

ECONOMIC GROWTH AND MACROECONOMIC VARIABLES INFLUENCES IN ROMANIA

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1. Introduction

At the macroeconomic level, the economics activities are developing through a continuous series of growth, developments, stagnations, processes and their results. In the meantime, there are periodically orientation modifications of these activities' evolution (passing from activity compressions and stagnations to growths and, vice versa, from growths to stagnations). The dynamics of macroeconomic flows was approached and analyzed with a series of specific notions such as: economic growth (positive, zero, negative); expansion and recession (depression); economic development and economic and social sub-development; economic progress and regress.

Having as theoretical background the IS-LM model or Hicks-Hansen for a small open economy, Romania's case, the current paper has as main objective the identification of the factors that influence the evolution of the real sector in Romania between 1990 and 2007, this being the main reason why we will analyze only the IS curve.

2. Theoretical Considerations

The IS-LM model is of Keynesian inspiration, developing the market conditions proposed by Keynes in his model. The IS-LM was elaborated by J. Hicks and B. Hansen, in the close economy scenario starting from the end of the 1930s, and by R. A. Mundell, in the open economy scenario the 1960s. The essential difference between the Keynes model and the IS - LM model is that the

IS - LM model takes into consideration the monetary market.

The IS-LM model for an open economy also includes, besides the two above mentioned markets met in the close market (goods and services market and monetary market), the external components of the market, aiming the exchanges of goods and services and capital flows. In this model, the J. Lecaillon hypothesis regarding the "rest of the world" global approach is used. This is another "national economy", connected with the studied one through commercial links. The world economy appears to be made of two economies: the national economy of the studied country and the "national economy of the rest of the world".

The real sector of the economy, described by the IS curve, has the classical linear equation form:

$$Y = C + I + G + NX, \quad (1)$$

where: Y—production (GDP), C—consumption, I—investments, G—government spending, NX—trade balance.

In the specialized literature, many neo Keynesian models that describe the effects of capital flows over net exports are presented: Borensztein (1998), Lim (2001) Holland and Pain (1998), Bosworth and Collins (1989; 2003) and the effects of foreign investments over domestic capital: Blanchard (1981), Chiarella, Flaschel, Franke, and Semmler (2000), Sebastian E. (1990).

According to Borensztein (1998), governments tend to see FDI as a subsidy on their own investment, as FDI investment is usually locally matched by

one for one or greater - hence the favourable regulatory changes. Bosworth and Collins (2003) reached the same conclusion, but the correlation established by the authors between foreign investments and the GDP growth was weaker: the increase with one percent of the foreign investments drives to an increase of the GDP by only 0, 1%. Regarding the causality connection between governmental expenditure and the GDP growth, the related literature presents some empirical studies: Barro (1996); Gemmel (1983); Grossman (1998); Hansen (1994); Landau (1985) that is based on the usage of regression as an analysis method. Empirically, it can be observed that the majority of the governmental expenses effects over economic growth are negative, the causality link being in fact of inverse proportionality, excepting the studies of Cronovich (1998), Ram (1986) and Romer (1989)¹.

The aim of this paper is to determine the influences of those factors over Romanian economy between 1990 and 2007.

3. Data Sources and Methodology

For the beginning, we will make the testing of the correlation among macroeconomic variables for the Romanian economy: (1) correlation between the GDP evolution and public expenditure; (2) correlation between the GDP evolution and the final consumption; (3) correlation between the GDP evolution and foreign direct investments; (4) correlation between the GDP dynamics and capital; (5) correlation between the GDP evolution and the external demand; (6) correlation between the GDP and the trade balance.

¹ The weak point of these studies (that is also a limit of our study) is constituted by the fact that the structure of public expenditure is not taken into consideration, being considered as an explicative variable in global value.

After establishing the existence of correlations among macroeconomic variables, we will determine the estimators of the IS curve equation by using Eviews Programme. Based on the IS curve equation estimators, recorded values will determine the contribution of each variable to the GDP forming and dynamics.

For statistical results, Matlab (Matrix Laboratory) has been used. The data is analyzed by using files witch contain the data set. Such a file, used for obtaining the results for this study, contains the data set, arranged on column (on every column there is a particular data set, meaning the evolution of a particular macroeconomic indicator). The further results have been obtained through applying the specific functions for analyzing the data.

For the graphical representations, the specific function has been used: plot (vector1, vector 2), vector 1 and vector 2 being obtained from the data file (by reading the columns for the specific macroeconomic indicators).

The specific function for the correlation coefficient ([R,P]=corrcoef(vector 1, vector 2) has been used. The results were shown as a 2x2 matrix, one 2x2 matrix for the R result and another for the P result, on the secondary diagonal, there are the results for R or P and on the main diagonal there is 1 (using the matrix elements coefficients), the elements from the main diagonal (with the coefficients 11 and 22-regarding the 2x2 matrix) mean that the result is 1 for a data set correlated with itself.

In order to assure the data comparability, the parameters' values were transformed into comparable values by bringing them to the same comparison base (the year 1990), the data being calculated both in lei and euro.

Data series construction was made based on the information offered by the National Institute of Statistics, the

National Bank of Romania and the Finance Ministry (see table no. 1, table no. 2, table no. 3 and table no. 4 from the Annex).

4. Results and Discussions

4.1. Correlation between the GDP and Public Expenditure

For Romania, using the specific function for the correlation: coefficient ($[R,P]=\text{corrcoef}(\text{column regarding the column for the GDP data, column regarding the column for the public expenses data})$) the results are: $R=0.56$, $p=0.014$.

The result obtained means that there is some correlation between the GDP and the public expenditure, but not a very strong one. These results are demonstrated by the interpretation of the two numerical results (R and P). Thus, R is analyzed by using the R-table. For a given probability level (it was considered 0.05-for 100 experiments, in only a maximum of 5 cases, it can be a random result), it is considered the degree of freedom $df=n-2$ (n is the number of years for the analyzed period, in this study $df=18-2=16$) and the value of R from this table is compared with the R which has been obtained in Matlab.

The correlation will be significant if the value obtained is greater than the R-value from the table. For a significant level of 0.05, $df=16$, R-value from the table is 0.468, which is lower than the value obtained. Furthermore, if the P value is lower than 0.05, the correlation is stronger. Thus, the correlated result obtained means that there is some correlation between the evolution of the GDP and the public expenditure.

The graphical representation of the evolution of the GDP depending on the evolution of the public expenditure shows two linear periods, one for the first 3 years (1990-1993) and the second for the last 7 years (2000-2007). Between these periods (1994-1999, the period

ringed in the *fig.1*), the relationship was fluctuant and diffuse.

The evolution of the two variables has the significance that the budgetary policy of the governments between 1994 and 1999 was not a coherent one, in order to establish the expenses level correlated with the real possibilities of the national economy.

The graphical representation of the two curves during the years will be significant for the conclusion, due to the fact that there is not a strong correlation between curves.

Thus, *fig. no. 2* shows the separate evolution of the GDP and public expenditure, over the years 1990 and 2007. The two curves are different, which shows a weak correlation between the two data sets. This fact is observed easier when each data trend is shown on graphical evolution.

As it can be observed, the two trends are significantly different, the trend for the GDP increase over the years (see *fig. 3*), but the trend for public expenditure slowly decreases over the years (see *fig. 4*). This graphical result, correlated with the numerical results which placed the correlation into an uncertain correlation suggests that, finally, there is a weak correlation between the two data sets.

Based on these observations, it can be highlighted that, in Romania, the dynamics of the economic growth is insignificantly influenced by the public expenditure evolution (see *fig. 5*).

4.2. Correlation between the GDP and Final Consumption

Using the specific function for the correlation coefficient ($[R,P]=\text{corrcoef}(\text{column regarding the column for the GDP data, column regarding the column for the final consumption data})$) the results are: $R=0.87$, $p=0.0002$.

The result obtained means that there is a *very good correlation* between the GDP and the final consumption.

The graphical representation of the evolution of the GDP depending on the evolution of the final consumption shows two linear periods, one for the first 3 years (1990-1993) and the second for the last 7 years (2000-2007). Between these periods (1994-1999, the period ringed in the *fig.6*), the relationship was fluctuant and diffuse (similar to *fig.1*).

Furthermore, *fig.7* shows the separate evolution of the GDP and final consumption (1990-2007). The two curves are almost identical, fact which states the stronger correlation between these two data sets. The trends highlighted for the two indicators are comparable (see *fig. 7*): the GDP and the final consumption have the same evolution, increased in the economic re-launching periods (1993-1996 and 2000-2007), and decreased in the recession periods (1990-1992 and 1997-1999).

As a consequence, in Romania the final consumption contributes significantly to the GDP growth.

4.3. Correlation between the GDP and the Foreign Direct Investments

Using the specific function for the correlation coefficient ($[R,P]=\text{corrcoef}$ (column regarding the column for the GDP data, column regarding the column for the foreign direct investments) the results are: $R=0.94$, $p=0.0007$.

The result obtained means that there is a *very good correlation* between the GDP and foreign direct investments. Furthermore, the graphical representation (*figure 8* and *figure 9*) of the evolution of foreign direct investments and the evolution the GDP show a step evolution of the foreign direct investments.

The foreign direct investment has the same evolution as the GDP, with only a slight difference between 1992 and 1994, and also between 1996 and 1998, which reveals the fact that foreign investors are very sensible to the Romanian economy evolution. In the

economic growth periods, capital flows are registered in Romania while in the recession periods the foreign capital is more reticent and the capital flow changes its direction.

Between 2003 and 2006, the investments had a constant growth especially as a result of fiscal relaxation. In 2005, the net foreign direct investments inflow registered 6.6% from the GDP, and in 2006 it reached 9.3% from the GDP. The reduction of the direct tax over work and capital stimulated the savings and investments, process reflected in the foreign investments growth. Between 2003 and 2006, this evolution led to the significant increase of their contribution to the real growth of the GDP.

4.4. Correlation between the GDP and Capital Evolutions

Using the specific function for the correlation coefficient, the results are: $R=0.32$, $p=0.19$.

This result is weaker than the correlations between the GDP and the capital evolution (*fig. 10*), so the correlations are more significant considering the capital components.

The graphical representation of the evolution of the GDP depending on the capital evolution shows four approximately linear periods: 1. The first three years 1990-1992 (both the GDP and capital decreased), 2. The next four years 1993-1996 (the GDP increased, capital decreased), 3. The next 3 years 1996-1998 (both the GDP and capital decreased) and 4. The last 9 years 1999-2007 (both the GDP and capital increased).

Furthermore, *fig.11* shows the separate evolution of the GDP and capital, over the years 1990 and 2007. The two curves evolved in different ways (the GDP evolution increased over the years, capital evolution slowly decreased on the first 9 years 1990-1998, then slowly increased 1999-2007).

Correlation between the GDP and Net Exports

Using the specific function for the correlation coefficient, the results are: $R=-0.97$, $p=0.0001$. The result obtained means that there is a very good correlation between the GDP and net exports. The fact that R has a minus sign means that the correlation is strong, *but negative* (there has been a real decrease of the GDP depending on the net exports evolution – *fig. 12* and *fig. 13*).

In the analyzed period, the net export has a negative contribution to the GDP growth, pursuant to increased goods and services imports caused by: (1) the dependency of the Romanian economy on energetic and raw materials imports; (2) capital goods imports.

The Correlation between the GDP and the Stocks Variation

Using the specific function for the correlation coefficient, the results are: $R=0.3999$, $p=0.11$. The result obtained means that there is a weak correlation between the GDP and stocks variation, even almost near the limit of the statistical significance level.

Despite the weak correlation, it can be observed that (see table no 1 and *fig. 10*), in the period 1990-1996, positive variation of the GDP, expressed in 1990 prices, is due to the positive stocks variations. The production has been continued, and the stocks have been increased, while the market did not request these products. This has been done so that the employment level should not be significantly affected and generate social dissatisfactions.

4.5. Correlation between the GDP and the External Demand

Using the specific function for the correlation: coefficient ($[R,P]=\text{corrcoef}$ (column regarding the column for the GDP data, column regarding the column for the external demand data) the results are: $R=0.78$, $p=0.001$. The result

obtained means that there is a strong correlation between the GDP and the external demand.

The graphical representation of the evolution of the GDP depending on the external demand shows two linear periods, one for the first 3 years (1990-1993) and the second for the last 7 years (2000-2007). Between these periods (1994-1999, the period ringed in the *fig. 14*) the relationship was fluctuant and diffuse.

4.6. Correlation between the GDP and the Trade Balance

Using the specific function for the correlation coefficient, the results are: $R=-0.91$, $p=0.0001$.

The result obtained means that there is a very good correlation between the GDP and the trade balance (*fig. 16*), but as R has the minus sign, it means that the correlation *is strong but negative* (there has been a real decrease of the GDP depending on the trade balance evolution). The graphical representation of the evolution of the GDP depending on the trade balance evolution shows a various evolution and a significant decrease after 1999.

Furthermore, the *fig. 17* shows the separate evolution of the GDP and trade balance, over the years 1990 and 2007. The two curves evolved in different ways (the GDP evolution increased over the years, trade balance slowly decreased over the years), but almost symmetrical, fact which states the strong negative correlation between these two data sets.

Thus, the fast expansion of imports led to the increase in trading deficit reflected in the growth of current account deficit.

The obtained results regarding the statistical tests reveal the existence of correlations among the studied variables. With the assistance of the Eviews programme, the IS curve equation parameters were estimated,

obtaining the following result: $a_1=0.022$; $a_2=0.714$; $a_3=0.091$; $a_4=0.088$; $a_5=0.312$; $a_6=0.004$.

5. Conclusions

In order to measure the economic growth, the paper used as indicator the real GDP growth rate.

The results obtained after the statistical analysis suggest that in Romania the most important contribution to the forming and dynamics of the GDP has the final consumption (the increase with one percent of the final consumption determines a GDP growth with 0.714%), foreign direct investments (that contributes with 0.312% to the GDP growth), followed public expenditure. The external demand has contributed with 0.088% to the GDP growth (the most reduced contribution to the economic growth and the development of the real sector).

Regarding the capital variation, this component does not generate a significant influence over the GDP growth, its contribution reaching 0.022%. Finally, the trade balance and the net exports had a negative effect over the GDP growth.

Obviously, the present analysis is empirical and it is not without its limitations: firstly, the data series taken from the National Financial Accounts are calculated upon different methodologies: *ESA 1979 methodology*, for figures of the 1990-1998 period, and *ESA 1995 methodology*, for figures of the 1999-2007 period; secondly, the capitals were determined without taking into account the influence of depreciation and amortization; in order to estimate the effects of public expenditure over the GDP growth, the structure of public expenditure was not taken into account, being considered as an explicative variable, as a global figure.

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ANNEX

Year/ Indicator	Fixed capital brut formation (bln. lei, prices 1990)	Stocks variations (bln. lei, prices 1990)	Export net (bln. lei, prices 1990)	Capitals (bln. lei, prices 1990)	GDP (bln. lei, prices 1990)	GDP growth rate (%)	Capital variations (%)
1990	169.8	89.7	-81.1	178.4	857.9	-5.6	-1.65
1991	107.5	102.1	-29.4	180.2	747.2	-12.9	1.0
1992	130.8	83.3	-57.3	156.8	681.5	-8.8	-12.98
1993	123.7	76.4	-34.4	165.7	691.7	1.5	5.67
1994	145.8	32.5	-14.8	163.5	718.7	3.9	-1.32
1995	164.6	22.3	-43.1	143.8	769.8	7.1	-12.04
1996	183.6	23.2	-67.4	139.4	800.0	3.9	-3.05
1997	159.0	-4.1	-53.1	101.8	751.2	-6.1	-26.97
1998	130.0	-3.0	-57.4	69.6	715.3	-4.8	-31.63
1999	125.1	-11.5	-34.1	79.5	706.6	-1.2	14.22
2000	136.3	4.0	-40.6	99.7	721.2	2.1	25.49
2001	156.1	14.5	-59.1	111.5	762.2	5.7	11.80
2002	169.0	2.9	-46.3	125.6	799.6	5.1	12.63
2003	187.3	4.0	-65.7	125.6	828.9	5.2	-0.01
2004	205.9	18.3	-85.4	138.8	837.4	8.4	10.54
2005	228.3	-4.2	-100.8	123.2	872.4	4.1	-11.21
2006	280.1	9.5	-131.6	158.0	917.8	5.2	28.16
2007	273.4	10.8	-120.7	163.5	983.1	7.1	3.47

Table no. 1: GDP Variation and Capital Variation, 1990-2007

Source: Computed by authors based on the data supplied by the National Institute of Statistics and the National Bank of Romania

Year	GDP	Final consumption	Total governmental expenditure
1990	857.9	676.8	332.0
1991	747.2	567.1	289.1
1992	681.5	524.7	286.2
1993	691.7	526.1	236.5
1994	718.7	555.2	247.2
1995	769.8	626.0	267.1
1996	800.0	660.5	270.4
1997	751.2	649.3	252.4
1998	715.3	645.8	246.7
1999	706.6	627.1	245.1
2000	721.2	621.4	254.5
2001	762.2	649.2	253.8
2002	799.6	661.1	258.2
2003	828.9	690.7	256.3
2004	837.4	718.2	260.4
2005	872.4	738.5	271.3
2006	917.8	812.3	288.1
2007	983.1	839.2	295.9

Table no. 2: GDP Evolution, Final Consumption and Total Governmental Expenditure, 1990-2007, (comparable prices 1990, bln. lei)

Source: Computed by authors based on the data supplied by the National Institute of Statistics and the Finance Ministry

Year	GDP (bln. Euro)	variation (%)	Foreign direct investments (bln. Euro)	variation (%)
1990	35.7	-5.6	----	-
1991	25.1	-12.9	0.035	-
1992	15.1	-8.7	0.059	68.57
1993	22.6	1.5	0.081	37.28
1994	25.3	3.9	0.28	245.67
1995	27.4	7.1	0.32	14.28
1996	28.2	3.9	0.21	-34.37
1997	31.3	-6.0	1.07	409.52
1998	37.4	-4.8	1.8	68.22
1999	33.5	-1.1	0.98	-45.55
2000	40.3	2.9	1.14	16.32
2001	44.9	5.5	1.29	13.15
2002	48.5	5.0	1.21	-6.20
2003	52.6	5.2	1.94	60.33
2004	60.8	8.5	5.18	167.01
2005	79.3	4.1	5.21	0.57
2006	97.2	7.9	9.06	73.89
2007	112.1	6.2	7.25	-19.97

Table no. 3: GDP Evolution and Foreign Direct Investments, 1990-2007 (bln.Eur)

Source: Computed by authors based on the data supplied by the National Institute of Statistics and the National Bank of Romania

Year/ Indicator	GDP (bln. lei, prices 1990)	Trade balance (FOB- FOB), bln. lei, prices 1990	Trade deficit /GDP (%)
1990	857.9	-77.25	-9.00
1991	747.2	-30.02	-4.1
1992	681.5	-51.41	-7.54
1993	691.7	-31.74	-4.58
1994	718.7	-10.52	-1.46
1995	769.8	-35.50	-4.61
1996	800.0	-58.50	-7.31
1997	751.2	-43.82	-5.83
1998	715.3	-45.58	-6.37
1999	706.6	-25.51	-3.61
2000	721.2	-34.91	-4.84
2001	762.2	-56.87	-7.46
2002	799.6	-45.78	-5.72
2003	828.9	-61.33	-7.40
2004	837.4	-76.20	-9.10
2005	872.4	-88.98	-10.2
2006	917.8	-111.05	-12.11
2007	983.12	-141.56	-14.4

Table no.4: Trade Balance and the Trade Deficit/GDP between 1990 and 2007

Source: Computed by authors based on the data supplied by the National Institute of Statistics

Year/ Indicator	GDP	External demand
1990	857.9	152.8
1991	747.2	115.72
1992	681.5	157.79
1993	691.7	130.24
1994	718.7	148.21
1995	769.8	172.91
1996	800.0	183.21
1997	751.2	180.10
1998	715.3	140.94
1999	706.6	170.35
2000	721.2	203.01
2001	762.2	215.25
2002	799.6	242.76
2003	828.9	259.21
2004	837.4	293.72
2005	872.4	276.95
2006	917.8	290.26
2007	983.2	293.65

Table 5.:GDP Evolution and External Demand, 1990-2007,
(Comparable prices 1990, bln. lei)

Source: Computed by authors based on the data supplied by the National Institute of Statistics

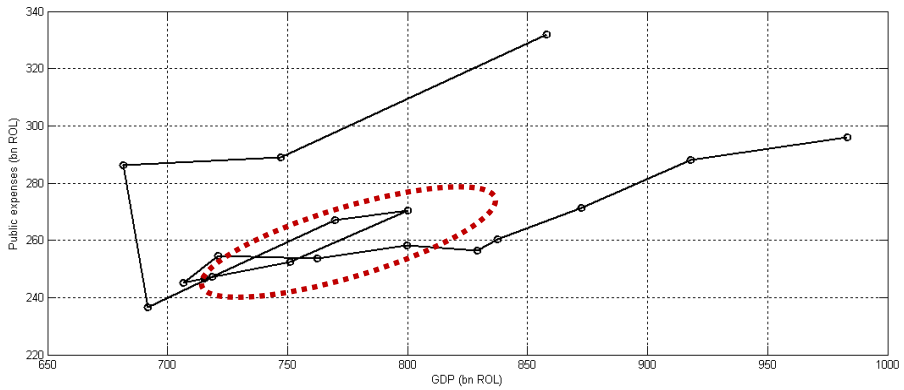


Figure 1: Correlation between GDP and public expenditure (1990-2007)

Note new toolbar buttons: [data brushing & linked plots](#)   [Play video](#)

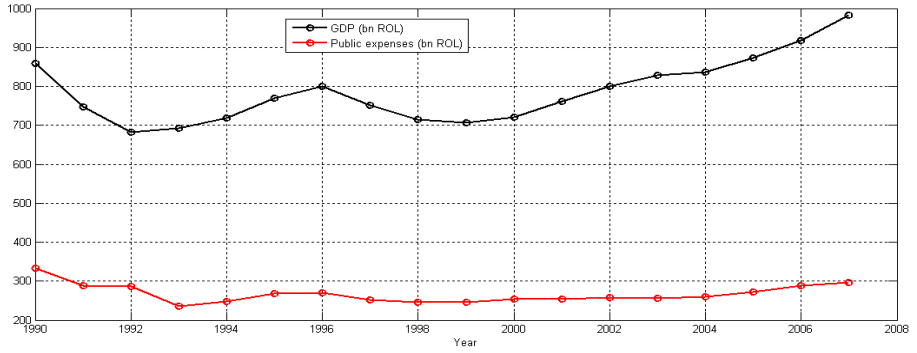


Figure 2: GDP evolution and public expenditure (1990-2007)

Note new toolbar buttons: [data brushing & linked plots](#)   [Play video](#)

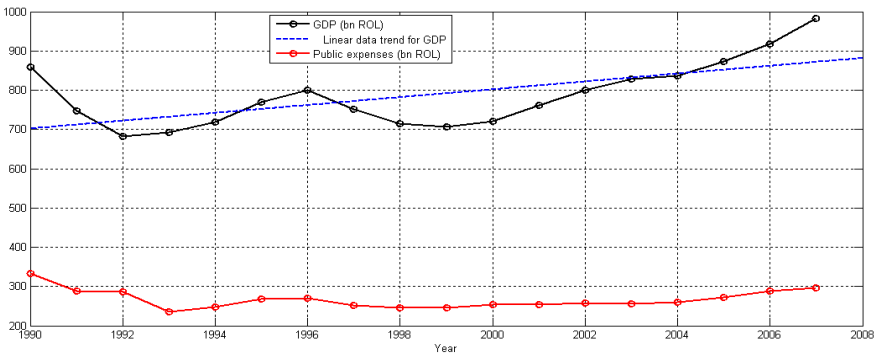


Figure 3: Linear data trend for GDP

Note new toolbar buttons: [data brushing & linked plots](#)   [Play video](#)

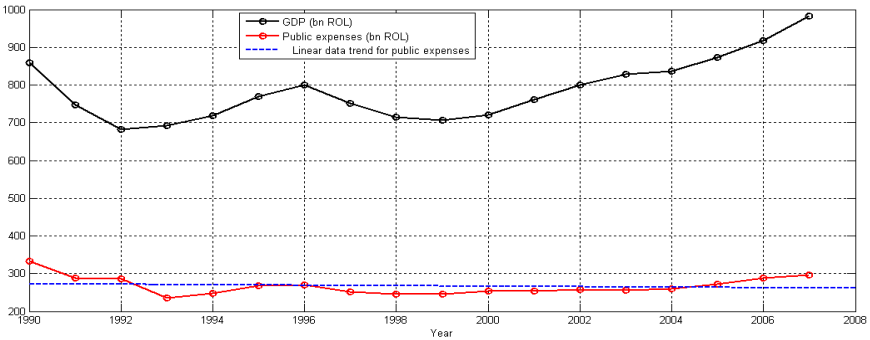


Figure 4: Linear data trend for public expenditure

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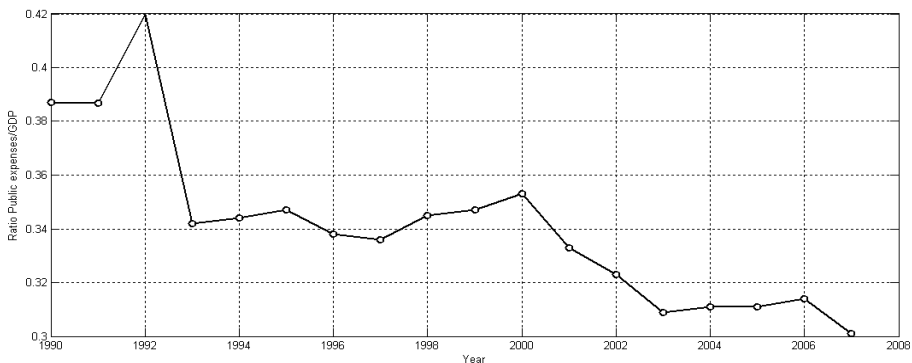


Figure 5: Public expenditure /GDP (%)

Note new toolbar buttons: [data brushing](#) & [linked plots](#) [Play video](#)

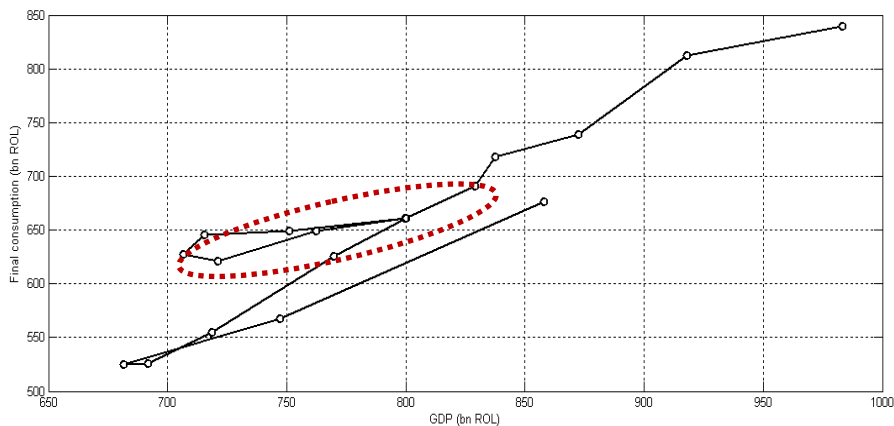


Figure 6: Correlation between GDP and final consumption, 1990-2007

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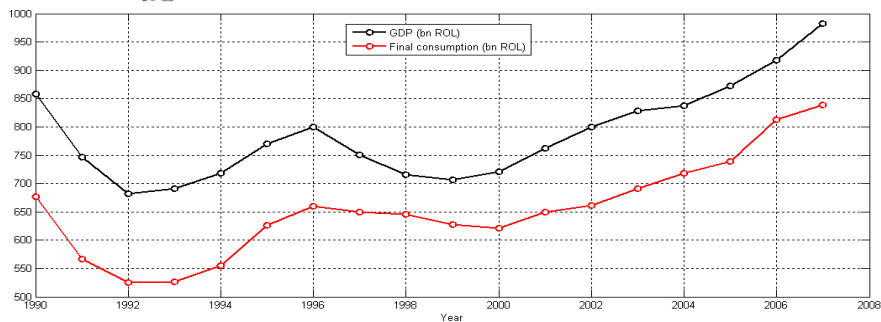


Figure 7: GDP evolution and final consumption, 1990-2007

Note new toolbar buttons: [data brushing](#) & [linked plots](#) [Play video](#)

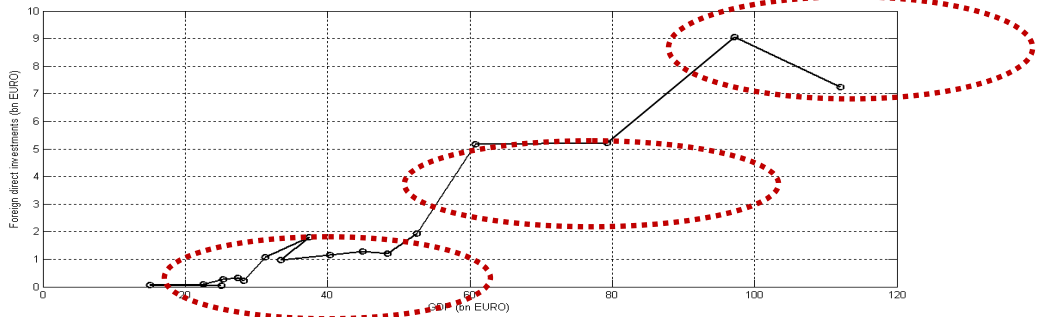


Figure 8: Correlation between GDP and the foreign direct investments, 1990-2007

Note new toolbar buttons: [data brushing](#) & [linked plots](#) [Play video](#)

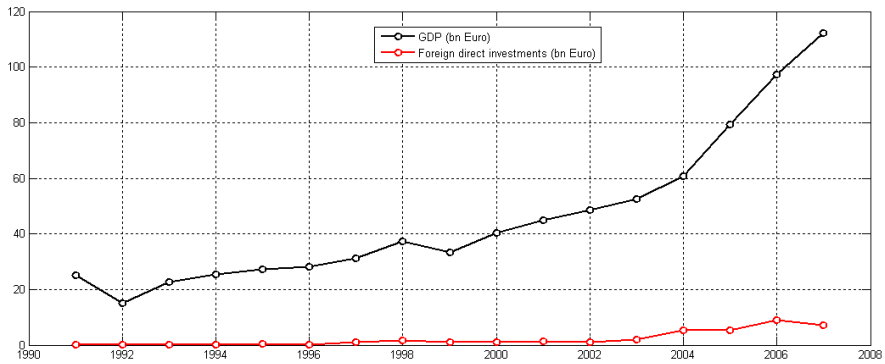


Figure 9: GDP evolution and the foreign direct investments

Note new toolbar buttons: [data brushing](#) & [linked plots](#) [Play video](#)

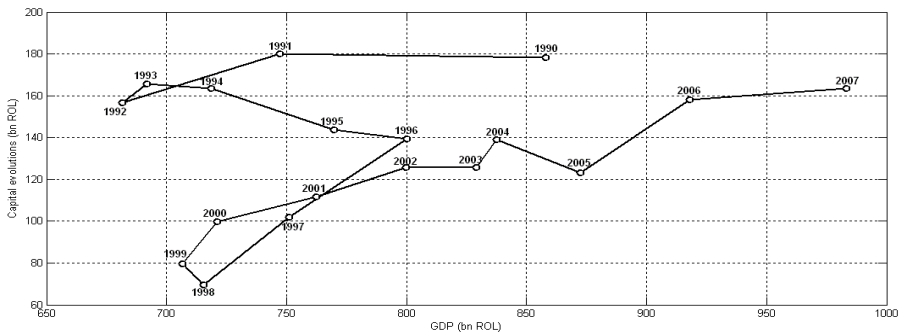


Figure 10: Correlation between GDP and capital evolutions

Note new toolbar buttons: [data brushing](#) & [linked plots](#) [Play video](#)

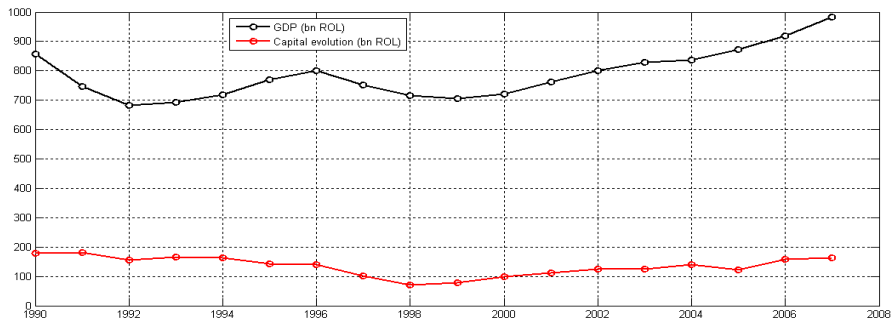


Figure 11: GDP evolution and capitals, 1990-2007

Note new toolbar buttons: [data brushing](#) & [linked plots](#)   [Play video](#)

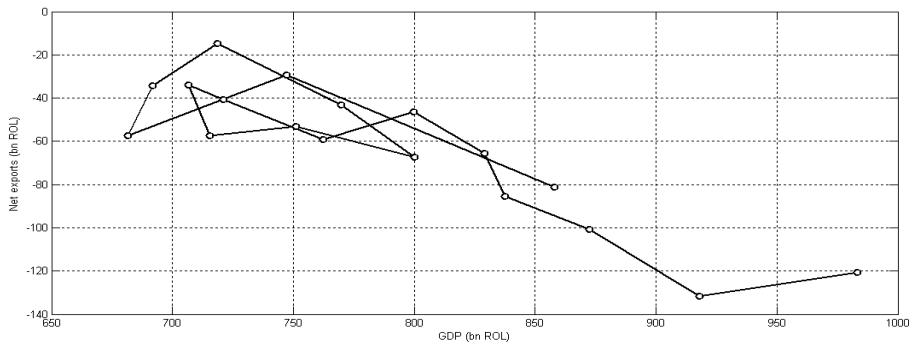


Figure 12: Correlation between GDP and net exports, 1990-2007

Note new toolbar buttons: [data brushing](#) & [linked plots](#)   [Play video](#)

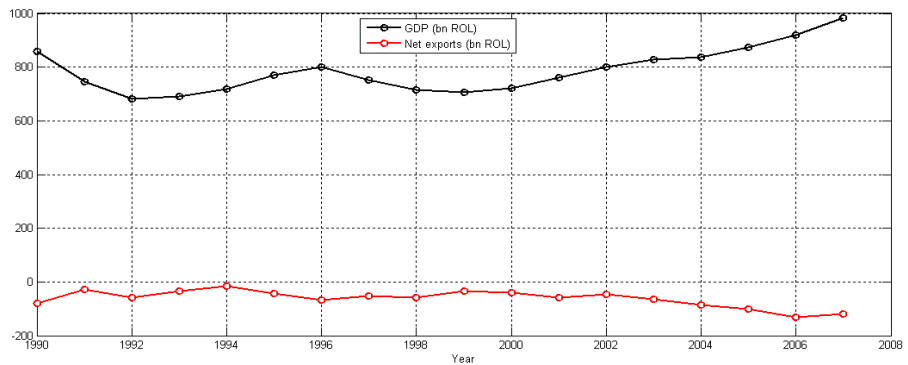


Figure 13: GDP evolution and net exports, 1990-2007

Note new toolbar buttons: [data brushing](#) & [linked plots](#)   [Play video](#)

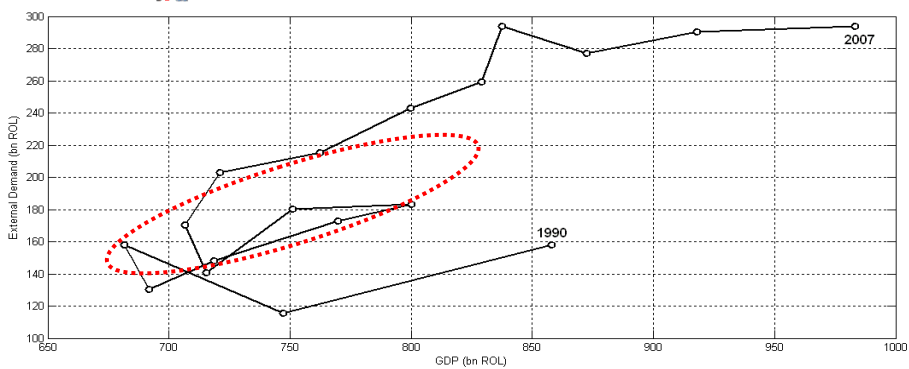


Figure 14: Correlation between GDP and external demand, 1990-2007

Note new toolbar buttons: [data brushing](#) & [linked plots](#) [Play video](#)

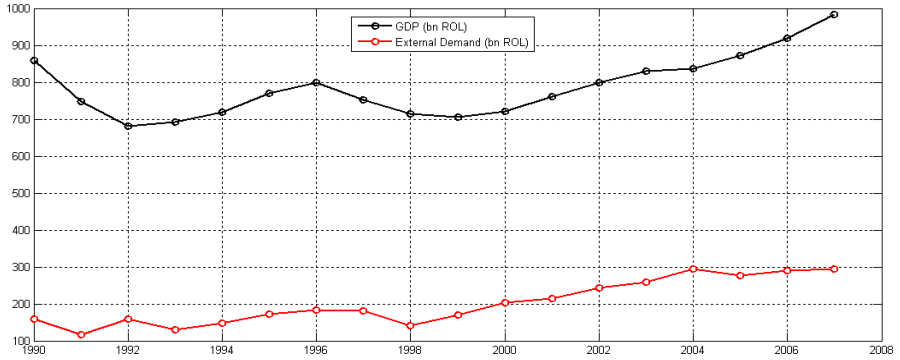


Figure 15: GDP evolution and external demand, 1990-2007

Note new toolbar buttons: [data brushing](#) & [linked plots](#) [Play video](#)

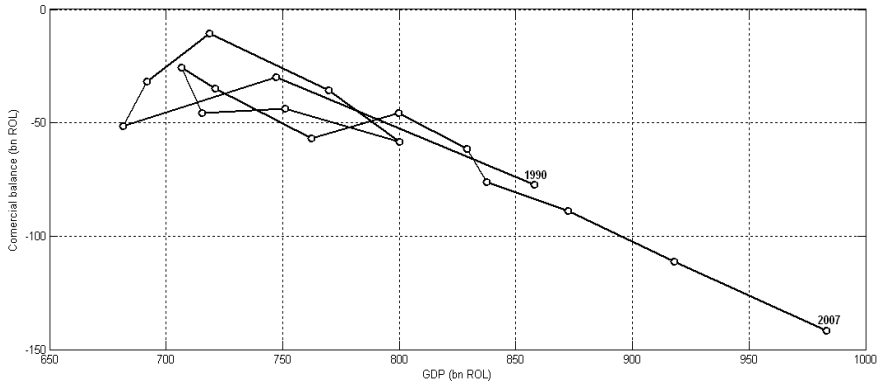


Figure 16: Correlation between GDP and trade balance

Note new toolbar buttons: [data brushing](#) & [linked plots](#) [Play video](#)

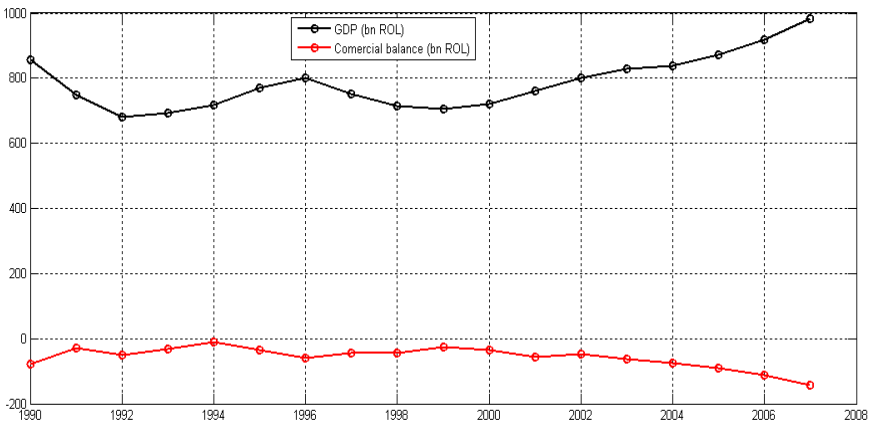


Figure 17: GDP evolution and trade balance