MENDEL UNIVERSITY IN BRNO

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Analysis of selected demographic and economic indicators of the ECOWAS countries

DIPLOMA THESIS

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In Brno, December 22, 2016

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Stanislava Morávková

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Abstract

The topic the thesis *Analysis of selected demographic and economic indicators of the ECOWAS countries* is analysis of the selected economic and demographic indicators in the countries of Economic Community of West African States over the period 2010 - 2014. The main aim is to find relationship between economic growth and demography. Thesis is divided into two parts. The theoretical part provides the overview of the region, description of demography, economic growth and their mutual relationship as well as description of the used methods. The analytical part is focused on the construction of the composite indicators and the canonical correlation analysis.

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Abstrakt

Témou diplomovej práce *Analýza vybraných demografických a ekonomických ukazovateľov krajín ECOWAS* je analýza vybraných ekonomických a demografických indikátorov v krajinách Hospodárskeho spoločenstva západoafrických štátov v rokoch 2010 - 2014. Hlavným cieľom je nájdenie vzťahu medzi ekonomický rastom a demografiou. Práca je rozdelená do dvoch častí. Teoretická časť poskytuje prehľad regiónu, opisuje demografiu, ekonomický rast a ich vzájomný vzťah a taktiež opisuje použité metódy. Analytická časť je venovaná konštrukcii kompozitného indikátoru a kanonickej korelačnej analýze.

Keywords

ECOWAS, demography, economic growth, canonical correlation analysis, composite indicator

Kľúčové slová

ECOWAS, demografia, ekonomický rast, kanonická korelačná analýza, kompozitný indikátor

Content

Introduction

Context and motivation

Africa in general – ECOWAS included, is known as an overpopulated continent with very high population growth. Indeed, the number of inhabitants is increasing each year. Population growth is often seen as negative. Although, it is wrong to generalize, because population growth is not just negative or positive. And this statement also applies to African continent. While in one country or region, it does not impact economy, in another one it can. Since the new millennium, ECOWAS also experiences boom of economic growth as well and it was the fastest growing region of Africa in the period 2013 – 2014.

In spite of the fact that there are many studies examining relationship between economic growth and demography, it is not possible to offer general universal answer whether there is or there is not relationship between economic growth and population. None of these studies focus on the Africa since new millennium and more importantly none of these studies are focused on ECOWAS region, which is characterized as a problematic region facing as many problems as possibilities. The region faces problem in terms of civil wars, coup d'etats, poverty and many others, but on the other hand, it consists one of the largest oil and gas producers in Africa, major agricultural producers of cocoa or groundnuts and it has a huge amount of mineral wealth.

My main motivation for writing the thesis *Analysis of selected demographic and economic indicators of the ECOWAS countries* is to find out, if there is relationship between economic growth and demography. This topic is interesting for me because while many people think that population growth is problem for economy, I think that with the lack of studies focused on this topic in the countries of the Economic Community of West African states, we do not really know if this relationship exists.

Aim and hypotheses

Objectives of the thesis are:

- analysis of the chosen demographic and economic indicators in the countries of the Economic Community of the West African States in the period 2010 - 2014
- construction of the composite indicator in order to examine the relationship between economic growth and demography
- examination of the short-run relationship between economic growth and demography using canonical correlation analysis

Two hypotheses were formulated:

1. There is a cross-sectional relationship between economic growth and demography.
2. There is a short-run relationship between economic growth and demography.

Thesis structure

The thesis is divided into theoretical and analytical part. Theoretical part is based on the literature review and it is focused on the presentation of the region, description of demography, economic growth and its mutual relationship and description of the methods, which were used in the thesis. The first part of the analytical part analyzes demographic and economic situation of the ECOWAS countries. The second part of the analytical part examines relationship between economic growth and demography. The final part of this thesis consists of discussion focused on the comparison of the analysis´ results with the results of the papers that studied relationship between demography and economic growth in the past.

Notes

1. Term economic growth used in the literature review is in most cases measured using GDP growth.
2. Economic growth in the analytical part is understood as a set of selected variables representing economic growth.

THEORETICAL PART

1 Economic Community of West African States

Economic Community of West African States, called ECOWAS is regional organization located in West Africa. The area of West Africa includes 18 states and most of these countries are identified as least developed countries. ECOWAS was founded in 1975 and it associates 15 countries (see Picture 1) – Benin, Burkina Faso, Cabo Verde, Cote d´Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. Out of all current member countries, two countries - Guinea and Niger have suspended membership rights. (Valuch, et al., 2011) The treaty of ECOWAS was revised in 1993 in order to speed up integration process and set up an economic and monetary union to increase economic integration and development in the region. (The World Bank Group, © 2013)

Picture 1: Countries of ECOWAS

Source: World Bank, 2013

Promotion of the economic cooperation in the West African region was the main objective for the creation of this community. Despite of the same socio-economic conditions in the countries of the Economic Community of West African States, it has different historic past – colonialism, language and administrative culture and during the 1980s various political crises forced the community to include the security agenda. (Bossuyt, 2016)

Demographic expansion is one of the many problems not only in the West Africa, but across whole Africa as well. It supports vulnerability in the humanitarian crisis and it has significant impact on the demands for resources – natural such as water, land, food or fuel and social such as health, education and security. (Humanitarian Futures Programme, 2009)

ECOWAS is well known as one of the least developed regions in the world. Underdevelopment of this region is caused by the rising corruption and political instability, which influence government revenue, production, savings, investments, growth and income distribution. (Nurudeen, et al., 2014) But since the beginning of the new millennium, economies of these countries have been growing at a quite fast pace. This economic growth was influenced by internal factors such as better macroeconomic management, high domestic demand and a relatively more stable political environment and external factors such as an increase of foreign direct investment, stronger economic cooperation with emerging economies and higher Official Development Assistance. (United Nations, 2014) Another contribution to economic growth in the countries of ECOWAS is service sector, which is vital source of income and employment. The growth has been particularly strong in this region and out of these countries – Cabo Verde and The Gambia were the only countries dependent on the export of services. (United Nations, 2015) Despite the positive progress (not only in the economy) that has been made, this growth is not sustainable from many reasons.

Economic growth of ECOWAS countries depends on the natural resources, which are non-renewable – e.g. fossil fuels, metallic and non-metallic minerals. These resources are being depleted and using of these resources has negative impact for future growth. Another reason of unsustainable growth is deindustrialization, which is associated with the current pattern of growth. There was significant decline in the share of manufacturing in the gross domestic

product (GDP) – in Western Africa, share of manufacturing in GDP fell from 13% to 5% in the period less than 15 years. Rapid urban growth and growing population are also a problem for economic growth. On one hand, young and growing population provides opportunities connected with the labor supply with creative potential. On the other hand, it means that countries need to use labor-intensive strategies instead of jobless growth strategies and create more learning possibilities for young people. Furthermore, it is essential that countries go through productivity-enhancing structural change. Structural transformations that countries experienced up to now did not involve a shift from low-productivity to high-productivity sectors and therefore it did not fasten process of economic growth in the past. Among the other reasons belong for example per capita agricultural output and productivity in the countries. (United Nations, 2012)

Benin

Benin's economy monitors economic growth after recovering from the period 2009 – 2010, when the economic crisis and floods hit the country. Benin has strong agricultural potential, sea access and a small portion of raw materials – limestone, sand, granite and timber. (AfDB, OECD, UNDP, ECA, 2013) Recovery of the economic activity was influenced mainly by an increase in agricultural production, the increase in port traffic and measures for its modernization. (AfDB, OECD, UNDP, 2014) In 2011, its economy is characterized by a labor market dominated by the informal sector. This sector employs about 95% of the working population and it has an important role in income generation. (AfDB, OECD, UNDP, UNECA, 2011) In the last year – 2014, economic growth in Benin is mostly driven by agriculture and services sectors together with the construction industry. Agriculture and services count together for more than 85% of GDP. (AfDB, OECD, UNDP, 2015)

Burkina Faso

The primary sector is essential for the economy of Burkina Faso. It is driven by food crops, cash crops and livestock, which further influence secondary and tertiary sector. Gold production is the main pillar of secondary sector. (AfDB, OECD, UNDP, ECA, 2013) In the last years, economic growth was recorded in the country. Economy was negatively affected by the political crisis, low prices of gold and cotton and the Ebola epidemic, which were in

West Africa in 2014. Together with the changes in gold and cotton prices, Burkina Faso's economy is also vulnerable to price change in oil and unpredictable climate. (AfDB, OECD, UNDP, 2015) Due to the lower gold prices in 2013, decrease of economic growth was monitored. It was positive and dynamic growth, but it was lower than a year before. (AfDB, OECD, UNDP, 2014)

Cabo Verde

Economic growth in Cabo Verde recorded slight slowdown over recent years – in period 2011 – 2013. It was caused by the weak global and domestic economies - decline in remittances, FDI from Europe and ODA. In 2014, economic growth slowly increases. It is mostly led by the construction sector. Tourism and tourism-related foreign investment are also important part of the growth. (AfDB, OECD, UNDP, 2015) The service sector – tourism together with commerce, transportation and public services is the primary source of GDP in the county. (U.S. Department of State, 2014) Tourism is a main driver of economic growth in Cabo Verde. The country is vulnerable to external shocks, because its lack of non-renewable natural resources and poor conditions of agriculture. (AfDB, OECD, UNDP, ECA, 2013)

Cote d´Ivoire

Economic growth of Cote d´Ivoire has significantly weakened and disrupted in 2010. It was caused by the political crisis after the presidential election. (AfDB, OECD, UNDP, UNECA, 2011) After stagnation of economic growth in 2010 – 2011, economic growth recovered and continued in the next years. Recovery of the growth was result of increased peace efforts, public investment and the pick-up in final consumption. The country has a strong potential in agriculture, because it is the world's biggest producer of cocoa. (AfDB, OECD, UNDP, ECA, 2013) The growth was also driven by internal demand – private infrastructure investment and household consumption and external demand, which increased export of commodity because of higher world prices. The national development plan, which aimed to improve the business climate and quicken structural reform also contributed to the increase of economic growth. It resulted in the increase of attractiveness of the country for FDI.(AfDB, OECD, UNDP, 2015)

The Gambia

In 2010, the economy in The Gambia slowed down. The country monitored growth, but it was lower than previous years. It was caused mainly by the global negative impact on trade, tourism and remittances. (AfDB, OECD, UNDP, UNECA, 2011) In 2011, recovery of the growth did not occur. The most important sector in the economy is agricultural sector. The growth was affected by the global crisis and unfavorable weather that harmed crop production. (AfDB, OECD, UNDP, UNECA, 2012) In the next years, economic growth experienced moderate recovery thanks to the recovery of agriculture and tourism, which just started to bloom. The growth dropped again in no time - in 2014, and it was result of the effect of Ebola on tourism and poor rainy weather, which led to crop production decline. (AfDB, OECD, UNDP, 2015)

Ghana

In 2011, Ghana monitored robust increase in economic growth. It was result of the start-up of oil production at the end of the year 2010. Next year, it dropped significantly, but it was still high economic growth. It was mainly caused by the oil revenues, the service sector and export of cocoa and gold. (AfDB, OECD, UNDP, ECA, 2013) The last years, Ghana experienced decline in GDP growth. Ghana needed to face major challenges such as sharp depreciation of currency, deepening energy crisis, deterioration of the macroeconomic imbalance, rising inflation and interest rate. The main driver of the economy is service sector, which represent over 50% of the economy. It is followed by industry sector at 28,4% and agriculture with almost 19,9%. (AfDB, OECD, UNDP, 2015)

Guinea

Guinea experienced small economic growth until 2013 when the country monitored decrease. It was consequence of the political instability and problems with mining investment. (AfDB, OECD, UNDP, 2014) In 2014, decline in economic growth was even worse than a previous year. It was result of the Ebola epidemic, electricity shortages and delays in the implementing of structural reforms. (AfDB, OECD, UNDP, 2015) The largest reserve of bauxite in the world, together with large amount of iron ore, gold and diamonds is situated in Guinea. There is also the potential for development of other metals, oil and gas. In addition to mining

industry, the driver of the Guinea's economy is also agriculture. (AfDB, OECD, UNDP, UNECA, 2011)

Guinea-Bissau

Guinea-Bissau recorded drop in economic growth in 2012. It was caused due to decline in the production and world prices of cashew nuts, political instability and problems after *coup d'état*. The country lacks development of mineral and oil resources with the only exception of small gold mining operations. (AfDB, OECD, UNDP, ECA, 2013) Over the next years, economy of Guinea-Bissau picked up itself and economic growth was registered. Increase of the growth was result of political normalization, re-connection with technical and financial partners and cashew-nut export. Economy depends on the socio-political climate, the performance of the cashew-nut sector and the absence of the Ebola epidemic that is affecting neighboring countries. (AfDB, OECD, UNDP, 2015)

Liberia

Over the past few years, economic growth was monitored in Liberia. Post-war economic growth was sustained and stable. It was result of the increase of the iron ore exports, construction and services sector performance. Its performance is highly dependent to fluctuations in commodity prices, FDI and overseas development assistance. Iron ore and rubber are the key export of the economy. (AfDB, OECD, UNDP, ECA, 2013) Economic growth significantly slowed down in 2014. The same as Guinea, Liberia was also effected by the Ebola virus, which was the main reason for decline of economic growth. Mining and rubber export kept their position, while service sector that employs 45% of inhabitants was affected. Agriculture monitored slight decline not only because of Ebola, but also for floods in the region. (AfDB, OECD, UNDP, 2015)

Mali

In recent years, economy of Mali recorded decline at the beginning of the period as well as increase of economic growth at the end of the period. Mali experienced food crisis that began in 2011 and political crisis that started with the coup. Weak performance of the secondary and tertiary sectors and above mentioned problems resulted in rapid drop of economic

growth. (AfDB, OECD, UNDP, ECA, 2013) The economy recovered in the following years – 2013 and 2014. Primary and service sectors contributed the most to the recovery of the economy, while performance of the secondary sector dropped in spite of increase in agro-food, energy and construction. (AfDB, OECD, UNDP, 2015)

Niger

In recent years, Niger registered economic growth with ups and downs. The first down occurred in 2011, right after the recovery of the growth in 2010. Slowdown of the economy was caused by the poor weather and impacts of the crises in Côte d'Ivoire, Nigeria and Libya. (AfDB, OECD, UNDP, UNECA, 2012) In 2012, Niger recorded one of the highest levels of growth in Africa. It was result of a good harvest and dynamic secondary sector, which was led by the mining industry. All sectors contributed to the growth. (AfDB, OECD, UNDP, ECA, 2013) The increase of economic growth in the last year is based on the agriculture with the help of the good weather. Construction sector, and the transport and communications sectors contributed to the economy as well. (AfDB, OECD, UNDP, 2015)

Nigeria

Nigeria monitored sustainable economic growth in the last years. Since 2010, economic growth slightly declined. Nigerian economy is driven by capital-intensive sectors - oil and gas sector, together with the agriculture. (AfDB, OECD, UNDP, ECA, 2013) In 2013, increase of the growth was recorded. The main driver of the economy is the non-oil sector and service sector and it is followed by manufacturing and agriculture sector. It indicates diversifying of the economy and its focus is more services-oriented, mainly with retail and wholesale trade, real estate, information and communication. (AfDB, OECD, UNDP, 2015) Oil sector was not that important for economic growth anymore due to the supply disruption – caused by oil theft and pipeline vandalism, and by weak investment that did not find any new oil. (AfDB, OECD, UNDP, 2014)

Senegal

In 2011, Senegal faced a decline of economic growth. It was caused by decline in the agricultural production. Since 2012, economic growth is stable. (AfDB, OECD, UNDP,

ECA, 2013) The year 2014 was negatively affected by the Ebola epidemic outbreak that had impact on the tourism sector and delayed rainfall that negatively influenced agriculture sector. (AfDB, OECD, UNDP, 2015) The main driver of the Senegal's economy is mining, construction, tourism, fisheries and agriculture. Between the key export industries belong phosphate mining, fertilizer production, agricultural product and commercial fishing. The focus is also on oil exploration projects. The country is strongly dependent on donor assistance, remittances and FDI. (CIA, 2016)

Sierra Leone

The economy of Sierra Leone had positive trend. At the beginning of the period, the main driver of the economy is export of minerals and cash crops, service sector, agricultural productivity and investment in infrastructure. (AfDB, OECD, UNDP, UNECA, 2011) The country experienced rapid growth in 2012. The driver of this growth was the mining sector, with support from agriculture, services and construction. Main reason of this growth is especially iron ore production. (AfDB, OECD, UNDP, ECA, 2013) The growth continued to the year 2013. Before 2014, Sierra Leone made large progress since the end of the civil conflict, but decline of economic growth was monitored. It was caused by the Ebola virus and it was a reason of the major drop in the growth. (AfDB, OECD, UNDP, 2015)

Togo

Togo monitored stable economic growth in spite of a difficult international environment. The economy is mainly driven by the primary sector, but in 2010, rain negatively affected its outputs. The biggest contribution to the growth had mining industry, followed with the tertiary sector. (AfDB, OECD, UNDP, UNECA, 2011) In 2013, economic growth declined slightly. The primary sector - cotton and food crops and services – retail, communications, transport and storage had the biggest contribution to the growth. (AfDB, OECD, UNDP, 2014) In 2014, Togo reached its growth as result of the development of transport infrastructure and agriculture. (AfDB, OECD, UNDP, 2015)

For the summary of the GDP growth see Figure 7 in Appendix.

Over the recent years, ECOWAS region registered growth. Last year, the region faced many challenges – between the main problems belong Ebola virus and the fall in commodity prices. The main impact of Ebola was visible in Guinea, Sierra Leone and Liberia. Despite of these problems, according to the IMF, the region maintained positive trend of its economic growth. (ECOWAS Bank for Investment and Development, 2014)

2 Demography and economic growth

A correlation among static and dynamic relationships was pointed out by J.B. Clark (1932). However, static state is just hypotheses, although in economic analysis effective, but unfeasible. The reason of this opinion is caused by the five factors: a) population change, b) Change of capital, c) Methods of production, d) organization and e) change in the reserves of natural resources (Clark, 2004) Until the early 18th century, world population size was relatively static. Since this time, extraordinary change has been registered in the population size and its structure. Economic and social circumstances and institutions determine demographic facts. On the other side, demographic facts also influence those circumstances and institutions. There is many studies, which are focused on the relationship among different economic outcome and demographic indicators. (Bloom, et al., 2008a) The recent findings, such as the age distribution of the population can have important economic effect, shows that population matters when it comes to economic growth and development. (Bloom, et al., 1999) Uncertainty is still present among demographic and economic relationship. (Bloom, et al., 2008a)

Discussion about the relationship between population and economic growth was for the first time mentioned by the Thomas Malthus in 18th century – in 1798, when his book *An Essay on the Principle of Population* was published. Malthusian model says that the causation goes in both directions. Increase of population is caused by the higher economic growth, which is responsible for stimulation of earlier marriages and higher birth rates and also for reduction of mortality from malnutrition and other factors. On the other hand, population growth decreases economic growth through diminishing returns. The center of the model is made by the dynamic interaction between those two aspects. (Becker, et al., 2005)

The standard approach, which is interested in the influence of demographic indicators on economic growth, acknowledges the possibility that economic growth may be negatively influenced by the rapid population growth – pessimistic view or that on the other hand, economic growth may be positively influenced by the rapid population growth. However, both of those two extreme views have only a little support. More often, association of the pace of economic growth and population growth is not significant – economic growth can,

but does not need to grow with population growth. This neutralist view is called population neutralism. (Bloom, et al., 1986)

As it was mentioned above, there are few empirical studies, which are focused on the relationship between population and economic growth. A cross-section regression analysis, which analyze the relationship between two variables is used in majority of these studies (e.g. Dawson and Tiffin 1998). Some of these studies did not confirm any statistically significant relationship among these two aspects and other studies were not able to reach conclusive opinion, because of the contradictive results. (Tsen, et al., 2005)

Minoru Tachi and Youchi Okazaki (1965) claimed that population growth in the country may affect economic development. Nowadays, many developed countries face the problem with the decline of the population growth – main problem is ageing population and lack of working people, which causes problems with pensions. The economies of the developing countries may be affected too, because of its rapid population growth. (Ali, et al., 2015)

Journal of Population and Social studies published study focused on the relationship of population growth and economic development (represented by GDP growth) – case study of Pakistan. The analysis used three tests in the paper – augmented Dickey-Fuller unit root test, Johansen co-integration test and Granger causality test. The results confirmed relationship among the variables and the study implies that population growth in the country has positive impact on economic growth. The study provides the evidence that economic growth in Pakistan is the population-driven economic growth. (Furuoka, et al., 2010)

Another study was published in International Journal of Economics, Finance and Management Sciences – *An Empirical Analysis of Population Growth on Economic Development: The Case Study of Bangladesh* that is examining whether population growth has positive or negative impact on economic development with the multivariate analyses. The results of this study demonstrates that population growth has negative effect on economic growth, because the resources are consumed by the population instead of productively used. Rapid population growth in Bangladesh is also a cause of the one of the highest dependency ratio in the world. (Ali, et al., 2015)

Another research by Fumitaka Furuoka was published in 2014. It is focused on the state in Borneo Island - Sarawak, in Malaysia. The results indicate that there is not statistically significant long-run relationship, but it has causal relationship between population growth and economic development in the state. It means that population cannot have positive neither negative impact on the economy. The results of his research also indicate that income growth caused population growth in the region. (Furuoka, 2014)

Another study examining the relationship between population growth and population growth - *The Long Run Relationship between Population Growth and Economic Growth: a Panel Data Analysis of 30 of the most Populated Countries of the World*, where the countries were selected according to the number of inhabitants. In this paper, economic growth is measured by per-capita income. The results of the econometric tests conclude that population growth and economic growth are positively related. (Sibe, et al., 2016)

Demographic change and population growth was examined by Bloom and Finley from Harvard School of Public Health - *Demographic Change and Economic Growth in Asia*. This study was focused on East-Asian countries and the main method used for this paper was regression analysis. Income data are used for economic growth and working-age shares, life expectancy, population growth and population density were used for regression analysis. The results say that economic growth has positive correlation with working-age population and significant negative correlation with population growth. Demographic factors play key role in explaining the growth performance in East Asia. (Bloom, et al., 2008b)

Another study about population growth and economic growth was published in the Southern Economic Journal - *Population Growth and Economic Growth: Long-Run Evidence from Latin America* is focused on seven countries in Latin America over most of the 20th century. The main methods used were unit root tests, the Johansen maximal likelihood methodology and Granger causality tests. Economic growth is measured by GDP per capita. The result indicates that long-run relationship between economic growth and population does not exist. This result supported the conclusion of the similar research focused on India by Dawson and Tiffin in 1998. (Thornton, 2001)

There are two well-known studies focused on Africa - *Sources of Slow Growth in African Economies* written by Jeffrey D. Sachs and Andrew M. Warner and *Geography, Demography, and Economic Growth in Africa* by David E. Bloom and Jeffrey D. Sachs. Their main aim is to find out why there is slow economic growth in Africa in the last century. These studies are not purely focused on the relationship between economic growth and demography, but it is part of the research. Cross-country regression analysis was used in both papers. Their results indicate that rapid population growth is not good for economic growth. Sachs and Warner observed that if working age population grows faster than the whole population, per-capita growth will be higher. Bloom and Sachs state that rising youth dependency ratio implies a lower per capita growth rate and low life expectancy slows the growth too, because it is connected to low rates of saving and investments. (Sachs, et al., 1997) (Bloom, et al., 1998)

Relationship between economic growth and population growth was examined in cross-section studies. For example, Easterlin (1967), Kuznets (1967), Simon (1992) and Thirlwall (1972) find a weak or insignificant relationship between economic growth – income per capita and population growth. For less developed countries is found negative and significant relationship by Kelly and Schmidt (1994). (Thornton, 2001) Richard A. Easterlin in his article *Effect of Population Growth in the Economic Development of Developing Countries* states that it is possible that the effect of population growth on economic development has been exaggerated and it is not possible to generalize the results for all developing countries that differs in so many aspects – growth rates, density, income levels and many others. (Easterlin, 1967) As it was mentioned above, a cross section study between population growth, growth of output and per capita income by Anthony P. Thirwall also concludes that the slowdown of the population growth would have no impact on the growth of output and output per capita. According to the author, the relationship between population growth and living standards is largely inconclusive. (Thirwall, 1972)

2.1 Demography

The concept of demography originates from the Greek words démos – people and grafein – describe. Demography is a science about human population and it explains theories and

concepts used while describing demographic situation. (Klufová, et al., 2010) Demography is an interdisciplinary science – it is placed between social and biological science. It studies collective biosocial phenomena and processes, which characterize reproduction of population. Biological aspects of population are condition of the population existence and therefore it is a fundamental aspect. However, economic and social aspects are closely linked to the biological aspect. Effect of economic and social aspects is reflected in a scale of the whole society, while biological ones are reflected mainly in the individual members of population. (Palát, et al., 2013)

Population is a group of people with specific characteristics living in a particular territory. Term of population has biological basis and it is widely used for all animal species. (Kalibová, et al., 2009)

Demographic phenomena and processes are events of a certain type that are observed as a mass phenomenon – natality, mortality, marriage, divorce, migration. (Klufová, et al., 2010) Basic demographic segmentation can be deduced from the structure of the issues it deals with as well as from the methods and the sources it uses. Demography is divided on:

- Demographic statics (population and its structure)
- Demographic dynamics (natural population change - fertility rate, mortality rate and mechanical population change - migration) (Klufová, et al., 2010) (Roubíček, 1997)
- Demographic prognosis (extrapolation, projection)

Another part of demography could be population politics, which is very important and problematic issue although it does not belong to demography, because it is part of politics. Next part could be also part of applied demography such as economic demography. (Roubíček, 1997)

2.1.1 Population status and structure

Number of inhabitants to the specific date – population status, is one of the basic characteristics, which is monitored by the demographic statistics. It is specified by determining the relevant time, territory or other characteristics such as gender, age, etc. There are distinguished three types of population status according to the time at which the

population was detected – initial state of population, end-year state of population and mid-year population. (Český statistický úřad, 2014) The most important phenomenon, which is monitored by the statistics of the population is population structure. There are three groups of characteristics according to which we describe different types of structures:

1. Biological characteristics (gender, age, marital status, etc.)
2. Economic characteristics (economic activity, profession, etc.)
3. Cultural characteristics (nationality, language, religion, education, etc.) (Scholzová, 1996)

Structure of the population according to age and sex belongs to the basic demographic structures. Both of these characteristics are usually analyzed together, but separate evaluation of the population according to sex has its reasons too. (Vystoupil, et al., 2014) The main feature of the demographic structure is figure of demographic structure, which is called tree of life or population pyramid. (Palát, et al., 2013)

2.1.1.1 Structure of the population according to sex

Sex is one out of two basic characteristics of every human being. It is primary classification characteristic in all population statistics and it is the most often published characteristics of the population of every area. (Klufová, 2008) If we look at the percentage of the males in the population, we are talking about variables of masculinity. Otherwise, we are talking about variables of femininity. (Scholzová, 1996) Variables of the masculinity and femininity are usually expressed in percentage and less often in mille.

Femininity index is the ratio of females and males in the population, which is the most often expressed pre one hundred or one thousand males. It is expressed as:

$$ife = \frac{\bar{S}_{females}}{\bar{S}_{males}} \times 100$$

where the $\bar{S}_{males}$ and $\bar{S}_{females}$ have the same characteristics as expressed in masculinity index.

Masculinity index is the ratio of males and females in the population, which is the most often expressed per one hundred or one thousand females. (Klufová, 2008)

2.1.1.2 Structure of the population according to age

Right after sex, age is the second most fundamental characteristic of person. (Klufová, 2008) Population is divided into three basic groups (biological generations) according to the ability to reproduce and age: 1) pre-reproduction I. biological generation (0-14 completed years), 2) reproduction II. Biological generation (15-49) 3) post-reproduction III. Biological generation (50 and more years) (Palát, et al., 2013)

In addition to biological generations, economic generations are defined. From economic activity point of view, life of a human being is divided into three different stages – preproduction age (I. economic generation), production age (II. economic generation) and postproduction age (III. economic generation). Preproduction age is 0 – 15 years and postproduction age can differ from country to country. (Roubíček, 1997)[1]

According to the Swedish demographer Axel Gustaf Sundbärk, age pyramid is divided into three basic types – progressive, stationary and regressive. These types of pyramids are derived from the representation of children´s and post-reproduction´s generation in the population. The II. Biological generation represents approximately 50% in every population. Population pyramid can be used for illustration of the population structure not only according to age, but also according to marital status, education, economic activity, etc. (Kalibová, 1998)

2.1.2 Demographic processes

In general, demographic processes present change of the status of the individual. Demographic processes are interesting events, which happens in the population during a specific time period – usually one-year interval. (Klufová, et al., 2010)

2.1.2.1 Natural movement of the population

Natural movement of the population is caused by the natality and mortality in the population. This type of movement changes number as well as age and sex structure of the inhabitants.

[1] This thesis works with economic generations of the population. People with age 15 – 64 are considered as the II. economic generation (production generation) in the analytical part.

Marriages and divorces belong to the natural movement of the population as well. (Srb, et al., 1971)

2.1.2.2 Mechanic movement of the population

Mechanic movement of the population is a change of a residence. The most common form of mechanic movement is migration. Migration is either internal, in the case of moving inside of the monitored stare or external migration, which monitors moving outside of the country. (Srb, et al., 1971)

2.1.2.3 Total movement of the population

Total movement of the population is a result of the natural and mechanic movement. Importance of this variable is connected with the ability to characterize short-term and long-term development of the population as well as its prognosis. Total increase (decrease) is sum of natural increase and balance of migration. Natural increase is difference between natality and mortality and balance of migration is calculated as difference between number of immigrants and emigrants in the country. (Klufová, et al., 2010)

2.2 Economic growth

Economic growth is defined as a growth of the economy, which is measured by an increase of the gross national product (GDP)[2] in real terms over time. Increase in the GDP is caused by the production of more goods and services than in the prior period of time. Increase of production is caused by increase of productivity or increase of the factors of production. (Shim, et al., 1995) In general, economic growth is not only increase in GDP, but it can also be an increase in gross national product (GNP)[3]. But this use of term economic growth is a little bit misleading for several reasons – e.g. positive change in GNP does not necessarily correspond to change in economic welfare. (Stanlake, et al., 1995) Widely shared and sustained improvements in well-being may be result of economic growth. In the presence of

[2] GDP is defined as total value of final goods and services produced within a country´s borders over the year.

[3] GNP, also called gross national income (GNI) is the value of final goods and services produced by domestic factors of production, whether at home or abroad.

growth, average income does not remain constant as in the case of growth absence. Also, in the absence of growth, any effort to raise incomes or provide better services would have to be done at the expense of the others and therefore any long-term development must involve economic growth. Nonetheless, broader development is not given by successful economic growth for two reasons – a) rates of economic growth cannot guarantee that improvement in material living standards are widespread and b) rise of household´s well-being is not guaranteed by the increase in its income, because it is counterbalanced by other dimensions – e.g. fear regarding future. (Schaffner, 2014)

In general, economic growth is central to economic development. In addition to GDP and GNI, economic growth also includes indicators such as capital stock, employment, investment, savings, consumption, government spending, imports and exports - the indicators that are known to be relevant to economic growth. (The World Bank Group, 2016a)

It is very difficult to find the indicator that will measure the activity of an economy and at the same time, the well-being. The GDP describes the size of the economy, but it does not cover all activities – especially social factors are not included. The GDP in connection with some other indicators, is a good measure for the evaluation of the economic performance. (MSc International Business Management with Logistics Thomas Bauer, 2012)

3 Data and Methodology

For elaboration of the theoretical part of this thesis was used literature review. Data and information were obtained mainly from internet sources, books, journals and specialized publications. The analytical part used database, annual reports and other documents provided by international organizations. The main source of data was The World Bank database. In addition to its own data, The World Bank collects data for particular indicators from the various databases as well.

Source of the data used in the economic analysis of this thesis were: World Bank national accounts data, OECD National Accounts data files, International Monetary Fund, International Financial Statistics and data files, International Labour Organization and Key Indicators of the Labour Market database.

Data for the variables used in the demographic analysis of this thesis were collected from following organizations: Food and Agriculture Organization, United Nation Population Division´s World Population Prospects, United Nations Statistical Division – Population and Vital Statistics Report, Census reports and other statistical publications from national statistical offices, Eurostat: Demographic Statistics, Secretariat of the Pacific Community: Statistics and Demography Programme, U.S. Census Bureau: International Database, World Bank population estimates, World Bank staff estimates from various sources including census reports, the United Nations Population Division's World Population Prospects, national statistical offices, household surveys conducted by national agencies and Macro International.

The overall ECOWAS data were calculated from the data for individual countries. Data were subsequently processed by using Microsoft Excel and STATISTICA. Average data over the last five-years were used in the examination of the cross-sectional relationship[4]. Panel data[5] were used for the examination of the short-run relationship.

[4] Cross-section data are data from the same time period. (Biørn, 2013)

[5] Panel data is a combination of the cross-section data and time series. (Biørn, 2013)

3.1 Chain and fixed-base index

Chain index (index with changing base) is defined as an index, where the values of the chosen indicator is compared in period of time, which changes according to some predefined key. (Löster, et al., 2009) It is constructed as a share of regular and immediately preceding value. Series of the chain indexes is then denoted as:

$$c_i = \frac{Q_1}{Q_0}, \frac{Q_2}{Q_1}, \ldots, \frac{Q_n}{Q_{n-1}}$$

If we want to express the result in percentage, it must be multiplied by 100. (Minařík, 2008)

Fixed-base index (index with fixed base) is defined as an index, where all values of the same indicator are compared with one beforehand chosen period. (Löster, et al., 2009) It is constructed so that in the denominator of the index remains the same value of the same basic period, which usually is the initial or final value. Fixed-base index can be expressed as:

$$f_i = \frac{Q_1}{Q_0}, \frac{Q_2}{Q_0}, \ldots, \frac{Q_n}{Q_0}$$

where Q_1, Q_2, ..., Q_n are values and Q_0 in in advance chosen basis. Similarly, to the chain index, we need to multiple results by one hundred if we want outcome in percentage value.

3.2 Composite indicator

Indicator is one of the main term of this thesis. It is a phenomenon or in case of ongoing monitoring it is a trend. Speaking of the indicator per se, it is a statistic data that is expressed by a general number, which represents either a specific economic (social) phenomenon, process or only part of it. (Jílek, 2001) Composite indicator is an indicator that provides a key to a matter of larger importance or make noticeable trend or phenomenon, which is not immediately identifiable. It is based on the sub-indicators that does not have one common meaningful unit of measurement and there is not any obvious way of weighting these sub-indicators. (European Commision, 2014) According to the OECD, composite indicator is defined as follows: "*A composite indicator is formed when individual indicators are*

compiled into a single index, on the basis of an underlying model of the multi-dimensional concept that is being measured."(OECD, Glossary of Statistical Terms)

Selection of the sub-indicators into composite indicator is not random, but it is subject to the economic importance, information value, ability of prediction, the amount of correlation with GDP, etc. (Czesaný S., 2012) Composite indicator should not been considered as a goal per se, but it should be seen as a starting point for a discussion and attracting of concern and interest of public. (Nardo, et al., 2005) Composite indicators have usually easier interpretation for the general public than finding a common trend in different indicators. On the other hand, composite indicator and its simplicity may lead to incorrect outputs and its subsequent interpretation evaluating the results may be misleading. (Nardo, 2005/03)

3.2.1 Pros and Cons

Note on Composite Indicators, which was presented at the meeting of European Commission in 2002 presented a list of advantages and disadvantages of composite indicators. According to Saisana and Tatantola, the following pros and cons are important to mention. (Saisana, et al., 2002)

Pros

- Complex or multi-dimensional issues may be summarized by composite indicators.
- The bigger picture of the issue is provided by the construction of composite indicator - it is easier to interpret composite indicator than finding a trend in many different indicators.
- Composite indicator can evaluate progress of countries over time - public interest increases, because a summary figure comparing the countries over time is provided
- Reduction of the size of the list of indicators or inclusion more information in current list may be possible thanks to composite indicator (Saisana, et al., 2002)

Cons

- Composite indicators can be misleading if they are poorly constructed or misinterpreted.

- The bigger picture, which is provided by composite indicator, can lead to simplistic policy conclusions.
- Judgement is important in the construction of composite indicator, because it can influence desired policy in the country and stages of the construction of composite indicator (e.g. selection of indicators) need to be transparent and based on sound statistical principles.
- Quantity of data, which is needed is high. (Saisana, et al., 2002) (Nardo, et al., 2005)

3.2.2 Construction of the composite indicator

Ten steps are followed in the construction of the composite indicators - *Development of a theoretical framework, Data selection, Imputation of missing data, Multivariate analysis, Normalization of the data, Weighting and aggregation, Uncertainty and sensitivity analysis, Back to the real data, Links to other variables* and *Presentation and visualization of the results*. (OECD, 2008)

3.2.2.1 Development if a theoretical framework

Development of a theoretical framework is a starting point in the construction of composite indicator. The theoretical framework should include concept definition, determination of sub-groups – in case that there are any and identification of the selected criteria. Definition of concept should provide clear sense of what is being measured by the indicator. Multi-dimensional concepts may be divided into sub-groups, its relationships need to be described in the framework. The selection criteria help to determine whether indicator is included in the overall composite indicator. (OECD, 2008)

3.2.2.2 Data selection

The composite indicator is a sum of its variables. The quality of these variables is important because it determines overall strengths and weaknesses of the indicator. The lack of relevant data is the greatest problem in the composite indicator construction. Selection of the variables should be based on their analytical soundness, measurability, relevance to the phenomenon and relationship to each other. (Freudenberg, 2003)

3.2.2.3 Imputation of missing data

Missing data is problem of many statistical analyses without exception of composite indicator. There are two types of missing data – missing in random or non-random type. Imputation of missing data is necessary to provide a complete dataset. Three methods for dealing with missing data are known – case deletion, single imputation and multiple imputation, but none of these method is perfect. The first method – case deletion, which is also called complete case analysis simply omits the missing data. The missing data are considered as a part of the analysis by the other two methods. These approaches try to impute values through either single imputation. (OECD, 2008)

3.2.2.4 Multivariate analysis

For the overall structure of the dataset, its suitability and subsequent methodological choices (e.g. weighting) should be used multivariate analysis. It is used for identification of the statistically similar groups of indicators or groups of countries and interpretation of the results. For the grouping information on individual indicators, it is necessary to have well defined structure of the composite indicator as well as the sufficient or appropriate dataset describing the phenomenon. Principal components analysis and factor analysis can be used. They uncover change of different variables in relation with each other as well as their association. For the grouping information on countries in the composite indicator is used cluster analysis, which groups the countries based on their similarity on different individual indicators. (OECD, 2008)

3.2.2.5 Normalization of the data

Normalization of dataset is used for a unification of the measurement units of the variables to the same unit to avoid summing up different things. It is necessary to normalize data if the variables have different units or if they are incommensurate with each other. The objectives of the composite indicator and the data properties should be taken into account in the choice of the right normalization method. There is number of normalization methods to choose from – ranking, standardization, re-scaling, distance to reference country, categorical scales, cyclical indicators, balance of opinions. (Nardo, et al., 2005)

3.2.2.6 Weighting and aggregation

Weighting variables is necessary in the construction of composite indicator. All variables have to be weighted – the weights of the variables can be equal or they can be different. (Freudenberg, 2003) There are many reasons for the indicators to have different weights – e.g. to reflect their economic significance, statistical adequacy, speed of available data, etc. There are several weighting techniques that are available – schemes based on statistical models (e.g. factor analysis) or on participatory methods (e.g. budget allocation). No matter of which method is used, weights are basically value judgements and weights usually have an important impact on the results. (Nardo, et al., 2005) There are also various methods for aggregation – e.g. linear or geometrical aggregation. Linear aggregation is used when all individual variables have the same measurement unit and geometric method is used when author wants some level of non-compensability between individual variables or dimensions. Besides that, linear method rewards base-indicators proportionally to the weights and geometric method reward those countries with higher scores. As long as the process of identification of the right weights and aggregation methods is transparent, the validity of composite indicator is not influenced by the absence of an objective way to identify these methods. (OECD, 2008)

3.2.2.7 Uncertainty and sensitivity analysis

The robustness of the composite indicator is measured by the uncertainty and sensitivity analysis. The combination of these two analysis also help to improve transparency. The main focus of uncertainty analysis is on uncertainty, which is present in the input factors spreading through the structure of the composite indicator and how it affects its values. Sensitivity analysis evaluates how the individual source of uncertainty contributes to the output variance. Sensitivity analysis is used less often than uncertainty analysis. These two analysis are almost always done separately, but use of them together can improve structure of the indicator. (OECD, 2008)

3.2.2.8 Back to the real data

A starting point of the analysis is provided by the composite indicator. It can also be used as summary indicator to lead policy and data work and it can also be deconstructed.

Decomposition of the composite indicator means identification of the contribution of subcomponents and individual variables and it can extend the analysis of country performance. The individual indicators point out strengths and weaknesses of each country. (OECD, 2008)

3.2.2.9 Links to other variables

There can be relationship among the composite indicator and other well-known variables and measures. The explaining power of a composite can be tested by these links. The best way for the illustration of these links is simple cross-plot correlation. The correlation between the composite indicator and other variable shows similar variation in the two data sets. The indicator change (due to the correlation) does not have to lead to a change in the composite indicator and vice versa. (OECD, 2008)

3.2.2.10 Presentation and visualization of the results

Presentation of the results is very important in any analysis. There exist various ways of the presentation of composite indicator results. The way of presenting ranges from the simple forms such as tables, bar or line charts to more sophisticated figures such as the four-quadrant model, etc. (Nardo, et al., 2005)

3.3 Correlation analysis

Correlation is defined as the association between two variables. It measures the type of dependence that is graphically represented by a set of regression lines and strength of dependence is identified by a Pearson correlation coefficient, whose value can range between interval – 1 and +1. (Jadczaková, 2015)

The direction (type) of the relationship is also indicated by the signs plus and minus. Positive sign means that while one variable grows, another one grows too and negative sign means that while one variable grows, another one decreases. A correlation with the value close to zero suggest strong association between two variables and the correlation close to zero suggest no linear association between the variables. Important correlation can be as small as 0,4 in absolute value. (Boston University School of Public Health, 2013)

3.4 Canonical correlation analysis

Method of canonical correlation belongs to the group of methods of hidden relationships. The main aim of these type of methods is to facilitate the task into the form, which is easy to solve and is favorable for further analysis. As well as factor and component analysis, canonical correlation analysis allows deeper understanding of the relationships between variables and simplify statistical evaluation otherwise difficult quantifiable context. Canonical correlation is a procedure that is focused on the relationship between two different groups of variables. (Palát, 2016)

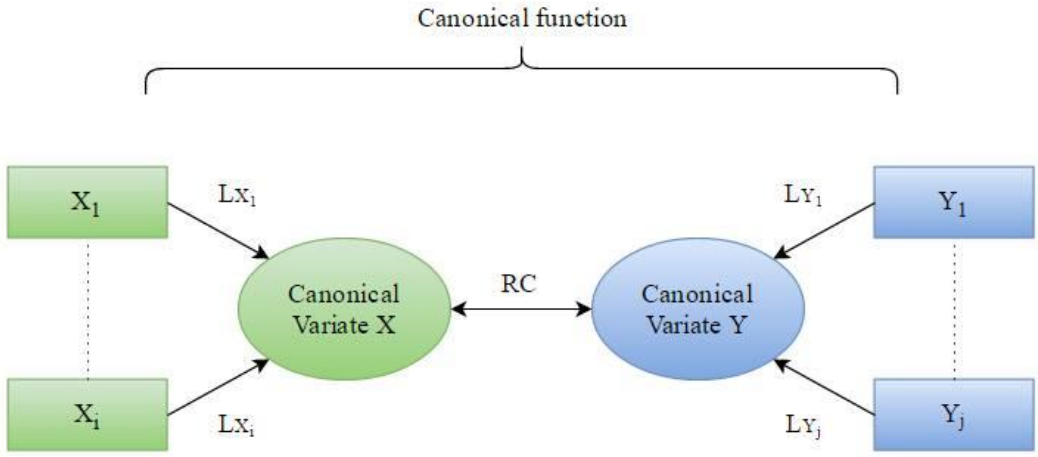
Definition of the canonical correlation analysis was introduced for the first time in the 1936 by Harold Hotelling. In general, canonical correlation analysis can be defined as an analytic technique, which examines the multivariate relation among two sets of variants. Each set consists two or more variables. (Hotelling, 1936)

While using this type of multivariate correlation, dataset is divided into two groups – the first set of data is referred as independent variables and the second group is referred as dependent variables. Use of these two terms does not mean that there is a casual relationship, but it simply refers to the correlation of these two datasets of multivariate variables. (Hair Jr., et al., 2010) Logical and natural group should be formed by the variables within each set. There should be also rational expectation that two set of data are related in terms of content. Potential research interest is examination of the relation between these two datasets. (Fan, et al., 2010)

For each set of data – independent as well as dependent variables, is formed a canonical variate. The *canonical variate* is defined as linear combination representing the optimally weighted sum of two or more variables. Each canonical variate is interpreted with a canonical loading. The *canonical loading* is defined as a linear correlation between the individual variables and their respective variates. *Canonical function* (see Picture 2) is developed in canonical correlation analysis. It is function that represents relationship between two linear composites – canonical variates. As it was mentioned above, canonical variate is formed for each dataset and it means that each canonical function consists of two canonical variates. The canonical function maximizes a canonical correlation coefficient among the two canonical

variates - the *canonical correlation coefficient* measures the strength of the overall relationships among them. In general, the correlation between the two canonical variates in a canonical function is determined by the canonical correlation coefficient. (Hair Jr., et al., 2010)

Picture 2: Canonical function



X_i = i^{th} measured variable on canonical variate X
Y_j = j^{th} measured variable on canonical variate Y
Lx_i = Loading of ith X measured variable on canonical variate X
Ly_j = Loading of jth Y measured variable on canonical variate Y
RC = Canonical correlation coefficient for the pair of canonical variates in the canonical function

Source: HAIR, J F J. a kol. *Multivariate data analysis : a global perspective.* 7. vyd. Upper Saddle River, NJ [u.a.]: Pearson, 2010. 800 s. ISBN 978-0-13-515309-3.

The main objective of the canonical correlation analysis is knowledge of the mutual simultaneous relationship of two groups of variables, more specifically phenomenon and processes, which can hide behind these variables. (Palát, 2016)

ANALYTICAL PART

4 Demographic analysis of ECOWAS

This part consists of analysis of population status and structure of ECOWAS according to chosen characteristics in the period from 2010 to 2014. The analysis includes comparison of individual countries as well.

ECOWAS has currently 15 member states. Basic statistical data for the year 2014 about each member as well as overall ECOWAS information is included in the Table 23 in Appendix. ECOWAS data were calculated from the dataset.

Table 1: Number of inhabitants in ECOWAS in the period 2010 – 2014 and its development between the years expressed by the chain and base-fixed index[6]

Years	2010	2011	2012	2013	2014
ECOWAS	304 386 840	312 920 968	321 686 695	330 663 496	339 825 169
Fixed-base i.	100,00%	102,80%	105,68%	108,63%	111,64%
Chain i.	102,80%	102,804%	102,801%	102,79%	102,77%

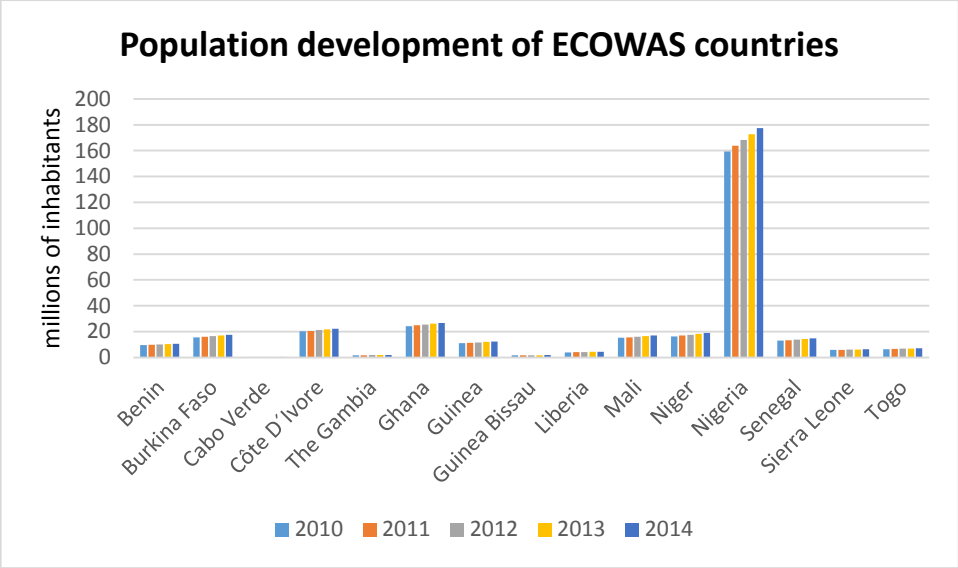
Source: Own work based on World Bank database on individual countries.

Overall, there was huge increase of population during the period 2010 – 2014 and the population of ECOWAS region increased by 35 438 329 people. Population has increased every year in this time period and in general, any significant fluctuation did not occur – see Table 1.

As it was mentioned ECOWAS consists of 15 individual countries. Figure 1 shows development of the population in these countries during the period 2010 – 2014.

[6] Chain index expresses percentual change in the number of inhabitants in one year compared to the previous one – for the year 2010 was used overall number of inhabitants in 2009. Fixed-base index expresses percentual change in the number of inhabitants in one year compared with one year, which is fixed – in this case, it is year 2010.

Figure 1: Population development in the individual countries, 2010 - 2014



Source: WB. Own work.

Development of the population in the individual countries is different. In terms of population, the largest country is Nigeria. It has incomparable more inhabitants than any other country of ECOWAS. During the monitored period, there is a huge increase recorded every year. In the year 2014, the population is by 18 051 244 people higher than in the year 2010.

Nigeria's share in the total population of the ECOWAS is 52,2%. Population density is 195 inhabitants per square kilometer, which is the highest population density just before The Gambia with 191 people per square kilometer and it is more than three times more than population density in the whole region.

The second largest country according to the number of inhabitants is Ghana. Population increase was not as rapid as in the case of Nigeria, it increased by 2 468 864 people during the five years. Population of Ghana represents 7,9% of the ECOWAS and its density is 118 people per square kilometer and it is still higher than average density in the region.

The smallest country by the population is Cabo Verde with the number of inhabitants 513 906 in 2014. Cabo Verde also recorded the smallest increase of the population during the monitored period 2010 – 2014 out of all countries in the region. Its population increased by 23 527 people. Population of Cabo Verde represents only 0,2% of the ECOWAS, but due to

its small land surface, its density is still higher than average – 128 people per square kilometer. (See Table 23 and Table 24 in Appendix)

The highest population growth ratio between the examined country has Niger, while the lowest growth was monitored in Cabo Verde. The average population growth in the whole region is approximately 2,7%. (See Table 25 in Appendix)

As for the percentage of the sexes in the ECOWAS population, there is only small difference in the share of females and males. Male population recorded a slight increase during the years. The proportion of the female population slightly exceed 50% and the share of males in the population is nearly 50 %.

By looking at Table 26 (in Appendix), we see that femininity index in the region has higher values than masculinity index over the relevant period of time. Masculinity index reached its peak in 2014, when it had the value of 99,65, which means that a hundred women accounted for a hundred men. On contrary, femininity index recorded its lowest value in 2014. Due to the almost the same proportion women and men in the population of the region, femininity and masculinity indexes are nearly the same.

Percentage of female population in the individual countries is displayed in the Table 27 in Appendix. The rest of the population (up to 100%) is male population. The countries have similar amount of the female and male population, which range from 49% - 51%. Due to the equal amount of female and male population, this indicator is not included in the further analyses examining relationship between economic growth and demography.

Development of life expectancy of inhabitants in the ECOWAS countries has changed in the monitored period. (See Table 28 in Appendix) In this period, life expectancy in the individual countries had mainly positive trend and it increased – usually by two years, some exceptions by three years and it stagnated whole time – example of Cabo Verde and Ghana. Life expectancy of ECOWAS was calculated as an average of the individual countries and its overall life expectancy increased from 57 to 59 years. The highest life expectancy is in Cabo Verde – 73 years and it is incomparably higher than any other country in the group. The second best is Senegal with life expectancy of 66 years in the 2014. Sierra Leone with the

life expectancy of 48 in the 2010 and 51 in the end of the monitored period is the country with the lowest life expectancy.

Table 2: Indicators of population age structure of ECOWAS in 2010 - 2014

	Population 0-14 (%)	Population 15-64 (%)	Population 65+ (%)	Ageing index (%)	Age dependency (%)		
					Total	Young	Old
2010	43,33	53,63	3,04	7,02	86,46	80,79	5,67
2011	43,26	53,71	3,03	7,00	86,19	80,54	5,64
2012	43,16	53,83	3,01	6,97	85,77	80,18	5,59
2013	43,04	53,98	2,98	6,92	85,25	79,73	5,52
2014	42,89	54,15	2,96	6,90	84,67	79,21	5,47

Source: WB. Own work.

Percentage share of the economic generations in the overall population of ECOWAS did not monitor significant change during the period 2010 - 2014. Change in the all generations was not even one percent. (See Table 2) Age dependency expresses how many people from preproduction and postproduction part of population accounts to one hundred inhabitants from production part of population in ECOWAS. On the monitored period, age dependency decreases slightly without any significant fluctuations. Decrease is caused due to the increase in the production part of population. From the individual countries, the highest age dependency can be found in Nigeria and the lowest one is in Cabo Verde. (See Table 30 in Appendix)

5 Economic analysis of ECOWAS

In the period 2010 – 2014, economic situation in the ECOWAS region recorded dynamic growth as well as slight decline. The countries in the region vary in many things and while economic growth could in one country remain solid, in other country it may extremely decline. This analysis consists of the indicators that were selected for the further analysis in the thesis.

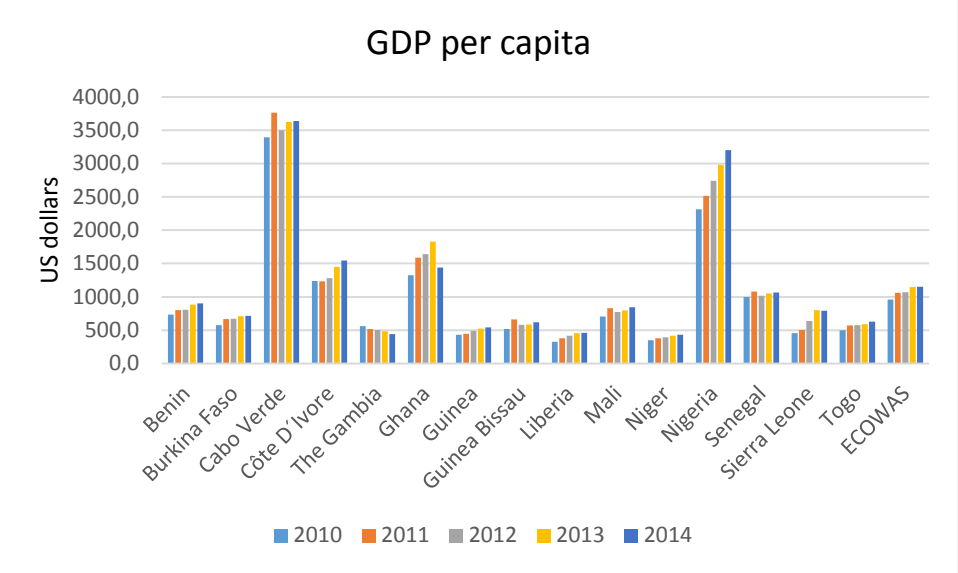
5.1 GDP per capita

Growth in the GDP per capita indicates to the increase in real GDP per person. GDP per capita gives us better picture of the effect of economic growth to the average inhabitant. (Pettinger, 2015)

All countries except of Cabo Verde, Cote d'Ivoire, Ghana and Nigeria are considered to be The Least Developed Countries. GDP per capita depends on the manufacturing industries in those where are significantly developed (few member countries), while GDP per capita of the others depend on agriculture, services and for some of them also on the extraction of the oil and minerals. (Uexkull, 2012)

As we can see in the Figure 2, GDP per capita vary from less than 500 US dollars in Niger – a landlocked country to more than 3500 US dollars in Cabo Verde – island country. GDP per capita of the whole region is in average approximately 1000 US dollars. Tourism sector, telecommunications and construction in Cabo Verde are the main reason for these results in GDP per capita. (IMF, 2008) Nigeria is worth to be mentioned as well, because of its ability to increase GDP per capita by more than 500 US dollars in five years and in the 2014, it has value 3200 US dollars.

Figure 2: GDP per capita in the ECOWAS countries, 2010 - 2014



Source: WB. Own work.

5.2 Inflation

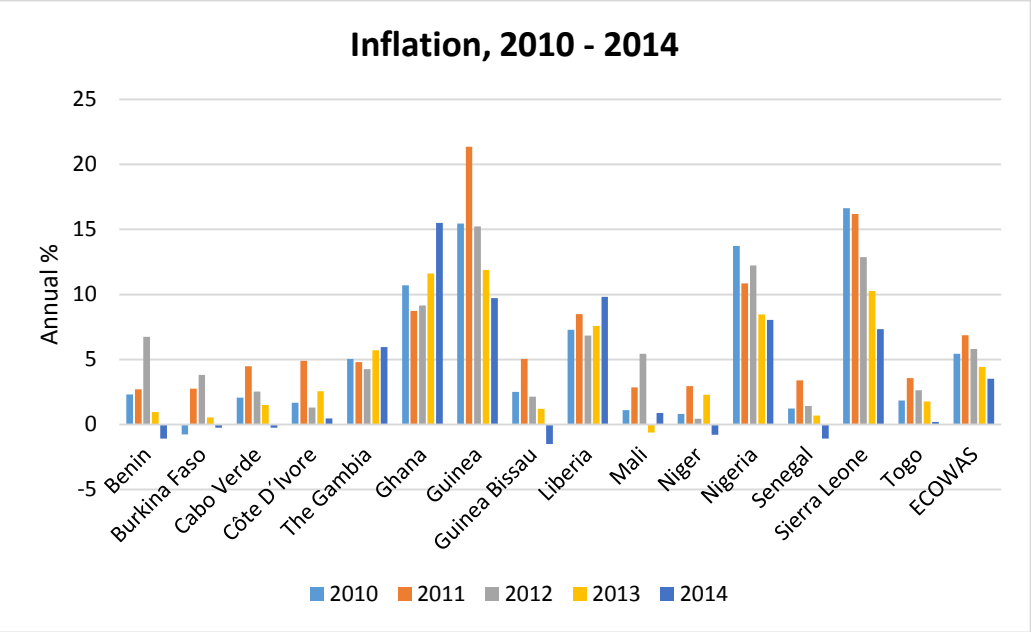
Inflation is significant in economic growth as well. High price inflation rate influences private investment – short-term retail and speculative activities prevail over creation of long-term productive assets. Therefore, rational price stability is important for sustainability of economic growth in real terms. (U.S. Department of State)

By looking at Figure 3, in the period 2010 – 2014, countries experienced decline in inflation except of Niger. Overall inflation of the ECOWAS declined from 6,87% in 2011 to 3,53% in 2014. The highest inflation rates were recorded in Guinea, Sierra Leone, Ghana, Liberia, Nigeria and The Gambia. On the other side, Cote D´Ivoire as well as Senegal and Togo experienced significant decline in inflation rate in the last year of the observed period.

The high inflation rate in the countries mentioned previous paragraph was caused by the Ebola epidemic, which affected three of these countries. The countries influenced by the disease faced pressures of inflation as the Ebola spread, which led to loss of competitiveness of companies, decline in commercial activities and disintegration of the purchasing power of households. Decline of the overall inflation rate was caused by the easing of pressures on the

world commodity markets and tight monetary policies, which were effective in many countries. (United Nations Economic Commision for Africa, May 2015)

Figure 3: Inflation in the ECOWAS countries, 2010 - 2014



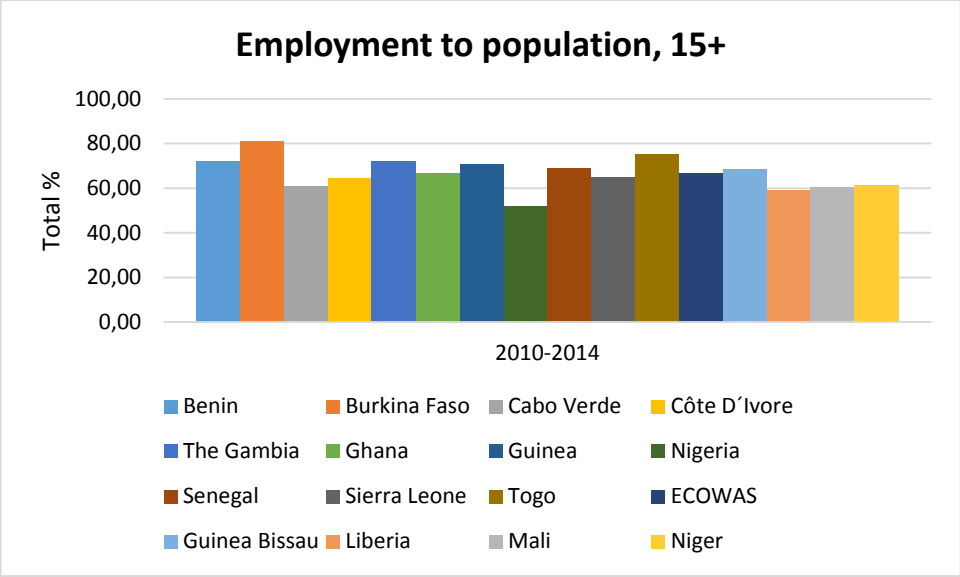
Source: WB. Own work.

5.3 Employment to population ratio

Employment to population ratio is indicator, which measures the country's economic performance and it offers an answer on the question what proportion of the working-age population is employed. (Leon, 1981) High overall ratio is good. Unfortunately, the indicator does not include any information about underemployment, low earnings, terrible working conditions or large informal sector. (OECD, 2002)

Figure 4 shows employment to population ratio in the ECOWAS as well as in individual countries during the years 2010 – 2014. Employment to population ratio of ECOWAS is 66,53%, but as it was mentioned above, it does not rule out existence of large informal sector or poor working conditions. The highest ratio was monitored in Burkina Faso with 80,74% and the lowest one was monitored in Nigeria with not even 52%.

Figure 4: Employment to population ratio, 15+ (%) in ECOWAS countries



Source: WB. Own work.

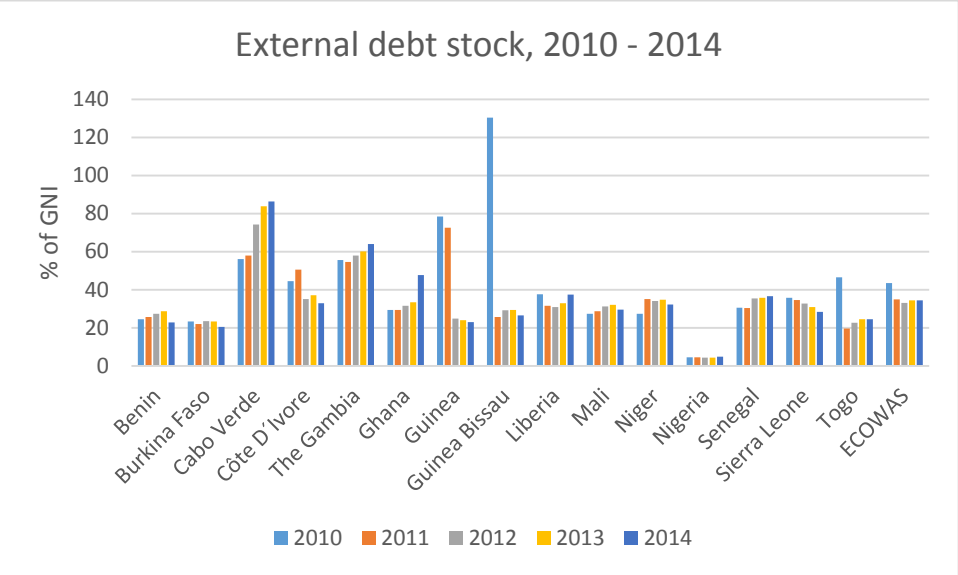
5.4 External debt stock

There are three ways for the country to finance its development – by borrowing, by taxing output or by printing money. (Anyanwu, et al., 2015) External debt is a type of debt borrowed by the government in the international market to finance domestic investment. It is common phenomenon in the developing countries. Internal capital is usually inadequate in African economies, because of the vicious circle of the low productivity, low income and low saving. (Adepoju, et al., 2007)

In the Figure 5, we can see that the external debt stock of Guinea-Bissau rapidly decreased in the year 2010. It was caused by the cancelation of the big part of the debt owed. (IMF, 2013) The Figure 5 also displays external debt stock in the ECOWAS region between 2010 – 2014. The annual average external debt of the ECOWAS countries together less than 40% of its total GNI. We can see that expressed as percentage of GNI, the lowest external debt has Nigeria. The highest external debt stock has Cabo Verde. Significant increase of the debt in the recent years is a result of the decline in revenues and grants as well as increase of the public investments. (IMF, 2014) In spite of the high external debt in Cabo Verde, it is considered to be a model for political rights and civil liberties in Africa. (AfDB, OECD,

UNDP, ECA, 2013) In case of Nigeria, low external debt is caused by oil production. (WorldAtlas, 2016)

Figure 5: External debt stock, 2010 – 2014 in ECOWAS countries (% of GNI)



Source: WB. Own work.

6 Composite indicator

Composite indicator was made in order to examine relationship among economic growth and demography and to evaluate, which country out of the Economic Community of West African States is the best from the economic and demographic point of view. This part of the thesis is primarily focused on the construction of the composite indicators – one for economy and one for demography.

6.1 Theoretical framework

Main reason for the construction of composite indicator is to evaluate overall economic performance of each country and at the same time, to assess their demographic situation. Based on these composite indicators is studied relationship between economic growth and demography. It is a complex topic and therefore composite indicators is used.

Economic growth could be simply measured by the GDP growth, but I decided to use more indictors, because more indicators mean that more information is included. For economic composite indicator were selected GDP per capita, inflation, employment to population ratio (15+) and external debt stock. Demographic situation could be important for economic performance of the country. Population change is one of them, but the same approach applies to demographic composite indicator - that more indicators mean more information. For the second indicator were chosen life expectancy at birth, age dependency ratio, density and population growth. Sub-indicators were chosen subjectively according to their importance to the topic. Availability of data played important role as well.

6.2 Selecting variables

Next step in the construction of the composite indicator is selecting variables. As it was mentioned above, two composite indicators will be constructed – one for economic growth and one for demography. Both of them will include four sub-indicators. Average value of each sub-indicator was used and they cover period of the last 5 years (2010 - 2014). As the last year of this analysis was selected year 2014, mainly because of the missing too many statistical data for the year 2015. As for the economic indicators, its selection was influenced

by the unavailability of some statistical data. Description of these variables is described in the following part.

Economic indicators

GDP per capita is considered to be a core indicator of economic performance. It is often used to measure average living standards or economic well-being, even though it has some deficiency in this regard – it does not show distribution of GDP among people. (OECD, 2012) Gross domestic product per capita is calculated as GDP divided by midyear population where GDP 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. Depletion and degradation of natural resources are not taken into account. (The World Bank Group, 2016b) Unit of these data is current U.S. dollars and source is World Bank and OECD. GDP per capita is marked as MAX.

Inflation, consumer prices is inflation measured by the consumer price index. It means that it expresses the annual percentage change of the relevant set of goods and services in the cost to the average consumer. The set of goods and services may be fixed or changed at specified time intervals, for example yearly. For calculation is commonly used the Laspeyres formula. (The World Bank Group, 2016c) It is very difficult to say if inflation is good or bad, because there is always someone who gains and who loses. High inflation (in some countries hyperinflation) can have catastrophic consequences, but deflation is not good for economy as well. Deflation causes lower economic activity, income as well as economic growth. Nowadays, it is believed by the most economist that low, stable and predictable inflation is good for an economy. (Öner, 2012) Therefore, inflation is marked as MIN. Data unit is percentage and source is IMF, International Financial Statistics and data files.

Employment to population ratio, 15+ says what proportion of the working-age population is employed. Working age population is considered to be age 15 and older. (The World Bank Group, 2016d) This indicator is used to show how well is the economy performing. It shows how fast is economy able to generate jobs to provide employment for a constant proportion of population. Employment to population ratio is often more statistically reliable than unemployment rate and it is exposed to fewer errors in the sample. (Leon, 1981) Statistical

data unit is percentage and source is ILO, Key Indicators of the Labour Market database. Employment to population ratio, 15+ is marked as MAX.

External debt stock is defined as a debt that is owed to nonresidents repayable in currency, goods or services. It is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt. (The World Bank Group, 2016e) External debt may have positive impact in terms of investment and growth of the country. At the same time, growth may be negatively affected, because most of the funds will go in the repayment of the debt rather than used for investments. (Benedict, et al., 2003) Data unit is % of GNI (GNI is defined in chapter 4.1 Economic growth) and source is WB and International Debt Statistics. External debt stock is marked as MIN.

The Table 3 summarizes all sub-indicators of economic growth that will be used for the construction of the composite indicator. These variable are marked with ordinal numbers X1 to X4. The table also displays their unit and source. Last column includes type of the indicators – MIN or MAX.

Table 3: Summary of economic indicators

Ordinal number	Indicator	Unit	Source	Type
X1	GDP per capita	$US	WB, OECD	MAX
X2	Inflation	annual %	IMF	MIN
X3	Employment to population, 15+	%	ILO	MAX
X4	External debt stock	% of GNI	WB, IDS	MIN

Source: WB, own work

Demography indicators

Life expectancy at birth is the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Total life expectancy was derived from male and female life expectancy at birth. (The World Bank Group, 2016f) This indicator is able to measure overall quality of life and sums up the mortality at all ages. (Central Intelligence Agency, 2016) Therefore, it is marked as MAX. Main source of life expectancy data is World Bank, which derives them from various sources. Unit of these data is year.

Age dependency ratio (% of working age population) is a measure of the age structure of the population. It is calculated as a sum of young and old age dependency ratio. (Eurostat, 2013) Data are shown as proportion of the young people (younger than 15 years old) and older people (older than 64) per hundred working-age population. Data source is WB estimation and it is marked as MIN.

Density is calculated as midyear population divided by land area in km^2. Term population include all residents excluding refugees without asylum, because they are residents of their country of origin. (The World Bank Group, 2016g) Source of the data is FAO and WB population estimates. Data unit is number of people per km^2 of land area.

It is very difficult to say whether MIN or MAX type is better for a country. Therefore, correlation matrix for density and GDP per capita was made in order to find out if the lower density, the better and vice versa. Correlation matrices were created for three countries with the lowest density – Mali, Niger, Guinea and three countries with the highest density – Nigeria, The Gambia and Cabo Verde.

Correlation in the group of the countries with the low density is -0,31 and correlation in the high density group of countries is -0,64. Correlation is negative in the both cases, which indicates negative relationship. In the countries with the high density, interdependence between GDP per capita and density is just stronger. Therefore, density is marked MIN.

Population growth (annual %) is increase in the number of inhabitants living in one country in the comparison with the previous year. It is derived from total population and it measures speed of the population change. (The World Bank Group, 2016h) Unit of measurement is percentage and data are taken from WB that used various sources such as UN or census reports. Population growth is marked as MIN.

Table 4 summarizes all demographic sub-variables that will be used for the construction of the composite indicator. These variable are marked with ordinal numbers Y1 to Y4. The table also displays their unit and source. Last column includes type of the indicators – MIN or MAX.

Table 4:Summary of demographic indicators

Ordinal number	Indicator	Unit	Source	Type
Y1	Life expectancy	age	WB	MAX
Y2	Age dependency	Per hundred persons aged 15 - 64	WB	MIN
Y3	Density	People per km^2	WB	MIN
Y4	Population growth	%	WB	MIN

Source: WB, own work

6.3 Descriptive statistics, correlations and weighting

Both of these datasets do not contain any missing value and therefore I can skip step where missing values are treated. Basic statistical analysis is needed before construction of the indicators – it includes mean, median, minimum, maximum, variance, standard deviation, coefficient of variance, kurtosis and skewness. This subchapter also contains both correlation matrixes.

Economic indicators

Table 5 : Descriptive statistics – economic indicators

	Mean	Median	Min.	Max.	Variance	Std.Dev.	Coef.Var.
X1	1077,514	667,1600	394,38	3584,41	856652,3	925,5551	85,89727
X2	5,216	2,1900	1,13	14,73	23,4	4,8350	92,69527
X3	66,533	66,7200	51,70	80,74	52,7	7,2591	10,91052
X4	36,021	33,7100	4,49	71,71	245,8	15,6794	43,52802

Source: WB, own work using Statistika

Table 5 shows that the highest value of mean and median have GDP per capita with 1077 U.S dollars and 667 U.S. dollars. On the other side, lowest value of these characteristics has inflation, representing value of 5,2% and 2,1%. GDP per capita also has the highest value of variance and standard deviation, but coefficient of variation is highest for inflation. It means that the highest variability can be found in inflation. The lowest variability has employment to population data.

Table 6: Skewness and kurtosis - economic indicators

	Skewness	Kurtosis
X1	1,986886	3,454395
X2	0,930660	-0,784998
X3	-0,048962	0,310790
X4	0,500538	1,580138

Source: WB, own work using Statistica

Table 6 displays skewness and kurtosis[7] of the economic indicators. The highest skewness is found in GDP per capita with the value of 1,98, which means right sided asymmetry. The highest value of kurtosis is found in GDP per capita and it indicates peaked distribution. The lowest value occurs in inflation and it indicates flat distribution.

Table 7: Correlation matrix - economic indicators

	X1	X2	X3	X4
X1	1	0,032378	-0,493785	0,160048
X2	0,032378	1	-0,254294	-0,136531
X3	-0,493785	-0,254294	1	0,118065
X4	0,160048	-0,13653	0,118065	1

Source: WB, own work using Statistica

Correlation matrix is necessary for determination of the similarity and dependency between the indicators. Value of correlation coefficient is always between -1 and +1. These two values also show the highest correlation. Value 0 means there is no correlation between the indicators. Table 7 displays correlation between economic indicators. We can see that highest correlation is between GDP per capita and employment to population and it has value – 0,49. This coefficient indicates moderate to significant relationship between the indicators. All other indicators have less significant value of correlation. In our case, it means that data does not require reduction and composite indicator can be constructed.

[7] Skewness describes asymmetry of the dataset – right-sided (coefficient of skewness is higher than zero) or left-sided asymmetry (lower than zero). Data are completely symmetric if the coefficient equals to zero. Kurtosis describes shape of the data distribution – peaked distribution (coefficient of kurtosis is higher than zero) or flat distribution (lower than zero). If the coefficient of kurtosis is equal zero, then data distribution is close to normal. (Jadczaková, 2015a)

Demographic indicators

Table 8: Descriptive statistics - demographic indicators

	Mean	Median	Min.	Max.	Variance	Std.Dev.	Coef.Var.
Y1	58,44	58,6	49,6	73	33,144	5,75708	9,85127
Y2	86,452	85,7	56,51	111,71	149,235	12,2162	14,13059
Y3	85,001	71,66	13,21	184,84	2688,47	51,8504	60,99953
Y4	2,5147	2,72	0,97	3,25	0,445	0,66746	26,54254

Source: WB, own work using Statistica

Table 8 displays basic statistical characteristics of the demographic indicator. The highest value of the mean and median has age dependency and the lowest value can be seen in population growth. Density has the most variable data with the highest value of coefficient of variation as well as variance and standard deviation. The lowest variability of data is monitored in life expectancy.

Table 9: Skewness and kurtosis - demographic indicators

	Skewness	Kurtosis
Y1	0,86132	2,052819
Y2	-0,42228	2,561752
Y3	0,63233	-0,12412
Y4	-1,57423	1,968202

Source: WB, own work using Statistica

Skewness and kurtosis of demographic indicators is displayed in Table 9. The highest negative value of skewness has population growth and it indicates left-sided asymmetry. Life expectancy and density show right-sided asymmetry, but it is not extreme. The highest value of kurtosis has age dependency ratio and it means peaked data distribution. With the similar value of kurtosis and peaked distribution are also life expectancy and population.

Table 10: Correlation matrix - demographic indicators

	Y1	Y2	Y3	Y4
Y1	1	-0,40592	0,0612	-0,326914
Y2	-0,405919	1	-0,386231	0,200958
Y3	0,0612	-0,38623	1	0,215399
Y4	-0,326914	0,200958	0,215399	1

Source: WB, own work using Statistica

Table 10 displays correlation matrix of the demographic indicators. The highest value of correlation can be seen between life expectancy and age dependency with the value -0,4 and also between life expectancy and density with the value -0,38. It means their relationship is moderate. Correlation coefficients of other indicators are lower and therefore, these data may be used for construction of the composite indicator.

Weighting of the data is not necessary. Correlation of the indicators (see Table 7, Table 10) does not show any significant relationship between them and therefore this step will be skipped. All indicators will have the same weight.

6.4 Normalization

Next step in the analyses is to standardize datasets with different units. Standardization is necessary to do in order to get dimensionless, easily aggregated indicators. As it was mentioned in theoretical part, there is number of standardization methods. For construction of these composite indicators was chosen MIN – MAX method (or re-scaling). In order to process with this standardization method, type of the indicators (min or max) was established in the previous chapter (see Table 3 and Table 4). Min type of indicator means that lower the value of indicator, the better. Max type means that the higher value, the better.

This method is based on the transformation of the original indicators to the range <0;100>. Max type of indicator is transformed with equation $B_1 = \frac{X_1 - \min(X_1)}{\max(X_1) - \min(X_1)} * 100$. Min type of indicator is calculated as $B_1 = \frac{\max(X_1) - X_1}{\max(X_1) - \min(X_1)} * 100$. Difference between the highest value (max) and the lowest value (min) of the indicator is called *range*. (Jadczaková, 2015b) The results of normalization are found in Table 37 and Table 39 in Appendix.

6.5 Aggregation and presentation of results

Next step in analysis was aggregation of the sub-indicators into the composite indicator. Sum approach was used for both of them, because datasets are not missing values. The higher the number of the sum, the better. It means that economic and demographic situation is the best in these countries. Sum of the composite indicator and ranking of the countries are shown in the Table 11 and Table 12. The last column in the Table 11 and Table 12 is index of each

country – its unit is percentage. It is calculated as sum of individual country divided by the overall mean. The result 100% indicates the average results. All countries with the index highest than 100% show above average results and vice versa, countries with the index lower than 100% have under average results. Either sum or index creates the final ranking.

Table 11 indicates that the best overall economic situation is in Burkina Faso, Togo and Benin. Burkina Faso shows the best employment, good inflation and the second lowest external debt. The only weakness is spotted in GDP per capita. On the other side, the worst situation can be found in Guinea with the highest inflation and low GDP growth.

Table 11 : Evaluation of the composite indicator of the economic situation

Countries	SUM	RANK	INDEX
Benin	243,098	3	124,320
Burkina Faso	281,052	1	143,730
Cabo Verde	225,113	5	115,123
Côte D´Ivoire	213,612	6	109,241
The Gambia	163,528	12	83,628
Ghana	170,442	11	87,164
Guinea	108,498	15	55,486
Guinea Bissau	192,567	9	98,478
Liberia	131,568	13	67,284
Mali	199,440	8	101,993
Niger	191,392	10	97,878
Nigeria	203,783	7	104,214
Senegal	235,830	4	120,603
Sierra Leone	127,068	14	64,983
Togo	246,138	2	125,875
Overall mean	195,542		

Source: Own work using MS Excel

Table 12 indicates that the best demographic situation can be found in Cabo Verde, which has the best life expectancy at birth and age dependency ratio. It is followed by Niger, which has the slowest population growth between these countries. The worst situation is monitored in Nigeria, which has the highest population density and in other demographic aspect does not show any outstanding results. It is followed by The Gambia with the fastest population growth and again, not so well results in other areas.

Table 12:Evaluation of the composite indicator of the demographic situation

Countries	SUM	RANK	INDEX
Benin	168,012	8	96,582
Burkina Faso	151,553	12	87,121
Cabo Verde	329,923	1	189,657
Côte D´Ivoire	160,256	10	92,124
The Gambia	76,745	14	44,117
Ghana	195,163	3	112,190
Guinea	184,656	6	106,150
Guinea Bissau	188,509	5	108,365
Liberia	194,928	4	112,055
Mali	163,617	9	94,056
Niger	243,159	2	139,781
Nigeria	66,092	15	37,993
Senegal	183,875	7	105,701
Sierra Leone	152,715	11	87,789
Togo	150,158	13	86,319
Overall mean	173,957		

Source: Own work using MS Excel

Relationship between economy and demography

This part of the thesis is focused on the relationship among the economy and demography with the using of the composite indicators calculated above. Correlation analysis is used.

Table 13: Correlation matrix of economic growth and demography

Variable	Demography	Economy
Demography	1,000000	0,044348
Economy	0,044348	1,000000

Source: WB. Own work.

The Table 13 displays correlation matrix. The correlation coefficient between economic growth and demographic situation is really low – close to zero. It means that there is no linear relationship between the indicators and demographic situation does not contribute to the economy in this region.

By comparing the results visually (see Table 11 and Table 12), Burkina Faso ranked as the best one in economic growth, but it ranked as 12 in the demographic situation. Cabo Verde, which ranked as the best country in the region from demographic point of view, has also above-average results in the analysis of economic growth. This supports correlation analysis above and it confirm that there is no relationship between economic growth and demography while using average data.

7 Canonical correlation analysis

Main aim of the canonical correlation analysis is to find out relationship between economy and demography in order to evaluate if there is a need for a change to maintain good economic performance of this group of countries. Similarly, as in the previous analysis, this analysis will analyze all 15 countries of ECOWAS, though not individually, but together as a group. Analysis used panel data and it means that it comprises data out of all countries for the last five years – from 2010 until 2014. Year 2015 was not included due to unavailability of data.

Selected indicators – GDP per capita, inflation, employment to population, external debt balance, life expectancy, age dependency, density and population growth, were divided into two groups – one represents economy (left set) and another one represents demography (right set). Their division is displayed in the Table 14. I decided to mark indicators from X1 – X4 and Y1 – Y4 in order to simplify them in the correlation table.

Table 14: Left and right set of the analysis

Left set: U (p=4)		**Right set: V (q=4)**	
X1	GDP per capita	**Y1**	Life expectancy
X2	Inflation	**Y2**	Age dependency
X3	Employment to population	**Y3**	Density
X4	External debt balance	**Y3**	Population growth

Source: own work

From the table 14, we can see that it is possible to get maximum four pairs of canonical variates, because the number of pairs depends on the lowest number of indicators in the group. Left and right set have the same amount of indicators (p=q) and therefore, four pairs.

Table 15: Correlation

	X1	X2	X3	X4	Y1	Y2	Y3	Y4
X1	1,0000	0,0083	-0,4868	0,1049	0,3802	-0,6350	0,5080	-0,6597
X2	0,0083	1,0000	-0,2311	-0,0246	-0,3184	-0,1465	0,1887	-0,1458
X3	-0,4868	-0,2311	1,0000	0,0918	0,0684	0,0414	-0,0459	0,1342
X4	0,1049	-0,0246	0,0918	1,0000	0,3745	-0,3321	0,0211	-0,3117
Y1	0,3802	-0,3184	0,0684	0,3745	1,0000	-0,3970	0,0657	-0,2212
Y2	-0,6350	-0,1465	0,0414	-0,3321	-0,3970	1,0000	-0,3866	0,9080
Y3	0,5080	0,1887	-0,0459	0,0211	0,0657	-0,3866	1,0000	-0,2986
Y4	-0,6597	-0,1458	0,1342	-0,3117	-0,2212	0,9080	-0,2986	1,0000

Source: WB, own work using Statistica

Next step is correlation matrix. Table 15 displays correlation between all indicators. Higher the correlation is, the better. Correlation between the indicators is not perfect and in some cases looks problematic, but I decided not to remove them in order to have the most accurate comparison among analyses.

Table 16: Canonical Analysis Summary

N=75		**Canonical R: ,88333 Chi2(16)=133,34 p=0,0000**	
		Left (Set)	Right (Set)
No. of variables		4	4
Variance extracted		100,000%	100,000%
Total redundancy		27,3432%	48,1084%
Variables:	**1**	GDP per capital	Life expectancy
	2	Inflation	Age dependency
	3	Employment to population	Density
	4	External debt balance	Population growth

Source: WB, own work using Statistica

Canonical analysis summary shows the first results and it is displayed in the Table 16. The file size n=75 (five-year data for 15 countries). Canonical R that refers to the overall correlation is 0,88 and thus overall statistical significance. Overall correlation is also equal to the correlation between the first pair of canonical vitiates. Value p tells us a risk probability of rejecting a true null hypothesis and in our case, it is equal to zero and it means that for the first pair of canonical variates is chance of error 0%. As we can see number of variables in both groups is four and variance extracted 100% explains how well canonical variate U

explains variates X1, X2, X3 and X4. It means that 100% of the variance was pulled out. The same applies to right set and canonical variate V with variates Y1, Y2, Y3 and Y4. The result 100% is caused by the fact that p=q. Total redundancy of the left set is 27,3% and means that left set explains variance of the right set on 27,3%. And vice versa, right set explains variance of the left set on 48,1%.

Table 17: Variance extracted - left set, right set

Root Factor	Variance (extractd)	Reddncy.
Root 1	0,237376	0,185219
Root 2	0,239535	0,064628
Root 3	0,303529	0,016493
Root 4	0,219560	0,007093

Root Variable	Variance (extractd)	Reddncy.
Root 1	0,533250	0,416082
Root 2	0,204044	0,055052
Root 3	0,066442	0,003610
Root 4	0,196263	0,006340

Source: WB, own work using Statistica

Table 17 indicates ability of the variates X1-X4 (on the left side) and Y1-Y4 (right side) to predict variability of their own set as well as variability of the second set. Variance extracted in the left set is equally distributed.[8] Canonical variate U3 explains 30% of the variability of the indicators of the economic performance, but it does not explain variability of the right set at all with redundancy 0%. Canonical variate U1 predicts the variability of the right set the best with the 41%. In the right set, canonical variate V1 reproduces 53% of its own variability and at the same time 18% of the variability of the left set. From the Table 17, we can conclude that the pair of canonical variates U1 and V1 predicts variability of the right, respectively left set the best.

Next step is to test importance of the canonical correlation coefficient to find out whether these coefficients can be considered representative to the other countries or regions. Testing points out if we need all four canonical coefficients.

[8] Sum of the variance in all roots gives us total variance extracted for left, respectively right set.

Table 18: Chi-Square Tests with Successive Roots Removed

Root Removed	Canonicl (R)	Canonicl (R-sqr.)	Chi-sqr.	df	p	Lambda (Prime)
0	0,883332	0,780275	133,3378	16	0,000000	0,146823
1	0,519428	0,269806	28,0190	9	0,000950	0,668211
2	0,233104	0,054338	6,1651	4	0,187179	0,915114
3	0,179733	0,032304	2,2822	1	0,130876	0,967696

Source: WB, own work using Statistica

Test of our hypotheses is displayed in the Table 18. The first column shows number of the roots removed. Canonical R indicates correlation among the pairs of the canonical variates – between the first pair of the canonical variates: $R_{(C)1} = R$ (U1, V1) = 0,883 and between the second pair is correlation 0,51. Value p shows probability of the error – probability of the false rejection of the hypothesis H0 when it is valid. The first two canonical roots are important, because chance of the error is 0%.

Two hypothesis are formulated:

H0: All canonical correlation coefficients are zero - $R_{(C)1} = R_{(C)2} = R_{(C)3} = R_{(C)4} = 0$

Ha: At least one (the first one) correlation coefficient is not zero - $R_{(C)1} \neq 0$

The hypothesis H0 is rejected, because p < 5%. The hypothesis Ha is accepted and the hypothesis are reformulated:

H0: All canonical correlation coefficients are zero - $R_{(C)2} = R_{(C)3} = R_{(C)4} = 0$

H1: At least one (the first one) correlation coefficient is not zero - $R_{(C)2} \neq 0$

The same as above, the hypothesis H0 is rejected and Ha is accepted because p < 5%. The hypotheses are reformulated until we accept the hypothesis H0.

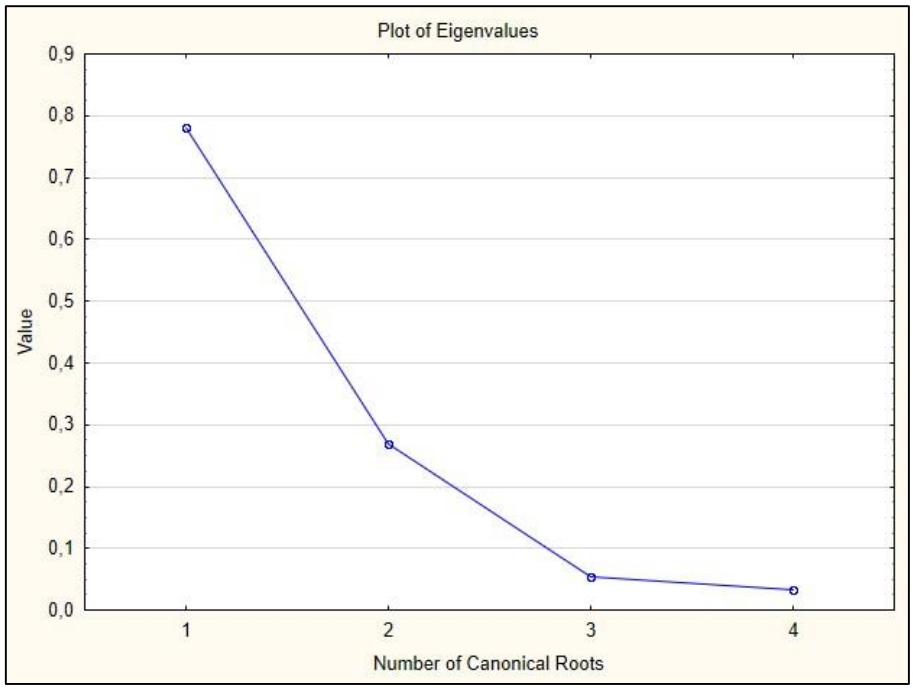
H0: All canonical correlation coefficients are zero - $R_{(C)3} = R_{(C)4} = 0$

H1: At least one (the first one) correlation coefficient is not zero - $R_{(C)3} \neq 0$

In this case, the hypothesis H0 is accepted, because p > 5 %. It means that the third and fourth canonical coefficients are equal to zero. The first and the second canonical coefficients are statistically important, because they are not equal to zero.

The third column in the Table 18 - Canonical R-sqr. explains variance within the function (in this case 78% for the first function and 26% of the variance within second function). It has the same value as eigenvalues, which together with the plot of eigenvalues is also helpful tool while deciding about optimal number of canonical roots. Based on the Figure 6, it is visible that two canonical roots are optimal, because they sufficiently describe correlation between both sets.

Figure 6: Plot of Eigenvalues



Source: WB, own work using Statistica

Table 19 and Table 20 shows how indicators X1 – X4 and Y1 – Y4 are associated with the pairs of canonical variates (roots) – in our case with the first and the second pair of canonical variates. The Root 3 and Root 4 were removed; therefore, the focus is only on the first two roots.

Table 19 indicates that GDP per capita contributes to the first canonical root the most, with the correlation -0,88 and the biggest contribution to the second root has inflation with correlation -0,86. It is important to know that negative factor loadings is as important as

positive one. The sign plus/minus refers to the way it relates to the factor – positively or negatively.

Table 19: Factor structure, left set

Root Variable	Root 1	Root 2
X1	-0,883880	-0,018754
X2	-0,039688	-0,867157
X3	0,101849	0,059775
X4	-0,395364	0,449729

Source: WB, own work using Statistica

From the Table 20, we can see that the most related to the first canonical variate has age dependency ratio (Y2) with the highest factor with 0,86 and to the second, life expectancy at birth with factor 0,71. Statistically unimportant are roots with low correlation.

Table 20: Factor structure, right set

Root Variable	Root 1	Root 2
Y1	-0,546998	0,718861
Y2	0,860024	0,183705
Y3	-0,624121	-0,490659
Y4	0,839420	0,157868

Source: WB, own work using Statistica

The canonical weights show what new indicators bring to the canonical variate. The highest canonical weight in the left set shows again GDP per capita in the Root 1 as well as in the Root 2 together with the inflation. In the right set, the highest weight has population growth in the Root 1 and age dependency ratio together with life expectancy at birth and population growth in the Root 2. The indicator age dependency ratio in the Root 1 has high value in the Table 20, but its weight (see Table 22) is low and it means that this indicator did not bring anything new to the canonical variate.

Table 21: Canonical weights, left set

Variable	Root 1	Root 2
X1	-1,06315	-0,205700
X2	-0,13497	-0,922428
X3	-0,42408	-0,297246
X4	-0,24822	0,475890

Source: WB, own work using Statistica

Table 22: Canonical weights, right set

Variable	Root 1	Root 2
Y1	-0,421385	1,031705
Y2	-0,200160	1,159704
Y3	-0,435579	-0,339539
Y4	0,797922	-0,768323

Source: WB, own work using Statistica

Significant canonical correlation between the indicators in the both sets based on the first two roots are results of the relationship between inflation and GDP per capita with the life expectancy, age dependency and population growth.

Canonical correlation analysis was conducted using four indicators in left set and four indicators in the right set to evaluate the relationship between the two sets of variables. Canonical correlation coefficients reflect the strength of the relationship between the pair of variates. Due to the same number of the indicators in both sets (p=q), four canonical coefficients were found. Their statistical importance was tested and the last two were rejected, because of their little relevance to the analysis (p > 5 %) and therefore, they were skipped in the interpretation.

Overall canonical correlation is 0,88. It is statistically very significant because value p is lower than α=0,05 and it can be interpreted as a simple correlation corresponding to the first and the most important canonical pair.

Explanation of the variability of the opposite set is total redundancy – in this case 27% and 48%. It means that the right set better explain the left set than vice versa. It also shows the size of the correlation between the indicators in its own set. Lambda (prime) tells us total

unexplained variance by the model, in this case $\lambda = 0{,}146$ and it means that this model explains about 85% of the variance shared between the variable sets.

Based on the result of factor structures, we can conclude that the relationship between economic growth and demography exists and it is based on the relationship between GDP per capita and inflation with life expectancy at birth, age dependency, density and population growth.

8 Discussion

Since forever, African countries – ECOWAS included, face population growth. But in the recent years - since the new millennium, rapid GDP growth is recorded in the countries of ECOWAS as well. There are many studies examining relationship between economic growth and demography, but all of these studies offer different results whether there is or there is not relationship between economic growth and demography. Some of the studies argue if the relationship is positive or negative. Purpose of this thesis was to examine the relationship between economic growth and demography and therefore, 2 hypotheses were formulated:

1. There is a cross-sectional relationship between economic growth and demography.

2. There is a short-run relationship between economic growth and demography.

A thorough analysis of the region's economic growth and its demography offers insight into the situation in each country. According to the results, the answer to the hypotheses are verified.

In the research with the case study Pakistan by Furuoka and Munir, where the relationship between economic growth and population growth was studied and the research by Sibe, Chitchous and Megne focused on the 30 the most populated countries was confirmed positive relationship. We cannot exactly compare these studies with my thesis, mainly because these authors used time-series and therefore, different analyses were used. However, the result of the canonical correlation analysis in this thesis supports this statement and it confirms correlation between economic growth and demography. Another difference between my thesis and these two studies or any studies focusing on this relationship is selection of the indicators. While majority of the papers use GDP growth (Furuoka and Munir) or in some cases income or per-capita income (case of Sibe et.al.) as indicator determining economic growth, economic growth in this thesis is used as a term for economic development and it is characterized by GDP per capita, inflation, employment to population ratio and external debt stock. The same applies to demography – the most studies looks for a correlation only with population growth, while this thesis focus on demography as whole with selected indicators – life expectancy, age-dependency ratio, density and population growth.

There are two studies focused on the slow economic growth in the African countries in the last century – one by Sachs and Warner (1997) and another one by Bloom and Sachs (1998). The relationship between economic growth and demography is not their main focus, but it is part of it. These two studies confirm, beside the other relationships, correlation between economic growth, dependency ratio and population change. The result of canonical correlation analysis supports this statement with one difference –the analysis in this thesis examines short-run relationship instead of long-run.

Different results from the analysis looking for relationship between economic growth and population growth are found in the research papers from Dawson and Triffin in the case of India in 1998 and Thorton in 2001 in seven countries of Latin America. These studies suggest that long-term relationship between economic growth and population change does not exist. The main difference between these two studies and my thesis are used methods. Authors used time-series in the analysis of the relationship. The composite indicator analysis, which is used in this thesis to find correlation between economic growth and demography as well, says that there is no cross-sectional relationship between demography and economic growth. This statement is confirmed with almost no correlation between demographic and economic indicators, which are calculated from the same variables used for canonical correlation analysis.

The analyses examine relationship with different approaches. While composite indicator works with the average data of the last five-year period, canonical correlation analysis works with the full dataset of each country.

While canonical correlation confirms the hypothesis with answer yes, the composite indicator analysis does not confirm the hypothesis. The main reason of the different results is that composite indicator does not include all the information and some information is lost in the analysis -each indicator is represented by one average number, which counts for five years.

Composite indicator analysis that used cross-section data in this thesis confirms the results of the early study by Anthony P. Thirwall in 1972 that found no relationship between population growth, the growth of output and output per capita. Many other studies written by

the authors such as Easterlin, Kuznets and Simon who also used cross-section data and studied this topic in the last century are confirmed by the results in this thesis.

Use of average data and lost information in process is not the limitation of the composite indicators in this thesis, because it examines cross-sectional relationship. It means that data are collected from the same point of time (they are also averaged in this case) and it does not take time into account. The most problematic aspect occurs while constructing of the demographic composite indicator. It is determination of the MIN or MAX type of indicator in the population growth and density. These two indicators are special, because it is very difficult to say whether they are MIN or MAX type. Decision needs to be done before construction of the composite indicator and after further consideration, I decided that they will be marked MIN. Population growth is MIN because even though growth of population is good for the country and it does not necessarily mean that more children is born, rapid population growth is not positive in our case. Density is marked as MIN as well. It is based on the correlation of the data of three countries with highest density and three countries with the lowest density with their GDP per capita. The results suggest negative correlation and therefore it was marked MIN.

From the two formulated hypotheses, one is confirmed and another denied. There is a short-run correlation between economic growth and demography in the ECOWAS region. The relationship does not exist when we do not include change in time into analysis. Although, the results of the analyses are different, due to the lost information and use of average data for the individual countries in the construction of the composite indicator, this analysis does not have such informative value as canonical correlation analysis, which works with all data.

This thesis gives us another answer to the question about relationship between economic growth and demography, but it provides the first answer for the region of ECOWAS. None of the previous researches focus on this region. There are two studies with the focus on the whole African continent (or Sub-Saharan Africa), but it is not up to date. Since new millennium, economic growth in Africa grew and the type of the relationship could shift.

Conclusion

The main aim of the thesis *Analysis of selected demographic and economic indicators of the ECOWAS countries* is to examine the relationship between demography and economic growth in the Economic Community of West African States region. Relationship is examined with the canonical correlation analysis and composite indicators. The canonical correlation analysis uses annual data for a five-year period, while composite indicator used average data from the same five-year period. The variables used for the analyses were divided into two sets - one representing economic growth and another representing demography. Each set consists four indicators. The set representing economic growth includes GDP per capita, inflation, employment to population ratio (15+) and external debt stock. The set representing demography consists life expectancy at birth, age dependency ratio, density and population growth. Another objective is to analyze demographic and economic situation and present their development over the recent years.

The theoretical part of this thesis provides overview of the region, description of demography, economic growth and the studies examining their mutual relationship.

The first part of the analytical part includes analyses of the selected demographic and economic indicators in the individual countries of ECOWAS and for the whole region as well. This analyses consist of the same indicators that are used for the further analysis in the thesis. The results of the demographic analysis confirm that the region has long way to go to improve their situation. While population growth does not necessarily mean problem, rapid population growth such as in Nigeria, together with their life expectancy at birth 53 years (2014 est.) could. The life expectancy in the region is higher than in Nigeria, but it is still low with just 59 years. The results of the economic analysis show that while the country may show great result in one aspect of economic growth, another aspect shows poor results. The analysis suggests that while the region recorded GDP growth over the recent years, focus needs to be also elsewhere – six countries have inflation higher than 5% and all countries, except of Nigeria are highly indebted.

The second part of the analytical part is focused on the construction of the demographic and economic composite indicator, followed by the correlation analysis in order to find relationship between economic growth and demography. With the same aim, canonical correlation analysis was made. Based on this analyses and their results, I was able to verify formulated hypotheses:

1. There is a cross-sectional relationship between economic growth and demography.
2. There is a short-run relationship between economic growth and demography.

The first hypothesis was not confirmed. Based on the composite indicators and correlation analysis, no relationship is found. The best demographic situation was found in Cabo Verde, Niger and Ghana and while economic growth of Cabo Verde is above average and ranked as 5th, economic growth of Niger and Ghana are below average. The worst rating of the demographic situation gained Nigeria, The Gambia and Togo and while The Gambia ranked as 12th in economic growth, another two countries ranked above average – Nigeria 7th and Togo 2nd.

The second hypothesis was confirmed. The results of the canonical correlation analysis proved that the short-run relationship between economic growth and demography exists. This analysis is using annual data for a five-year period over the years 2010 – 2014 and it is possible to confirm that there is significant short-run relationship between economic growth and demography in the region.

From the results of this thesis as well as from all previous studies, we can generally conclude that the relationship between economic growth and demography (or in many studies population growth) is not universal and it is different from country to country or from region to region. It is even different over the time.

After evaluation of the results from the previous analyses, I think that it would be useful to extend the analysis to a larger time interval – 10/15 years, use time-series and find out the type of relationship, because it would give us more information about the relationship and it would confirm one of the thesis hypothesis.

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LIST OF ABBREVIATONS

AfDB	African Development Bank
CIA	Central Intelligence Agency
ECA	Economic Commission for Africa
ECOWAS	Economic Community of West African States
FAO	Food and Agriculture Organization
FDI	Foreign direct investment
GDP	Gross domestic product
GNI	Gross national income
ILO	International Labour Organization
IDS	International Debt Statistics
IMF	International Monetary Fund
OECD	Organisation for Economic Co-operation and Development
ODA	Official development assistance
UN	United Nations
UNDP	United Nations Development Programme
WB	The World Bank

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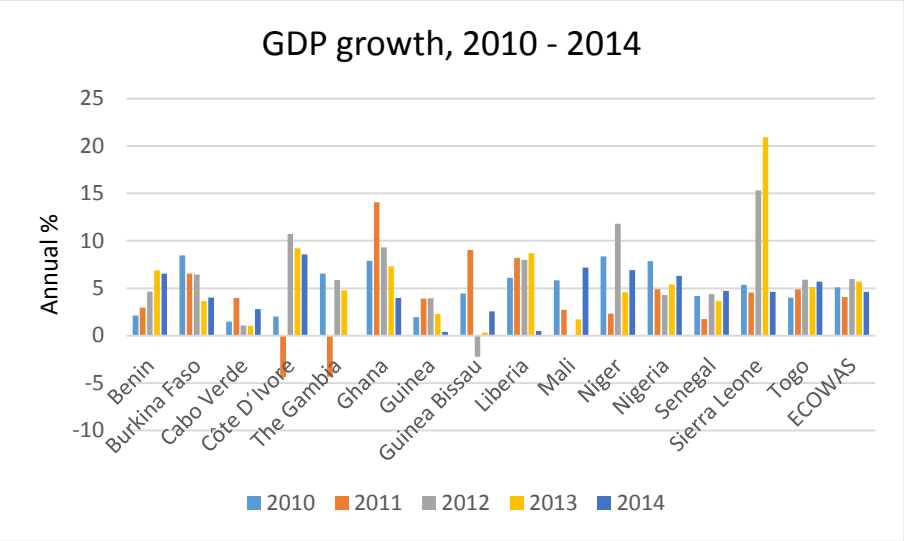
Appendix

Figure 7: GDP growth in the individual ECOWAS countries



Source: World Bank. Own work.

Table 23: ECOWAS countries and its basic statistical data for the year 2014

Countries	Population	Land Area (km^2)	Population Density (people/km^2)
Benin	10598482	112760	93,99
Burkina Faso	17589198	273600	64,29
Cabo Verde	513906	4030	127,52
Côte D´Ivoire	22157107	318000	69,68
The Gambia	1928201	10120	190,53
Ghana	26786598	227540	117,72
Guinea	12275527	245720	49,96
Guinea Bissau	1800513	28120	64,03
Liberia	4396554	96320	45,65
Mali	17086022	1220190	14
Niger	19113728	1266700	15,09
Nigeria	177475986	910770	194,86
Senegal	14672557	192530	76,21
Sierra Leone	6315627	72180	87,5
Togo	7115163	54390	130,82
ECOWAS	339825169	5032970	67,52

Source: World Bank, 2014. Own work.

Table 24: Population of individual countries in the 2010 – 2014

Population	2010	2011	2012	2013	2014
Benin	9509798	9779391	10049792	10322232	10598482
Burkina Faso	15632066	16106851	16590813	17084554	17589198
Cabo Verde	490379	495159	500870	507258	513906
Côte D´Ivore	20131707	20604172	21102641	21622490	22157107
The Gambia	1693002	1749099	1807108	1866878	1928201
Ghana	24317734	24928503	25544565	26164432	26786598
Guinea	11012406	11316351	11628767	11948726	12275527
Guinea Bissau	1634196	1673509	1714620	1757138	1800513
Liberia	3957990	4079574	4190155	4293692	4396554
Mali	15167286	15639115	16112333	16592097	17086022
Niger	16291990	16946485	17635782	18358863	19113728
Nigeria	159424742	163770669	168240403	172816517	177475986
Senegal	12956791	13357003	13780108	14221041	14672557
Sierra Leone	5775902	5908908	6043157	6178859	6315627
Togo	6390851	6566179	6745581	6928719	7115163
ECOWAS	304386840	312920968	321686695	330663496	339825169

Source: World Bank. Own Work.

Table 25: Population growth in the individual countries (%)

Population growth	2010	2011	2012	2013	2014
Benin	2,87	2,80	2,73	2,67	2,64
Burkina Faso	3,03	2,99	2,96	2,93	2,91
Cabo Verde	0,76	0,97	1,15	1,27	1,30
Côte D´Ivore	2,24	2,32	2,39	2,43	2,44
The Gambia	3,25	3,26	3,26	3,25	3,23
Ghana	2,52	2,48	2,44	2,40	2,35
Guinea	2,73	2,72	2,72	2,71	2,70
Guinea Bissau	2,31	2,38	2,43	2,45	2,44
Liberia	3,51	3,03	2,67	2,44	2,37
Mali	3,17	3,06	2,98	2,93	2,93
Niger	3,88	3,94	3,99	4,02	4,03
Nigeria	2,68	2,69	2,69	2,68	2,66
Senegal	2,94	3,04	3,12	3,15	3,13
Sierra Leone	2,25	2,28	2,25	2,22	2,19
Togo	2,71	2,71	2,70	2,68	2,66
ECOWAS	**2,72**	**2,71**	**2,70**	**2,68**	**2,67**

Source: World Bank. Own Work.

Table 26: Proportion of the female and male population in ECOWAS

Population	2010	2011	2012	2013	2014
ECOWAS	304 386 840	312 920 968	321 686 695	330 663 496	339 825 169
% of females	50,15	50,14	50,12	50,1	50,09
% of males	49,85	49,86	49,88	49,9	49,91
No. of females	152659824,8	156893209,9	161235083,9	165677284,8	170209957,3
No. of males	151727015,2	156027758,1	160451611,1	164986211,2	169615211,7
Femininity index	100,61	100,55	100,49	100,42	100,35
Masculinity index	99,39	99,45	99,51	99,58	99,65

Source: World Bank. Own Work.

Table 27: Percentage of the female population

Female population (%)	2010	2011	2012	2013	2014
Benin	50,24749	50,21433	50,18802	50,16647	50,14714
Burkina Faso	50,50642	50,47923	50,45296	50,42753	50,40286
Cabo Verde	50,7797	50,74612	50,71995	50,69866	50,67872
Côte D´Ivore	48,94122	48,98471	49,02559	49,06451	49,10225
The Gambia	50,47649	50,48279	50,48807	50,49243	50,49598
Ghana	50,51119	50,50024	50,45225	50,38288	50,3122
Guinea	49,94259	49,92686	49,90931	49,89101	49,87348
Guinea Bissau	50,36262	50,36095	50,36037	50,36042	50,36081
Liberia	49,71326	49,68828	49,66439	49,64147	49,61952
Mali	49,60156	49,57861	49,56197	49,54857	49,53468
Niger	49,6582	49,64121	49,62861	49,61875	49,60964
Nigeria	49,16054	49,14141	49,12305	49,10556	49,08905
Senegal	51,0351	51,01979	50,9942	50,96243	50,92948
Sierra Leone	50,61987	50,60028	50,57926	50,55772	50,53668
Togo	50,74215	50,70948	50,67863	50,64907	50,62012
ECOWAS females	50,15	50,14	50,12	50,1	50,09
ECOWAS males	49,85	49,86	49,88	49,9	49,91

Source: World Bank. Own Work.

Table 28: Life expectancy in ECOWAS

Life expectancy (no. of years)	2010	2011	2012	2013	2014
Benin	59	59	59	59	60
Burkina Faso	57	57	58	58	59
Cabo Verde	73	73	73	73	73
Côte D´Ivore	50	51	51	51	52
The Gambia	59	60	60	60	60
Ghana	61	61	61	61	61
Guinea	56	57	58	58	59
Guinea Bissau	54	54	55	55	55
Liberia	59	60	60	61	61
Mali	56	57	57	58	58
Niger	58	59	60	61	61
Nigeria	51	52	52	52	53
Senegal	64	65	65	66	66
Sierra Leone	48	49	50	50	51
Togo	57	58	59	59	60
ECOWAS	57	58	59	59	59

Source: World Bank. Own Work.

Table 29: Indicators of population age structure in ECOWAS

	Population 0-14	Population 15-64	Population 65+	Total population
2010	131890818	163242662	9253360	304386840
2011	135369611	168069852	9481505	312920968
2012	138839978	173163948	9682770	321686695
2013	142317569	178492155	9853772	330663496
2014	145751015	184015329	10058825	339825169

Source: World Bank. Own Work.

Table 30: Age dependency ration in the individual countries

Age dependency ratio	2010	2011	2012	2013	2014
% of working age population					
Benin	86,22322	85,61009	84,8531	83,97857	83,01347
Burkina Faso	95,23232	95,01741	94,54329	93,86897	93,06758
Cabo Verde	60,21635	58,28727	56,35184	54,57737	53,13371
Cote D´Ivore	87,37669	86,74231	86,01977	85,22006	84,36521
The Gambia	95,61762	95,68609	95,54568	95,22764	94,75893
Ghana	74,31059	73,94148	73,75139	73,63948	73,43398
Guinea	86,74106	86,31388	85,77908	85,17242	84,51257
Guinea Bissau	80,61027	80,30529	79,90909	79,46076	78,97441
Liberia	86,63408	86,27681	85,7009	84,89951	83,9323
Mali	99,24313	99,9839	100,3578	100,4581	100,3874
Niger	110,4488	111,2635	111,8554	112,3096	112,6829
Nigeria	87,46484	87,82376	88,06623	88,15806	88,04449
Senegal	87,8258	87,68616	87,71708	87,81623	87,80904
Sierra Leone	85,3711	85,15787	84,61954	83,84116	82,92507
Togo	83,64757	83,50832	83,26334	82,90798	82,43086

Source: World Bank. Own Work.

Table 31: Density in the individual countries

Density	2010	2011	2012	2013	2014
Benin	84,33663	86,72748	89,12551	91,54161	93,9915
Burkina Faso	57,13474	58,87007	60,63894	62,44355	64,288
Cabo Verde	121,6821	122,8682	124,2854	125,8705	127,5201
Côte D´Ivore	63,30725	64,79299	66,36051	67,99525	69,67644
The Gambia	167,2927	172,8359	178,568	184,4741	190,5337
Ghana	106,8723	109,5566	112,2641	114,9883	117,7226
Guinea	44,81689	46,05385	47,32528	48,62741	49,95738
Guinea Bissau	58,11508	59,51312	60,97511	62,48713	64,02962
Liberia	41,09209	42,35438	43,50244	44,57737	45,64529
Mali	12,43027	12,81695	13,20477	13,59796	14,00276
Niger	12,86176	13,37845	13,92262	14,49346	15,08939
Nigeria	175,0439	179,8156	184,7233	189,7477	194,8637
Senegal	67,29752	69,37622	71,57382	73,86403	76,2092
Sierra Leone	80,02081	81,86351	83,72343	85,60348	87,4983
Togo	117,5005	120,724	124,0224	127,3896	130,8175

Source: World Bank. Own Work.

Table 32: GDP per capita

GDP per capita	2010	2011	2012	2013	2014
US dollar					
Benin	732,95	799,04	807,69	882,64	903,46
Burkina Faso	574,46	665,81	673,03	709,07	713,46
Cabo Verde	3393,93	3766,11	3497,69	3623,22	3641,11
Côte D´Ivore	1236,09	1231,87	1281,38	1447,22	1545,94
The Gambia	562,57	516,98	504,99	484,11	441,29
Ghana	1323,10	1587,19	1641,83	1827,10	1441,64
Guinea	430,06	447,79	487,35	521,54	539,62
Guinea Bissau	518,60	660,59	580,64	584,28	615,94
Liberia	326,60	378,81	414,19	453,34	457,86
Mali	704,06	829,85	772,25	798,32	842,11
Niger	351,01	378,20	393,64	417,67	431,38
Nigeria	2314,96	2514,15	2739,85	2979,84	3203,24
Senegal	998,12	1081,13	1019,27	1051,38	1067,13
Sierra Leone	453,02	505,26	637,65	802,54	792,58
Togo	496,48	572,03	573,21	589,01	630,00
ECOWAS	**961,07**	**1062,32**	**1068,31**	**1144,75**	**1151,12**

Source: World Bank. Own Work.

Table 33: Inflation rate, consumer prices

Inflation, consumer prices	2010	2011	2012	2013	2014
annual %					
Benin	2,307357	2,712801	6,753124	0,971852	-1,08721
Burkina Faso	-0,76423	2,759767	3,818152	0,533739	-0,24414
Cabo Verde	2,078665	4,473883	2,543294	1,512154	-0,24363
Côte D´Ivore	1,675665	4,905476	1,312723	2,569961	0,461946
The Gambia	5,048937	4,796485	4,254535	5,69973	5,947375
Ghana	10,70757	8,726837	9,160778	11,60833	15,49317
Guinea	15,46198	21,35047	15,22456	11,88842	9,713977
Guinea Bissau	2,517851	5,046102	2,130546	1,207126	-1,50924
Liberia	7,291037	8,4866	6,834768	7,574898	9,826358
Mali	1,108927	2,855534	5,427387	-0,60622	0,89277
Niger	0,804073	2,942385	0,45509	2,298522	-0,78625
Nigeria	13,7202	10,84079	12,21701	8,475827	8,057383
Senegal	1,228681	3,403228	1,421378	0,698627	-1,07815
Sierra Leone	16,63522	16,19181	12,87008	10,26641	7,329444
Togo	1,834169	3,572277	2,630774	1,766766	0,189645
ECOWAS	5,44374	6,870963	5,803613	4,431077	3,530896

Source: World Bank. Own Work.

Table 34: Employment to population ratio, 15+

Employment to population ratio, 15+	2010	2011	2012	2013	2014
total % (modeled ILO estimate)					
Benin	72	72	72,1	72,1	72,2
Burkina Faso	80,8	80,8	80,7	80,7	80,7
Cabo Verde	60,3	60,7	61	61,4	61,6
Côte D´Ivore	64,6	64,6	64,6	64,5	64,6
The Gambia	72,1	72	72	72	72
Ghana	65,2	65,9	66,6	68,1	67,8
Guinea	70,6	70,6	70,7	70,7	70,7
Guinea Bissau	68,2	68,2	68,2	68,3	68,3
Liberia	58,9	59,1	59,2	59,3	59,3
Mali	60,4	60,5	60,6	60,7	60,7
Niger	61,4	61,4	61,4	61,4	61,4
Nigeria	51,4	51,6	51,7	51,8	52
Senegal	69,4	68,5	68,6	68,6	69
Sierra Leone	64,9	65	65	65	65,1
Togo	75,2	75,2	75,3	75,4	75,4
ECOWAS	66,36	66,41	66,51	66,67	66,72

Source: World Bank. Own Work.

Table 35: External debt stock

External debt stock	2010	2011	2012	2013	2014
% of GNI					
Benin	24,571	25,687	27,399	28,696	22,846
Burkina Faso	23,345	22,040	23,499	23,252	20,514
Cabo Verde	56,087	57,968	74,244	83,822	86,430
Côte D´Ivore	44,488	50,565	35,015	37,086	32,970
The Gambia	55,567	54,611	57,968	60,113	63,928
Ghana	29,380	29,422	31,565	33,453	47,685
Guinea	78,430	72,632	24,826	24,066	22,932
Guinea Bissau	130,353	25,720	29,175	29,334	26,567
Liberia	37,623	31,568	30,803	32,886	37,372
Mali	27,276	28,662	31,169	32,122	29,494
Niger	27,312	35,167	34,078	34,701	32,145
Nigeria	4,413	4,480	4,287	4,389	4,889
Senegal	30,537	30,297	35,373	35,769	36,579
Sierra Leone	35,722	34,559	32,723	30,904	28,354
Togo	46,515	19,685	22,636	24,439	24,463
ECOWAS	43,441	34,871	32,984	34,335	34,478

Source: World Bank. Own Work.

Table 36: Raw data matrix - economic indicators

Raw data matrix	MAX	MIN	MAX	MIN
Countries	**X1**	**X2**	**X3**	**X4**
Benin	825,16	2,33	72,08	25,84
Burkina Faso	667,16	1,22	80,74	22,53
Cabo Verde	3584,41	2,07	61	71,71
Côte D´Ivoire	1348,5	2,19	64,58	40,02
The Gambia	501,99	5,15	72,02	58,44
Ghana	1564,17	11,14	66,72	34,3
Guinea	485,27	14,73	70,66	44,58
Guinea Bissau	592,01	1,88	68,24	48,23
Liberia	406,16	8	59,16	34,05
Mali	789,32	1,94	60,58	29,74
Niger	394,38	1,14	61,4	32,68
Nigeria	2750,41	10,66	51,7	4,49
Senegal	1043,41	1,13	68,82	33,71
Sierra Leone	638,21	12,66	65	32,45
Togo	572,15	2	75,3	27,55
MIN	394,38	1,13	51,7	4,49
MAX	3584,41	14,73	80,74	71,71
RANGE	3190,03	13,6	29,04	67,22

Source: World Bank. Own Work.

Table 37: Standardized data matrix - economic indicators

Type of indicator	MAX	MIN	MAX	MIN
Countries	**X1**	**X2**	**X3**	**X4**
Benin	13,50394824	91,17647	70,17906336	68,23861946
Burkina Faso	8,551016762	99,33824	100	73,16274918
Cabo Verde	100	93,08824	32,02479339	0
Côte D´Ivoire	29,90943659	92,20588	44,35261708	47,14370723
The Gambia	3,373322508	70,44118	69,97245179	19,74114847
Ghana	36,67018805	26,39706	51,72176309	55,65307944
Guinea	2,849189506	0	65,2892562	40,3600119
Guinea Bissau	6,195239543	94,48529	56,95592287	34,93008033
Liberia	0,369275524	49,48529	25,68870523	56,02499256
Mali	12,38044783	94,04412	30,5785124	62,43677477
Niger	0	99,92647	33,40220386	58,06307647
Nigeria	73,85604524	29,92647	0	100
Senegal	20,34557669	100	58,95316804	56,53079441
Sierra Leone	7,643501785	15,22059	45,79889807	58,40523654
Togo	5,572674865	93,60294	81,26721763	65,69473371

Source: World Bank. Own Work.

Table 38: Raw data matrix - demographic indicators

Raw data matrix	MAX	MIN	MIN	MIN
	Y1	Y2	Y3	Y4
Benin	59,2	84,74	89,14	2,74
Burkina Faso	57,8	94,35	60,68	2,96
Cabo Verde	73	56,51	124,45	1,09
Côte D´Ivoire	51	85,94	66,43	2,37
The Gambia	59,8	95,37	178,74	3,25
Ghana	61	73,82	112,28	2,44
Guinea	57,6	85,7	47,36	2,72
Guinea Bissau	54,6	79,85	61,02	2,4
Liberia	60,2	85,49	43,43	2,8
Mali	57,2	100,09	13,21	3,02
Niger	59,8	111,71	13,95	0,97
Nigeria	52	87,91	184,84	2,96
Senegal	65,2	87,77	71,66	3,07
Sierra Leone	49,6	84,38	83,74	2,24
Togo	58,6	83,15	124,09	2,69
MIN	49,6	56,51	13,21	0,97
MAX	73	111,71	184,84	3,25
RANGE	23,4	55,2	171,63	2,28

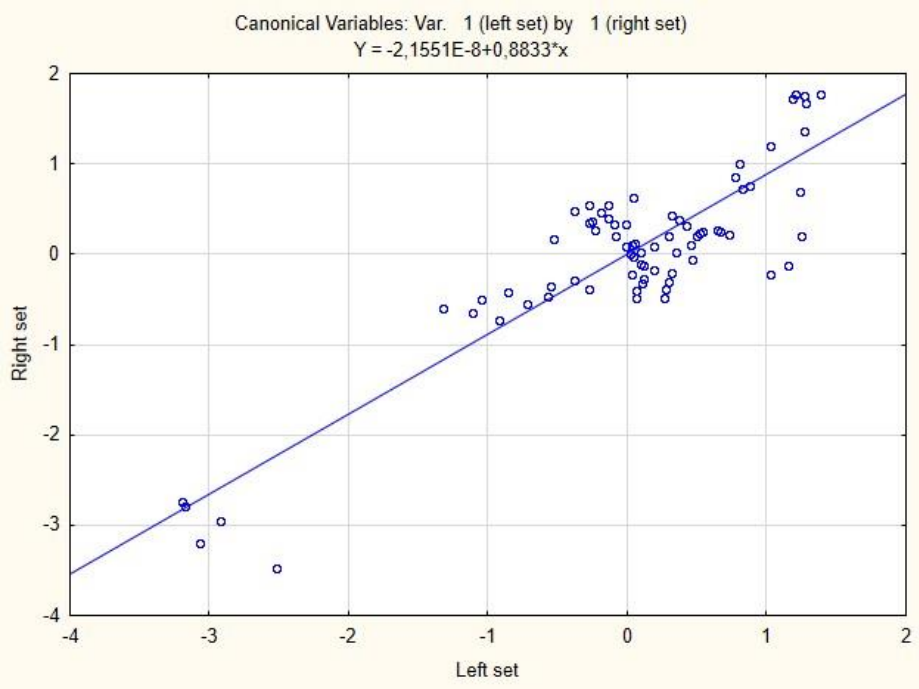
Source: World Bank. Own Work.

Table 39: Standardized data matrix - demographic indicators

Indicator type	MAX	MIN	MIN	MIN
	Y1	Y2	Y3	Y4
Benin	41,02564	48,8587	55,75948	22,3684211
Burkina Faso	35,04274	31,44928	72,34167	12,7192982
Cabo Verde	100	100	35,18616	94,7368421
Côte D´Ivoire	5,982906	46,68478	68,99144	38,5964912
The Gambia	43,58974	29,60145	3,554157	0
Ghana	48,71795	68,6413	42,27699	35,5263158
Guinea	34,18803	47,11957	80,10255	23,245614
Guinea Bissau	21,36752	57,71739	72,14356	37,2807018
Liberia	45,29915	47,5	82,39236	19,7368421
Mali	32,47863	21,05072	100	10,0877193
Niger	43,58974	0	99,56884	100
Nigeria	10,25641	43,11594	0	12,7192982
Senegal	66,66667	43,36957	65,94418	7,89473684
Sierra Leone	0	49,51087	58,90579	44,2982456
Togo	38,46154	51,73913	35,39591	24,5614035

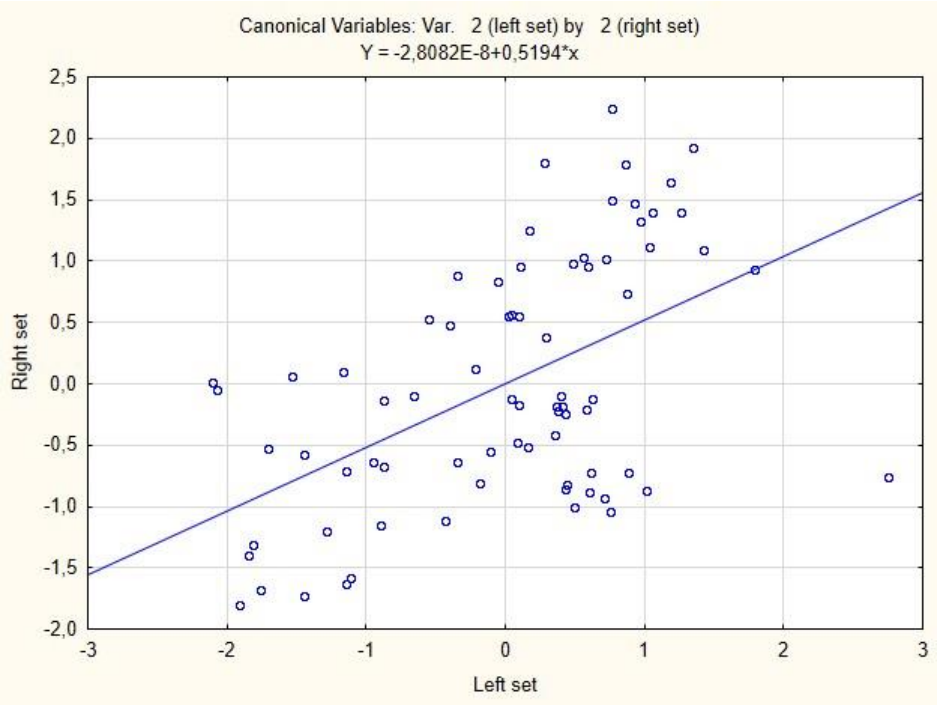
Source: World Bank. Own Work.

Figure 8: Scatterplot of canonical correlations - root 1(left set) by root 1 (right set)



Source: WB, own work using Statistica

Figure 9: Scatterplot of canonical correlations - root 2(left set) by root 2 (right set)



Source: WB, own work using Statistica