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Factors influencing the economic growth in Benin

Bachelor Thesis

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I hereby declare on my honour that I wrote this bachelor's thesis independently, and I used no other sources and aids than those indicated.

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Abstract

Benin is a developing and democratic country, which thanks to its strategic location in West Africa, and its human capital, political stability, potential and heritage has several advantages which could help improve its economic condition. Our objective is to determine factors influencing the economic growth of Benin during the year 1991 to 2015. Time series analysis and multiple OLS regressions in Gretl were used to find that foreign direct investment, export of good and services, access to electricity and population growth positively and significantly influence the economic growth. And natural resources, debt and unemployment negatively and significantly influence the economic growth of Benin. However, evidence of the impact of Agriculture and Aid on economic growth were not found. This study suggests that, the government of Benin should focus more on activities that attract foreign direct investment; should continue to promote and boost Export; should make an important and necessary effort to invest into production of electricity, in order to become independent; and to motivate a reasonable growth of the population.

Keywords: Gross Domestic Product, Economic Growth, Benin, Export

JEL classification: F63, E17, F35, J64, O47

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Introduction

Benin is a developing country of west Africa which is bordered by Togo to the west, Nigeria to the east, and Burkina Faso and Niger to the north. As of 2016, it had an estimated population of 10.9 million (The world Bank, 2018). Benin has a stable and democratic government. Since the end of a Marxist-Leninist regime in 1989, it has organized six presidential elections, seven legislative elections, and three local elections peacefully. Presidential elections held in March 2016 were won by the multi-millionaire and cotton sector tycoon, Patrice Talon. In December 2016, the new government adopted an ambitious development program called “Programme d’ Actions du Gouvernement” structured around 45 flagship projects aimed at improving the productivity and living conditions of the population (The world Bank, 2018). The GDP growth per capita of Benin has been varying over the years, which indicate that several factors have been influencing it along in time.

According to the Financial dictionary (2012), the economic growth rate is the change in a nation's GDP from one period of time (usually a year) to the next. The economic growth rate shows by how much GDP has grown or shrunk in raw dollar amounts. It is considered one of the most important measures of how well or poorly an economy is performing. There have been several empirical works that specifically looks into factors that determine growth in developing economies in recent years. Since growth is a very dynamic process, studies that are based on cases hundreds of years ago might not be as relevant now. The technological changes in the last few decades have revolutionized the way countries improve their economy (Parash Upreti, 2015).

This thesis will consist of determining factors affecting the economic growth in Benin in order to find out, while using time series model and OLS regressions whether they are significant and in influencing, and how they influence the GDP growth per capita. The reason behind the choice of working on that theme is that Benin is a model of democracy and stability, with all the necessary assets to become a centre of inclusive and sustainable development, economic dynamism and social progress, which however is still trying to improve its bad economic condition; and its strategic location in West Africa, its human capital, political stability, potential and heritage, are all indisputable advantages (Patrice Talon, 2016). Even though several reforms have been put in place and that the GDP of Benin has been varying over the years, Benin has always been considered as being a poor country with a very low GDP per capita of 789.44USD in 2016 (world Bank). It is necessary to analyse some factors that may affect the GDP growth, and see the way how they affect it. Those factors are to be found in order to determine the model of growth of the country and to understand how the GDP respond to change over time of the observed factors. The dependent variable to model is the GDP Growth per capita.

Our work will consist of firstly an overview of the economic situation of Benin; mention some of the empirical work done on the causes of economic growth; defining and presenting each of the variable

and mention the previous work done in analysing their effect on economic growth including the results of those studies; presenting our variable in a table showing the Variables, their descriptions, unit of variables and the predicted signs; collecting the data from the world bank data; importing our collected data into Gretl; presenting the time series of all of our variables; running multiple ordinary least square regressions in Gretl using the collected data; summarising our findings; And the conclusion and references.

1.Economic Overview of Benin

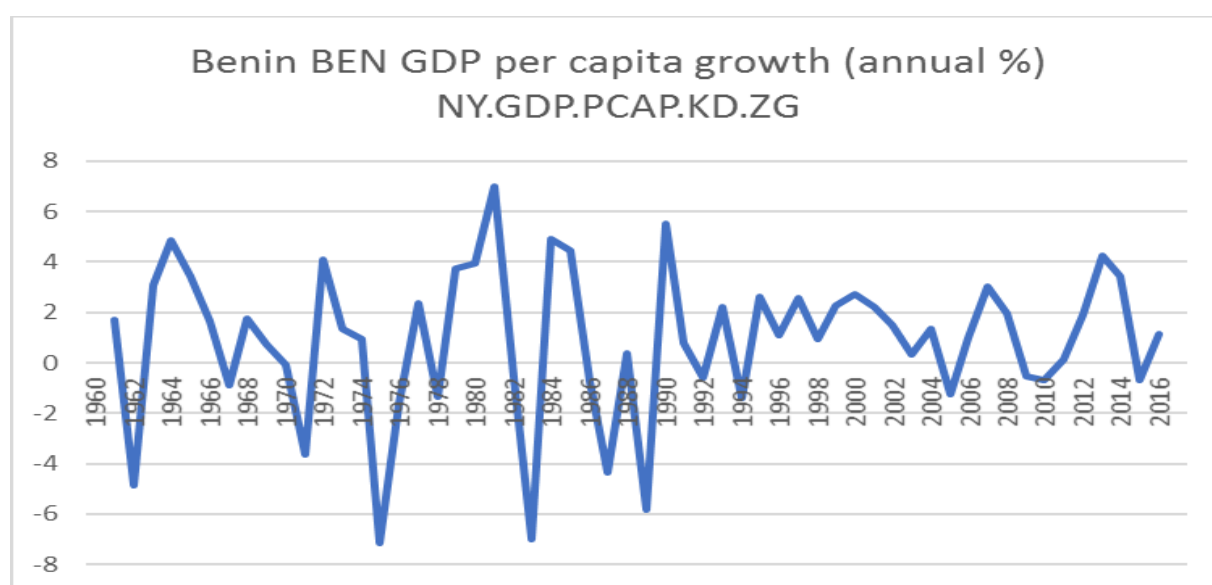
Benin's economy relies heavily on informal re-export and transit trade to Nigeria, which makes up roughly 20% of GDP, and on agricultural production. The tertiary sector as a whole accounts for 50% of GDP, while agriculture accounts for approximately 25% of GDP and between 45% and 55% of the country's employment. Real GDP growth is projected to accelerate to 5.4% in 2017, from 4.0% in 2016. Growth has been relatively significant in recent years at 4.8% in 2012, 7.2% in 2013, and 6.4% in 2014, but decelerated to 2.1% in 2015, mainly due to a slowdown of re-export activities and a fall in agriculture production. Cotton production reached approximately 451,000 tons in 2016 from 269,218 tons in 2015, and the government expects an increase of 11% in 2017. Industrial production growth will accelerate at 7.2% in 2017, from 4.5% in 2016. The sector will benefit from cotton ginning activities, as well as dynamism in the construction sub-sector linked to the implementation of a government investment plan. Inflation rate is estimated at -0.8% for 2016 and is projected to remain under the West Africa Economic Market Union's target of 3% in 2017. With the partial implementation of the Government Action Program, PAG (Programme d'Actions du Gouvernement), Benin's overall fiscal deficit (including grants), will increase in 2017 to 7.9 % of GDP, from 6.2% in 2016; and decrease thereafter to 4.1% and 1.9% of GDP in 2018 and 2019 respectively (World bank 2018).

However, economic growth has failed to significantly reduce Benin's poverty rate, which has remained steady at 50.9% (World Bank 2014). Despite moderate GDP growth of between 4% and 5% annually over the past two decades, poverty remains widespread and often on the rise in Benin. National poverty rates were 37.5% in 2006, 35.2% in 2009, 36.2% in 2011, and 40.1% in 2015. Female-headed households experience lower levels of poverty (28% compared to 38% for male-headed households), but women remain more vulnerable and continue to suffer from a lack of economic opportunities. Women are also underrepresented in high-level decision-making positions. The education and health sectors represent a significant share of annual public expenditure (on average 23% of public expenditure is allocated to education and 7% to the health sector). Significant efforts are needed to ensure more equity in their geographical distribution and greater effectiveness and efficiency in the management of these two sectors. (World, Bank 2018) The poverty rate is the ratio of the number of people (in a given age group) whose income falls below the poverty line; taken as half the median household income of the total population. It is also available by broad age group: child poverty (0-17 years old), working-

age poverty and elderly poverty (66-year-olds or more). However, two countries with the same poverty rates may differ in terms of the relative income-level of the poor. (OECD Library, 2015)

Benin is vulnerable to exogenous shocks, primarily: adverse weather conditions, terms of trade shocks (cotton and oil prices), and developments in Nigeria. The outlook for 2017 is clouded by the impact of a possible further depreciation of the Nigerian naira, which will be felt through more reduction in re-exports and exports to Nigeria, as 80% of Benin's imports are typically destined for Nigeria via informal cross-border trade. The government needs to accelerate reforms to reduce poverty and promote shared prosperity. Despite some progress, a weak business environment continues to be a deterrent for domestic and international investors. In Doing Business (DB) indicators, Benin ranked 153 in DB2016 and 155 in DB2017, but made progress on "starting a business" as well as on "getting electricity." However, more needs to be done to improve access to credit and tax payments. In addition, Benin continues to face major corruption challenges, ranking 95 out of 175 countries in the Transparency International's 2016 Corruption Perceptions Index (it was ranked 83 in 2015). (World, Bank 2018)

1- GDP per capita growth of Benin (annual %)



Source: World Bank national accounts data.

As we can see from this graph showing the GDP per capita growth rate of Benin from 1960 to 2016, the GDP per capita growth of the Republic of Benin is being rising and falling throughout the years. There must be several factors that affect the variation of GDP per capita growth of the country. However, we have decided to focus mostly on factors like Foreign direct investment net inflows; Exports of goods and services; Life expectancy at birth; External debt stocks; Net official development assistance and official aid received; Total natural resources rents; Unemployment; Access to electricity and Agriculture.

Robert Barro (1996) studied a panel of 100 countries from 1960 to 1990 to find the factors that affected the economic growth of countries. He found that the growth rate of real per capita GDP was associated with maintenance of the rule of law, smaller government consumption, longer life expectancy, more male secondary and higher levels of schooling, lower fertility rates, higher levels of investment, the level of democracy, a lower inflation rate, and openness to trade. He also emphasized the theory of convergence, which implies that as the real GDP level rises, the growth rate falls. Barro's sample of 100 countries included 18 countries from Sub-Saharan Africa, 22 from Latin America, and 18 from Asia of all economic levels, but included very few developing countries (i.e. the poorest countries). Many of these countries were excluded from the sample because data was missing. Despite international aid and support, developing countries were not able to grow and prosper because of economic traps. The traps include conflicts or wars, rent seeking on natural resources, dependence on only one neighbouring country, and lack of the rule of law (Collier, 2007). Although real per capita GDP growth of developing countries was higher than the world average, they had low levels of socio-economic conditions. It was partly due to weak institutions, low human and physical capital, conflicts, poverty, a low level of productivity, lack of international trade, and heavy reliance on external help. Since they had a low level of real per capita GDP, the theory of convergence, "catching up," should hold true. In fact, it seemed to, because despite all the problems, they had higher growth rates compared to developed countries. (Parash Upreti, 2015, p 38, pp1-2)

Douglas Hawks (2003) mention that, Keynes suggested that governments should take an active role in managing the economy; that Keynes believed that by being involved in the bond market, both as a seller and a buyer, governments could influence interest rates; by influencing interest rates, governments could encourage or discourage consumers from saving money; And if the economy was struggling, the government could buy bonds, making interest rates drop. Since people wouldn't be able to make much money on their savings, and because they could borrow money so cheap, there would be more spending, and thus, economic growth. For Daron Acemoglu (2006), the baseline of Solow model implies that growth is driven by: capital accumulation, exogenous technological progress and later human capital. Developed by Adam Smith in *Wealth of Nations* (1776), Smith argued that there are several factors which enable increased economic growth which are: Role of markets in determining supply and demand; The productivity of labour; And Increasing returns to scale thanks to specialisation that we see in modern factories and the economies of scale of increased production. The neo-classical theory of economic growth suggests that increasing capital or labour leads to diminishing returns. Therefore, increasing capital has only a temporary and limited impact on increasing the economic growth. As capital increases, the economy maintains its steady-state rate of economic growth. To increase the rate of economic growth in the Solow/Swan model we need an increase in proportion of GDP that is invested – however, this is limited as higher proportion of investment leads to diminishing returns and convergence on the steady-state of growth; and technological progress which increases productivity of

capital/labour. It suggests poor countries who invest more should see their economic growth converge with richer countries. (Tejvan Pettinger 2017)

According to Parash Upreti (2015) high volume of exports, plentiful natural resources, longer life expectancy, and higher investment rates have positive impacts on the growth of per capita gross domestic product in developing countries. We will verify whether some of those factors and some additional factors of choice are relevant in affecting the growth of Benin. Several economists have been working on the factors that could influence the economic growth of a country in order to find a way to ameliorate economic conditions thanks to their successful theories and findings. Since each country has different characteristics, it is difficult to imagine only one generalised and universal model of growth for all countries. For Prateek Agarwal (2017), the following six causes of economic growth: Natural Resources, Physical Capital or Infrastructure, Population or Labor, Human Capital, Technology, Law are key components in an economy. Improving or increasing their quantity can lead to growth in an economy. The discovery of more natural resources like oil, or mineral deposits may boost economic growth as this shift or increases the country's Production Possibility Curve; An increased investment in physical capital such as factories, machinery, and roads will lower the cost of economic activity and increase output through higher productivity; with a growing population means there is an increase in the availability of workers or employees, which means a higher workforce, and which however may lead to unemployment due to the effect of large population; An increase in investment in human capital can improve the quality of the labor force and increase productivity; Technology could increase productivity with the same levels of labor, thus accelerating growth and development; And an institutional framework which regulates economic activity such as rules and laws is necessary. However, Poor health and low levels of education; Lack of necessary infrastructure; Flight of Capital; Political Instability; Lack of an institutional framework and Protectionist strategies limit growth (Prateek Agarwal 2017). This also helps to understand more about the causes of economic growth and gave us an intuition for additional factors to include in our model.

The determinants of economic growth are inter-related factors influencing the growth rate of an economy. There are six major factors that determine growth with four of them been grouped under supply determinants and the other two are efficiency and demand. The four supply factors are natural resources, capital goods, human resources and technology and they have a direct effect on the value of goods and services supplied. Economic growth measured by GDP means the increase of the growth rate of GDP, but what determines the increase of each component is very different. There are also socio-political factors and events that have a major influence on the economic advancement of a country. There are also differences between economic and non-economic determinants. "Proximate" or economic determinants refers to factors like capital accumulation, technological progress, labour and "ultimate" or non-economic sources refers to factors like government efficiency, institutions, political

and administrative systems, cultural and social factors, geography and demography (Acemoglu, 2009) (Florin Teodor Boldeanu, Liliana Constantinescu, 2015, P 330)

1.1 Foreign direct investment

Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. FDI data do not give a complete picture of international investment in an economy. (The World Bank, 2015). FDI is an important factor in the economic aspect that unites states, regions and businesses. FDI is different from other types of capital flows, it includes not only the capital itself, but the transfer of technology and skills, managerial expertise and know – how, as well as the introduction of the new processing methods (Rodrik and Subramanian, 2008). For Shiva s. Makki and Agapi Somwaru (2004), foreign direct investment and trade are often seen as important catalysts for economic growth in the developing countries; FDI is an important vehicle of technology transfer from developed countries to developing countries; And also stimulates domestic investment and facilitates improvements in human capital and institutions in the host countries.

FDI can have some positive impact on the development process in developing countries. It presents an opportunity for these countries to finance their economic growth, particularly if FDI were to generate some foreign exchange on the side. A developing country may also access the technological and managerial assets of foreign investors through FDI, the diffusion of which can have a substantial impact on productivity growth. FDI tends to bind foreign investors to the operation of the investment projects and should enhance their willingness to transfer technology and job training. Moreover, the introduction of efficient and internationally competitive foreign enterprises into an economy can stimulate local entrepreneurship by providing increased competition, a demonstration effect, and opportunities for subcontracting. FDI may also furnish a part of the initial capital and create profits needed for future industrial investment. There are more dynamic gains from the industrial development induced by FDI, including more employment, a better-trained labor force, a higher national income, more innovations, and enhanced competitiveness in addition to foreign market outlets for a developing country's exports. FDI from the West may also be used as a foreign policy instrument to provide a host country with a gateway to the international community and to deter possible external political interventions. These positive aspects of FDI, however, should be viewed against a number of negative impacts. First, with no significant linkages to other economic sectors, FDI tends to operate in an enclave, and thus it is unlikely to have the same multiplier effect as in developed and articulated economies. This negative impact is aggravated by the tendency of Multinational Corporations (MNCs) to internalize production

and distribution in order minimize transaction costs. Thus, growth under FDI could lead to sectoral disarticulation in some developing countries. Second, although foreign investors often tend to reinvest their earnings locally during periods of economic growth in a host country, during economic downturns they may actually increase repatriation of funds, further depressing the economy. In addition, they often compete with local firms for domestic as well as external sources of funding and displace the possible development of local firms. Third, some developing countries may have to confront the increasing control exercised by large MNCs over certain sectors of their economies as a result of many firm-specific advantages. These include brand names, patented superior technology, marketing and management skills, control of a large section of world markets, and economies of scale. MNCs also tend to take control of domestic economic policies and at times may take actions that are contrary to a developing country's national interests or independence. (Hooshang Amirahmadi And Weiping Wu, 1994, p185-186)

Foreign direct investment (FDI) has been a big source of external funding in developing and developed countries. The impact of FDI on economic growth has been extensively discussed in economic research. There have been both positive and negative analysis of FDI on economic growth. For Parash Upreti (2015), most economists and policymakers believe that FDI stimulates development in investment in technology, increases the capital stock, and increases employment; and some worry, however, that it has a crowding out effect on domestic investment and eliminates competition in the local markets. Foreign Direct Investment plays an important role on the growth of countries under economic and developmental transformation and is a subject of vast empirical research. From the previous work of Dumor Koffi, Zonon Ifred Baba Tounde Paterne, and Gbongli komlan (2016) while studying the impact of the foreign direct investment on economic growth in Benin, they arrive at the conclusion that FDI positively and meaningfully affects the growth rate. However, they found that, regarding for the role played by human capital and the rate of openness, it appeared that in the presence of these two variables, the impact of FDI is low and that it affects positively but not significantly growth rates. Therefore, they concluded that the human capital and the degree of trade openness do not reinforce the impact of FDI on the growth rate in Benin. Moreover, Sarumi Adewumi (2016) in a study on the impact of FDI on growth in developing countries, has used data for the entire continent and data for eleven countries within the continent for the empirical analysis, and time series data from 1970-2003, to discover that the contribution of FDI to growth is estimated to be positive in most of the countries but not significant. Galaye Ndiaye and Helian Xu (2016) while investigating the impact of foreign direct investment (FDI) on economic growth in WAEMU (West African Economy Monetary Union) from 1990 to 2012, found that FDI has a positive impact on economic growth. They also mentioned that FDI in WAEMU is going to facilitate the trade, FDI liberalization, economic cooperation, improve the business environment and increase the labour cost and that FDI will allow WAEMU countries to attract more foreign capital for the creation of jobs and wealth. Samuel Antwi and Xicang Zhao (2013) studying the Impact of FDI on

economic growth in Ghana; applied the cointegration methodology on yearly data of FDI, GDP and GNI to determine the extent to which these variables are related; and study establishes that a long-run equilibrium and causal relationship exists between the dependent variable FDI and the two independent variables GDP and GNI; And that in the short-run, effects of GDP and Gross National Income (GNI) volatility on FDI are nearly imaginary. There are also studies that have found no positive effects on economic growth like Carkovic & Levine (2003) for whom FDI does not exert a robust, independent influence on growth refer to evidence found by Hans (2001).

Benin set up a large series of reforms in order to improve the business climate and attract FDI. After slowing down due to the global economic crisis, FDI influx has gone up. In 2014, FDI reached USD 405 million, which represents a 600% increase since 2006. The influx dropped to USD 149 million in 2015 and reached USD 160 million in 2016 according to the UNCTAD (World Investment Report, 2017). In terms of stock, FDI represent less than 20% of GDP. The National Infrastructure Development Plan, that contains a series of private-public partnerships, should boost FDI. Most of the FDI in Benin arrived through the acquisition of interests in privatised companies. Many infrastructure projects are funded by grants or loans from the World Bank or other international development banks. Benin also received international aid to expand its energy sector and port infrastructure (Santander trade, 2017). Knowing that in some of the studies FDI had a positive effect and that in others a negative effect, we expect that foreign direct investment may have a positive or negative effect on the GDP growth per capita of Benin.

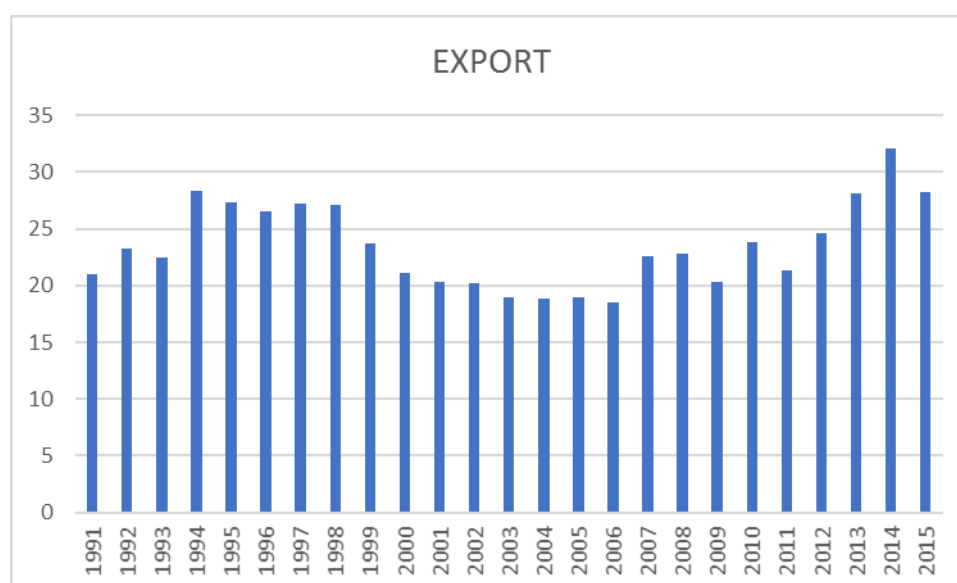
1.2 Export

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 (World Bank 2017). ⁸Exports are the goods and services produced in one country and purchased by citizens of another country. It doesn't matter what the good or service is. It doesn't matter how it is sent. It can be shipped, sent by email, or carried in personal luggage on a plane. If it is produced domestically and sold to someone from a foreign country, it is an export (Kimberly Amadeo, 2018). Export may be considered as a source of benefit to the country that is exporting the goods and services for several reasons. According to Kimberly Amadeo (2018), the more a country export, the greater their competitive advantage because it gains expertise in producing the goods and services; and also gain knowledge about how to sell to foreign markets.

Export should be observed to have a positive effect on the economic growth of a country. However, it might not be the case for all countries. Divers observation have been made on the way how export affect the economic growth of a country. For Parash Upreti (2015) a high volume of exports has a positive impact on the growth of per capita gross domestic product in developing countries. Muhammad S. Anwer and R.K. Sampath (1997), after utilizing unit root and cointegration techniques, found that out of 96 countries only 8 show unidirectional or bidirectional causality from exports to GDP with positive relationship between the two variables. They also observed that causality from GDP to Exports with positive relationship between the two variables is found for only 9 countries. For Bédia F. Aka (2006) in a study of the relationship between openness, globalization and economic growth, found that Globalization have a negative effect on economic growth in Ivory Coast; and that although a positive effect of openness on growth is observed in the short-run, both increasing openness and globalisation have not positively contributed to the long-run economic growth of the country. which for her is a finding that is in the opposite of the prediction of the new growth theory about the potential long-run effects of trade on growth.

Benin is the 150th largest export economy in the world. In 2016, Benin exported \$2.49B and imported \$13.7B, resulting in a negative trade balance of \$11.2B. In 2016 Benin exported \$2.49B, making it the 150th largest exporter in the world. During the last five years the exports of Benin have increased at an annualized rate of 145B%, from \$1.14B in 2011 to \$2.49B in 2016. The most recent exports are led by Gold which represent 16.1% of the total exports of Benin, followed by Raw Cotton, which account for 8.79%. (OEC Benin export).

Exports of goods and services (Base of the pyramid, current US\$) from 1991 to 2015



Source: World bank data

From this Graph showing the export of good and services of Benin export was quite low in from 1991 to 1993 and from 2000 to 2006 and high in 2014 and fell in 2015. We understand that the effect of export on the growth of a country vary depending of the country characteristics. However, knowing that export may have a positive effect on the economic growth of a county, which was observed in previous researches, we expect export to affect positively the economic growth of Benin.

1.3 Life expectancy

Life expectancy at birth indicates the number of years a new born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. (world bank, 2017). In this study, the indicator of life expectant expectancy used is the Life expectancy at birth, total (years). Life expectancy at birth used here is the average number of years a new born is expected to live if mortality patterns at the time of its birth remain constant in the future. It reflects the overall mortality level of a population and summarizes the mortality pattern that prevails across all age groups in a given year. (world bank, 2017). According to the latest WHO data published in 2015 life expectancy in Benin is: Male 58.8, female 61.1 and total life expectancy is 60.0 which gives Benin a World Life Expectancy ranking of 162 (WHO 2015).

An increase in life expectancy is directly related to the control of diseases and better health. It should normally have a positive effect on the labor force and increase the growth of an economy. Life expectancy may also be affected by economic growth through better health service. However, for Daron Acemoglu and Simon Johnson (2007), a 1 percent increase in life expectancy leads to a 1.7–2 percent increase in population; and Life expectancy has a much smaller effect on total GDP. Thus, for them, there is no evidence that the large increase in life expectancy raised income per capita. According Cervellati and Sunde (2009) improvements in life expectancy reduce population growth and foster human capital accumulation after the onset of the demographic transition, which implies that the effect of life expectancy on population, human capital and income per capita is not the same before and after the demographic transition. On the other hand, Belgi Turan (2009), found a weak positive relationship between life expectancy and labor force participation for females, but no relationship among males; and the new data suggests that in sub-Saharan Africa, increases in life expectancy will have a positive impact on growth through fertility and education but the effect will be small. Moreover, for Rashidul Alam Mahumud, Lal B Rawal, Golam Hossain, Ripter Hossain and Nurul Islam (2013), the increased life expectancy has direct impact on increased per capita real income and higher expenditure on health. Junsen Zhang and Jie Zhang (2005) while analysing the effect of life expectancy on fertility, saving, schooling and economic growth, have observed that life expectancy has a significant positive effect on the saving rate, secondary school enrolment and growth but a significant negative on fertility. For Casper Worm Hansen and Lars Lønstrup (2013), countries with higher levels of infectious-disease

mortality prior to the medical breakthrough experienced higher growth rates in life expectancy and population size, and lower growth rates in per capita GDP in the time after the medical breakthroughs in the 20th Century. As we can see from those previous research the effect of life expectancy is not the same everywhere and may be positive negative or insignificant. However, knowing that Benin is an African country, and that Africa has been hit by different diseases and epidemics, we expect that an increase in life expectancy may have a positive or possibly, a negative effect on the GDP growth of Benin.

1.4 External Debt

Gross external debt, at any given time, is the outstanding amount of those actual current, and not contingent, liabilities that require payment(s) of interest and/or principal by the debtor at some point(s) in the future and that are owed to non-residents by residents of an economy (The World bank,2017). The indicator of external debt used in this study is the external debt stock is the External debt stocks, total (US Department of Defence, current US\$). Total external debt is debt owed to non-residents repayable in currency, goods, or services. Total external debt is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. Data are in current U.S. dollars (World Bank, International Debt Statistics). In general countries may acquire a debt in order to finance some project that they expect, will generate profit or wealth. In this regard we might expect external debt to have a positive effect on the growth of a country. However, a very high rate of external debts may lead to the incapacity of repayment and may slow down the economic growth. Thus, If the external debt is not too high or too low, it may not have a significant effect on economic growth of the country. This might be also analysed on the point of view that the resource obtained from those debts might be misallocated or misused by the issuers. Various researches have been done on the relationship between debt and economic growth. Benedict Clements, Rina Bhattacharya, and Toan Quoc Nguyen (2003) in a study of the relationship between external debt, public investment, and growth in low-income countries, found that a substantial reduction in the stock of external debt for highly indebted poor countries would directly increase per capita income growth by about one percentage point per annum and that Reductions in external debt service could also provide an indirect boost to growth through their effects on public investment. In addition, Dereje Abera Ejigayehu (2013), in a work on the impact of external debt on economic growth, has empirically investigated on selected (Eight) heavily indebted poor African countries; and found that the impact of external debt on economic growth is statistically significant in terms of debt crowding out effect over the selected eight countries in particular and over all the heavily indebted poor African countries in general in a restricted sense. Moreover, Faraji Kasidi and A. Makame Said (2013), in a study

investigating the impact of external debt on economic growth of Tanzania for the period of 1990-2010 found that there is a significant impact of the external debt and debt service on GDP growth and that the total external debt stock has a positive effect of about 0.36939 and debt service payment has a negative effect of about 28.517. However, Utomi Ohunma Winifred (2014) while studying the impact of external debt on economic growth in Nigeria for the period 1980-2012, has observed an insignificant long run relationship and a bi-directional relationship between external debt and economic growth in Nigeria. We can understand from those previous analyses done that the effect of debt on the economic growth is different from one country to another and that debt might have a negative crowding out effect, positive effect or an insignificant long run relationship and a bi-directional relationship with economic growth. Its effect depends on the way how countries have invested the funds acquired into the different economic activities. Corruption leads to the waste or dissipation of those funds.

1.5 Net official development assistance

Net official development assistance is disbursement flows (net of repayment of principal) that meet the Development Assistance Committee (DAC) definition of Official Development Assistance (ODA) and are made to countries and territories on the Development Assistance Committee list of aid recipients. Net official aid refers to aid flows (net of repayments) from official donors to countries and territories in part II of the DAC list of recipients: more advanced countries of Central and Eastern Europe, the countries of the former Soviet Union, and certain advanced developing countries and territories. Official aid is provided under terms and conditions similar to those for ODA. Part II of the DAC List was abolished in 2005. The collection of data on official aid and other resource flows to Part II countries ended with 2004 data. Data are in current U.S. dollars (World bank, 2017).

In Africa aids may not be efficient in rising the growth of African countries due to the inefficient use of those funds; and that some of those countries may have become dependent on aids. According to Ravinder Rena (2013), in today's developing countries especially in Africa most of the rulers and the ruled alike see development as the result only of foreign aid and donor hand-outs, rather than people's own efforts; Which leads to the inability of the continent to provide its people with adequate resources, to have even the basic capabilities to feed its population and prepare suitable ground for development and the need for foreign aid in these countries seems indisputable. Being dependent on aid make the countries not willing to invest on new activities that could generate incomes, while waiting for aids to be received. Aid may be considered as good if they are provided directly to those who need it the most and used efficiently. Foreign aid can only be valuable, if the recipient country benefits from it in the reduction and elimination of poverty, inequality and unemployment through promotion of work-culture and should not be considered as a principal factor for development; rather it should only be regarded as

a necessary compliment to the domestic efforts nurtured by culture of self-reliance and hard work, because aid cannot be depended upon indefinitely (Ravinder Rena, 2013).

On our opinion, foreign aids may have a negative impact on African countries economic growth because it can create dependency and lack of motivation to invest in lucrative activities; and a positive effect in countries that use it efficiently. Maurice W. Phiri (2017) in a study investigating the impact of aid on the economic growth of 12 least developed countries in Sub-Saharan Africa over a period of 20 years, took a fixed effects instrumental variable approach and the results implied that aid has a statistically insignificant negative impact on economic growth. He therefore concluded that aid is ineffective in promoting growth, which for him may perhaps be due to misallocation of aid or inefficient use. Willing to determine the impact of official development assistance on economic growth in Kenya, Veledinah M. Joseph (2013) found that While ODA seems to contribute to economic growth in the short run even though its effect is not statistically significant. He also found that a statistically significant negative effect in the short run of private external resource flows and trade openness was established. On the other hand, for Akpan H. Ekpo and Udoma J. Afangideh (2012), in a work related to the relation between official development assistance and economic performance in Nigeria from 1970-2010; found a positive but insignificant relationship between ODA and economic development in Nigeria. In addition, for Alice Sindzingre (2010) it is impossible to define whether development aid has a positive or negative effect on growth in developing countries because this depends on many other factors which cannot be excluded from the observation; and every country has different characteristics influencing the impact of aid which do not permit to make broad generalizations. From our understanding of those previous observations, we expect that aid may have a negative or positive effect on the economic growth of Benin.

1.6 Total natural resources rents

Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. The estimates of natural resources rents are calculated as the difference between the price of a commodity and the average cost of producing it. This is done by estimating the world price of units of specific commodities and subtracting estimates of average unit costs of extraction or harvesting costs (including a normal return on capital). These unit rents are then multiplied by the physical quantities countries extract or harvest to determine the rents for each commodity as a share of gross domestic product (GDP). (World Bank, 2011).

Natural resources which may be use as inputs, a raw material that contribute to the production of certain output should be determined to have a positive effect on the economic growth of any country when it is well exploited and well distributed in production and export. Thorvaldur Gylfason and Gylfi Zoega

(2001) after using empirical evidence from 85 countries from 1965 to 1998, suggested that abundant natural capital may on average crowd out physical capital thereby inhibiting economic growth. Their results also suggest that abundant natural resources may hurt saving and investment indirectly by slowing down the development of the financial system. However, for them, high growth rates in a handful of formerly resource-dependent economies seem to indicate that economic and structural reforms can overcome any adverse effect of natural resources on economic growth. Jean-Philippe C. Stijns (2001) observed that the data available on fuel and minerals reserves at the time when the analysis was done, showed that natural resource abundance has not been a significant structural determinant of economic growth between 1970 and 1989. In addition, Christa N. Brunnschweiler (2008) found a positive direct empirical relationship between natural resource abundance and economic growth; and no evidence of negative indirect effects of natural resources through the institutional channel. From those previous observations we understand and expect that natural resources may crowd out physical capital, positively affect, or be insignificant in affecting the GDP growth of a country

1.7 Unemployment

For the regression analysis, I will work with data on Unemployment, total (% of total labor force) (modelled ILO estimate) (SL.UEM.TOTL. ZS) from 1991 to 2001 from the World Bank data. The standard definition of unemployed persons is those individuals without work, seeking work in a recent past period, and currently available for work, including people who have lost their jobs or who have voluntarily left work. Persons who did not look for work but have an arrangement for a future job are also counted as unemployed. Some unemployment is unavoidable. At any time, some workers are temporarily unemployed between jobs as employers look for the right workers and workers search for better jobs. It is the labour force or the economically active portion of the population that serves as the base for this indicator, not the total population. The series is part of the ILO estimates and is harmonized to ensure comparability across countries and over time by accounting for differences in data source, scope of coverage, methodology, and other country-specific factors. The estimates are based mainly on nationally representative labor force surveys, with other sources (population censuses and nationally reported estimates) used only when no survey data are available. (International Labour Organization, 2017).

Benin is one of the poorest countries in Africa and with a densely populated. It is also relatively democratic and relatively politically stable. The informal economy covers approximately 94% of the working population and contributes to around 35% of the Gross Domestic Product (GDP). The Government is generally respecting the worker rights, but the rights to strike have been fragmented and collective bargaining has been kept at a standstill on several occasions. Benin has seven trade union

federation centres, which have formalized cooperation to undertake joint activities and making joint demands for decent work. Some conflicts are rising among centers and accusing of collaborating with rival political groups. It has affected the dialogue between trade unions. The trade union movement is fast expanding in Benin (Benin – Labour Market Profile 2014, p1, pp1)

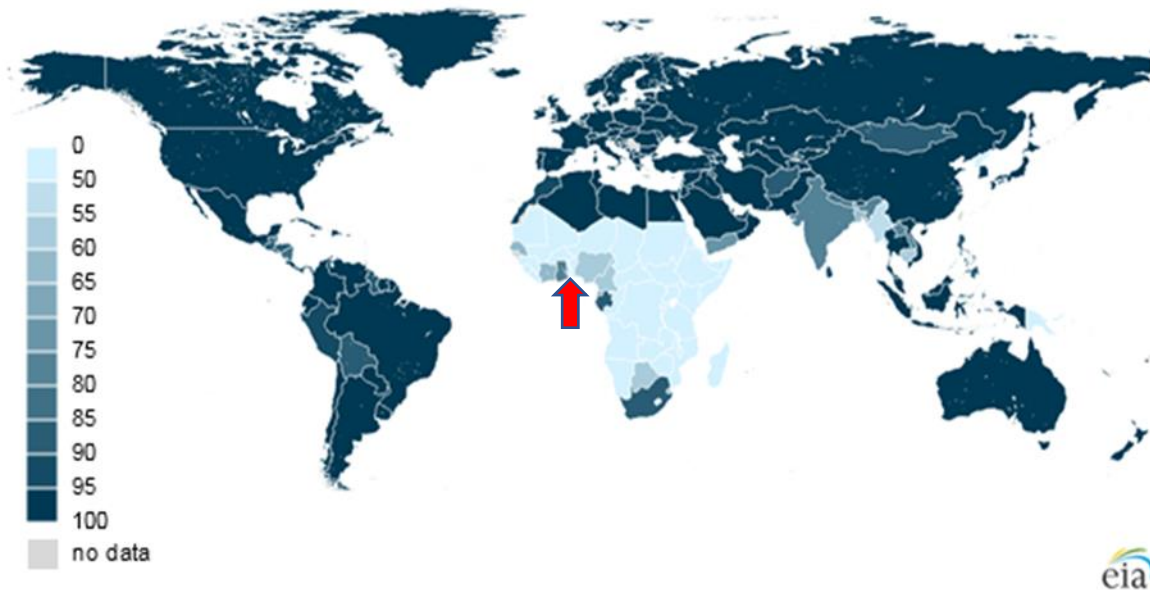
In a study of the relationship between unemployment and Economic Growth in Nigeria in the 21st, Olawunmi Omitogun and Adedayo Emmanuel Longe (2017), have observed that the impact of unemployment varies over time as effort towards eradicating it are been made by the government in the country. However, for Teboho Jeremiah Mosikari (2013) there is no causality found between unemployment rate and GDP growth. According to Katarzyna Nagel (2015) empirical research reveal both the evolution of the relevant views and the lack of consistency between the concepts explaining the relationship between economic growth and unemployment in different regions of the world and in different groups of countries. Thus, relationship between unemployment and economic growth for most researchers is perceived as being unclear. We can understand from most of the previous observation on economic growth and unemployment, that the effect of unemployment on economic growth is difficult to analyse and to observe, and that the effect varies from one country to another depending on the reform put in place to eradicate it.

1.8 Access to electricity

Access to electricity is the percentage of population with access to electricity. Electrification data are collected from industry, national surveys and international sources (World Bank 2017). Benin suffers from a great dependence on electricity, which it exports mostly from Ghana and Nigeria. The electricity shedding in Benin have a negative impact on the industrial development of the country and may adversely affect all the economic sectors of the country. which can discourage foreign investors and slows down the economic evolution of the country. The country solely depends on imports to satisfy its petroleum product demand, while 85% of its electricity consumption is answered by imports from Ghana, Cote d'Ivoire and Nigeria. Households account for 48% of the country's total electricity consumption followed by the institutional sector and the industrial sector, which account for 32% and 24% respectively. Although in the five past years the final total energy consumption has perceptibly increased, the structure of final energy consumption has not changed. In 2010 the national electrification rate was at 27% with 4% in rural areas and about 54% in urban areas (Benin Energy Situation, Energypedia)

World Share of population with access to electricity, by country (2014)

Share of population with access to electricity, by country (2014)



Source: U.S. Energy Information Administration 2017

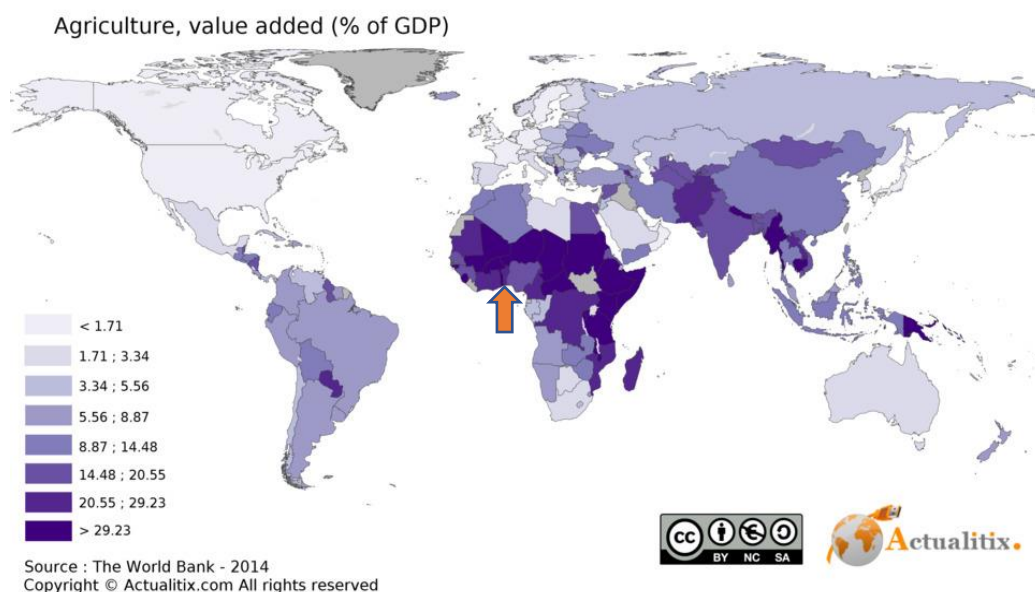
From the map above, we can observe that Benin is among the countries that have the least access to electricity (0-50) in 2014, which is unfavorable for the growth of the country. Thus, it is important to analyse the effect of the access to electricity on the economic growth of Benin to determine how far better off the country would have been if it was to produce its own electricity rather than to export it. In a study of the effect of Energy use and Economic Growth in Africa, Mohamed El Hedi Aroui, Adel Ben Youssef, Hatem M'Henni and Christophe Rault (2014), have used a bootstrap panel analysis of causality between energy use and economic growth for a sample of sixteen African countries over the period 1988-2010 and their results showed that growth and energy use are strongly linked in Africa. However, for them, African countries are heterogeneous and there is no “one way” recommendation about energy-growth relationship that may work for all countries in Africa. The paper also shows that four different situations are found: Growth significantly affects energy; Energy use positively causes GDP growth; Energy use negatively causes GDP growth and; Bidirectional causality between energy use and GDP. As it was observed that energy and growth are strongly linked in African countries, we expect that access to electricity has a positive effect on the economic growth of Benin.

1.9 Agriculture

Agriculture corresponds to International Standard Industrial Classification (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, In (ISIC), revision 3. Note: For VAB (National Bank of Ukraine) countries, gross value added at factor cost is used as the denominator. (World bank, 2017) Agriculture is a very important sector for African countries and mainly for Benin, which is an agricultural country. About 55% of the economically active population was engaged in the agricultural sector in 2000, which accounted for 38% of GDP that year. Small, independent farmers produce 90% of agricultural output, but only about 17% of the total area is cultivated, much of it in the form of collective farms since 1975. The agricultural sector is plagued by a lack of infrastructure, poor utilization of rural credit, and inefficient and insufficient use of fertilizer, insecticides, and seeds. Smuggling of crops for export or the domestic black-market results in understating of crop figures. An estimated 20% of output is informally traded with Nigeria (Nation encyclopaedia, Benin – Agriculture). We can observe from the map below that in Even though Benin suffers from the lack of agricultural infrastructure, poor utilization of rural credit, and inefficient and insufficient use of fertilizer, insecticides and seeds; in 2014 it has a relatively high level of agriculture value added as a percentage of GDP compared to the rest of the world.

World agriculture value added (% of GDP)



Source: World Bank 2014

A good agricultural production and a good export volume of those agricultural products should have a positive effect on the economic development of most developing countries. However, even though most of the African country like Benin are mostly dependent on agriculture, they still have not reach good and high enough level of production and volume of export of the agricultural output to strongly affect their economic growth. Agriculture should have a positive effect on the economic growth of any country if it is well developed and used efficiently for the country needs. However, the effect of agriculture on

the growth may vary from one country to another. Evert J. Los and Cornelis Gardebroek (2015), after working using a panel time series approach for post-WW II Africa; the estimation results imply that the agricultural sector performs different roles in different stages of economic development. They observed that in low income countries, increasing the level of food production plays a pivotal role in generating further economic development, whereas in the more developed upper middle-income countries the outflow of labor to other economic sectors is crucial for understanding economic growth. In addition, they mentioned that, the statement that argument that reallocation of labor from agriculture towards other economic sectors is among the main drivers of economic growth for developing countries, is only found to be valid under specific circumstances and that the panel causality results show the existence of a bidirectional causal relation between agricultural and economic development. Muhammd Abrar ul haq (2015) in study investigating the relationship between agricultural export and economic growth in Pakistan observed that agricultural exports have a negative relationship with economic growth of Pakistan while non-agricultural exports have positive relation with economic growth and on the basis of the result; and they suggested that Pakistan have to do structural changes in agricultural exports by converting its agricultural exports into value added products. Dalila Cervantes-Godoy and Joe Dewbre (2010), while investigating the economic importance of agriculture for poverty reduction, looked for shared characteristics of twenty-five developing countries posting extraordinary success in reducing extreme poverty over the past twenty to twenty-five years; and found that while economic growth generally was an important contributor to poverty reduction, the sector mix of growth mattered substantially, with growth in agricultural incomes being especially important.

Knowing that, it was previously observed by Evert J. Los and Cornelis Gardebroek (2015) that there is a bidirectional causal relation between agricultural and economic development and that growth in agricultural incomes has been important in reducing poverty, we can come to a conclusion that if Benin was to focus more on developing its Agricultural sector by investing into agricultural infrastructure, fertilizer, insecticides, seeds; and on profitable and efficient volume of export of agricultural products, it would impact highly and positively its economic growth. However actually from our data, we do not expect agriculture to have a significant effect on the economic growth of Benin. It may have a positive but may be insignificant effect on the GDP per capita growth of the country due to poor management of the agricultural sector.

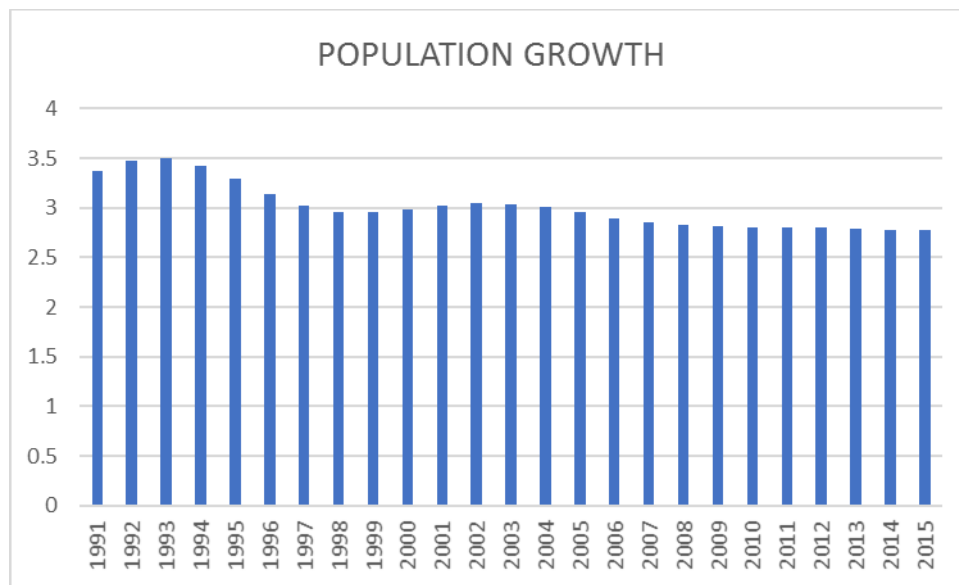
1.10 Population growth

Annual population growth rate for year t is the exponential rate of growth of midyear population from year $t-1$ to t , expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship (World Population Prospects: The 2017 Revision). For San Fox and Tim Dyson (2015), the general view of economists was that high birth

rates and rapid population growth in poor countries would divert scarce capital away from savings and investment, thereby placing a drag on economic development. They hypothesized that larger families have fewer aggregate resources and fewer resources per child. Larger families therefore spread their resources more thinly to support more children. This leaves less for saving and investing in growth-enhancing activities. It also reduces spending on enhancing the economic potential of each child. According to them, given that there is a fixed quantity of land, a growth population will eventually reduce the amount of resources that each individual can consume, ultimately resulting in disease, starvation, and war; and a high birth rates and rapid population growth in poor countries would divert scarce capital away from savings and investment, thereby placing a drag on economic development. Brandon Lozeau (2007) in a research base on determining the effects of population growth on economic performances in china, observed that even though India and China have almost similarly sized populations, it is the technological progress of the Chinese that has allowed them to better sustain the population growth of the last few decades and increase their per capita income and that without this important technological progress a rise in the standard of living becomes very difficult and sustaining high population growth becomes more challenging. Based on a study of population and economic growth in developing countries Minh Quang Dao (2012) has observed the effect of population growth on per capita GDP growth is linear and everywhere negative and that it is stronger when interaction terms are included in the statistical model. Which made him suggest that governments in developing countries can influence population growth in order to stimulate growth as it is the case in China that provides a clear example by suddenly introducing a collection of highly coercive methods to reduce the total fertility rate from about 5.8 to 2.2 births per woman between 1970 and 1980 (Minh Quang Dao 2012). Such a policy, if introduced in African countries, may be found to have a positive effect on the growth by firstly affecting the way how family invest into the number child they have, secondly leaving the population with the possibility to invest their savings into productive activities, thirdly increasing the quality of child care by parent knowing that they will focus on giving a better education and living standard to the few children they could have.

Apart from increasing the total number of people who must be supported on a limited resource base, high fertility has a strong distorting effect on population age structure. High-fertility populations are dominated by large numbers of dependent children, leaving few resources to boost current consumption or to save and invest for the future. Even resources for the children themselves—for child health and education—are swamped by the numbers (National Transfer Account Bulletin, 2013, p1, pp4)

Population growth in Benin from 1991 to 2015



Source: world bank data base

The graph above shows that the population growth rate was quite high in Benin around the year 1992 to 1994 and started to decrease in 1994 to and was relatively constant from 2008 till 2015. Benin may thus not be considered as being the type of country with a fast-increasing population growth rate for the period of our choice for the chosen period. However, looking at this graph does not tell us whether population growth affect positively or negatively; is significant or insignificant to the economic growth of Benin for the period 1991-2015, which is why a regression analysis is needed to discover the relation between Unemployment the other variables and Benin GDP per capita growth. Population growth may affect country positively or negatively depends on the characteristic of the country. Also depending on whether a country is over populated or under populated.

2.Data and Method

Economic growth theories and models shows the different ways in which the present economic activity can have an influence on future economic developments and can also identify sources that may lead to continued economic growth of a country. We aim is to identify some of the sources that have contributed to the economic growth of the Republic of Benin throughout the year 1991 to 2015 to be able to determine factors that may lead to a continuous growth of the country and economic sector that need to be better developed to favor a better growth. The economic growth theories have changed over time depending on the period and on the dynamics of economy, and the improvements in mathematical and statistical tools have had a significant impact in formulating a model and interpreting it. We have been able collect data from 1991 to 2015 for all the chosen variables from the world bank data. The variables

we will use in our study as well as their descriptions, units and the predicted signs, are listed in the table below.

Variables, description, unit of variables and predicted signs

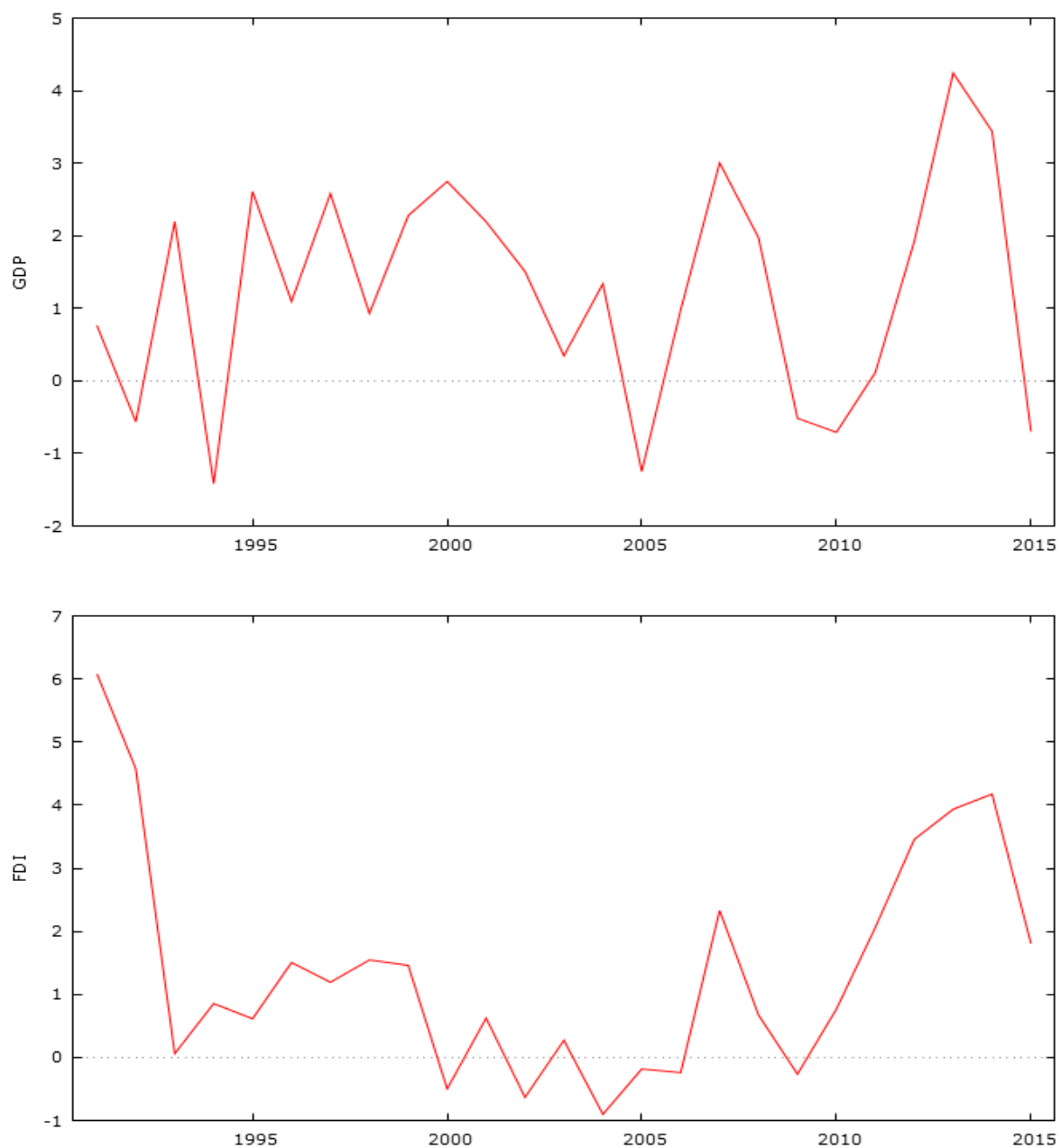
Variables	Description	Unit	Predicted sign
GDP	GDP per capita growth	(annual %)	Dependent variable
FDI	Foreign direct investment, net inflows	(% of GDP)	+ or -
EXPORT	Exports of goods and services	(% of GDP)	+
LIFE	Life expectancy at birth, total	(years)	+ or -
DEBT	External debt stocks, total	(DOD, current US\$)	+ or -
AID	Net official development assistance and official aid received	(current US\$)	+ or -
RESOURCES	Total natural resources rents	(% of GDP)	+ or -
UNEMPLOYMENT	Unemployment, (modelled ILO estimate)	(% of total labor force)	-
ELECTRICITY	Access to electricity	(% of population)	+
AGRICULTURE	Agriculture, value added	(% of GDP)	+
POPULATION	Population growth	(annual %)	+ or -

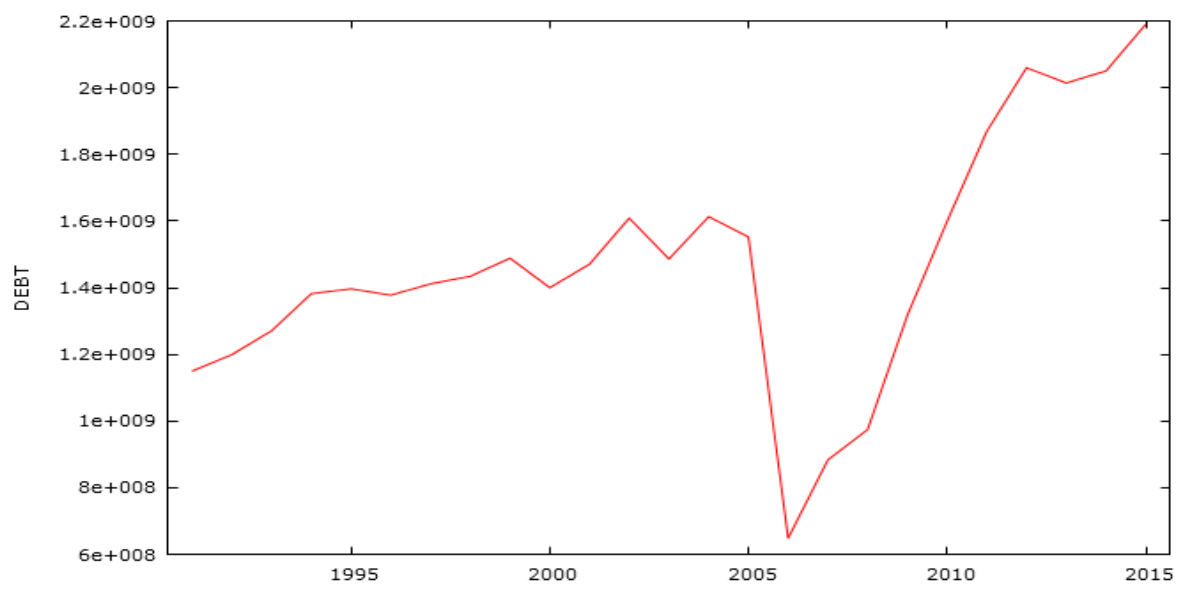
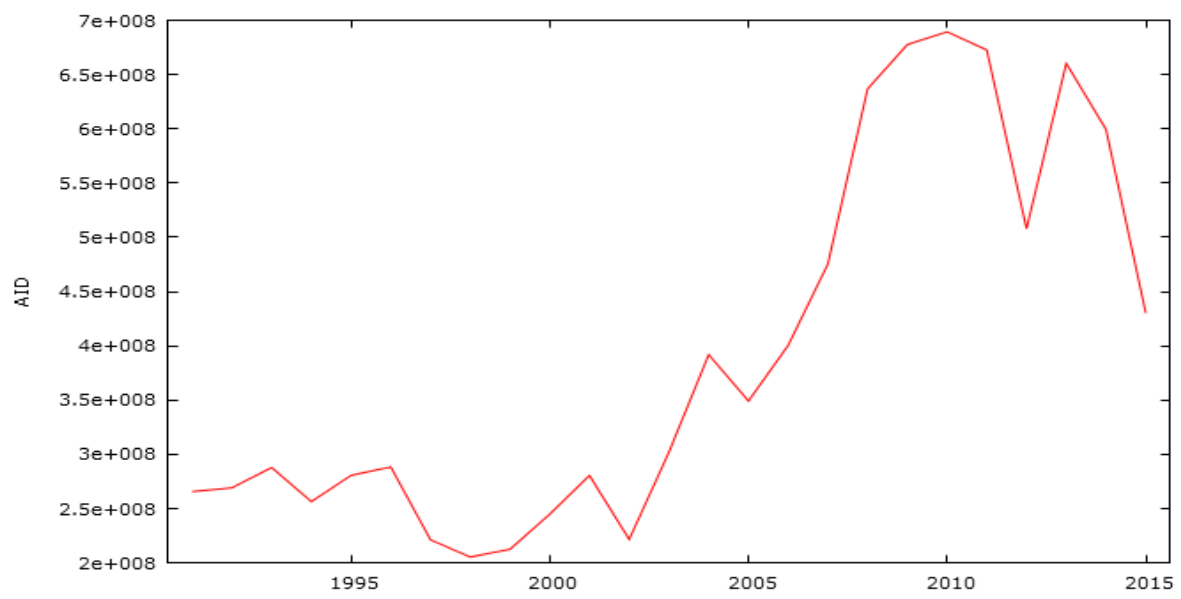
Real GDP per capita is a measurement of the total economic output of a country divided by the number of people and adjusted for inflation. It's used to compare the standard of living between countries and over time (Kimberly Amadeo, 2018). In our analysis we have chosen to use the GDP growth per capita because economic growth per capita looks at the average increase in real GDP per person in a country. Thus, it is important to take population into account because it gives a better indication of how the average person is affected by economic growth (Tejvan Pettinger, 2017). The GDP per capita growth is the annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP per capita is gross domestic product divided by midyear population. 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

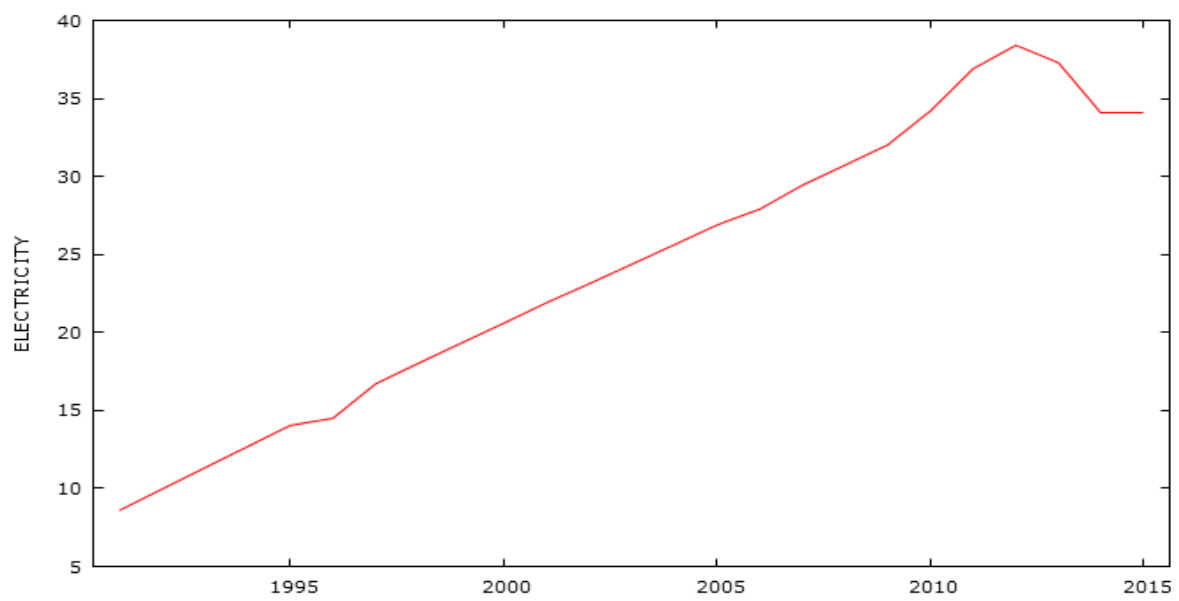
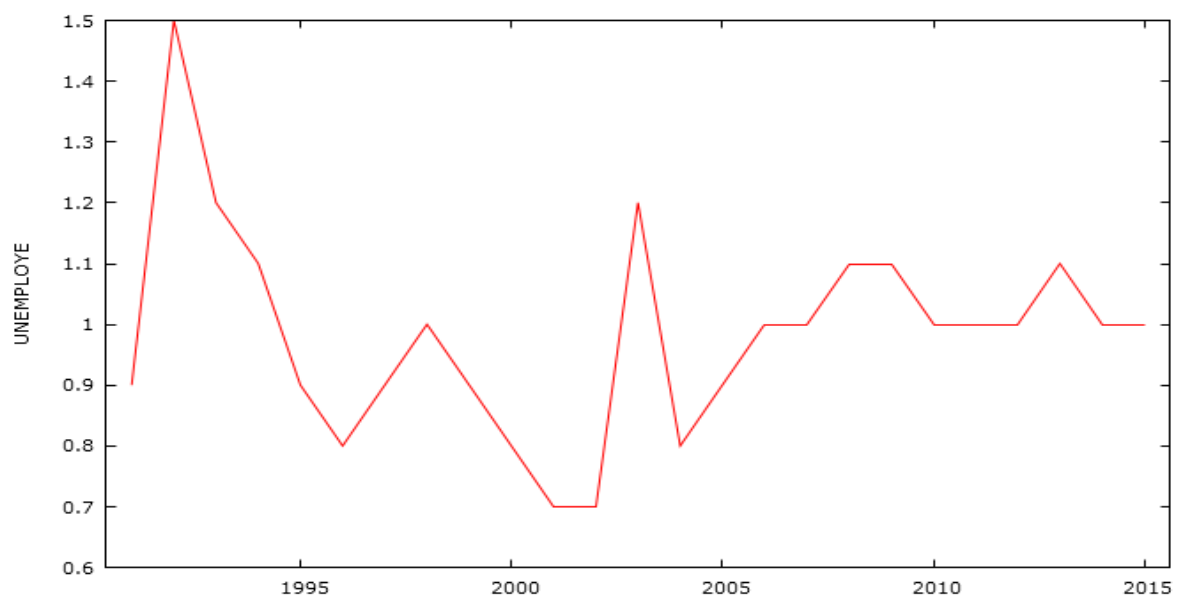
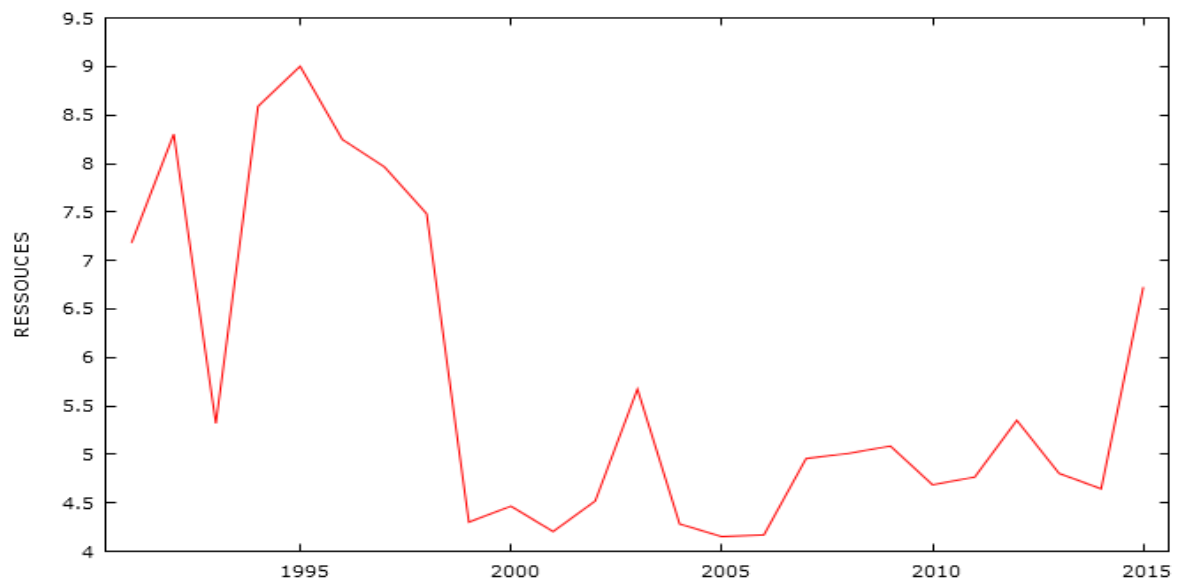
degradation of natural resources. The independent variables in this study were found in the world bank list of data and were previously define. Our work will consist of multiple ordinary least scare regressions run into Gretl (World Bank national accounts data, and OECD National Accounts data files)

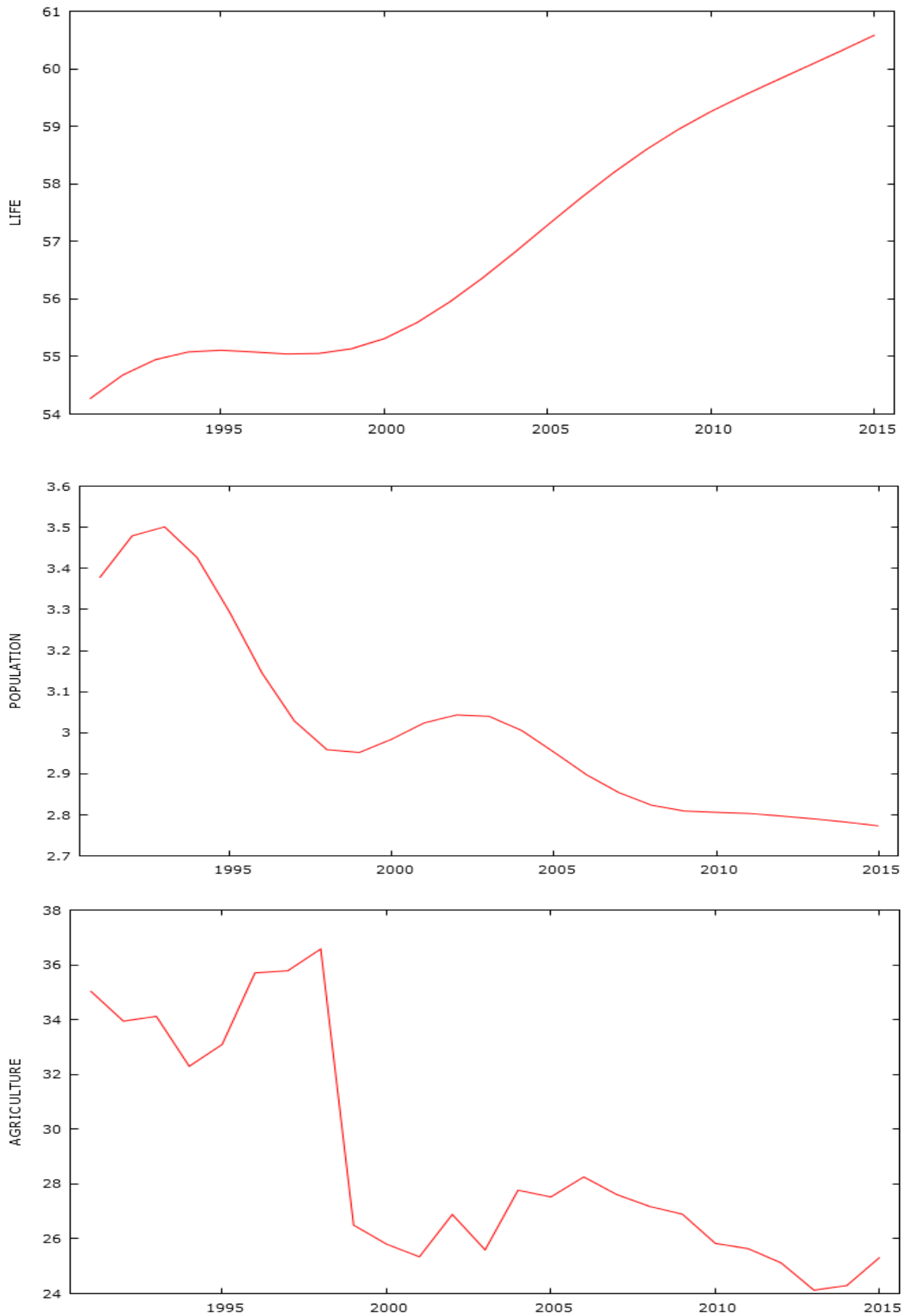
2.1 Time series

If both our dependent variable and our independent variables, both exhibit a monotonous trend, we will find a relationship even though they have nothing in common. The time series of all of our variables are represented as follow:







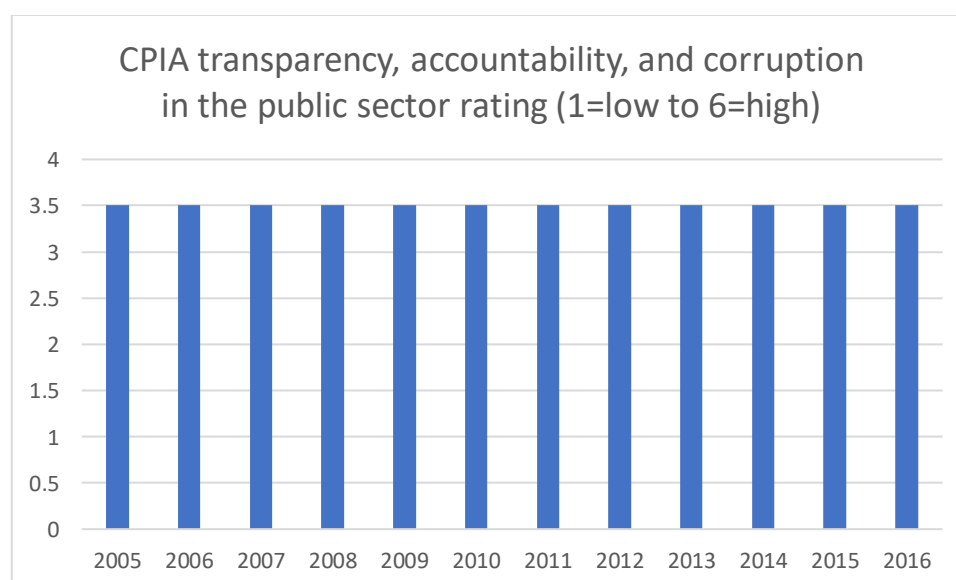


Having a look at all these time series, we can see that all of them shows different time trends; some of them exhibit an increasing and others a decreasing time trend. Which means that our variables behave

differently over time; And that while some variables are increasing over time like GDP, Export, FDI, Life Debt, Aid, and electricity; the others like Natural resources, Agriculture, Unemployment and Population are decreasing over time.

Moreover, we were only able to find the data from 1991 to 2015 for all our variables simultaneously, which was a limitation to our analysis. This result may have been different if we could have found the data for a longer period. But some data were missing from the world bank data file. We also tried to find data for corruption, which did not seem to be a reliable variable to analysis in relation to economic growth rate of Benin, because corruption was quite high and constant throughout the years 2006 to 2016. Data available on corruption from the world bank data, was only present from the year 2006 to 2016. The graph below shows us that Country Policy and Institutional Assessment (CPIA) transparency, accountability, and corruption in the public-sector rating (1=low to 6=high) was constant and high at 3.5 from 2006 to 2016. This value of export is defined as Transparency, accountability, and corruption in the public sector assess the extent to which the executive can be held accountable for its use of funds and for the results of its actions by the electorate and by the legislature and judiciary, and the extent to which public employees within the executive are required to account for administrative decisions, use of resources, and results obtained. (World Bank Group, CPIA database, 2017). This constant values of export at 3.5 and the insufficient data on corruption did not allow us to include corruption in our analyses.

CPIA transparency, accountability, and corruption in the public-sector rating (1=low to 6 = high)



Source: World Bank data

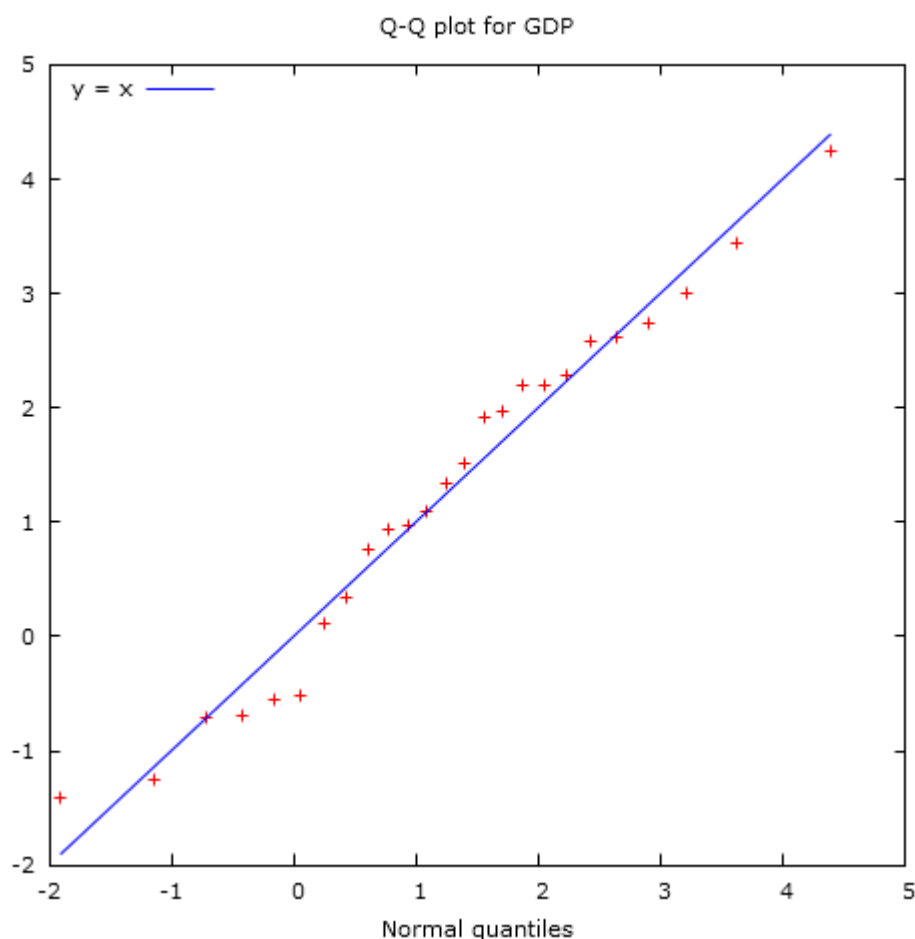
2.2 The Statistical Models

Assuming that, we have chosen to analyse how our independent variable FDI, EXPORT, LIFE, DEBT, AID, RESOURCES, UNEMPLOYMENT, ELECTRICITY, AGRICULTURE and POPULATION factors affect per capita GDP growth in Benin, we can work with the following statistical model:

$$\text{GDP/capita} = \beta_0 + \beta_1 \text{FDI}_t + \beta_2 \text{EXPORT}_t + \beta_3 \text{LIFE}_t + \beta_4 \text{DEBT}_t + \beta_5 \text{AID}_t + \beta_6 \text{RESOURCES}_t + \beta_7 \text{UNEMPLOYMENT}_t + \beta_8 \text{ELECTRICITY}_t + \beta_9 \text{AGRICULTURE}_t + \beta_{10} \text{POPULATION}_t + u_t.$$

2.2.1 Statistical distribution

To see the whole picture and to understand whether the GDP per capita is normally distributed. This Q-Q plot shows us that the GDP is not normally distributed because we can see that there are some points which are not close to the line.



2.2.2 Summary statistics

The summary statistics of all the variable is presented in the Gretl output below. We could observe from statistical summary that Agriculture has the highest mean. And, we also observed

that Electricity has the highest standard deviation, which indicate a higher spread of the data for electricity from its mean. Most of our variables had different measures, which is the reason why some of the values in the table are quite high, and others values very low. GDP, FDI, Population, Unemployment, Electricity, Agriculture, Resources and Export are expressed in percentage; life expectancy expressed in year; Debt and AID, expressed in current US\$. This is included in the Figure 1 from the appendix.

SUMMARY STATISTICS, USING THE OBSERVATIONS 1991 – 2015

Variable	Mean	Median	S.D.	Min	Max
GDP	1.24	1.34	1.53	-1.42	4.24
FDI	1.41	0.854	1.81	-0.900	6.08
EXPORT	23.5	22.9	3.71	18.5	32.1
LIFE	57.0	56.4	2.11	54.3	60.6
DEBT	1.4700000000	1.4300000000	3.6800000000	6.4800000000	2.1900000000
	00	00	00	00	00
AID	3.9000000000	3.0200000000	1.7100000000	2.0500000000	6.8900000000
		0	0	0	0
RESSOURCES	5.76	5.01	1.62	4.15	9.00
UNEMPLOE	0.984	1.00	0.172	0.700	1.50
ELECTRICI TY	24.1	24.4	9.27	8.60	38.4
AGRICULT RE	28.9	27.2	4.18	24.1	36.6
POPULATIO N	3.01	2.96	0.231	2.77	3.50

2.2.3 Multicollinearity test

First, we have tested for multicollinearity to verify if the independent variables are not correlated with each other. We observed the following result after the correlation test.

Correlation coefficients, using the observations 1991 - 2015					
5% critical value (two-tailed) = 0.3961 for n = 25					
FDI	EXPORT	LIFE	DEBT	AID	
1.0000	0.4426	0.1308	0.2175	0.1493	FDI
	1.0000	0.1765	0.4425	0.0822	EXPORT
		1.0000	0.4958	0.8793	LIFE
			1.0000	0.2724	DEBT
				1.0000	AID
RESSOURCES	UNEMPLOYE	ELECTRICITY	AGRICULTURE	POPULATION	
0.2981	0.3348	-0.0183	0.1339	0.0918	FDI
0.5105	0.1314	0.0160	0.1886	-0.0295	EXPORT
-0.4689	0.1236	0.9521	-0.7272	-0.8044	LIFE
-0.0982	-0.1263	0.4801	-0.4349	-0.3731	DEBT
-0.4188	0.2328	0.8256	-0.5816	-0.6557	AID
1.0000	0.2565	-0.6158	0.7768	0.5961	RESSOURCES
	1.0000	-0.0303	0.1274	0.2416	UNEMPLOYE
		1.0000	-0.8172	-0.9065	ELECTRICITY
			1.0000	0.7168	AGRICULTURE
				1.0000	POPULATION

Figure 2

From the first regression, it can be observed that the coefficients are correlated with each other and that they may not produce significant variables for the explanatory variables. There is clearly the presence of multicollinearity between the independent variables.

VIF of All Variables Used in The Model (see Figure 7)

Variables	VIF
FDI	2.081
EXPORT	3.235
LIFE	245.190
DEBT	3.263
AID	10.719
RESSOURCES	4.650
UNEMPLOYE	1.883
ELECTRICITY	64.218
AGRICULTURE	8.789
POPULATION	37.336

One more way of measuring multicollinearity is with VIF, which stands for the Variable Inflation Factor. VIF measures how much the variance of an estimated regression coefficient increases if the predictors are correlated. If there are no factors that are correlated, then the VIF will have a value of 1. If the VIF number is a little greater than 1, then it is moderately correlated, however, if the number is between 5-10 is when there should be a need for concern.

Minimum possible value = 1.0 and when Values > 10.0 indicate a collinearity problem, which is the case here. One way to solve this problem is to include a linear (trend) term if the residuals show a consistent increasing or decreasing pattern. Which means that all our variables need to be detrended.

2.2.4 Model 1

After adding the time variable into our model in order to detrend all the variables; we have run an ordinary least squares regression of the GDP per capita growth on the dependent variables FDI, Export, Life, Debt, Aid, Resources, Unemployment, Electricity, Agriculture and Population. The new model is therefore:

$GDP/capita = \beta_0 + \beta_1 FDI_t + \beta_2 EXPORT_t + \beta_3 LIFE_t + \beta_4 DEBT_t + \beta_5 AID_t + \beta_6 RESOURCES_t + \beta_7 UNEMPLOYMENT_t + \beta_8 ELECTRICITY_t + \beta_9 AGRICULTURE_t + \beta_{10} POPULATION_t + u_t$. We obtained the following Gretl output.

Model 1: OLS, using observations 1991-2015 (T = 25)

DEPENDENT VARIABLE: GDP

Figure 3

HAC STANDARD ERRORS, BANDWIDTH 2 (BARTLETT KERNEL)					
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	117.823	43.3410	2.719	0.0176	**
FDI	0.376166	0.124213	3.028	0.0097	***
EXPORT	0.427092	0.0731566	5.838	<0.0001	***
LIFE	-2.90867	1.02251	-2.845	0.0138	**
DEBT	-2.45024e-09	7.19530e-010	-3.405	0.0047	***
AID	2.64007e-09	2.79254e-09	0.9454	0.3617	
RESSOURCES	-0.635304	0.314910	-2.017	0.0648	*
UNEMPLOYE	-2.33320	0.890754	-2.619	0.0212	**
ELECTRICITY	0.301094	0.129524	2.325	0.0369	**
AGRICULTURE	0.108307	0.139997	0.7736	0.4530	
POPULATION	9.29104	3.25315	2.856	0.0135	**
Time	0.672993	0.354287	1.900	0.0799	*
Mean dependent var	1.244480	S.D. dependent var		1.534162	
Sum squared resid	24.76766	S.E. of regression		1.380292	
R-squared	0.561538	Adjusted R-squared		0.190533	
F(11, 13)	22.56101	P-value(F)		1.13e-06	
Log-likelihood	-35.35675	Akaike criterion		94.71350	
Schwarz criterion	109.3400	Hannan-Quinn		98.77027	
Rho	-0.446339	Durbin-Watson		2.888818	

R-squared provides an estimate of the strength of the relationship between our model and the response variable. Here, the Adjusted R-square is 0.19 . After observing this result, we have decided to test whether there is the presence of heteroskedasticity in the model. We obtained the following result.

BREUSCH-PAGAN TEST FOR HETEROSKEDASTICITY

Figure4

OLS, USING OBSERVATIONS 1991-2015 (T = 25)

DEPENDENT VARIABLE: SCALED UHAT^2

	COEFFICIENT	STD. ERROR	T-RATIO	P-VALUE	

CONST	-99.9561	75.5840	-1.322	0.2088	
FDI	-0.568181	0.195639	-2.904	0.0123	**
EXPORT	0.319751	0.118912	2.689	0.0186	**
LIFE	1.73016	1.82209	0.9495	0.3597	
DEBT	-3.96355E-010	1.20201E-09	-0.3297	0.7468	
AID	-1.99395E-09	4.70341E-09	-0.4239	0.6785	
RESSOURCES	0.0935576	0.325395	0.2875	0.7782	
UNEMPLOYE	-1.05918	1.95021	-0.5431	0.5962	
ELECTRICITY	0.404999	0.211776	1.912	0.0781	*
AGRICULTURE	-0.206929	0.173981	-1.189	0.2556	
POPULATION	2.34757	6.48972	0.3617	0.7234	
TIME	-1.02693	0.672944	-1.526	0.1510	
EXPLAINED SUM OF SQUARES = 39.731					
TEST STATISTIC: LM = 19.865475,					
WITH P-VALUE = P(CHI-SQUARE(11) > 19.865475) = 0.047220					

The above result shows us a P-value = 0.472 < 0.05. we reject H_0 at 5% significance level. This indicate that there is the presence of heteroskedasticity in the model. After observing for heteroskedasticity we found necessary to correct heteroskedasticity.

2.2.5 Model 2: model 1 with Heteroskedasticity corrected

When willing to correct for heteroskedasticity, we run the heteroskedasticity corrected regression on the initial model including all our independent variables, using the following model $GDP_t/capita = \beta_0 + \beta_1 FDI_t + \beta_2 EXPORT_t + \beta_3 LIFE_t + \beta_4 DEBT_t + \beta_5 AID_t + \beta_6 RESOURCES_t + \beta_7 UNEMPLOYMENT_t + \beta_8 ELECTRICITY_t + \beta_9 AGRICULTURE_t + \beta_{10} POPULATION_t + ut$. This helps us to correct for heteroskedasticity. The Gretl output obtained shows the following result:

Figure5**MODEL 2: HETEROSKEDASTICITY-CORRECTED, USING OBSERVATIONS 1991-2015 (T = 25)****DEPENDENT VARIABLE: GDP**

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	114.239	45.4594	2.513	0.0259	**
FDI	0.362216	0.125701	2.882	0.0129	**
EXPORT	0.388693	0.0613545	6.335	<0.0001	***
LIFE	-2.69745	0.937113	-2.878	0.0129	**
DEBT	-2.52344e-09	6.01062e-010	-4.198	0.0010	***
AID	2.88035e-09	2.01819e-09	1.427	0.1771	
RESSOURCES	-0.429801	0.238023	-1.806	0.0942	*
UNEMPLOYE	-2.44352	1.06264	-2.299	0.0387	**
ELECTRICITY	0.277068	0.103302	2.682	0.0188	**
AGRICULTURE	0.0188960	0.150264	0.1258	0.9019	
POPULATION	7.78815	1.98395	3.926	0.0017	***
Time	0.598323	0.359538	1.664	0.1200	

STATISTICS BASED ON THE WEIGHTED DATA:

Sum squared resid	18.75117	S.E. of regression	1.200999
R-squared	0.952365	Adjusted R-squared	0.912058
F(11, 13)	23.62803	P-value(F)	8.60e-07
Log-likelihood	-31.87822	Akaike criterion	87.75643
Schwarz criterion	102.3829	Hannan-Quinn	91.81320
Rho	-0.426152	Durbin-Watson	2.852282

STATISTICS BASED ON THE ORIGINAL DATA:

Mean dependent var	1.244480	S.D. dependent var	1.534162
Sum squared resid	25.89613	S.E. of regression	1.411386

We can see here after correcting for heteroskedasticity (by going to other linear models + Heteroskedasticity corrected) in Gretl, that Aid and Agriculture are insignificant, when looking at the p-values using the significant level of 5%. while all the other variables are significant in affecting the GDP per capita. However, when we remove Agriculture and aid from the model, we observe that all the other eight variables are significant in affecting the GDP per capita growth. Which is shown in the Gretl output in the figure 6 in the Appendix.

Here only eight independent variables significantly affect the GDP growth per capita. Looking at this Gretl output showing the regression of GDP on the dependent variables FDI, EXPORT,

LIFE, DEDT, RESSOURCES, UNEMPLOYMENT, ELECTRICITY, AGRICULTURE and POPULATION, we can see that, One percent increase in Foreign direct investment, net inflows (% of GDP) increases the GDP growth per capita by 0.36%. One percent increase in EXPORT Exports of goods and services (% of GDP) increases the GDP per capita increases the GDP growth per capita by 0.39%. A One-year increase in Life expectancy at birth, total (years) decreases GDP growth per capita by 2.69%. An increase in the External debt stocks, total (DOD, current US\$) by one-dollar US, decreases the GDP growth per capita by 2.52%. One percent increase in Total natural resources rents (% of GDP) decreases the GDP growth per capita by 0.43%. One percent increase in Unemployment, total (modelled ILO estimate) (% of total labor force) decreases GDP pe capita growth by 2.44%. A one percent increase in Access to electricity (% of population) increases the GDP per Capita Growth by 0.28%. And finally, one percent increase in the Population growth (annual %) increases GD per capita by 7.79%. Agriculture and Aid were found to be insignificant in affecting the GDP growth per capita.

3.Implication and Discussion.

In this paper, the aim was to understand more about the way how different factors affect the GDP growth per capita of a Benin, known as being a developing country. Several researches were done in the past, which gave us an intuition about what we could expect to observe in our model. Robert Barro (1996) found that the growth rate of real per capita GDP was associated with longer life expectancy as well as with higher levels of investment. For Parash Upreti (2015) high volume of exports, plentiful natural resources, longer life expectancy, and higher investment rates have positive impacts on the growth of per capita gross domestic product in developing countries. Six causes of economic growth were identified: Natural Resources, Physical Capital or Infrastructure, Population or Labor, Human Capital, Technology and law (Prateek Agarwal ,2017). For others, FDI can have some positive impact on the development process in developing countries because it presents an opportunity for these countries to finance their economic growth, particularly if FDI were to generate some foreign exchange on the side. A developing country may also access the technological and managerial assets of foreign investors through FDI, the diffusion of which can have a substantial impact on productivity growth. (Hooshang Amirahmadi, Weiping Wu, 1994). The other Authors mentioned in this paper, made some researches on the way how every single of our independent variables affect the GDP the economic growth. Those previous researches helped us to predict that FDI, Life Expectancy, Debt, Aid, Natural Resources and Population growth

could have positive or negative effects; Export, Agriculture and Access to Electricity could have positive effects; And Unemployment could have a negative effect on the economic growth of Benin. However, we found that. FDI, Export, electricity and population growth affect positively and significantly the GDP Growth per capita. And that, Life expectancy, Natural Resources, Debt and Unemployment affect negatively and significantly the GDP per capita growth of Benin. But, Agriculture and Aid are observed to be insignificant in affecting the GDP growth per capita of Benin. This may be due to the fact that most of or variable were correlated with each other, or due to the lack of sufficiently large data. In contrary to what Parash Upreti (2015) found about Natural resource, and Life expectancy in the case of developing countries, Natural resource and Life expectancy are not favourable to the economic growth of Benin. However foreign direct investment, and export have a positive impact on the economic growth of Benin. Which goes along with the finding of Barro(1996) about economic growth being associated with the level of investment. But compared to his observation on life expectancy, Benin economic growth is not positively associated with longer life expectancy. The idea of Prateek Agarwal that Population or labor capita been a cause of economy growth was found true for Benin. However Natural resources negatively affect the growth of the country. As Florin Teodor Boldeanu and Liliana Constantinescu (2015) mentioned, Economic growth measured by GDP means the increase of the growth rate of GDP, but what determines the increase of each component is very different; and There are also differences between economic and non-economic determinants. “Proximate” or economic determinants refers to factors like capital accumulation, technological progress, labour and “ultimate” or non-economic sources refers to factors like government efficiency, institutions, political and administrative systems, cultural and social factors, geography and demography. There might thus be other elements or determinants that influence our chosen independent variable or even the GDP growth per capita making them behave the way they do.

Conclusion

Benin is one of the developing countries of West Africa which still have some difficulties in developing its economy. Knowing that it has always been between the countries with the lowest GDP per Capita, we have found it important and necessary to analyse the growth of the GDP per capita in Benin and the factors influencing it during the last decades. Yearly data spreading from 1991 to 2015 was extracted from The World Bank data. Even though data for other variables were missing or did not cover the entire period the we worked on, like corruption, we were able to work with what was available and useful for this study. Many researches have been done on factors that affect the economic growth in general and the economic growth of different location in particular. Some of those previous works were mentioned in this paper in order to understand the way how the economic growth was observed to be affected in the past, and to be able to state Hypothesis about how it could be affected in the case of the Republic of Benin. Multiple ordinary least squares regressions were run using the data collected from the world bank data and imported into Gretl. The results were interpreted according to some of our knowledge acquired on introductory econometrics. We found that the economic growth is positively influenced by FDI, Export, electricity and population growth; and negatively influenced by Life expectancy, Natural Resources, Debt and Unemployment. However, we did not find any evidence that Agriculture and Aid affect economic growth. This study suggests that, the government of Benin should focus more on activities that attract foreign direct investment; should continue to promote and boost Export of good and services; should make an important and necessary effort to invest into production of electricity in order to become independent on other country like Nigeria; And to motivate a reasonable growth of the population which constitute the labor force.

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[http://databank.worldbank.org/data/Views/Metadata/MetadataWidget.aspx?Name=Agriculture,%20value%20added%20\(%%20of%20GDP\)&Code=NV.AGR.TOTL.ZS&Type=S&ReqType=Metadata&ddlSelectedValue=AFG&ReportID=63112&ReportType=Table](http://databank.worldbank.org/data/Views/Metadata/MetadataWidget.aspx?Name=Agriculture,%20value%20added%20(%%20of%20GDP)&Code=NV.AGR.TOTL.ZS&Type=S&ReqType=Metadata&ddlSelectedValue=AFG&ReportID=63112&ReportType=Table)

- World Bank. Metadata. Population growth (annual %) (SP.POP.GROW)

<http://databank.worldbank.org/data/Views/Metadata/MetadataWidget.aspx?Name=Population%20gro>

[wth%20\(annual%20% \)&Code=SP.POP.GROW&Type=S&ReqType=Metadata&ddlSelectedValue=AGO&ReportID=49436&ReportType=Table](#)

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5. Appendix

Year	GDP	FDI	EXPORT	LIFE	DEBT	AID	RESSOURCES	UNEMPLOYE	ELECTRICITY	AGRICULTURE	POPULATION
1991	0.764700702	6.080271075	21.00248606	54.26785366	1149708000	265660000	7.181380921	0.899999976	8.595435143	35.0437735	3.3771591
1992	-0.562599754	4.575651876	23.23914805	54.67817073	1198998000	269040000	8.301253853	1.5	9.962705612	33.94190414	3.479002651
1993	2.195190168	0.061716924	22.46438304	54.94580488	1270599000	287760000	5.318729694	1.200000048	11.32727051	34.1194608	3.500773846
1994	-1.415683604	0.85407956	28.32701862	55.0797561	1382105000	256380000	8.588490587	1.100000024	12.6864233	32.29399457	3.426061164
1995	2.609371547	0.614368303	27.3689425	55.11012195	1396512000	280560000	9.001388011	0.899999976	14.03745937	33.09015959	3.293613638
1996	1.094014901	1.504261846	26.49881155	55.08012195	1377637000	288290000	8.246718247	0.800000012	14.5	35.70530039	3.145323911
1997	2.580644359	1.190992206	27.17613459	55.04558537	1411354000	221150000	7.962858864	0.899999976	16.70435524	35.78193016	3.028375321
1998	0.93026303	1.545858391	27.09293955	55.05470732	1433928000	205230000	7.480920252	1	18.01480484	36.57664979	2.958613225
1999	2.277471448	1.45975477	23.68818308	55.13558537	1488491000	212440000	4.302064364	0.899999976	19.3074131	26.49962035	2.95175447
2000	2.747800216	-0.496774564	21.14038924	55.3107561	1399689000	244770000	4.466274991	0.800000012	20.58498192	25.80426476	2.983994776
2001	2.19312213	0.624013838	20.34916272	55.58917073	1470317000	280420000	4.205235762	0.699999988	21.9	25.3414264	3.023780214
2002	1.508016469	-0.631986845	20.18788163	55.94865854	1608561000	221540000	4.520265779	0.699999988	23.11058426	26.8860438	3.043082958
2003	0.346990897	0.271786054	18.98405146	56.36209756	1485973000	301990000	5.674131343	1.200000048	24.36641884	25.5945024	3.039674832
2004	1.337853336	-0.900192566	18.8185548	56.81492683	1612808000	391790000	4.282284895	0.800000012	25.62280655	27.77229815	3.005342106
2005	-1.247442478	-0.182887348	18.93203883	57.28560976	1551744000	349080000	4.15270439	0.899999976	26.8836441	27.52527473	2.952383516
2006	0.97833194	-0.240209747	18.52802261	57.74912195	648365000	400310000	4.170646691	1	27.9	28.25733916	2.897532753
2007	3.004341023	2.328591486	22.58650821	58.18897561	883286000	475290000	4.957317121	1	29.43333054	27.61541214	2.854074076
2008	1.973127354	0.67317874	22.85463824	58.59070732	974330000	636720000	5.010157283	1.100000024	30.72432709	27.18074342	2.823521711
2009	-0.515263247	-0.263935312	20.37180711	58.94680488	1317169000	677560000	5.086227216	1.100000024	32.02407455	26.89697092	2.809336884
2010	-0.70882861	0.766902232	23.78772956	59.25926829	1599164000	689270000	4.687139241	1	34.2	25.83182491	2.806108844
2011	0.1163546	2.061551522	21.38207854	59.53660976	1868559000	672610000	4.765977662	1	36.9	25.63837234	2.803422015
2012	1.919316666	3.453698611	24.59335432	59.79785366	2059616000	507880000	5.351275385	1	38.4	25.12041998	2.797040405
2013	4.24347992	3.934158153	28.15332243	60.0565122	2013609000	660200000	4.805235742	1.100000024	37.27555466	24.12492192	2.790253243
2014	3.439136515	4.174097283	32.07625794	60.31812195	2049873000	599320000	4.644890263	1	34.1	24.2925863	2.782287129
2015	-0.697706831	1.80487912	28.221547	60.58468293	2189758000	430140000	6.726689202	1	34.1	25.32139578	2.772977926

Figure 1

Summary Statistics, using the observations 1991 – 2015					
	Mean	Median	S.D.	Min	Max
GDP	1.24	1.34	1.53	-1.42	4.24
FDI	1.41	0.854	1.81	-0.900	6.08
EXPORT	23.5	22.9	3.71	18.5	32.1
LIFE	57.0	56.4	2.11	54.3	60.6
DEBT	1.47e+00	1.43e+00	3.68e+00	6.48e+00	2.19e+00
	9	9	8	8	9
AID	3.93e+00	3.02e+00	1.71e+00	2.05e+00	6.89e+00
	8	8	8	8	8
RESSOURCES	5.76	5.01	1.62	4.15	9.00
UNEMPLOYE	0.984	1.00	0.172	0.700	1.50
ELECTRICIT	24.1	24.4	9.27	8.60	38.4
Y					
AGRICULTU	28.9	27.2	4.18	24.1	36.6
RE					
POPULATION	3.01	2.96	0.231	2.77	3.50

Figure 2

Correlation coefficients, using the observations 1991 - 2015

5% critical value (two-tailed) = 0.3961 for n = 25

FDI	EXPORT	LIFE	DEBT	AID	
1.0000	0.4426	0.1308	0.2175	0.1493	FDI
	1.0000	0.1765	0.4425	0.0822	EXPORT
		1.0000	0.4958	0.8793	LIFE
			1.0000	0.2724	DEBT
				1.0000	AID
RESSOUCES	UNEMPLOYE	ELECTRICITY	AGRICULTURE	POPULATION	
0.2981	0.3348	-0.0183	0.1339	0.0918	FDI
0.5105	0.1314	0.0160	0.1886	-0.0295	EXPORT
-0.4689	0.1236	0.9521	-0.7272	-0.8044	LIFE
-0.0982	-0.1263	0.4801	-0.4349	-0.3731	DEBT
-0.4188	0.2328	0.8256	-0.5816	-0.6557	AID
1.0000	0.2565	-0.6158	0.7768	0.5961	RESSOUCES
	1.0000	-0.0303	0.1274	0.2416	UNEMPLOYE
		1.0000	-0.8172	-0.9065	ELECTRICITY
			1.0000	0.7168	AGRICULTURE

Figure 3

Model 1: OLS, using observations 1991-2015 (T = 25)

Dependent variable: GDP

HAC standard errors, bandwidth 2 (Bartlett kernel)

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	117.823	43.3410	2.719	0.0176	**
FDI	0.376166	0.124213	3.028	0.0097	***
EXPORT	0.427092	0.0731566	5.838	<0.0001	***
LIFE	-2.90867	1.02251	-2.845	0.0138	**
DEBT	-2.45024e-09	7.19530e-010	-3.405	0.0047	***
AID	2.64007e-09	2.79254e-09	0.9454	0.3617	
RESSOURCES	-0.635304	0.314910	-2.017	0.0648	*
UNEMPLOYE	-2.33320	0.890754	-2.619	0.0212	**
ELECTRICITY	0.301094	0.129524	2.325	0.0369	**
AGRICULTURE	0.108307	0.139997	0.7736	0.4530	
POPULATION	9.29104	3.25315	2.856	0.0135	**
Time	0.672993	0.354287	1.900	0.0799	*
Mean dependent var	1.244480	S.D. dependent var	1.534162		
Sum squared resid	24.76766	S.E. of regression	1.380292		
R-squared	0.561538	Adjusted R-squared	0.190533		
F(11, 13)	22.56101	P-value(F)	1.13e-06		
Log-likelihood	-35.35675	Akaike criterion	94.71350		
Schwarz criterion	109.3400	Hannan-Quinn	98.77027		
	-0.446339	Durbin-Watson	2.888818		
Rho					

Figure 4

Breusch-Pagan test for heteroskedasticity
OLS, using observations 1991-2015 (T = 25)
Dependent variable: scaled uhat^2

	coefficient	std. error	t-ratio	p-value	
const	-99.9561	75.5840	-1.322	0.2088	
FDI	-0.568181	0.195639	-2.904	0.0123	**
EXPORT	0.319751	0.118912	2.689	0.0186	**
LIFE	1.73016	1.82209	0.9495	0.3597	
DEBT	-3.96355e-010	1.20201e-09	-0.3297	0.7468	
AID	-1.99395e-09	4.70341e-09	-0.4239	0.6785	
RESSOURCES	0.0935576	0.325395	0.2875	0.7782	
UNEMPLOYE	-1.05918	1.95021	-0.5431	0.5962	
ELECTRICITY	0.404999	0.211776	1.912	0.0781	*
AGRICULTURE	-0.206929	0.173981	-1.189	0.2556	
POPULATION	2.34757	6.48972	0.3617	0.7234	
time	-1.02693	0.672944	-1.526	0.1510	

Explained sum of squares = 39.731

Test statistic: LM = 19.865475,
with p-value = $P(\text{Chi-square}(11) > 19.865475) = 0.047220$

Figure 5

Model 2 : Heteroskedasticity-corrected, using observations 1991-2015 (T = 25)

Dependent variable: GDP

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	114.239	45.4594	2.513	0.0259	**
FDI	0.362216	0.125701	2.882	0.0129	**
EXPORT	0.388693	0.0613545	6.335	<0.0001	***
LIFE	-2.69745	0.937113	-2.878	0.0129	**
DEBT	-2.52344e-09	6.01062e-010	-4.198	0.0010	***
AID	2.88035e-09	2.01819e-09	1.427	0.1771	
RESSOURCES	-0.429801	0.238023	-1.806	0.0942	*
UNEMPLOYE	-2.44352	1.06264	-2.299	0.0387	**
ELECTRICITY	0.277068	0.103302	2.682	0.0188	**
AGRICULTURE	0.0188960	0.150264	0.1258	0.9019	
POPULATION	7.78815	1.98395	3.926	0.0017	***
Time	0.598323	0.359538	1.664	0.1200	

Statistics based on the weighted data:

Sum squared resid	18.75117	S.E. of regression	1.200999
R-squared	0.952365	Adjusted R-squared	0.912058
F(11, 13)	23.62803	P-value(F)	8.60e-07
Log-likelihood	-31.87822	Akaike criterion	87.75643
Schwarz criterion	102.3829	Hannan-Quinn	91.81320
Rho	-0.426152	Durbin-Watson	2.852282

Statistics based on the original data:

Mean dependent var	1.244480	S.D. dependent var	1.534162
Sum squared resid	25.89613	S.E. of regression	1.411386

Figure 6

Model 3: Heteroskedasticity-corrected, using observations 1991-2015 (T = 25)

Dependent variable: GDP

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	71.5367	23.9693	2.985	0.0093	***
FDI	0.313645	0.0850797	3.686	0.0022	***
EXPORT	0.419784	0.0329249	12.75	<0.0001	***
LIFE	-1.75324	0.477253	-3.674	0.0023	***
DEBT	-2.52861e-09	5.03010e-010	-5.027	0.0002	***
RESSOURCES	-0.526696	0.123777	-4.255	0.0007	***
UNEMPLOYE	-2.27341	0.764532	-2.974	0.0095	***
ELECTRICITY	0.364951	0.0536154	6.807	<0.0001	***
POPULATION	5.63340	2.62577	2.145	0.0487	**
time	0.194430	0.161780	1.202	0.2481	

Statistics based on the weighted data:

Sum squared resid	19.55417	S.E. of regression	1.141758
R-squared	0.983941	Adjusted R-squared	0.974306
F(9, 15)	102.1200	P-value(F)	8.12e-12
Log-likelihood	-32.40237	Akaike criterion	84.80474
Schwarz criterion	96.99350	Hannan-Quinn	88.18539
rho	-0.407879	Durbin-Watson	2.815726

Statistics based on the original data:

Mean dependent var	1.244480	S.D. dependent var	1.534162
Sum squared resid	26.15602	S.E. of regression	1.320505

Figure 7

Variance Inflation Factors

Minimum possible value = 1.0

Values > 10.0 may indicate a collinearity problem

FDI	2.081
EXPORT	3.235
LIFE	245.190
DEBT	3.263
AID	10.719
RESSOURCES	4.650
UNEMPLOYE	1.883
ELECTRICITY	64.218
AGRICULTURE	8.789
POPULATION	37.336
time	408.495

$VIF(j) = 1/(1 - R(j)^2)$, where $R(j)$ is the multiple correlation coefficient between variable j and the other independent variables

Belsley-Kuh-Welsch collinearity diagnostics:

--- variance proportions ---									
lambda	cond	const	FDI	EXPORT	LIFE	DEBT	AID	RESSOURCES	
UNEMPLOYE	ELECTRIC~	AGRICULT~	POPULATI~	time					
10.981	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
0.000	0.000	0.000	0.000	0.000					
0.643	4.132	0.000	0.017	0.000	0.000	0.000	0.000	0.000	
0.000	0.000	0.000	0.000	0.000					
0.292	6.132	0.000	0.054	0.000	0.000	0.000	0.001	0.000	
0.000	0.000	0.000	0.000	0.000					
0.053	14.372	0.000	0.000	0.002	0.000	0.027	0.027	0.000	
0.009	0.000	0.000	0.000	0.000					
0.014	27.825	0.000	0.106	0.002	0.000	0.028	0.007	0.023	
0.096	0.002	0.001	0.000	0.000					
0.007	38.413	0.000	0.065	0.048	0.000	0.068	0.001	0.044	
0.093	0.002	0.002	0.000	0.001					
0.005	48.111	0.000	0.017	0.025	0.000	0.081	0.209	0.008	
0.469	0.000	0.001	0.000	0.003					
0.003	60.960	0.000	0.123	0.157	0.000	0.019	0.233	0.089	
0.024	0.023	0.002	0.000	0.003					
0.001	122.276	0.000	0.000	0.063	0.000	0.056	0.006	0.009	
0.065	0.215	0.030	0.014	0.048					
0.000	253.714	0.000	0.000	0.295	0.000	0.452	0.005	0.667	
0.228	0.319	0.878	0.007	0.082					
0.000	430.464	0.014	0.000	0.347	0.003	0.050	0.180	0.059	
0.002	0.391	0.038	0.329	0.001					
0.000	3655.779	0.986	0.618	0.060	0.997	0.220	0.332	0.102	
0.014	0.047	0.048	0.649	0.863					

lambda = eigenvalues of $X'X$, largest to smallest

cond = condition index

note: variance proportions columns sum to 1.0

Figure 8

Model : OLS, using observations 1991-2015 (T = 25)

Dependent variable: GDP

HAC standard errors, bandwidth 2 (Bartlett kernel)

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	40.0371	19.2375	2.081	0.0550	*
EXPORT	0.438376	0.120104	3.650	0.0024	***
LIFE	-1.01210	0.487913	-2.074	0.0557	*
DEBT	-1.63980e-09	9.52833e-010	-1.721	0.1058	
AID	3.45352e-010	3.30648e-09	0.1044	0.9182	
RESSOUCES	-0.698112	0.239556	-2.914	0.0107	**
UNEMPLOYE	-1.59426	1.03401	-1.542	0.1439	
ELECTRICITY	0.257625	0.172951	1.490	0.1571	
AGRICULTURE	0.0100538	0.105260	0.09551	0.9252	
POPULATION	3.30002	3.34065	0.9878	0.3389	
Mean dependent var	1.244480	S.D. dependent var	1.534162		
Sum squared resid	30.09567	S.E. of regression	1.416467		
R-squared	0.467217	Adjusted R-squared	0.147547		
F(9, 15)	23.10056	P-value(F)	3.20e-07		
Log-likelihood	-37.79228	Akaike criterion	95.58456		
Schwarz criterion	107.7733	Hannan-Quinn	98.96520		
Rho	-0.150463	Durbin-Watson	2.266677		

