 US\$) in 2019 (Appendix Table A).

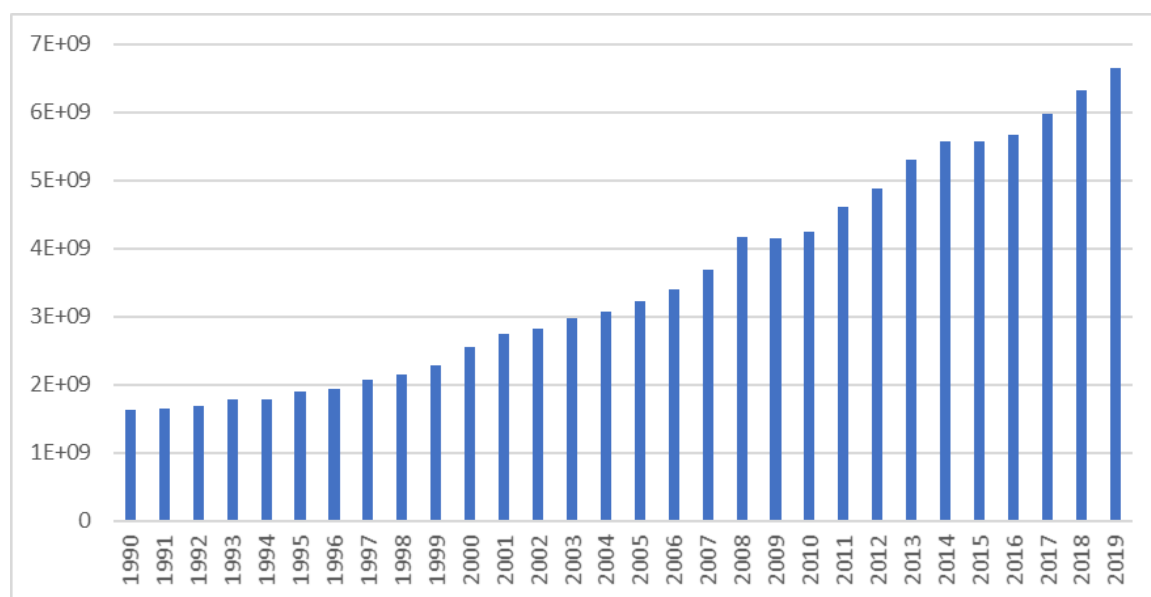
Graph 6: Benin’s exports of goods and services (constant 2010 US\$)



Source: World Bank national accounts data, and OECD National Accounts data files, 2020

The next graph represents services value added (constant 2010 US\$) in Benin. Form this graph it is observed that services have been increasing at a relatively slow rate from 1990 to 1999 and at a faster rate from 2000 to 2019, with its the lowest value of 1618264496 in (constant 2010 US\$) and highest value 6650423559 in (constant 2010 US\$) in 2019 (Appendix Table A). Thus Benin services have increased at a faster rate during the last twenty years.

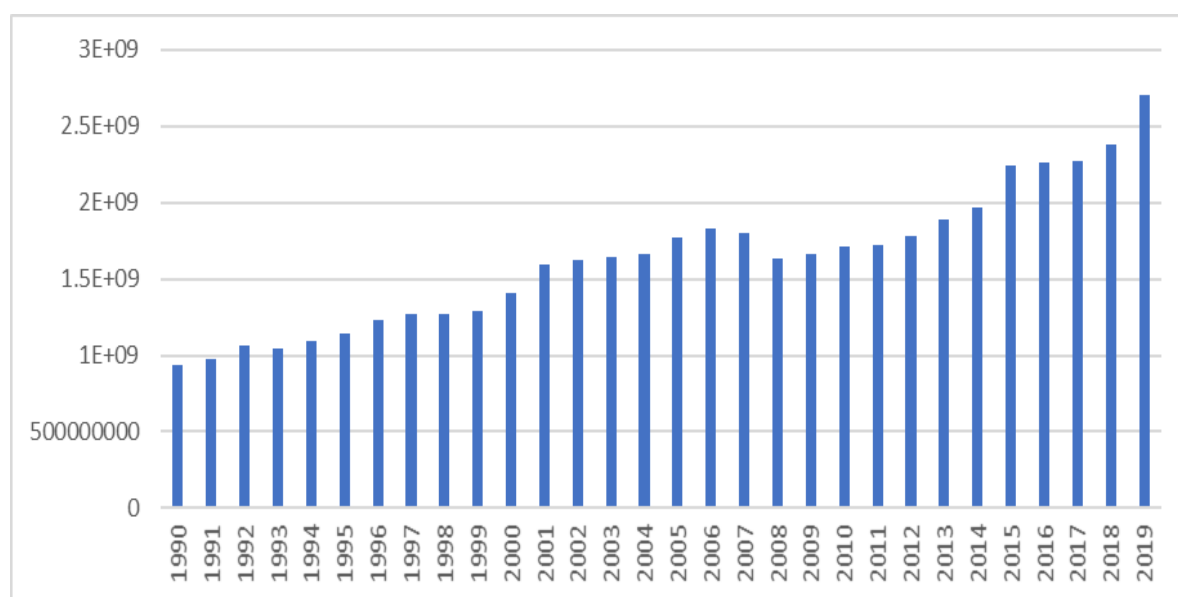
Graph 7: Benin's services value added (constant 2010 US\$)



Source: World Bank national accounts data, and OECD National Accounts data files, 2020

In addition, the next graph of Industry (including construction), value added (constant US\$) from 1990 to 2019 shows that Industry (including construction), value added has been fluctuating from 1990 to 2019. However it has an increasing trend with its lowest value 934831552.2 (constant US\$) in 1990 and its highest value 2701776067 (constant US\$) in 2019 (Appendix Table A).

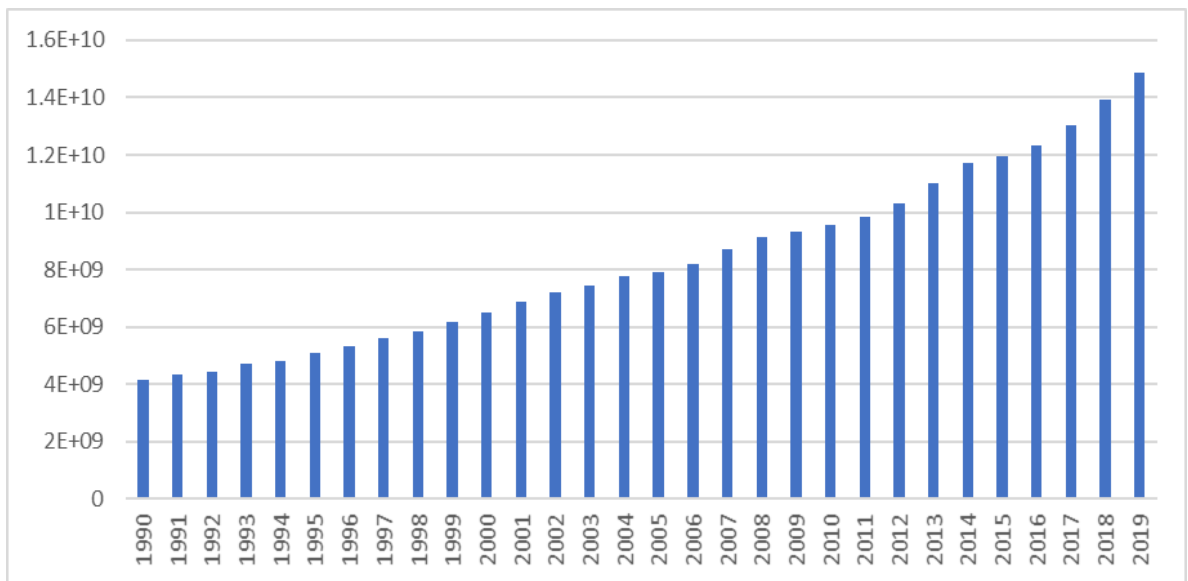
Graph 8: Benin's industry (including construction), value added (constant 2010 US\$)



Source: World Bank national accounts data, and OECD National Accounts data files, 2020

Those three graphs show that services, export of goods and services, and industry (including construction) added value have been improving throughout the year 1990 to 2019. The World bank (2020) also mentioned that the fiscal deficit of Benin (grants included) decreased considerably from 2.9% to 0.5% of GDP between 2018 and 2019, driven by the insubstantial execution of externally financed projects. The debt-to-GDP ratio was stabilized, moving from 41.5% in 2018 to 41.6% in 2019 and the total risk of debt distress remains non excessive. The external current account deficit (including grants) expanded from -4.6% of GDP in 2018 to -5.1% of GDP in 2019, due to the falling cotton prices and the increase in imports of construction inputs and energy products. Lately, most exported products were cotton and cashew nuts, while mainly energy products, machinery and construction material were imported. Likewise, the eight countries of the West African Economic and Monetary Union (WAEMU), Benin's monetary policy is managed by the Central Bank of West African States (BCEAO), that has kept the CFA franc pegged to the euro. A depreciation of the real effective exchange rate (REER) by 5% was observed in 2019, because of the nominal depreciation of the euro against the US dollar and the persistently lower inflation rate of WAEMU in relation to its trading partners. Even though it remains weak, the business environment has improved in Benin. The country occupies position 76 in terms of Logistics Performance Index and ranks 149 out of 190 countries in the World Bank's Doing Business report on business regulation (World bank, 2020). Despite the progress that Benin has made in "starting a business" and "getting electricity," it must, however, put emphasis on the areas of "getting credit" since the population needs to have access to more credit in order to invest into the creation of new businesses and into other productive economic activities. Moreover, even with all the efforts put into the eradication of corruption, Benin continues to struggle with major corruption-related challenges, ranking 85 out of 180 countries on Transparency International's Corruption Perceptions Index for 2018, with a score of 40/100 (World bank, 2020). It can be observed from the following graph that GDP (constant 2010 US\$) has been increasing during 1990 to 2019, considering that Benin obtained its independence since 1960. It can be observed that Benin's GDP (constant 2010 US\$) had an increasing trend during 1990 to 2019, with its lowest value 4150135201 (constant 2010 US\$) in 1990 and highest value 14867185273 (constant 2010 US\$) in 2019 (Appendix Table A).

Graph 9: Benin's GDP (constant 2010 US\$)



Source: World Bank national accounts data, and OECD National Accounts data files, 2020

From the economic indicators previously mentioned, the graphs and the current economic situation of Benin, it can be deduced that the economic situation of the country is improving and that there is a positive dynamic in achieving the stated goals. However, the country is growing at a slower rate than it should since it is not operating at its full potential and relying on aids provided by international organisations.

5 Results and Discussion

An economic indicator is any economic statistic, such as the unemployment rate, GDP, or the inflation rate, which indicate how well the economy is doing and how well the economy is going to do in the future (Moffatt, 2018). Levels of real national income, spending, and output are useful indicators of economic performance, for the reason that they indicate whether an economy is growing, or in recession (Economics Online, 2021). In this study, GDP has been employed as an indicator of economic performance, owing to the fact that it represents one of the most usual indicators used to track the health of a nation's economy.

Since the 1990 the Republic of Benin leaders have been trying to improve the country's economic situation. After changes in the constitution and regime in the early 1990s were carried out, the remnants and slogans of Marxism were abandoned, and privatization of the economy initiated (Dov, 2017). Benin was the first country in the 1990s to make the transition from a dictatorship to a multiparty democracy. Thanks to the ambitious action plan to kickstart development through investments in infrastructure, education, agriculture, and governance followed by the government of the president Patrice Talon since 2016, electricity generation, which has been a constraint for Benin's economic growth, has increased and blackouts have been considerably reduced allowing businesses to be more productive. However, private foreign direct investment is small compared to foreign aid that accounts for a large proportion of investment in infrastructure projects. Misappropriation has significantly dropped at the Port of Cotonou, though the port is still struggling with effective implementation of the International Ship and Port Facility Security (ISPS) Code. Benin occupies position 76 in terms of Logistics Performance Index and ranks 149 out of 190 countries in the World Bank's Doing Business report on business regulation, showing that poverty remains a problem (World bank, 2020). Even though Benin has made progress in terms of "starting a business" and "getting electricity," it must, however, put emphasis on the areas of "getting credit" since the population needs to have access to more credit in order to invest. Moreover, despite the effort made to eradicate corruption, Benin continues to struggle with major corruption-related challenges, ranking 85 out of 180 countries on Transparency International's Corruption Perceptions Index for 2018, with a score of 40/100 (World bank, 2020).

Agriculture plays a very crucial role in Benin's economy. More than 70 percent of Benin's population earn a living from agriculture. Most of them are subsistence farmers, growing crops on small family plots. However, poor infrastructure and flooding that can wipe out harvests and seed stocks, are just a few of the challenges faced by Benin farmers. The agricultural sector problems of Benin arise from bad transports, insufficient storage, and the failure of farmers to provide legal evidence of land ownership as collateral for loans. Even though it offers the country the potential for sustainable growth and employment, agriculture in Benin is still heavily dependent on rainfall and an important commodity 'cotton' whose productivity has stayed modest over time.

Many studies on different counties revealed that Agriculture growth can be the key to economic growth. Xuezheng, Shilei, and Feng (2010) found that although the share of agriculture in GDP has declined significantly over time, the contribution of agricultural growth has maintained an upward trend with the elimination of the price index and it has made an important market, foreign exchange, factor (finance and labour), output contributions to nonagricultural growth and remains an irreplaceable driving force for economic growth in China. For Matsuyama (1992) in the closed economy case, the model predicts a positive link between agricultural productivity and economic growth, while, for the small open economy case, it predicts a negative link. Yetiz and Özden (2017) found a unidirectional granger causality from agriculture to GDP in Turkey. Labintan and Ding (2012) results reveal that Agricultural land and rainfall had a positive effect on productivity while labor and government effectiveness had a negative effect, and agricultural research, extension and country openness doesn't have any significant effect in Benin. Phiri et al (2020) results suggest that the impact of agriculture on economic growth in Zambia is significant in both the short-run and long-run, with coefficient unit effects of 0.428 and 0.342, respectively. For Enu (2014) agricultural output had a significantly positive impact on Ghana's growth as compared to the other sectors (agricultural output (0.354515); service output (0.283401); industrial sector (0.303257)). MOUSSA (2018) using time series data from 1970 to 2016 found that there is a long-run causality and the absence of short-run causality between GDP per capita and agricultural value added in Benin. On the other hand, Gardner (2005) using data from 85 countries during 1960-2001, observed that the growth of agriculture as a sector is surprisingly

independent of the growth of income per capita for those who work in that sector. From most of the studies that focused on the relationship between Agriculture and economic growth, a large majority provide proof that agriculture has a strong and positive effect on the economic growth of most agricultural countries. Agriculture plays a primordial role in promoting economic growth and providing jobs to the unemployed. Agricultural countries like Benin agriculture also contribute to the other sectors such as services, export and industries since they are needed to complete the agricultural projects.

In this thesis the goal was to determine the role of agriculture in economic performance of the Republic of Benin. From the research it was determined that more than 70 percent of the population are dependent on employment in the agricultural sector, which accounts for more than 25 percent of the GDP (World Food Programme, 2020). Cotton being the most important Benin's cash crop, it contributes approximately to 35 percent of the country's export revenues and provides an income to roughly three million people (Food and Agricultural Organization, 2021). In addition agriculture account in 2019 for 26.87% of Benin GDP and for 28.42% on average from 1990 to 2019. GDP and Agriculture forestry, and fishing value added have an increasing trend and are highly correlated with one another, with a correlation coefficient of 99,8%. The chosen OLS regression model contains GDP (constant, 2010 US\$), Agriculture, forestry, and fishing value added (constant, 2010 US\$), Exports of goods and services (constant 2010 US\$), Services, value added (constant 2010 US\$) and Industry (including construction), value added (constant 2010 US\$); With log difference of GDP as the dependent (explained) variable, log difference of Agriculture as the independent variable (explanatory variable), and log difference of export, services and industry as control variables. The time series of the five variables are not stationary when level of variables are used during the unit root test with lag 1, but stationary when log differences of the variables are used during the test with lag 1. During the statistical verification of the linear regression model, it was observed that: all coefficients are significant, there was no multicollinearity; Autocorrelation absence; Normality presence of random variable; And homoscedasticity in the model. And R-squared = 0.722353, which indicates that 72.22% of the variation in GDP is explained by the Agriculture, Exports, services and Industry. The ordinary least squares (OLS) regression in this study produces unbiased estimates that have the smallest variance of all possible linear estimators. The coefficients obtained from the regression show that a 1% increase in a year-on-year change

in the value added by Agriculture leads on average to 0.28% growth in year-on-year value of GDP; a 1% increase in a year-on-year change in the value added by Exports of good and services leads on average to 0.03% growth in year-on-year value of GDP; a 1% increase in a year-on-year change in the value added by Services leads on average to 0.30% growth in year-on-year value of GDP; and a 1% increase in a year-on-year change in the value added by Industry leads on average to 0.07% growth in year-on-year value of GDP. As it can be seen from the results, services along with agriculture have approximately identical importance to the GDP. Industry and Exports contributions are in turn relatively low. And because 0.28% growth in year-on-year value of GDP as a response to a 1% increase in a year-on-year change in the value added by Agriculture represent a large value, and knowing that there is many other sectors contributing to GDP, the growth of agriculture is indispensable for the GDP growth and in turns indispensable for the economic performance of the Republic of Benin. Even though agriculture may not be a dominant activity in all countries a serious attention needs to be put on its development in most countries, Particularly Sub-Saharan African countries like Benin.

In Benin the government action programme (2016-2020) aims to consolidate democracy, rule of law and good governance by strengthening the foundations of democracy and rule of law and improving governance; Initiate structural economic change by reforming the macroeconomic framework and maintaining stability, improving economic growth and improving educational performance; And to improve the living environment for the people by Improving basic social services and social protection and and promoting a balanced and sustainable development throughout the country.

Benin's Real GDP, agriculture, export, services and industry have increasing trends from 1990 to 2019, which show that they have been increasing throughout that period. From the economic indicators mentioned in the previous chapters, the graphs and the current economic situation of Benin, it can be concluded that the economic situation of the country is improving and that there is a positive dynamic in achieving the stated goals. However, the country is growing at a slower rate than it should due to the fact that it is not operating at its full potential and relying on aids provided by international organisations.

6 Conclusion

Benin Agriculture constitutes one of the main activities and the sector that employs a major portion of the country's population. Which is the reason why it was important to understand the role it plays in Benin's economic performance. Knowing that levels of real national income, spending, and output are useful indicators of economic performance for the reason that they indicate whether an economy is growing, or in recession, real GDP was used as an indicator of economic performance. It has been observed that GDP, agriculture, export, and services have had increasing trends from 1990 to 2019. The goals and plans put in place by the different governments of Benin since 1990 have helped the economy of Benin maintain a modest growth. The ambitious action plan to kickstart development through investments in infrastructure, education, agriculture, and governance followed by the government of the president Patrice Talon since 2016, has permitted to improve electricity generation. The problem of thieving in the port of Cotonou has also reduced. Benin is said to occupy position 76 in terms of Logistics Performance Index and ranks 149 out of 190 countries in the World Bank's Doing Business report on business regulation. Even though Benin has made progress in terms of starting a business and getting electricity, the areas of getting credit needs to improve. In addition, though corruption has reduced, Benin continues to struggle with major corruption-related challenges. In Benin foreign aid that accounts for a larger proportion of investment in infrastructure projects than private investment and foreign direct investment. It is said by the World Bank (2020) that in spite of the continuous, robust economic growth over the past twenty years, poverty remains prevalent due to limited growth in per capita terms, which was only 1.5% on average during the period 2008–2018. From the numerous evidence found, it is observed that the Republic of Benin economic situation has been improving, poverty has relatively reduced, and there is a positive dynamic in achieving economic goals. The country is growing at a slower rate than it should due to the fact that it is not operating at its full potential and relying on aids provided by international organisations.

The first pillar of Benin's economy is the autonomous port of Cotonou. The country's economy is heavily dependent on Nigeria and the large majority of goods transhipped in the port of Cotonou involve business with Nigeria. Benin is also an important transit

country for Niger, Burkina Faso and Mali. The second important pillar of Benin's economy is agriculture. However, most of Benin's farmers are subsistence farmers, growing crops on small family plots, using poor infrastructure and facing flooding. Bad transports, insufficient storage, and the incapability of farmers to provide legal evidence of land ownership as collateral for loans are some of the problems that negatively affect Benin's agricultural sector. And even though it offers the country the potential for sustainable growth and employment, agriculture in Benin is still heavily dependent on rainfall and an important commodity 'cotton' whose productivity has stayed modest over time. In Benin more than 70 percent of the population earn a living from agriculture. Benin production of cotton represents approximately 35 percent to the country's export revenues and provides an income to roughly three million people (Food and Agricultural Organization, 2021). Also agriculture accounted for 26.87% of Benin's GDP in 2019 and 28.42% on average from 1990 to 2019. Having 28.42% as an average value of Agriculture, forestry, and fishing, value added (% of GDP) from 1990 to 2019 reveal that agriculture has accounted for more than one fourth of Benin's GDP. From the regression analysis it was observed that a 1% increase in a year-on-year change in the value added by Agriculture leads on average to 0.28% growth in year-on-year value of GDP; a 1% increase in a year-on-year change in the value added by Exports of good and services leads on average to 0.03% growth in year-on-year value of GDP; a 1% increase in a year-on-year change in the value added by Services leads on average to 0.30% growth in year-on-year value of GDP; and a 1% increase in a year-on-year change in the value added by Industry leads on average to 0.07% growth in year-on-year value of GDP. This shows that services along with agriculture have approximately identical importance to the GDP, and that Industry and Exports contributions are in turn relatively low. A 0.28% growth in year-on-year value of GDP represents a large value as a response to a 1 % increase in a year-on-year change in the value added by Agriculture. From all the above mentioned, it can be concluded that the growth of agriculture is essential to the GDP growth of the Republic of Benin, and therefore essential to the economic performance of the country. This study recommends that for agriculture to further contribute to a better economic performance of Benin, the country's farmers need to be supported with appropriated infrastructures, farming inputs, better irrigation techniques, that would help solve the problem of reliance on rain. More workers should be trained to provide the proper education to farmers in the use of modern production techniques to help enhance the country's production capacity.

The government of Benin should: subsidize the prices of agro-chemical products and fertilizer for farmers and promote the use of modern farm tools; put in place more research institutes to improve seedling production; provide scholarship for the studies in the field of agriculture to the high school graduates to motivate the younger generation to learn more on how to improve and develop the country's agriculture; and motivate agricultural investment by providing an insurance system for the agricultural investors in case of unexpected losses. Since cotton constitutes a larger source of revenue for Benin, the government of the country should promote a better development of the production of cotton, and also other agricultural products. In addition, the country should work on acquiring technological knowledge and needed technologies to improve industrial production. Because if adequate technologies were used for the transformation of agricultural products, agriculture would have a much more positive impact on the economic performance and will further contribute to the economic growth of Benin.

7 References

Abellanos, A.L. and Pava, H.M. (1987). Introduction to Crop Science. Central Mindanao University, Musuan, Bukidnon: Publications Office. p. 238

Adenom, M.O., and Unit, S. (2016). Analysis of agriculture and gross domestic product of Nigeria using first difference regression model. Journal of the Nigerian Statistical Association Vol, 28, pp.79-94. ISSN: 0331-9504

Anjum, S., and Tarique, M. (2017). Agriculture and poverty reduction in India: An empirical study. Asian Journal of Research in Social Sciences and Humanities, 7(9), pp. 35-48. ISSN: 2249-7315

Art. 97 (d), Chapter I, Title II, of the Labour Code of the Philippines. Presidential Decree No. 442, as amended. Available at:
<https://www.ilo.org/dyn/travail/docs/1131/Labor%20Code%20of%20the%20Philippines%20-%20DOLE.pdf>

Azra, D.K., Ahmed, E., and Ahmed, S.S. (2013). Agriculture and Economic Growth: Empirical Evidence from Pakistan. Sarhad Univ. Int. J. Basic Appl. Sci, 1 (1), pp. 307-313. ISSN: 2307-552X

Benin Ministry of Agriculture. (2020). National Adaptation Global Support Programme. [online] Available at:
<https://www.globalsupportprogramme.org/partners/benin-ministry-agriculture>. Accessed 16 November 2020.

Clunies-Ross, A., Forstyth, D., and Huq, M. (2009). Development economics 1st ed., Glasgow, UK: Mc-Graw Hill Education. ISBN-10: 0077114531

Cotton technical Assistance programme for Africa. (2012). Benin. [online] Available at: <http://www.cottontapafrika.org/benin.html>. Accessed 16 November 2020.

Crop Explorer for Major Crop Regions - United States Department of Agriculture. West Africa - Crop Production Maps. [online] Available at: https://ipad.fas.usda.gov/rssiws/al/wafrica_cropprod.aspx. Accessed 16 November 2020.

Danford School. (2020). What is Agriculture? [online] Available at: <https://danfordschool.com/2020/02/01/what-is-agriculture/>. Accessed 16 November 2020.

Dictionary.com. Agriculture. [online] Available at: <https://www.dictionary.com/browse/agriculture>. Accessed 16 November 2020.

Dictionary.com. GDP. [online] Available at: <https://www.dictionary.com/browse/gdp>. Assessed 29 Jan 2021.

Dov, R. (2017). Encyclopaedia Britannica. [online] Available at: <https://www.britannica.com/place/Benin/Economy>. Accessed 16 November 2020

Duignan, B. (2017). Gross domestic product. [online] Encyclopaedia Britannica. Available at: <https://www.britannica.com/topic/gross-domestic-product>. Accessed 16 November 2020.

Economics online. (2021). Measuring performance [online]. Available at: https://www.economicsonline.co.uk/Managing_the_economy/Measuring_performance.html. Accessed 16 November 2020.

Enu, P. (2014). Analysis of the agricultural sector of Ghana and its economic impact on economic growth. *Academic Research International*, 5(4) pp. 267-277. ISSN:2223-9944

Erezi, D. (2019). Minister sheds tears as Benin reaches milestone in cotton production. [online] *The Guardian*. Available at: <https://guardian.ng/news/minister-sheds-tears-as-benin-reaches-milestone-in-cotton-production/>. Accessed 16 November 2020.

Federal Ministry for Economic Cooperation and Development. (2016). Situation and cooperation. [online] Available at: https://www.bmz.de/en/countries_regions/subsahara/benin/zusammenarbeit/index.html. Accessed 16 November 2020.

FocusEconomics. (2013). Economic Indicators, News and Forecasts – FocusEconomics [online]. Available at: <https://www.focus-economics.com/economic-indicator/gdp-per-capita>. Accessed 16 November 2020.

Food and Agriculture Organisation–FAO. (2017). World Agriculture: Towards 2015/2030. FAO Corporate Document Repository 2017.

Food and Agricultural Organization. (2021). Benin. [online] Available at: <http://www.fao.org/agriculture/ippm/projects/benin/en/>. Assessed 31 Jan 2021.

Gardner, B. L. (2005). Causes of rural economic development. *Agricultural Economics*, 32 (s1), pp. 21-41. ISSN: 0169-5150

Government Action Programme 2016-2021. The Summary. Available at: <http://revealingbenin.com/wp-content/uploads/2017/02/The-Summary.pdf>

Index mundi. (2019). Benin - Agriculture, value added (constant 2010 US\$). [online] Available: <https://www.indexmundi.com/facts/benin/indicator/NV.AGR.TOTL.KD>. Accessed 16 November 2020.

Izuchukwu, O. (2011). Analysis of the contribution of agricultural sector on the Nigerian economic development. *World Review of Business Research*, 1(1), pp. 191-200.

Kabore, JP. (2020). International Fund for Agricultural Development. [online] Available at: <https://www.ifad.org/en/web/operations/country/id/benin>. Accessed 16 November 2020.

Labintan, A. C., and Ding, S. (2012). An assessment of agricultural productivity and major driving factors in the republic of Benin. *Ethiopian Journal of Environmental Studies and Management*, 5(4), pp. 468-474. ISSN: 1998-0507

Madhuri, T and Dheeraj, V. (2020). GDP Deflator. [online] Wall street Mojo. Available at: <https://www.wallstreetmojo.com/gdp-deflator/>. Accessed 16 November 2020.

MasterClass. (2020). Economics 101: What is the difference between Real GDP and Nominal GDP? [online]. Available at: <https://www.masterclass.com/articles/economics-101-what-is-the-difference-between-real-gdp-and-nominal-gdp>. Accessed 16 November 2020.

Matsuyama, K. (1992). Agricultural productivity, comparative advantage, and economic growth. *Journal of economic theory*, 58 (2), pp. 317-334. ISSN: 0022-0531

Merriam-webster dictionary. (2020). Agriculture. [online] Available at: <https://www.merriam-webster.com/dictionary/agriculture>. Accessed 16 November 2020.

Moffatt, M. (2018). Economic indicators: A beginner's guide. [online] Available at: <https://www.thoughtco.com/beginners-guide-to-economic-indicators-1145901>. Accessed 16 November 2020.

Moussa, A. (2018). Does agricultural sector contribute to the economic growth in case of republic of Benin. *Journal of Social Economics Research*, 5 (2), pp. 85-93. ISSN: 2312-6264

New agriculturist. (2008). Country Profile-Benin. [online] Available at: <http://new-ag.info/en/country/profile.php?a=389>. Accessed 16 November 2020.

Osabohien, R., Matthew, O., Gershon, O., Ogunbiyi, T., and Nwosu, E. (2019). Agriculture development, employment generation and poverty reduction in West Africa. *The Open Agriculture Journal*, 13(1). ISSN: 1874-3315

Phiri, J., Malec, K., Majune, S. K., Appiah-Kubi, S. N. K., Gebeltová, Z., Maitah, M., ... and Abdullahi, K. T. (2020). Agriculture as a Determinant of Zambian Economic Sustainability. *Sustainability*, 12(11), 4559. ISSN: 2071-1050

Republic Act No. 6657. Philippine Law Firm. Comprehensive agrarian reform law of 1988. Available at: <https://www.bcphilippineslawyers.com/republic-act-no-6657/>. Accessed 29 January 2021. ISBN-10: 9711601273

Rimando, T.J. (2004). *Crop Science 1: Fundamentals of Crop Science*. U.P. Los Baños: University Publications Office. p. 1

Rubenstein, J.M. (2003). *The Cultural Landscape: An Introduction to Human Geography*. 7th ed. Upper Saddle River, NJ: Pearson Education, Inc. p. 496

Roser, M. (2013). Employment in agriculture. [online] Our World in Data. Available at: https://ourworldindata.org/employment-in-agriculture?source=post_page----- ----- . Assessed 8 Feb 2021.

Signé, L. (2019). How the France-backed African CFA franc works as an enabler and barrier to development. [online] Quartz Africa. Available at: <https://qz.com/africa/1763066/how-the-france-backed-african-cfa-franc-works/>.

Solutions Team. (2016). Benin infographic. [online] Solutions 4 Africa. Available at: <https://solutions4africa.com/index.php/benin-publisher/298-quickly-learn-more-about-benin-on-this-from-this-cool-infographic>

Staff, Editorial, et al. (2020). 43 important facts About BENIN - page 1 of 3. Available at: <https://thefactfile.org/benin-facts/>. Assessed 29 Jan 2021.

The Economic Times. (2020). Definition of Gross Domestic Product. [online] Available at: <https://economictimes.indiatimes.com/definition/gross-domestic-product>. Accessed 16 November. 2020.

The Free dictionary. GDP. WordNet 3.0, Farlex clipart collection. 2003-2008. [online] Available at: <https://www.thefreedictionary.com/GDP>. Assessed 29 Jan 2021.

Theodora.com. (2020). Benin Economy 2020. Available at: https://theodora.com/wfbcurrent/benin/benin_economy.html

The 192ND General Court of the Commonwealth of Massachusetts. Sec 1a. Chapter 128. Available at: <https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXIX/Chapter128/Section1A>. Assessed 29 Jan 2021.

Tomšík, K., Smutka, L., Lubanda, J. P., and Rohn, H. (2015). Position of agriculture in Sub-Saharan GDP structure and economic performance. *Agris on-line Papers in Economics and Informatics*, 7(665-2016-45047), pp. 69-80. ISSN: 1804-1930

United States Department of Agriculture. (2019). Commodity Intelligence Report. [online] Available at: <https://ipad.fas.usda.gov/highlights/2019/07/benin/index.pdf>

West Africa: Land Use and Land Cover Dynamics. (2020). The Republic of Benin. [online] Available at: <https://eros.usgs.gov/westafrica/country/republic-benin>. Assessed 29 Jan 2021.

Wathi. (1970). Presentation of Benin. [online] Available at: <https://www.wathi.org/laboratoire/initiatives/presentation-benin/>. Assessed 29 Jan 2021.

World Food Programme. (2020). Benin. [online] Available at: <https://www.wfp.org/countries/benin>. Accessed 16 November. 2020.

World Bank. (2020). Overview. [online] Available at:
<https://www.worldbank.org/en/country/benin/overview>. Accessed 16 November. 2020.

World bank. (2019) Benin tackles agriculture challenges with tangible results for beneficiaries. [online] Available at:
<https://www.worldbank.org/en/results/2019/11/08/benin-tackles-agriculture-challenges-with-tangible-results-for-beneficiaries#:~:text=In%20Benin%2C%20the%20World%20Bank%27s%20support%20for%20agriculture,and%20the%20West%20Africa%20Agricultural%20Productivity%20Project%20%28WAAPP%29>.
Accessed 16 November. 2020.

World Bank. (2020). Agriculture. Overview. [online] Available at:
<https://www.worldbank.org/en/topic/agriculture/overview>. Assessed 08 November 2020.

World Bank national accounts data, and OECD National Accounts data files. (2020). Services, value added (constant 2010 US\$). Available at:
<https://data.worldbank.org/indicator/NV.SRV.TOTL.KD>

World Bank national accounts data, and OECD National Accounts data files. (2020). Industry (including construction), value added (constant 2010 US\$). Available at:
<https://data.worldbank.org/indicator/NV.IND.TOTL.KD>

World Bank national accounts data, and OECD National Accounts data files. (2020). GDP (constant 2010 US\$). Available at:
<https://data.worldbank.org/indicator/NY.GDP.MKTP.KD>

World Bank national accounts data, and OECD National Accounts data files. (2020). Agriculture, forestry, and Fishing, value added (constant 2010 US\$). Available at:
<https://data.worldbank.org/indicator/NV.AGR.TOTL.KD>

World Bank national accounts data, and OECD National Accounts data files. (2020). Exports of goods and services (constant 2010 US\$). Available at:
<https://data.worldbank.org/indicator/NE.EXP.GNFS.KD>

World Bank national accounts data, and OECD National Accounts data files. (2020). Agriculture, forestry, and fishing, value added (% of GDP). Available at:
<https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS>

XLSTAT support centre. (2020). [online] Available at:
https://help.xlstat.com/s/article/unit-root-dickey-fuller-and-stationarity-tests-on-time-series?language=en_US#:~:text=There%20are%20two%20different%20approaches:%20stationarity%20tests%20such,a%20unit%20root%20and%20hence%20is%20not%20stationary. ISBN-10: 6200491097

Xuezhen, W., Shilei, W., and Feng, G. (2010). The relationship between economic growth and agricultural growth: The case of China. In 2010 International Conference on E-Business and E-Government, pp. 5315-5318. IEEE. ISBN: 978-1-4244-6647-4

YETİZ, F., and ÖZDEN, C. (2017). Analysis of causal relationship among GDP, agricultural, industrial and services sector growth in Turkey. Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 10(3), pp. 75-84. ISSN: 2564-6931

8 Appendix

Table A: Data collected and used in the analysis

Year	GDP	Agriculture	Exports	Services	Industry
1990	4150135201	938555801.6	661898367.9	1618264496	934831552.2
1991	4325511591	1014505874	776366871.1	1640372483	977244408.2
1992	4453447715	1021292268	939233952.7	1686965260	1065708495
1993	4713358588	1124717831	1065997175	1773088138	1046593466
1994	4808587306	1161639365	1092108459	1776271969	1097184883
1995	5099275960	1228629429	1072912943	1899606475	1140207560
1996	5319783136	1297476561	1043059020	1942613689	1227961119
1997	5624856122	1376402148	1141762984	2062475112	1271043405
1998	5847657355	1448621233	1268333356	2149400920	1268658327
1999	6160007012	1535289017	1443215985	2276140125	1290856497
2000	6520842618	1605452360	1290689007	2560991025	1409725625
2001	6868608004	1745781825	1352490179	2751739661	1598029773
2002	7187519594	1798807243	1488059352	2821434610	1627733700
2003	7435027350	1830717877	1514812367	2982576799	1646892725
2004	7764375608	1961030262	1435904510	3077175958	1664604800
2005	7897392139	1989007228	1579965377	3226712043	1774388377
2006	8208844660	2129584403	1575302774	3403581305	1828483015
2007	8700254776	2258031979	2004334916	3685679040	1796115372
2008	9126269458	2305350599	2206625512	4161228503	1636210529
2009	9337934308	2484761109	2099280184	4147015545	1661277063
2010	9535344283	2464041236	2199999216	4247751748	1717225219
2011	9817948328	2487496319	1986364091	4617788618	1720235932
2012	10290311747	2622926585	2464992367	4876821621	1783268333
2013	11030332696	2783174913	3025339819	5303820255	1893823514
2014	11731605852	3012989534	3779940964	5568395482	1967521742
2015	11940211526	3013674821	3020327543	5567013335	2238781514
2016	12338975598	3283886767	3427506360	5670097094	2258742622
2017	13038787443	3532283660	3667431805	5979805019	2269337290
2018	13912028869	3791167164	3850803396	6320672535	2379195373
2019	14867185273	3986775451	4182533083	6650423559	2701776067

Source: World Bank national accounts data, and OECD National Accounts data files, 2020

Table B: Correlation coefficient for GDP and Agriculture, forestry, and fishing value added

```
corr(GDP, Agriculture) = 0.99835345
Under the null hypothesis of no correlation:
t(28) = 92.0958, with two-tailed p-value 0.0000
```

Source: Author's own computation from Gretl, 2021

Table C: ADF Test for level of variable GDP

```
Augmented Dickey-Fuller tests, order 1, for GDP
sample size 28
unit-root null hypothesis: a = 1

test with constant
model: (1 - L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.155
estimated value of (a - 1): 0.0390882
test statistic: tau_c(1) = 2.65803
asymptotic p-value 1
```

Source: Author's own computation from Gretl, 2021

Table D: ADF Test for level of variable Agriculture

```
Augmented Dickey-Fuller tests, order 1, for Agriculture
sample size 28
unit-root null hypothesis: a = 1

test with constant
model: (1 - L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.007
estimated value of (a - 1): 0.0750627
test statistic: tau_c(1) = 3.5863
asymptotic p-value 1
```

Source: Author's own computation form Gretl, 2021

Table E: ADF Test for level of variable Exports

```
Augmented Dickey-Fuller tests, order 1, for Exports
sample size 28
unit-root null hypothesis: a = 1

test with constant
model: (1 - L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: -0.051
estimated value of (a - 1): 0.0523229
test statistic: tau_c(1) = 0.852238
asymptotic p-value 0.9949
```

Source: Author's own computation form Gretl, 2021

Table F: ADF Test for level of variable Services

```
Augmented Dickey-Fuller tests, order 1, for Services
sample size 28
unit-root null hypothesis: a = 1

test with constant
model: (1 - L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.020
estimated value of (a - 1): 0.0370749
test statistic: tau_c(1) = 2.01143
asymptotic p-value 0.9999
```

Source: Author's own computation form Gretl, 2021

Table G: ADF Test for level of variable Industry

```
Augmented Dickey-Fuller tests, order 1, for Industry
sample size 28
unit-root null hypothesis: a = 1

test with constant
model: (1 - L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.050
estimated value of (a - 1): 0.0432508
test statistic: tau_c(1) = 0.95568
asymptotic p-value 0.9962
```

Source: Author's own computation form Gretl, 2021

Table H: ADF Test For log difference of GDP

```
Augmented Dickey-Fuller tests, order 1, for ld_GDP
sample size 27
unit-root null hypothesis: a = 1

test with constant
model: (1 - L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: -0.041
estimated value of (a - 1): -1.00491
test statistic: tau_c(1) = -3.57599
asymptotic p-value 0.006267
```

Source: Author's own computation form Gretl, 2021

Table I: ADF Test for log difference of Agriculture

```
Augmented Dickey-Fuller tests, order 1, for ld_Agricultur
sample size 27
unit-root null hypothesis: a = 1

test with constant
model: (1 - L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.065
estimated value of (a - 1): -1.30462
test statistic: tau_c(1) = -3.99196
asymptotic p-value 0.001458
```

Source: Author's own computation form Gretl, 2021

Table J: ADF Test for log difference of Exports

```
Augmented Dickey-Fuller tests, order 1, for ld_Exports
sample size 27
unit-root null hypothesis: a = 1

test with constant
model: (1 - L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: -0.124
estimated value of (a - 1): -1.31144
test statistic: tau_c(1) = -4.58033
asymptotic p-value 0.000136
```

Source: Author's own computation form Gretl, 2021

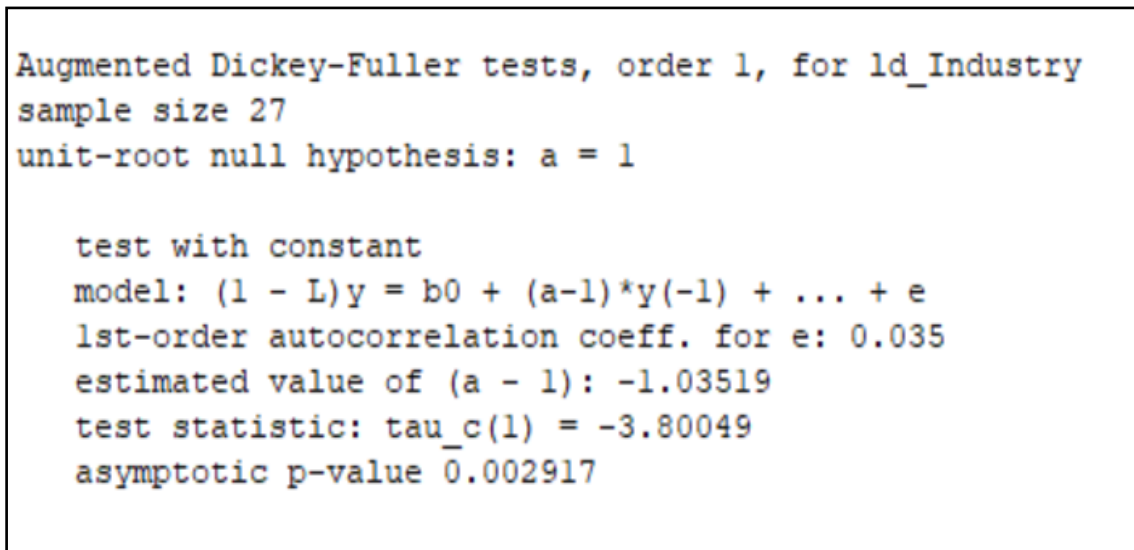
Table K: ADF Test for log difference of Services

```
Augmented Dickey-Fuller tests, order 1, for ld_Services
sample size 27
unit-root null hypothesis: a = 1

test with constant
model: (1 - L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: -0.013
estimated value of (a - 1): -1.15933
test statistic: tau_c(1) = -4.25984
asymptotic p-value 0.0005163
```

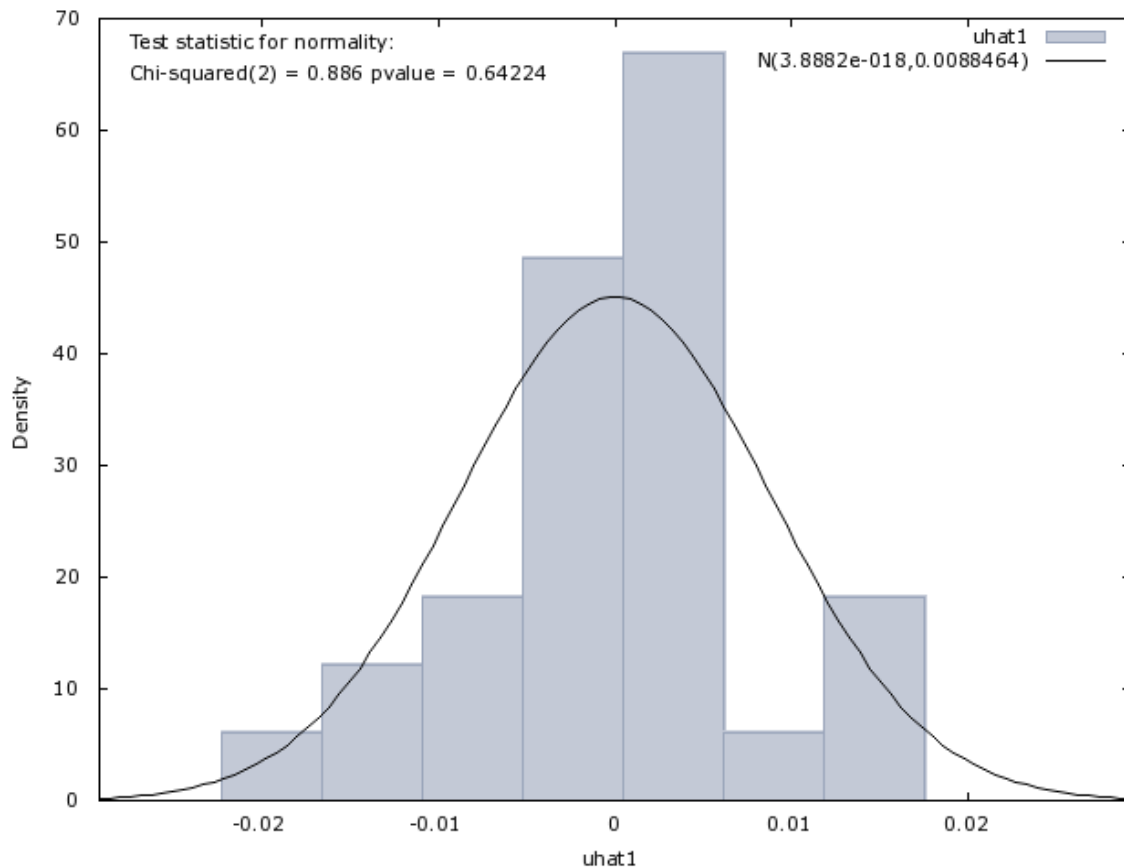
Source: Author's own computation form Gretl, 2021

Figure L: ADF Test for log difference of Industry



Source: Author's own computation form Gretl , 2021

Graph 1: Normality test additional result



Source: Author's own computation form Gretl, 2021

