

POPULATION DECLINE AND ITS CHALLENGES FOR ECONOMIC GROWTH

SALA ADRIAN LUCIAN,
PHD STUDENT

UNIVERSITY OF CRAIOVA, FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION
e-mail: sala_lucian@yahoo.com

Abstract

The aim of this paper is to analyze the effects of population decline on economic growth in Romania compared with the large economies in the EU, by their implications on the main economic indicators of growth, GDP and GDP/capita. Population around the world, including in Romania, is in decline, which will continue to accelerate in the following decades. Statistics show that, in order to stop the population, decrease, the birth rate should remain above 2.1 children per woman. In developed countries, this rate is already below 2.1 and, in the developing countries, it will drop below this level in the next decades. Based on these facts, this article examines the following hypothesis: the population decline does not imply a decline in GDP or GDP/capita. There is no reason to believe that the GDP of a nation would suffer a decline as a result of its population numbers dwindling since the productive base of a nation will not dissolve. The research applies the statistical and econometrical methods. The data sets are from public official statistics. The expected results are that economic growth will maintain its level or will decrease at a pace slower than that recorded by the population.

Keywords: population changes, economic growth, statistical methods

Classification JEL: C12, J11

1. INTRODUCTION

In the last few decades, the structure of the population has changed significantly in large part due to lower fertility rates and higher life expectancy. These changes have overtime caused a decline in population numbers with noticeable effects on economic growth. The share of the population aged over 65 has increased at a faster pace than anytime in history as a consequence of low fertility rates causing the family unit to shrink.

Lee and Mason (2011) offer a number of potentially important issues related to changes in population age structure. After analyzing the interaction between the changes in the structure of the population and investments in human capital, they verified that increased human capital investment is connected with decreasing fertility rates and may very well lessen the increased cost connected with an ageing population. Demographic ageing is accompanied by increasing transfers from the working segment of the population to the elderly in developed countries, by way of increasing payroll taxes and raising family expenses.

To get a better grasp of the implications of demographic decline on growth, an analysis has been carried out focusing on Romania and five of the largest economies of the European Union (EU), namely: Germany, France, Italy, Spain and the UK.

Romania also is undergoing a demographic shift in the age structure of its population, having economic and social consequences. An ageing population has a negative effect on public spending, and also on the labor market, and as a consequence on economic growth.

Cristea and others (2016) present the case that pension systems in Romania and Croatia are also directly influenced by population ageing, driven largely by the growing share of people over 65 in the population structure in all the states, amid rising life expectancy and declining birth rates.

Developed countries are entering into a period of uncertainty as regards to population ageing, due to several factors, including an increase in longevity and a decrease in fertility rates (Harper and Leeson, 2009).

This decline in population growth has been noticed from the '70s, when the adult population engaged in the working force, in a number of countries, overtook the child population (Mason and Lee, 2011).

In the countries that are more developed, a greater number of women have been taking part in an active manner in the labor market (Börsch-Supan, 2013). Highly-developed country's, have a priority of maintaining fertility rates above 2.1 replacement level (Nimwegen and Erf, 2010). In 2011, the fertility rates of almost all the European member states had declined below the replacement level (**Figure no. 1**). In particular, for Germany, Spain, Italy, Romania, France, and the United Kingdom, the fertility rate is now below the replacement level.

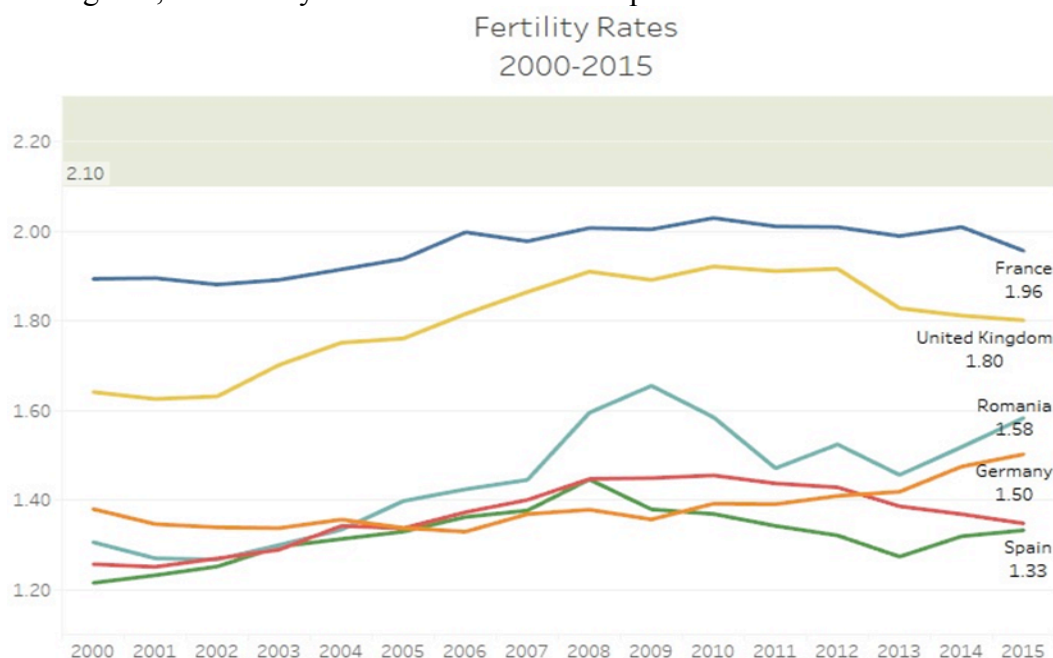


Figure no. 1. Fertility Rates 2000-2015

Source: Own creation, based on EUROSTAT Data

Structural ageing of a population produces subtle but deep changes on a country's economic growth (Albuquerque and Ferreira, 2015). Available data points out that a nation with an ageing population group tends to be linked to decreasing productivity levels, lower savings, and increased government spending (Sharpe, 2011; Walder and Döring, 2012).

More recently, a great majority of publications reveal that the working segment of the population has become smaller than that of retired people. As a result of the changes that are taking place, most countries are becoming old (Weil, 2006; Bell and Rutherford, 2013; Börsch-Supan, 2013).

Projections made by the United Nationsⁱ (UN) (2015) present the current global life expectancy to increase to 75 years by 2050, from 65 years in 2005.

The available literature argues in the favor of a negative relationship between population decline caused by ageing and economic growth (Narciso, 2010; Walder and Döring, 2012).

According to Mason and Lee (2013), and Meijer and others (2013) economic growth is affected mainly through three mechanisms: consumption and saving patterns, public and social expenditure, and human capital. It is also important to point out that a reverse causality exists between economic growth and population ageing, in that economic growth may be a determining factor to population ageing (Alders and Brower, 2004).

Walder and Döring (2012) noted that a rise in population ageing will lead to changes in household's consumption patterns, changing overall spending preferences according to their needs.

According to Lee and Mason (2007), the increase in the ageing population will have the effect of reducing the per capita income of all three generations (child, working group, and pensioner) which will lead to a net decrease in the family's total consumption.

The surge in the old age dependency ratio is anticipated to diminish the disposable income of the working population and lead to a further drop in the fertility rate (Hock and Weil, 2012).

2. MATERIALS AND METHODS

For the purpose of determining whether there is a tangible link between the decline in population numbers as a whole and the main indicators of economic growth, most notably the Gross Domestic Product (GDP) and the Gross Domestic Product per inhabitant (GDP per capita). As covered previously, there is no doubt that the major five economies in the European Union (Germany, UK, France, Spain and Italy) are facing a dangerous situation regarding population numbers, this situation being reflected in Romania also, where we have seen a steady decline in population numbers.

The analysis allows us to draw a comparison between each developed country and Romania, with the aim of proving that a decrease of population does not necessarily mean a decrease of the economic growth for all the countries. The main objective is to test the validity of the hypothesis that **a declining population does not necessarily imply a decline in GDP and GDP per capita**.

The data on population and on the main indicators of growth was obtained from Eurostat, for the period 1993 to 2016.

The methods used are Least Squares Regression (LS) and Correlation under the Eviews9 program, the results are presented in a visual way using images and tables that can be found in the Annex.

3. RESULTS AND DISCUSSIONS

In Romania, as can be observed (**Figure no. 2 from ANNEX**), between 1993 and 2016 the population has decreased from 22.7 Million to 19.7 Million, as a result of migration, declining fertility rates and other natural causes. The Romanian GDP and GDP per capita have steadily moved upwards resulting in a negative correlation of 0.9 in both cases (**Table no. 1 from ANNEX**).

Germany is a particularly interesting case as it is the “oldest” developed country in the European Union (EU) and its economic powerhouse at the same time, its population suffers from a visible decline (**Figure no. 3 from ANNEX**) from 82.5 Million inhabitants in 2004 to 80.2 Million in 2010, the population numbers are at present close to its 2004 figure in large part due to migrants. Two scenarios have been tested, in the first one a weak negative correlation of -0.3 was obtained (**Table no. 2 from ANNEX**), due to the large fluctuation in population numbers, according to DESTATISⁱⁱ between 2010-2015, 4.6 Million migrants have entered in Germany. For the second scenario, we subtracted net migration from the general population, the results reflecting our expectations with a negative correlation of -0.6 (**Table no. 3 from ANNEX**).

In the case of Italy (**Figure no. 4 from ANNEX**), we can observe two aspects: a steady growth in population numbers caused mainly by migration; and an increase in GDP and GDP per capita until 2008, followed by a correction brought about by the economic crisis and a return to previous levels of growth in the years that followed, recovering the losses. The results of the analysis show that, between population and GDP there is a positive correlation of 0.8, and between the population and GDP per capita, of 0.75 (**Table no. 4 from ANNEX**).

France stands out with a strong positive correlation of 0.99 between population growth and economic growth (*Table no. 5 from ANNEX*). The population of France has grown at a steady pace through an increase in fertility rates, having the highest rates of any of the analyzed countries and also as a result of migration (*Figure no. 5 from ANNEX*).

Spain has seen a steady increase in population numbers from 39.2 Million in 1993, reaching a peak of 46.8 Million in 2012, followed by a steady decline to 46.4 Million in 2016 (*Figure no. 6 from ANNEX*). This increase is mostly caused by migration, since the fertility rates are among the lowest, currently hovering at 1.3 children per female. The economy has been impacted harder than expected by the economic crisis in 2008 with lingering results. The results of the analysis are in line with expectations and are of a positive correlation rate between the population numbers and GDP of 0.95, and population and GDP per Capita, of 0.93(*Table no. 6 from ANNEX*).

The United Kingdom has seen a sharp rise of population from 57 Million in 1993 to 65 Million in 2016 (*Figure no. 7 from ANNEX*) due to the open-door policies, the economic growth since 2008 has moved sideways, hovering around levels recorded in 2008. The results of the analysis are as follows: 0.81 correlation coefficient between GDP and population, and 0.98 correlation coefficient between population and GDP per capita (*Table no. 7 from ANNEX*). The results of the analysis **confirm the hypothesis that economic growth can be maintained even with declining population numbers**. In all cases, there can be observed a positive economic growth trend, but the cases that stand out the most are Romania and Germany, where under a noticeable population decline, visible economic growth exists. The main reason being that even with a decline in population numbers, the effects on economic growth can be offset by a rise in efficiency brought about by automation, by the structural shift of workers from lower paying sectors to higher paying ones and with the help of migration to fill lower skilled positions.

The fact is that, even under those conditions, a level of moderate growth can be achieved and even sustained for a foreseeable period of time, opening the door for corrective measure to come into effect.

4. CONCLUSIONS

Following the results of the analysis under the guidance of an ample literature on the effect of population ageing and its subsequent decline on economic growth, there can be observe that for the 5 main economic engines of the European Union (EU), a main theme emerges that is in effect with different levels of intensity.

In the case of Romania and Germany an inverse pattern can be observed, with negative correlations suggesting that a decline in population does not mean a decline in economic growth, giving further credence to the hypothesis. Germany is a particularly interesting case because it is trying to solve its population decline by way of migration, the influx of migrants solves to some degree the population challenges that Germany faces, but a different set of problems arises from the fact that an overwhelming majority of those workers are low skilled, and have difficulty integrating and acquiring basic language skills.

The econometric analysis hold firm for the other countries subject to the study Italy, Spain, UK and France supporting the hypothesis that economic growth as measured through GDP and GDP per capita will maintain an adequate level of growth even under declining population numbers.

Economic growth can be maintained under the guise of a shift in population growth, even with a scenario of a negative growth pattern in population numbers.

ⁱ (United Nations: “World Population Prospects: The 2015 Revision”,
https://esa.un.org/Unpd/wpp/Publications/Files/Key_Findings_WPP_2015.pdf)

ⁱⁱ (DESTATIS, “ Net Migration & Integration” ,
<https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/Bevoelkerung/MigrationIntegration/MigrationIntegration.html>)

REFERENCES

- [1] **Albuquerque, P. C. and Ferreira, J.** (2015), “Envelhecimento, emprego e remunerações nas regiões portuguesas: uma análise shift-share – Ageing, employment and remunerations in Portuguese regions: a shift-share analysis”. *eure*, 41 (122), pp. 239-260.
- [2] **Alders, P. and Broer, D. P.** (2004), “Ageing, fertility, and growth”. *Journal of Public Economics*, 89, pp. 1075-1095.
- [3] **Börsch-Supan, A.** (2013), “Myths, scientific evidence and economic policy in an aging world”. *The Journal of the Economics of Ageing*, 1-2, pp. 3-15.
- [4] **Cristea, M., Marcu N., and Cercelaru O.V.** (2016), "Longer life with worsening pension system? Aging population impact on the pension system in two countries: Romania and Croatia." *Economic and Social Development: Book of Proceedings*, :28
- [5] **Harper, S. and Leeson, G.** (2009), “Introducing the journal of population ageing”, *Journal of Population Ageing*, 1, pp. 1-5.
- [6] **Hock, H. and Weil, D. N.** (2012), “On the dynamics of the age structure, dependency and consumption”. *Journal of Population Economics*, 25, pp. 1019-1043.
- [7] **Lee, S. H. and Mason, A.** (2007), “Who gains from the demographic dividend? Forecasting income by age”. *International Journal Forecast*, 23, pp. 603-619.
- [8] **Mason, A. and Lee, R.** (2011), “Population aging and the generational economy: key findings”. In R. Lee, A. Mason (eds), *Population Aging And Generational Economy Project. A Global Perspective*, Cheltenham, UK, and Northampton, MA, USA, Edward Elgar, pp. 3-31.
- [9] **Mason, A. and Lee, R.** (2013), “Labor and consumption across the lifecycle”. *The Journal of the Economics of Ageing*, 1-2, pp. 16-27.
- [10] **Meijer, C., et al.** (2013), “The effect of population aging on health expenditure growth: a critical review”. *European Journal of Ageing*, 10, pp. 353-361.
- [11] **Narciso, A.** (2010), “The impact of population ageing on international capital flows”, *mpa Paper*, 26457
- [12] **Nimwegen, V. N. and Erf, D. V. R.** (2010), “Europe at the crossroads: demographic challenges and international migration”. *Journal of Ethnic and Migration Studies*, 36, pp. 1359-1379.
- [13] **Sharpe, A.** (2011), “Is ageing a drag on productivity growth? A review article on ageing, health and productivity: the economics of increased life expectancy”. *International Productivity Monitor*, 21, pp. 82-94
- [14] **Walder, A. B. and Döring, T.** (2012), “The effect of population ageing on private consumption – a simulation for Austria based on household data up to 2050”. *Eurasian Economic Review*, 2, pp. 63-80.
- [15] **Weil, D. N.** (2006), “Population Aging”. *nber working paper*, 12147.

ANNEX – TABLES AND IMAGES

Image no. 2. Changes in the GDP and Population of Romania.....	2
Image no. 3. Changes in the GDP and Population of Germany.....	2
Image no. 4. Changes in the GDP and Population of Italy	3
Image no. 5. Changes in the GDP and Population of France	3
Image no. 6. Changes in the GDP and Population of Spain	4
Image no. 7. Changes in the GDP and population of United Kingdom.....	4
Image no. 8. Changes in the GDP/Capita and Population of France	5
Image no. 9. Changes in the GDP/Capita and Population of Germany	5
Image no. 10. Changes in the GDP/Capita and Population of Italy.....	6
Image no. 11. Changes in the GDP/Capita and Population of Romania.....	6
Image no. 12. Changes in the GDP/Capita and Population of Spain.....	7
Image no. 13. Changes in the GDP/Capita and population of the United Kingdom	7
Image no. 14. Regression line for GDP/Capita, GDP and population of Romania	8
Table nr. 1. Covariance Analysis between ROMANIA_GDP, ROMANIA_GDP_CAPITA and ROMANIA_POPULATION	8
Image no. 15. Regression line for GDP/Capita, GDP and population of Germany.....	9
Table nr. 2. Covariance Analysis between GERMANY_GDP, GERMANY_GDP_CAPITA and GERMANY_POPULATION	9
Image no. 16. Regression line for GDP/Capita, GDP and population minus net migration of Germany	10
Table nr. 3. Covariance Analysis between GERMANY_GDP, GERMANY_GDP_CAPITA and GERMANY_POPULATION_MINUS_NET_MIGRATION.....	10
Image no. 17. Regression line for GDP/Capita, GDP and population of Italy	11
Table nr. 4. Covariance Analysis between ITALY_GDP, ITALY_GDP_CAPITA and ITALY_POPULATION.....	11
Image no. 18. Regression line for GDP/Capita, GDP and population of France.....	12
Table nr. 5. Covariance Analysis between FRANCE_GDP, FRANCE_GDP_CAPITA and FRANCE_POPULATION.....	12
Image no. 19. Regression line for GDP/Capita, GDP and population of Spain.....	13
Table nr. 6. Covariance Analysis between SPAIN_GDP, SPAIN_GDP_CAPITA and SPAIN_POPULATION.....	13
Image no. 20. Regression line for GDP/Capita, GDP and population of the United Kingdom	14
Table nr. 7. Covariance Analysis between UK_GDP, UK_GDP_CAPITA and UK_POPULATION.....	14

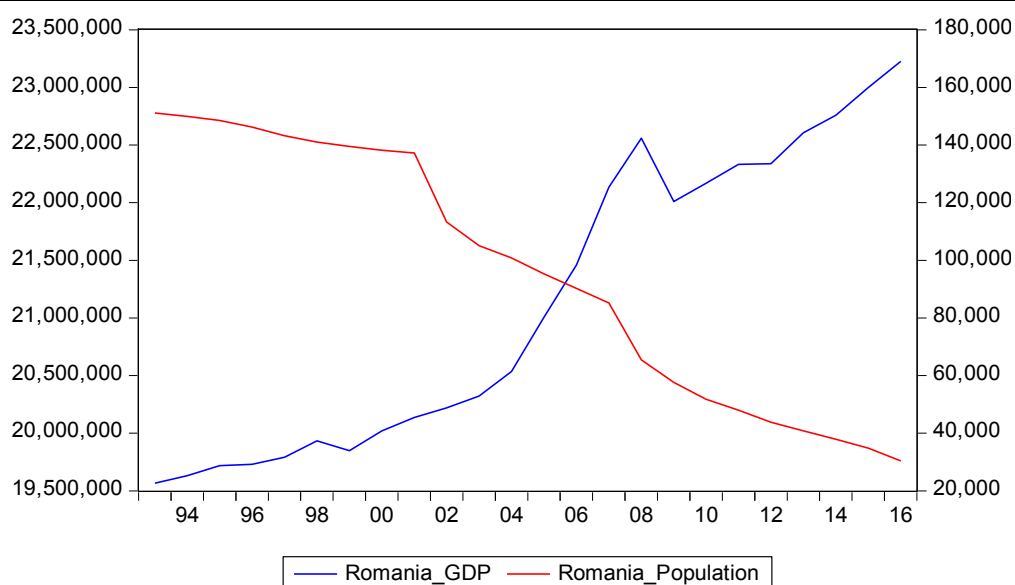


Image no. 2. Changes in the GDP and Population of the Romania
Source: Own processing of data in Eviews

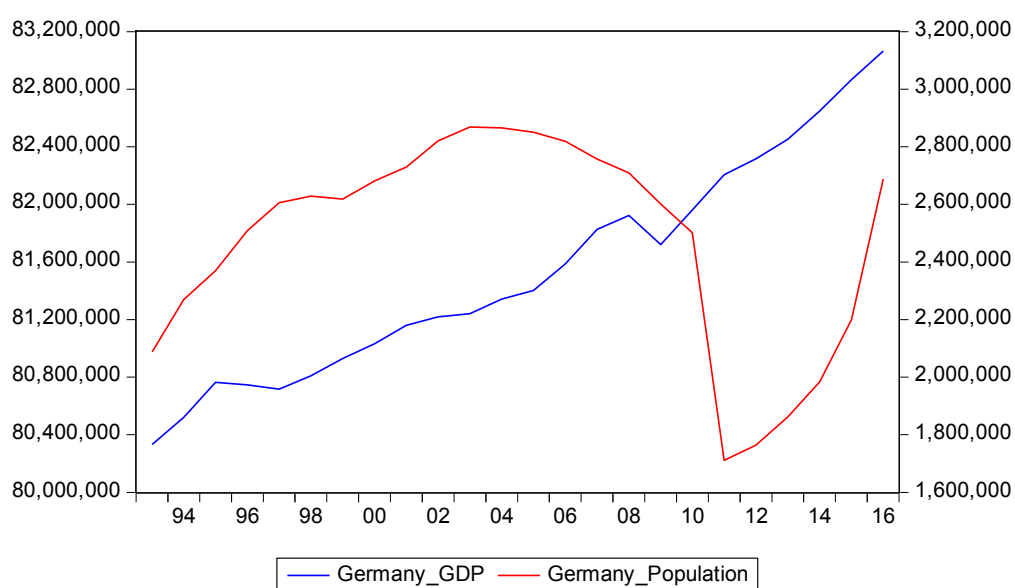


Image no. 3. Changes in the GDP and Population of Germany
Source: Own processing of data in Eviews

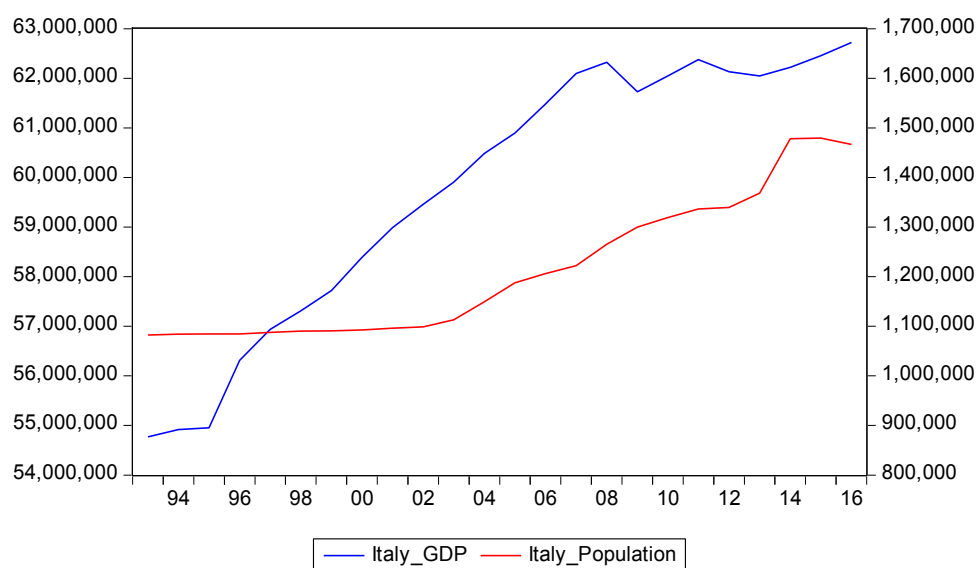


Image no. 4. Changes in the GDP and Population of Italy

Source: Own processing of data in Eviews

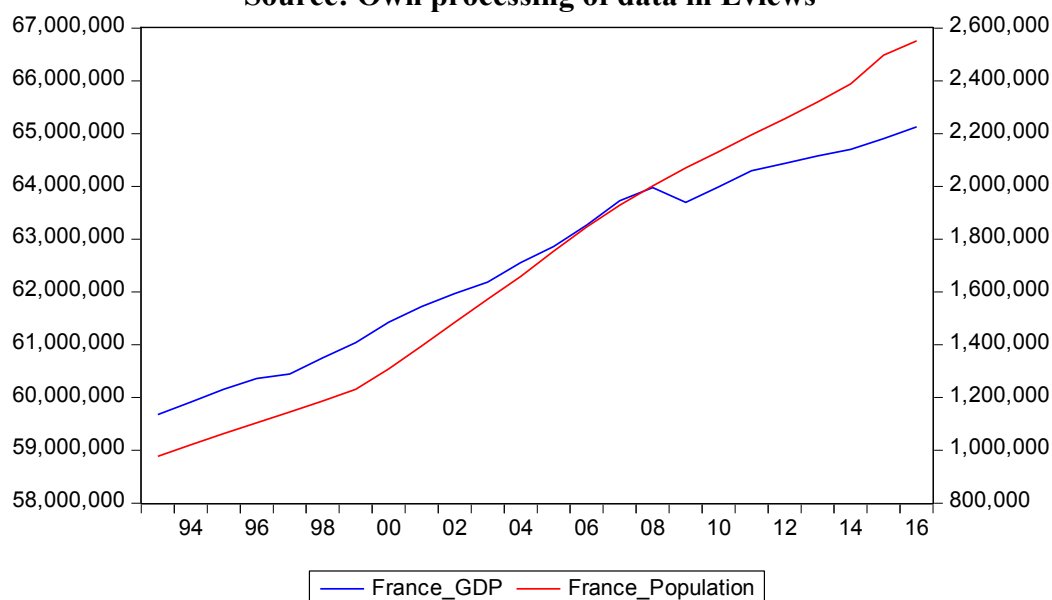


Image no. 5. Changes in the GDP and Population of France

Source: Own processing of data in Eviews

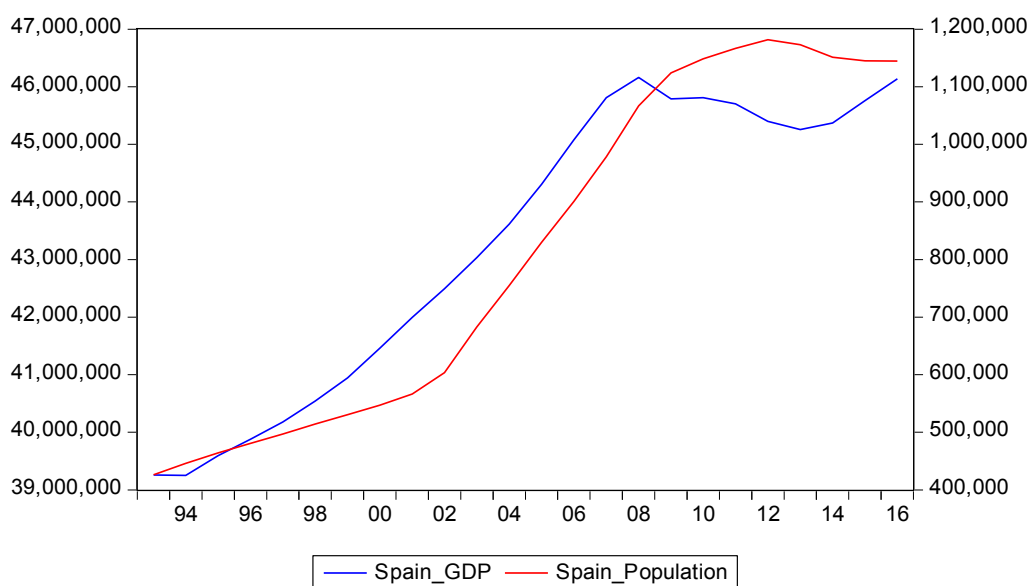


Image no. 6. Changes in the GDP and Population of Spain
Source: Own processing of data in Eviews

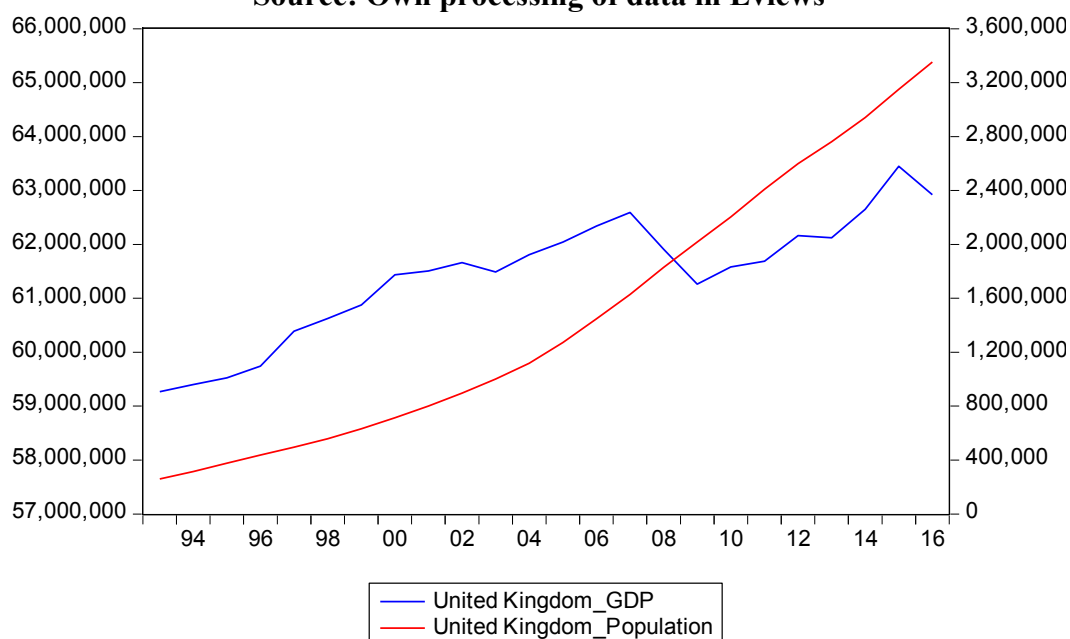


Image no. 7. Changes in the GDP and population of the United Kingdom
Source: Own processing of data in Eviews

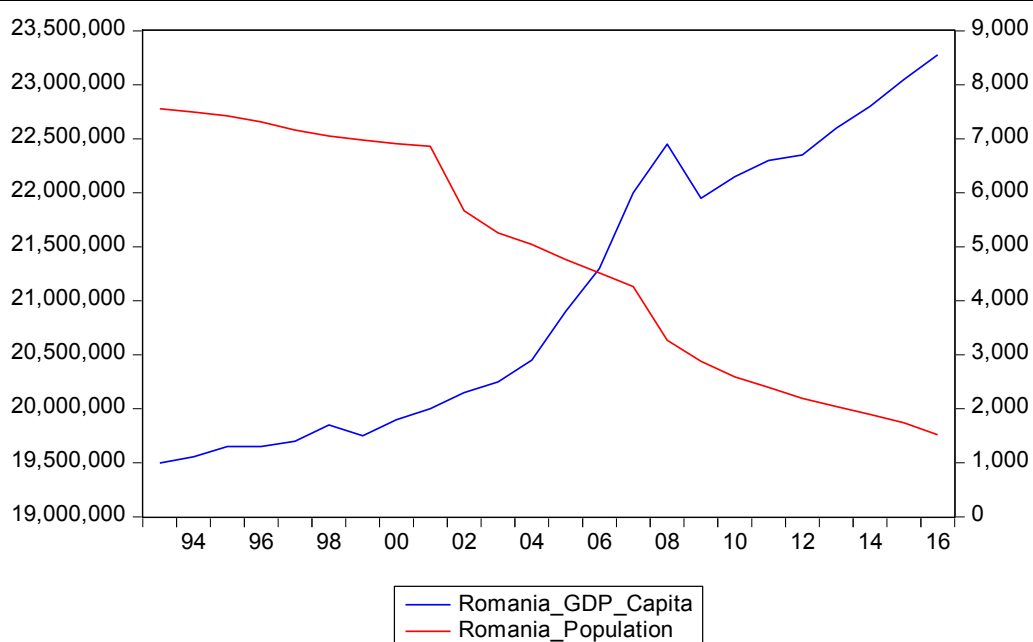


Image no. 8. Changes in the GDP/Capita and Population of Romania
Source: Own processing of data in Eviews

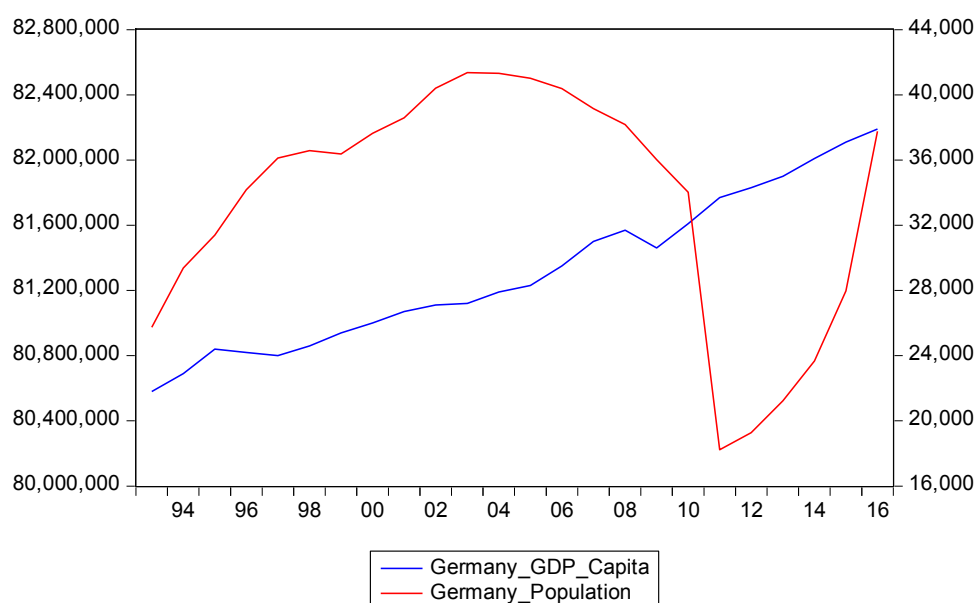


Image no. 9. Changes in the GDP/Capita and Population of Germany
Source: Own processing of data in Eviews

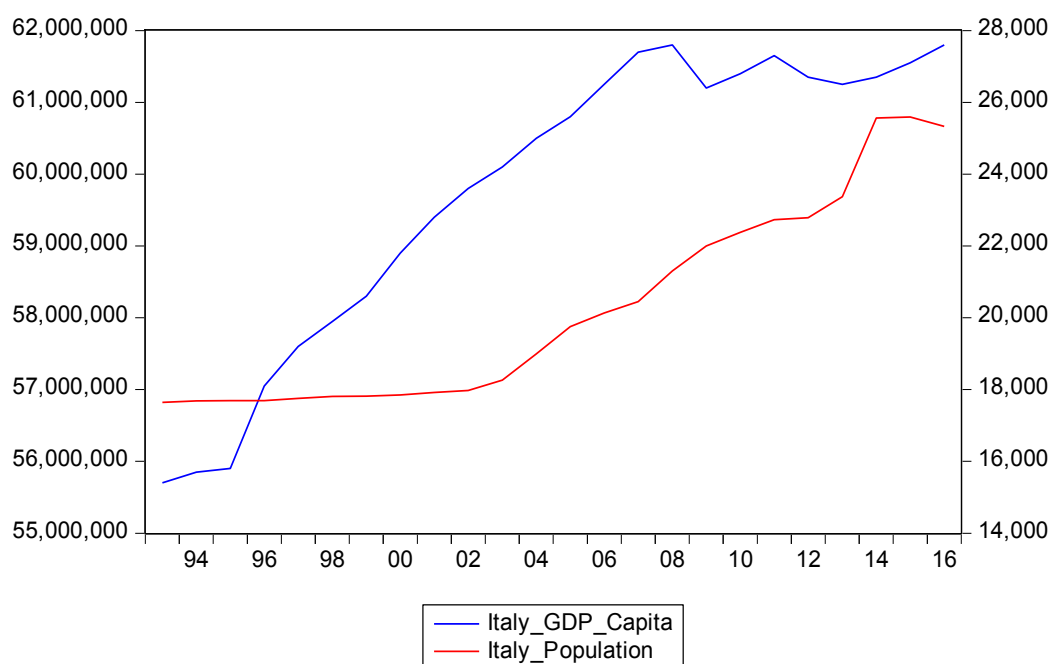


Image no. 10. Changes in the GDP/Capita and Population of Italy
Source: Own processing of data in Eviews

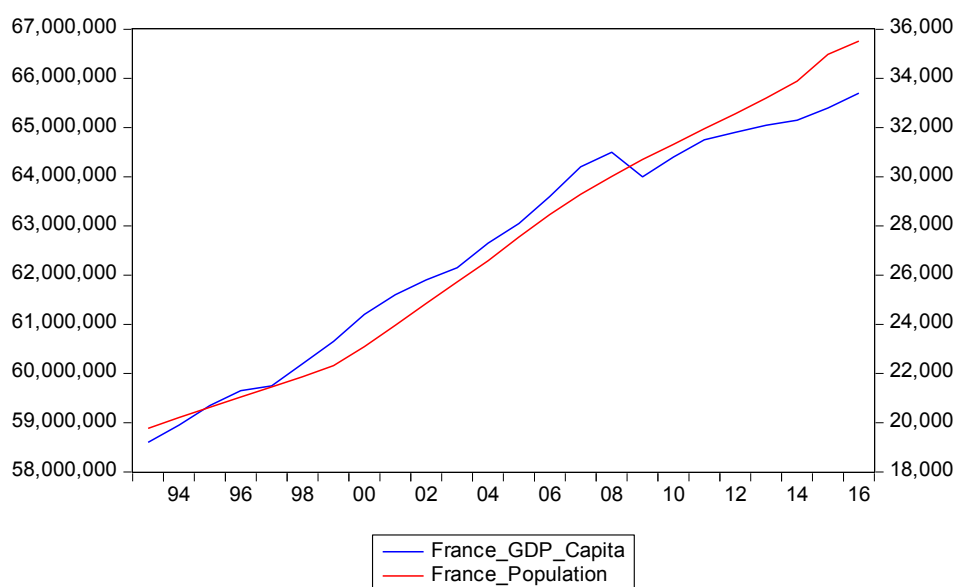


Image no. 11. Changes in the GDP/Capita and Population of France
Source: Own processing of data in Eviews

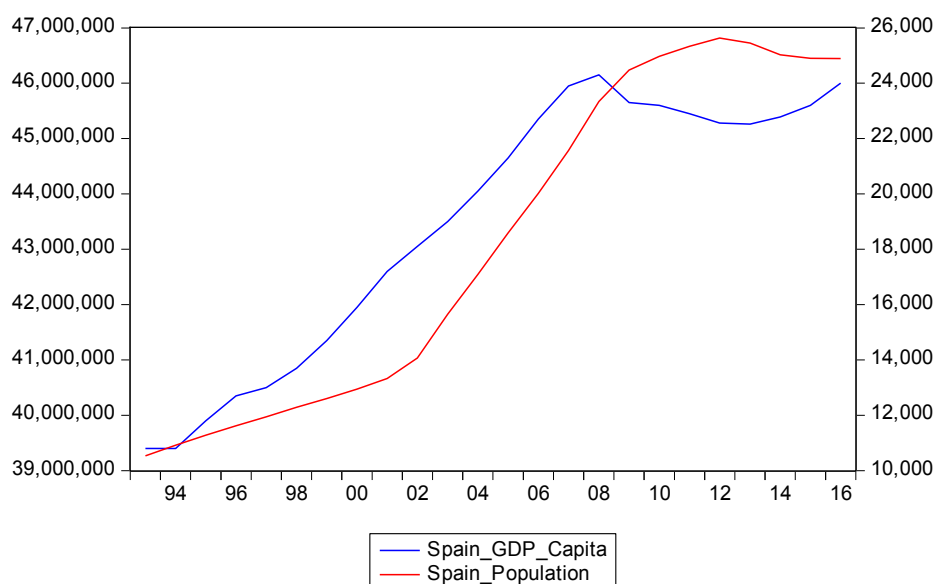


Image no. 12. Changes in the GDP/Capita and Population of Spain
Source: Own processing of data in Eviews

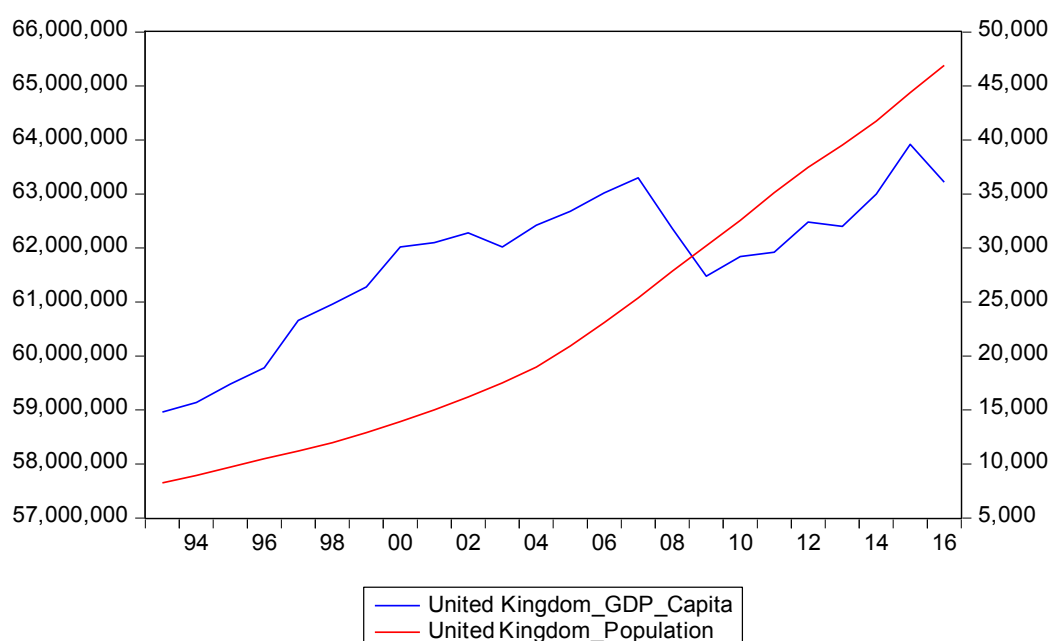


Image no. 13. Changes in the GDP/Capita and population of the United Kingdom
Source: Own processing of data in Eviews

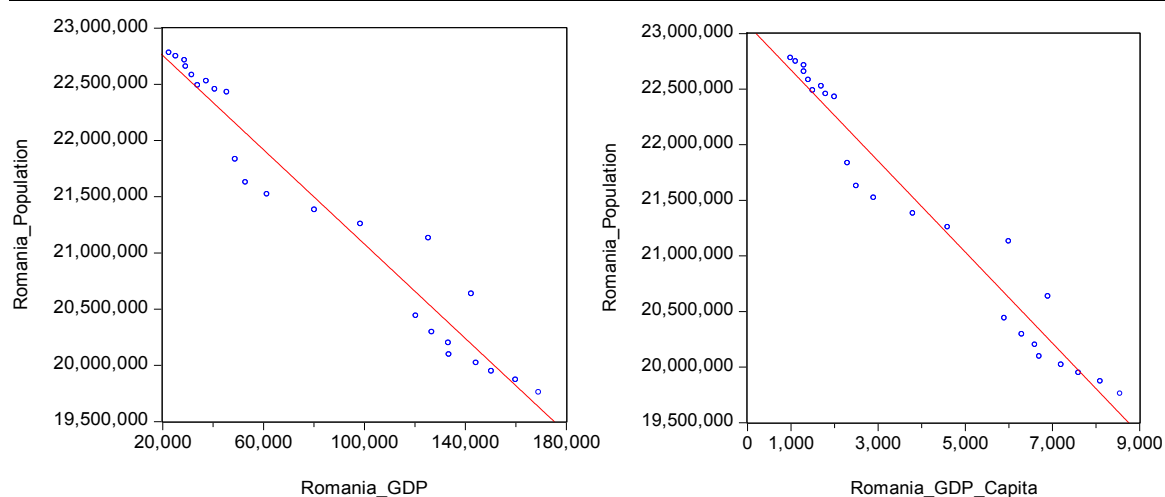


Image no. 14. Regression line for GDP/Capita, GDP and population of Romania

Source: Own processing of data in Eviews

Table nr. 1. Covariance Analysis between ROMANIA_GDP, ROMANIA_GDP_CAPITA and ROMANIA_POPULATION

Covariance Analysis: Ordinary

Date: 03/26/17 Time: 22:06

Sample: 1993 2016

Included observations: 24

Correlation			
t-Statistic	ROMANIA_GDP	ROMANIA_GDP_CAPIT A	ROMANIA_POPULATIO N
ROMANIA_GDP	1.000000		

ROMANIA_GDP_CAPITA	0.999368	1.000000	
	131.9050	-----	
ROMANIA_POPULATION	-0.975329	-0.978317	1.000000
	-20.72285	-22.15535	-----

Own Creation

Data Sources: Eurostat Database

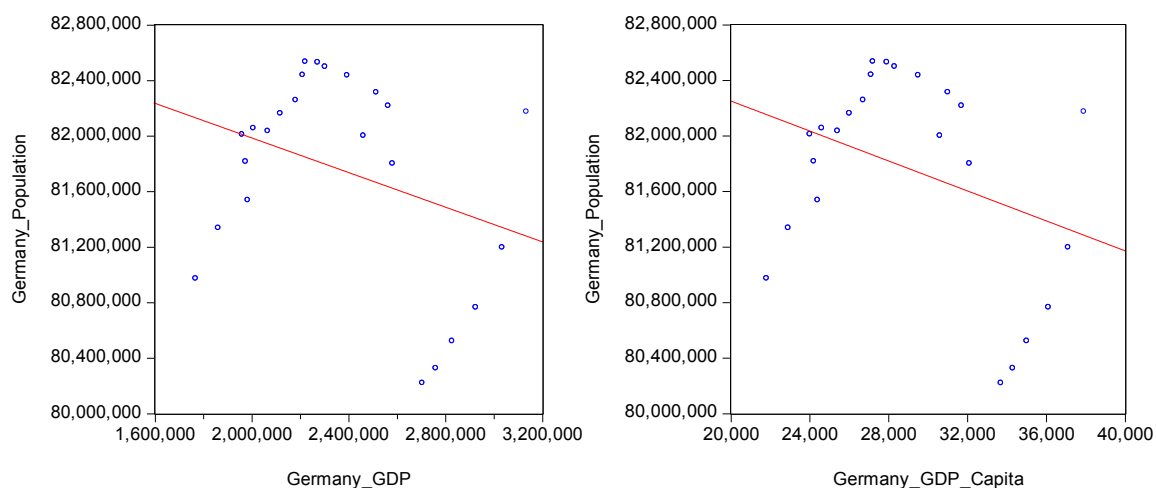


Image no. 15. Regression line for GDP/Capita, GDP and population of Germany
Source: Own processing of data in Eviews

Table nr. 2. Covariance Analysis between GERMANY_GDP, GERMANY_GDP_CAPITA and GERMANY_POPULATION

Covariance Analysis: Ordinary

Date: 04/08/17 Time: 20:41

Sample: 1993 2016

Included observations: 24

Correlation			
t-Statistic	GERMANY_GDP	GERMANY_GDP_CAPITA	GERMANY_POPULATION
GERMANY_GDP	1.000000 -----		
GERMANY_GDP_CAPITA	0.998872 98.68551	1.000000 -----	
GERMANY_POPULATION	-0.329754 -1.638317	-0.352141 -1.764721	1.000000 -----

Own Creation

Data Sources: Eurostat Database

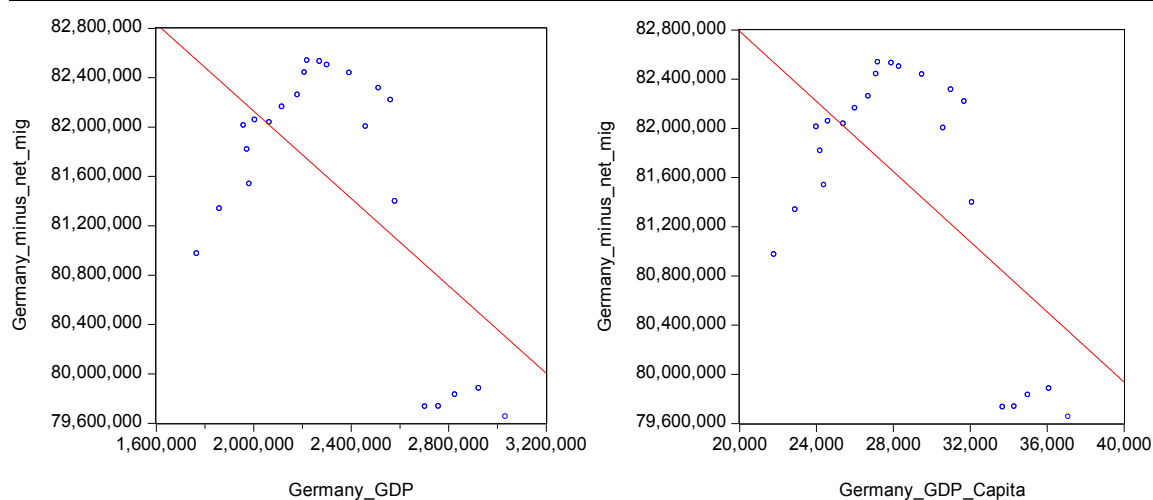


Image no. 16. Regression line for GDP/Capita, GDP and population minus net migration of Germany

Source: Own processing of data in Eviews

Table nr. 3. Covariance Analysis between GERMANY_GDP, GERMANY_GDP_CAPITA and GERMANY_POPULATION_MINUS_NET_MIGRATION

Covariance Analysis: Ordinary

Date: 04/08/17 Time: 20:44

Sample: 1993 2015

Included observations: 23

Balanced sample (listwise missing value deletion)

Correlation			
t-Statistic	GERMANY_GDP	GERMANY_GDP_CAPITA	GERMANY_MINUS_NET_MIG
GERMANY_GDP	1.000000		

GERMANY_GDP_CAPITA	0.999369	1.000000	
	128.9026	-----	
GERMANY_MINUS_NET_MIG	-0.607550	-0.613912	1.000000
	-3.505235	-3.563962	-----

Own Creation

Data Sources: Eurostat Database

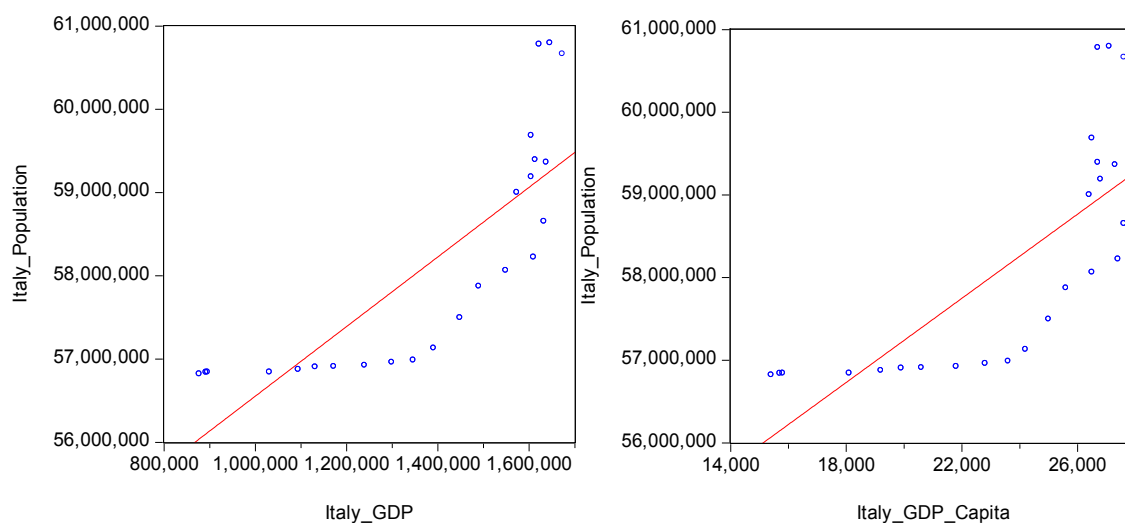


Image no. 17. Regression line for GDP/Capita, GDP and population of Italy
Source: Own processing of data in Eviews

Table nr. 4. Covariance Analysis between ITALY_GDP, ITALY_GDP_CAPITA and ITALY_POPULATION

Covariance Analysis: Ordinary

Date: 03/26/17 Time: 22:04

Sample: 1993 2016

Included observations: 24

Correlation				
t-Statistic	ITALY_GDP	ITALY_GDP_CAPITA	ITALY_POPULATION	
ITALY_GDP	1.000000			

ITALY_GDP_CAPITA	0.995799	1.000000		
	51.00805	-----		
ITALY_POPULATION	0.811269	0.757083	1.000000	
	6.508240	5.435376	-----	

Own Creation

Data Sources: Eurostat Database

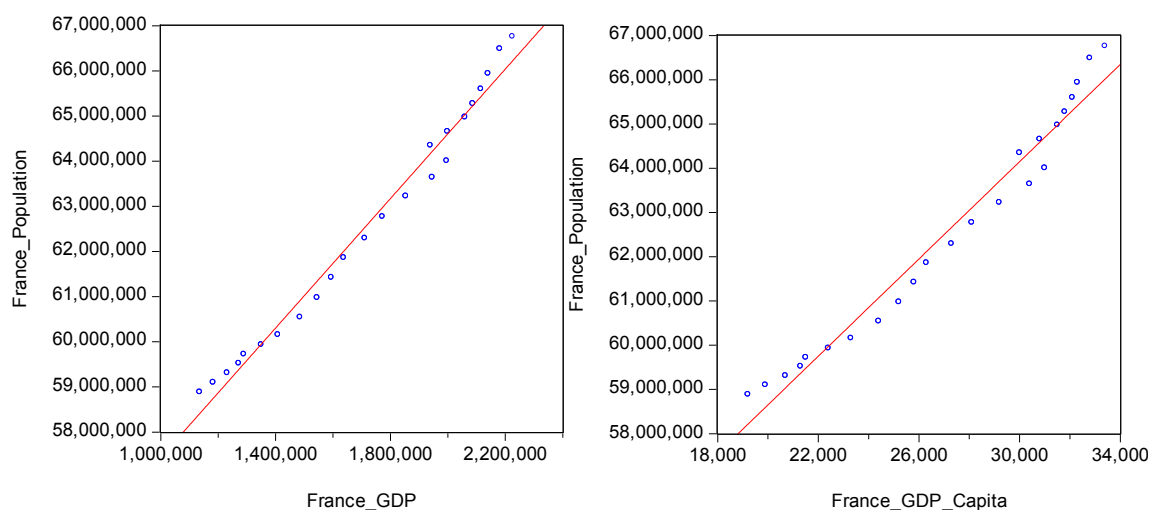


Image no. 18. Regression line for GDP/Capita, GDP and population of France
Source: Own processing of data in Eviews

Table nr. 5. Covariance Analysis between FRANCE_GDP, FRANCE_GDP_CAPITA and FRANCE_POPULATION

Covariance Analysis: Ordinary

Date: 03/26/17 Time: 22:02

Sample: 1993 2016

Included observations: 24

Correlation		FRANCE_GDP_CAPITA		FRANCE_POPULATION	
t-Statistic		FRANCE_GDP			
FRANCE_GDP		1.000000			

FRANCE_GDP_CAPITA		0.998642	1.000000		
		89.90838	-----		
FRANCE_POPULATION		0.991638	0.983920	1.000000	
		36.04242	25.83839	-----	

Own Creation

Data Sources: Eurostat Database

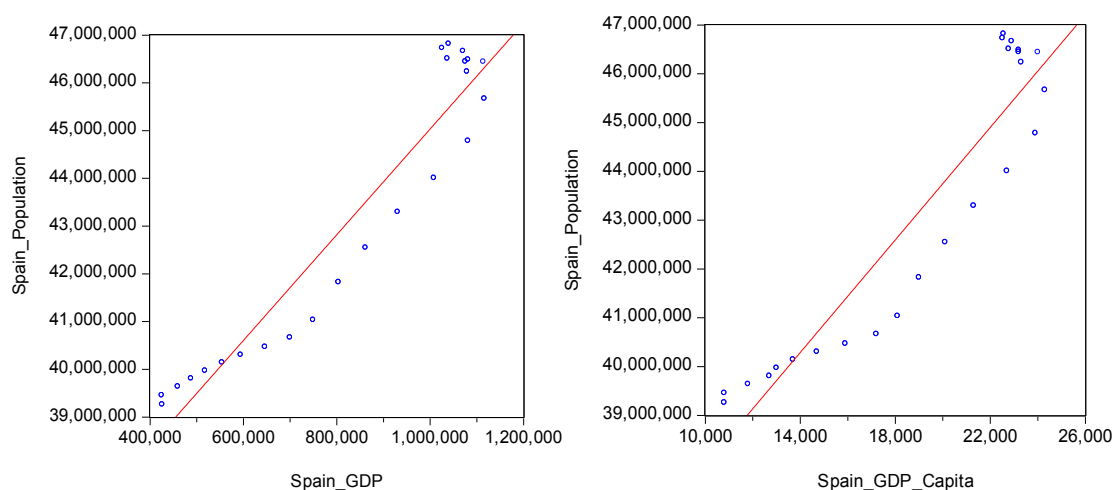


Image no. 19. Regression line for GDP/Capita, GDP and population of Spain
Source: Own processing of data in Eviews

Table nr. 6. Covariance Analysis between SPAIN_GDP, SPAIN_GDP_CAPITA and SPAIN_POPULATION

Covariance Analysis: Ordinary

Date: 03/26/17 Time: 22:06

Sample: 1993 2016

Included observations: 24

Correlation			
t-Statistic	SPAIN_GDP	SPAIN_GDP_CAPITA	SPAIN_POPULATION
SPAIN_GDP	1.000000 -----		
SPAIN_GDP_CAPITA	0.996381 54.98417	1.000000 -----	
SPAIN_POPULATION	0.956983 15.47047	0.933050 12.16521	1.000000 -----

Own Creation

Data Sources: Eurostat Database

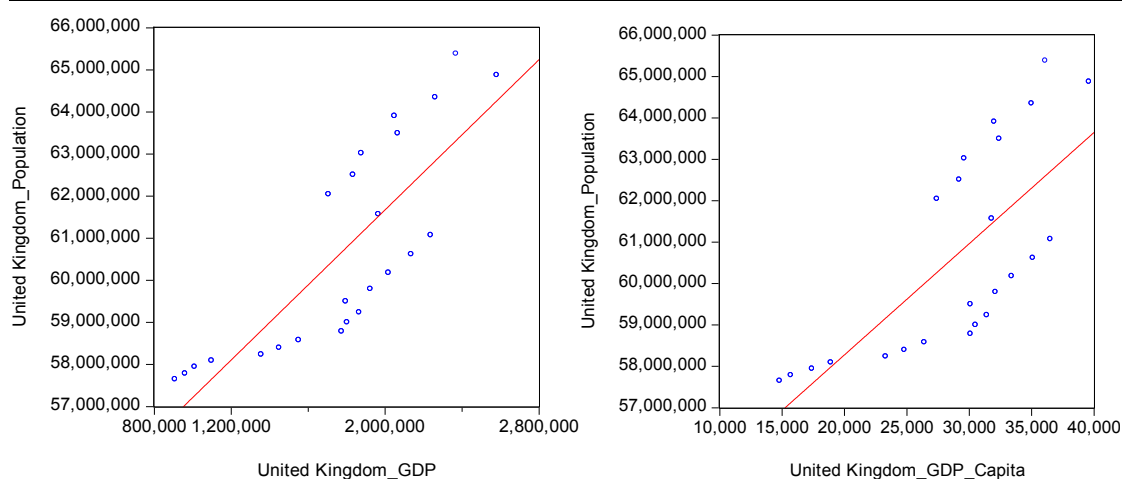


Image no. 20. Regression line for GDP/Capita, GDP and population of the United Kingdom
Source: Own processing of data in Eviews

Table nr. 7. Covariance Analysis between UK _GDP, UK _GDP_CAPITA and UK _POPULATION

Covariance Analysis: Ordinary

Date: 03/26/17 Time: 22:07

Sample: 1993 2016

Included observations: 24

Correlation			
Probability	UNITED_KINGDOM_GDP	UNITED_KINGDOM_GDP_CAPIT	UNITED_KINGDOM_POPULATION
UNITED_KINGDOM_GDP	1.000000 -----		
UNITED_KINGDOM_GDP_CAPIT	0.989987 0.0000	1.000000 -----	
UNITED_KINGDOM_POPULATION	0.810886 0.0000	0.726321 0.0001	1.000000 -----

Own Creation

Data Sources: Eurostat Database