Professor Emilia ȚIȚAN, PhD
E-mail: Emilia.titan@csie.ase.ro
Vladimir GEORGESCU, PhD Candidate
The Bucharest University of Economic Studies

RECOVERY AND LONG-LASTING EFFECTS OF THE RECENT CRISIS: A MULTIVARIATE ANALYSIS

Abstract. *This paper aims to find evidence on whether and to what extent the recent crisis leaves a permanent or a long-lasting effect on the state of the economy for the EU28 countries and to investigate on the characteristics of the recovery process. The analysis is multivariate and the framework concentrates on a limited number of relevant variables in order to find evidence with regard to the evolutions in the EU28 economies in the aftermath of the crisis. An important issue is whether it is reasonable to expect a robust return of growth and how different this new path is in comparison to the pre-crisis levels. Additionally, an analysis is performed in order to find the way in which the EU28 countries behave relative to each other in the context of the crisis and its aftermath.*

Key words: *recovery, output gap, long-lasting effect, multivariate analysis*

JEL Classification: C12, E30, F43, F44

1. Introduction

Boom and bust periods are typical for the evolution of the economy and can be to a large extent natural movements. However, when confronted with a steep recession, the economy is seriously disrupted and it suffers damage that can be of different magnitudes and stretched over various time horizons. A key question is whether a crisis leaves a permanent or a long-lasting effect on the state of the economy.

This article performs an empirical study aiming to find evidence regarding the issue mentioned before and proposes a multivariate framework for analysis that is centered on a limited number of relevant variables. Data for EU28 countries are

analyzed, in order to find evidence regarding the permanent or long lasting effects of the recent crisis and the characteristics of the recovery process.

Another issue that is particularly important is whether it is reasonable to expect robust growth in the aftermath of the crisis and how much different is the new growth path in comparison to the pre-crisis levels.

An analysis is also performed in order to find the relative behavior of the EU28 countries in the context of the crisis and its follow-up. It is interesting to see whether the countries become more homogeneous or not in terms of the analyzed variables.

During the recent crisis, European Commission (2009) tried to evaluate the situation and provided several scenarios for the possible developments over the long term. The optimistic scenario implied a complete recovery, the intermediate one considered that potential output would experience a permanent level loss (while potential output growth returns to the same slope as the one before the crisis), and the scenario viewed as pessimistic stated that the loss in the level of potential output would increase with time (the slope of potential output growth is lower than the one before the crisis). Of course, it is also possible to additionally consider situations like a recovery path that exceeds the initial growth trend, or different other evolutions, but the three possibilities that are outlined by European Commission (2009) are clearly useful for an analysis.

Furceri and Mourougane (2009) investigate the effect of financial crises on developments in potential output. For their analysis, they consider the period 1960-2007 and a panel of OECD countries. They find that "financial crises have a negative and persistent effect on potential output. The amplitude of the long-term effect lies in general between 1.5 to 2.4%, but a much more pronounced effect is observed for deep and severe financial crises" (p. 14).

Furceri and Zdzienicka (2010a) look at the aftermath of banking crises from the perspective of public debt. They analyze a set of 154 countries for the period 1980-2006 and state that "banking crises have produced a significant and long-lasting increase in the government debt-to-GDP ratio, with the effect being a function of the severity of the crisis" (p. 11). Bearing in mind this piece of evidence, it is plausible to expect that a deep financial crisis influences sensitive variables in the economy, that are difficult to be set back on track. Therefore, in the absence of substantial positive shocks, a scenario is imaginable in which the recovery process is difficult and takes much longer than the actual recessionary period. Takáts and Upper (2013) find evidence that indicates "some weak negative association between public debt ratios and recoveries: increasing public debt seems to lead to somewhat weaker recoveries" (p. 22). Using this argument, these authors express doubts on the theory that fiscal stimulus represents the right approach for economic recovery.

Takáts and Upper (2013) make another useful finding and state that "bank lending to the private sector and economic growth are essentially uncorrelated after those financial crises that were preceded by credit booms" (p.22). Moreover, the authors consider that this can be evidence that "deleveraging in advanced economies might not be as harmful for the recovery as many fear" (p. 22).

Furceri and Zdzienicka (2010b) investigate on the effects of banking crises in the case of developing countries. They analyze a set of 159 countries over the period 1970-2006 and obtain several interesting results, among which is the fact that "banking crises significantly affect economic performance of developing countries […] with a peak effect reached three years after the occurrence of a banking crisis" (p. 14).

2. Data

The original data are from Eurostat and the AMECO database of the European Commission and have annual frequency. The variables we consider are real GDP growth (%), output gap (%), HICP inflation (%), unemployment (%), debt to GDP ratio (%), government balance (%, +/-), exports of goods and services (% of GDP), imports of goods and services (% of GDP). We take averages for all EU28 countries for two periods (2004-2007 and 2010-2013).

For Estonia and Poland, data is not available for the period 2004-2007 for the variables debt/GDP (%) and government balance (%, +/-).

In Table 1, other minor data issues are depicted with an asterisk (some data are provisional, differences in definitions, missing observations).

3. Empirical analysis

For our multivariate analysis, we consider the EU28 countries and two periods, namely 2004-2007 and 2010-2013. These two periods enable us to see patterns in the behavior of the variables before the beginning of the crisis and after the crisis start. Even though the recent crisis did not start at the same time and did not manifest in the same way in all EU countries, the considered split is suitable in order to capture useful information about the situation before the crisis and the one after the beginning of the crisis. The years 2008 and 2009 are left intentionally out, since they contain information from a period of turmoil, and we are more interested in the period preceding the crisis and the period of the aftermath and recovery.

Each economy is described synthetically by eightindicators, with values representing averages over the two periods. Comparing each pair ofcolumns of the resulting panel, one for the period 2004-2007 and one for the period 2010-2013, it is possible to have an overview of the situation in the EU28 countries as a result of the crisis. In the

second period, the evolutions which we regard as positive are colored in green, and the ones which we consider negative are depicted in red. In situations in which we cannot compare (because of missing data), the observations in the second period are not colored. Moreover, for the variable imports of goods and services (% of GDP), all observations from the second period are not colored. This is because it is possible to have arguments in both directions, namely that an increase of the share of imports of goods and services is a positive or a negative development. However, we consider this variable as very relevant for the analysis.

Table 1. Overview of selected relevant indicators before and after the crisis

	Real GDP (%)		Output gap (%)		HICP Inflation (%)		Unemployment (%)		Debt/GDP (%)		Government balance (%,+/-)		Exports of goods and services (% of GDP)		Imports of goods and services (% of GDP)	
	Average 2004-2007	Average 2010-2013	Average 2004-2007	Average 2010-2013	Average 2004-2007	Average 2010-2013	Average 2004-2007	Average 2010-2013	Average 2004-2007	Average 2010-2013	Average 2004-2007	Average 2010-2013	Average 2004-2007	Average 2010-2013	Average 2004-2007	Average 2010-2013
BE	2.7	1.1	1.4	-0.7	2.1	2.4	8.2	7.9	92.3	102.6	-0.6	-3.7	79.5	84.2	75.4	82.8
BG	6.5	0.9	2.1	-0.5	6.8	2.3	9.5	11.7	25.3	17.0	1.4	-1.7	53.3	65.2	69.3	66.7
CZ	6.1	0.6	3.6	-1.6	2.3	2.1	7.2	7.0	28.1	42.6	-2.2	-3.2	65.7	74.0	63.4	69.1
DK	2.4	0.6	2.9	-3.4	1.6	2.0	4.5	7.4	35.1	45.0	4.3	-2.4	49.7	53.5	45.9	48.1
DE	2.2	2.1	-0.6	-0.2	2.0	1.9	10.1	5.9	65.3	78.5	-2.1	-1.2	43.1	50.2	37.4	44.5
EE	8.2	4.7	8.5	-0.8	4.6	3.8	7.2	11.9	NA	8.1	NA	0.1	72.6	85.7	80.9	83.5
IE	5.2	0.3	2.1	-2.5	2.5	0.5	4.5	14.1	25.6	110.9	1.5	-14.7	81.1*	103.4*	69.8*	82.0*
GR	3.9*	-5.7*	2.3	-10.5	3.2	2.0	9.5	20.7	103.3	162.3	-6.4	-10.5	23.2	25.9	34.4	32.1
ES	3.6	-0.7	2.6	-6.1	3.2	2.3	9.2	23.1	40.5	76.5	1.4	-9.0	26.2	31.3	31.8	31.3
FR	2.3	1.0	2.4	-1.1	1.9	1.8	8.7	9.7	65.2	87.0	-2.9	-5.2	26.6	26.8	27.3	29.2
HR	4.6	-1.4	3.2	-2.1	2.8*	2.3*	12.1	14.9	36.9	63.2	-3.7	-6.1	42.6	42.3	49.2	42.2
IT	1.6	-0.6	1.2	-2.7	2.2	2.3	7.2	9.9	101.0	120.5	-3.2	-3.4	26.9	29.0	27.0	29.0
CY	4.3	-1.5	2.8	-1.3	2.1	2.4	4.6	10.5	60.2	76.1	-1.0	-5.3	48.3	43.5	52.1	46.6
LV	10.0	3.3	7.4	-4.8	7.5	1.3	8.7	15.7	11.1	42.2	-0.7	-3.3	45.0	58.4	62.9	61.4
LT	8.2	3.7	5.0	-3.3	3.4	2.4	7.3	14.6	18.1	38.1	-0.9	-5.4	55.5	78.9	64.9	79.7
LU	5.3	1.7	1.1	-2.3	3.2	2.8	4.6	5.1	6.8	20.8	1.2	0.1	163.5	175.5	135.3	144.8
HU	3.2	0.5	3.2	-3.0	5.6	4.0	7.1	10.8	62.6	79.4	-7.2	-3.7	72.1	91.9	73.5	85.0
MT	2.5	2.4	0.2	-0.3	2.1	2.2	6.9	6.5	67.3	68.6	-3.0	-3.1	83.1	95.9	85.9	92.9
NL	2.9	0.1	-0.5	-2.2	1.6	2.2	4.6	5.2	46.8	63.9	-0.4	-3.9	70.8	84.7	62.8	75.9
AT	3.1	1.5	0.1	-0.7	2.0	2.5	4.8	4.5	66.2	81.9	-2.8	-2.7	55.2	56.6	50.5	52.8
PL	5.5	3.0	-0.5	0.8	2.4	2.8	15.1	10.0	NA	54.6	NA	-5.1	39.0	45.5	40.9	45.4
PT	1.6	-1.0	-0.1	-4.5	2.5	2.1	8.7	14.3	66.8	115.0	-4.9	-7.3	29.7	36.6	38.3	39.5
RO	6.7	1.3	4.6	-2.2	8.1*	4.6*	7.2	7.0	14.8	34.8	-1.9	-4.3	32.6	39.6	43.9	43.7
SI	5.3	-0.4	3.5	-3.2	3.1	2.2	5.9	8.6	25.5	52.0	-1.3	-7.6	64.0	73.5	65.0	69.9
SK	7.7	2.5	3.2	-1.7	4.1	2.5	14.9	14.1	33.7	47.8	-2.7	-4.6	80.6	91.0	83.7	88.1
FI	4.2	1.0	1.5	-1.8	1.0	2.6	8.0	8.0	38.7	51.2	3.5	-2.0	43.3	40.5	38.1	40.6
SE	3.8	3.0	1.5	-1.2	1.3	1.2	7.1	8.1	44.4	37.0	1.9	-0.6	49.4	48.4	41.5	42.6
UK	3.2	1.2	1.2	-3.0	2.0	3.3	5.1	7.9	42.0	82.8	-3.3	-7.8	26.8	31.4	29.5	33.2

Note: Data not available for EE and PL, period 2004-2007, for Debt/GDP(%) and Government balance(%,+/-). Other minor data issues are depicted with an asterisk (some data are provisional, differences in definitions, missing observations).

Source: *Eurostat, European Commission, authors' calculations*

First of all, the performance of real GDP is negative for all EU28 countries in the second period compared to the first period. The pace of economic growth is severely disrupted in most countries, but with rather large differences across the board. This negative performance is actually why we are discussing about a crisis, but this does not mean that all indicators are going to have negative evolutions. In quite many situations, depicted in green, the opposite happens. The crisis is a period that is an opportunity to set back on track parameters that have gone off balance.

For the output gap, we have considered positive evolutions to be the ones that bring the value of the variable closer to zero, regardless of the sign. For an important number of countries, the second period represents a chance to bring more balance back into the economy, by reducing the gap between actual and potential output.

Most countries see also a reduction in the level of HICP inflation, a consequence of downward pressures due especially to a decrease in consumption. However, in a number of countries HICP inflation increases in the second period, which is an unusual evolution and deserves consideration, which is not, however, in the scope of this article.

Unemployment rises in most countries, which is one of the effects of the crisis that is most damaging to the respective economies and to the EU28 as a whole. The inertia of unemployment is usually quite high and it is likely to have a long-lasting effect that will impede growth for many years. At the same time, there are countries that reduce their unemployment rates and seem to benefit from the crisis from this perspective. The most striking cases are the ones of Germany, with a decrease from 10.1% in the first period to 5.9% in the second period, and Poland, with a decrease from 15.1% in the first period to 10.0% in the second period.

With the exception of Bulgaria and Sweden, for all countries for which we can make a comparison, the debt-to-GDP ratio increases in the second period compared to the first period. In the same logic as the growth in unemployment, the growth in this indicator has long-lasting effects and acts as a brake for economic growth. Of course, this is a topic that is very important lately and it can be debated with multiple arguments and evidence separately. However, we can intuitively consider, for example, the argument that a higher debt-to-GDP ratio means more resources directed for paying interest rather than invested in the economy, other things constant.

So the table gives us a second reason to expect that the recovery after the crisis will be rather long and difficult.

In terms of government deficit, for the countries for which we can make a comparison, only Germany, Hungary and Austria improve their situation in the second period. The great majority of countries from the EU28 display, on average, increased deficits in the second period compared to the first period. This is an important reason for the deterioration of the debt-to-GDP ratios, and a factor that makes recovery more

difficult. Though usually the situation of the government deficit can be improved over a shorter time than that of the debt-to-GDP ratio, fiscal consolidation has its costs that are reflected in lower potential for economic growth. Of the variables we considered for the analysis, this one provides an additional reason to expect that the growth path before the crisis has been affected considerably over the long term, and that even if a new growth path is set after the critical phase of the crisis is over, chances are that this new trajectory has a lower slope.

An interesting result is the fact that most EU28 countries display an increase in the share of exports of goods and services to GDP, which we consider to be a positive development. With internal consumption under pressure, countries try to find external markets for their products, in order to support their output. In most cases, this is one of the engines of the recovery, but the power of this engine is different from case to case, depending on various factors, such as size of the economy and degree of openness. Some countries manage to use this channel quite effectively, a typical example being Germany.

Several countries display a decrease in the share of imports of goods and services to GDP, but most countries experience an increase in this share. We do not attempt to classify the developments into positive or negative, since arguments can be brought in both directions. It can be that an increase in the share of imports of goods and services to GDP can have a detrimental effect on output, but at the same time, if the imports represent mostly technologies that are going to be used for production, the overall effect on GDP over the medium and long run can turn out to be positive.

In any case, the developments in most EU28 countries in the aftermath of the crisis point to an increase in the share of total trade to GDP, which can be viewed as a positive development, with economies trying to diversify and find new opportunities.

The data in the table can be used for a correlation analysis, in which relationships between variables are monitored before and after the crisis. This can provide an overview of the dynamics of the relationships considering the impact of the crisis.

Table 2 provides the correlation matrices for the periods 2004-2007 and 2010-2013. In both matrices, correlation coefficients greater than 0.5 are colored in green, and correlation coefficients lower than -0.5 are colored in red. We use these values as a rule of thumb to determine which correlations are strong. A few relationships are interesting to consider in particular.

Table 2a. Correlation matrix for the period 2004-2007

	Real GDP (%)	Output gap (%)	HICP Inflation (%)	Unemployment (%)	Debt/GDP (%)*	Government balance (%,+/-)*	Exports of goods and services (% of GDP)	Imports of goods and services (% of GDP)
Real GDP (%)	1	0.75	0.65	0.23	-0.72	0.18	0.21	0.39
Output gap (%)	0.75	1	0.60	-0.02	-0.51	0.05	0.00	0.19
HICP Inflation (%)	0.65	0.60	1	0.18	-0.41	-0.16	0.01	0.24
Unemployment (%)	0.23	-0.02	0.18	1	0.09	-0.28	-0.26	-0.16
Debt/GDP (%)*	-0.72	-0.51	-0.41	0.09	1	-0.50	-0.34	-0.40
Government balance (%,+/-)*	0.18	0.05	-0.16	-0.28	-0.50	1	0.22	0.13
Exports (g+s, % of GDP)	0.21	0.00	0.01	-0.26	-0.34	0.22	1	0.95
Imports (g+s, % of GDP)	0.39	0.19	0.24	-0.16	-0.40	0.13	0.95	1

*Data not available for EE and PL, period 2004-2007, for Debt/GDP(%) and Government balance(%,+/-)

Source: Eurostat, European Commission, authors' calculations

For the period 2004-2007, a strong positive correlation is visible between real GDP (%) and the output gap (%). This reflects the fact that a higher growth in output before the crisis has been associated with an increasing imbalance from the equilibrium state of the economy. This is an indication that, even if the growth rates of GDP looked much better before the crisis, they did not necessarily have a solid foundation, and their sustainability was precarious.

Another strong positive correlation is that between real GDP (%) and HICP inflation (%). This is a typical relationship in good times, in the sense that economic growth is associated with higher inflation, which is also a sign of drifting away from a point of equilibrium. This movement away from a point of equilibrium is also illustrated by a relatively high positive correlation between HICP inflation (%) and the output gap (%). Looking at these correlations so far, we can say that they indicate that even if a recovery will put the economies of the analyzed countries on a more modest growth path, this can be actually a good thing, since the higher level of growth before the crisis was associated with the building up of imbalances, and a new growth path should ensure that the economy is as close as possible to the equilibrium, a situation described, for example, by an output gap that is smooth and close to zero.

A very strong but expected positive correlation is that between the exports of goods and services (% of GDP) and imports of goods and services (% of GDP).

A strong negative correlation is that between real GDP (%) and debt/GDP (%). This is quite an obvious relationship, also from the mathematical point of view. The debt/GDP (%) is also negatively correlated with the output gap (%), though the intensity is a little lower than in the previous case. An interpretation of this relationship is a bit more difficult to point out, but a possible one is that, for example, a high level of the output gap, even though it creates imbalances, leads to a decrease in the debt-to-GDP ratio. However, even if this holds, over the long term it is not desirable to decrease the level of public debt by creating further imbalances.
Another obvious negative correlation is that between the debt/GDP (%) and the government balance (%,+/-).

For the period 2010-2013, a strong positive correlation is visible between real GDP (%) and the output gap (%). The relationship between real GDP (%) and HICP inflation (%) is not strong anymore, which is an interesting development of the period from the aftermath of the crisis. At the same time, a strong positive relationship is observed between real GDP (%) and government balance (%, +/-). The government balance (%, +/-) correlates strongly also with the output gap (%). The correlation between exports of goods and services (% of GDP) and imports of goods and services (% of GDP) is positive and almost perfect.

Table 2b. Correlation matrix for the period 2010-2013

	Real GDP (%)	Output gap (%)	HICP Inflation (%)	Unemployment (%)	Debt/GDP (%)	Government balance (%,+/-)	Exports of goods and services (% of GDP)	Imports of goods and services (% of GDP)
Real GDP (%)	1	0.64	0.16	-0.37	-0.70	0.56	0.35	0.38
Output gap (%)	0.64	1	0.12	-0.68	-0.48	0.52	0.24	0.24
HICP Inflation (%)	0.16	0.12	1	-0.20	-0.29	0.30	0.04	0.10
Unemployment (%)	-0.37	-0.68	-0.20	1	0.30	-0.58	-0.29	-0.26
Debt/GDP (%)	-0.70	-0.48	-0.29	0.30	1	-0.62	-0.38	-0.41
Government balance (%,+/-)	0.56	0.52	0.30	-0.58	-0.62	1	0.24	0.26
Exports (g+s, % of GDP)	0.35	0.24	0.04	-0.29	-0.38	0.24	1	0.99
Imports (g+s, % of GDP)	0.38	0.24	0.10	-0.26	-0.41	0.26	0.99	1

Source: Eurostat, European Commission, authors' calculations

The relationship between real GDP (%) and debt/GDP (%) continues to be strong and negative. The almost perfectly uncorrelated output gap (%) and unemployment (%) from the first period become strongly negatively correlated in the second period. This is an interesting and important result, as the decrease in the level of the output gap is associated with a rise in unemployment. Furthermore, an increase in the level of unemployment (%) is associated with a deterioration in the situation of the government deficit (%). The strong negative relationship between debt/GDP (%) and the government deficit (%, +/-) is maintained in the second period and gains momentum.

It is interesting to note the more important role of the government balance (%, +/-) in the aftermath of the crisis. This variable displays 2 new strongly positive relationships (with real GDP (%) and the output gap (%)) and an additional strongly negative relationship (with unemployment(%)) compared to the first period. Another important development is the evolution of HICP inflation (%), which becomes close to uncorrelated with real GDP (%) and the output gap (%) in the second period, from strongly positive correlations in the first period. It is also worth to highlight the strongly negative correlation between the output gap(%) and unemployment(%) in the second period, compared to the first period when they were almost uncorrelated.

The results of the correlation analysis indicate that the crisis has produced also a rebalancing of the relationships between variables in the two periods. This leads to a different economic landscape, where not only changes in the levels of the variables are visible, but also changes in the nature and intensity of the relationships.

Table 3 displays several descriptive statistics for the considered variables of the EU28 countries (minimum, maximum, average, variance and standard deviation), for the periods 2004-2007 and 2010-2013, respectively. It is particularly interesting how the whole picture of the recent crisis in the EU can be roughly approximated by using only 16 numbers, namely the simple average of the values of the 8 variables for the EU countries, in the period before the peak of the crisis and in the period from the aftermath of the crisis. These aspects are also observable in the previous part of the analysis , but maybe they are more visible when concentrated in a very synthetic way.

Table 3. Descriptive statistics

	Minumum		Maximum		Average		Variance		Standard deviation	
	2004-2007	2010-2013	2004-2007	2010-2013	2004-2007	2010-2013	2004-2007	2010-2013	2004-2007	2010-2013
Real GDP (%)	1.6	-5.7	10.0	4.7	4.5	0.9	4.80	4.10	2.19	2.02
Output gap (%)	-0.6	-10.5	8.5	0.8	2.4	-2.4	4.73	4.79	2.18	2.19
HICP Inflation (%)	1.0	0.5	8.1	4.6	3.1	2.4	3.35	0.68	1.83	0.83
Unemployment (%)	4.5	4.5	15.1	23.1	7.8	10.5	7.92	20.84	2.81	4.57
Debt/GDP (%)*	6.8	17.0	103.3	162.3	47.0	69.1	699.61	1144.74	26.45	33.83
Government balance (%,+/-)*	-7.2	-14.7	4.3	0.1	-1.4	-4.7	7.69	10.73	2.77	3.28
Exports (g+s, % of GDP)	23.2	25.9	163.5	175.5	55.3	63.0	807.86	1043.68	28.42	32.31
Imports (g+s, % of GDP)	27.0	29.0	135.3	144.8	56.4	60.1	559.36	698.59	23.65	26.43

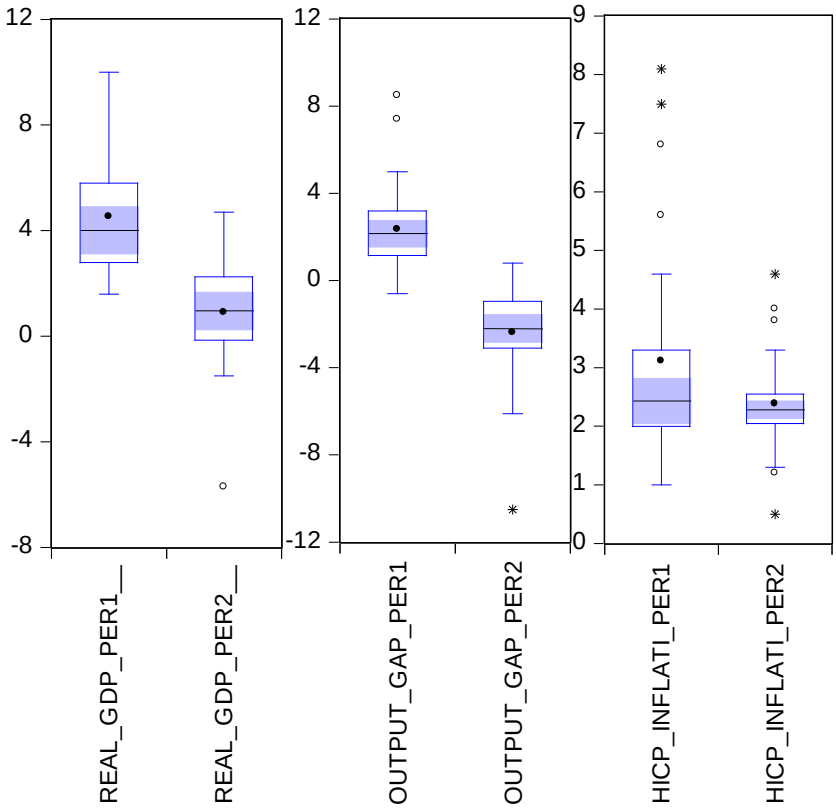
*Data not available for EE and PL, period 2004-2007, for Debt/GDP(%) and Government balance(%,+/-)

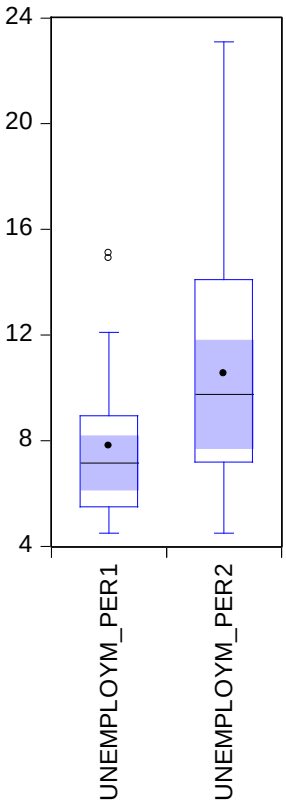
Source: Eurostat, European Commission, authors' calculations

The decrease of real GDP (%) from 4.5% in the first period to 0.9% in the second period is consistent with a change in the output gap(%) from 2.4% to -2.4%. The medium and long term decrease in inflation and the rise in unemployment are also developments that explain much of what happened during and after the crisis, with unemployment having an important impact on the state of the economy. The rising debt/GDP (%) and deteriorating government balance (%, +/-) are factors that are expected to slow down the overall recovery process, while the dynamics of trade seems to be a factor of improvement in the economic situation, also considering that, even though both exports and imports of goods and services have risen as a percentage of GDP, the growth of exports has been larger. One important thing to note, however, is that this very synthetic picture is considering simple averages, and it is also possible to weigh the variables according to specific criteria, like share in the GDP of the EU28 of the different member states. This, however, is not within the scope of this article.

The variables under scrutiny can be also displayed as boxplots. This is done in Figure 1. Each boxplot compares the period 2004-2007 (PER1) with the period 2010-2013 (PER2).

Figure 1. Boxplots

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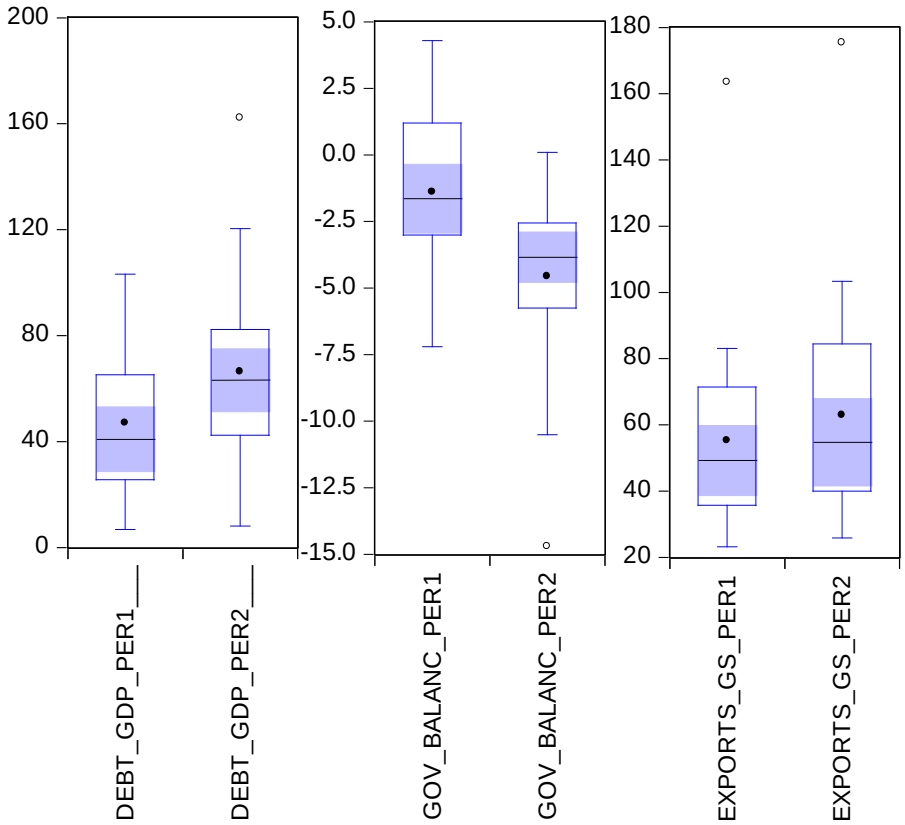
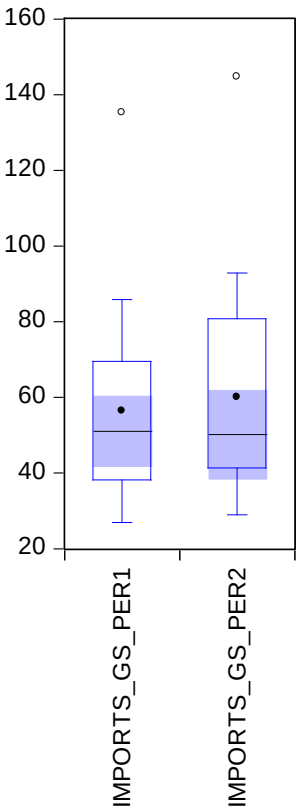
UNEMPLOYM_PER1
UNEMPLOYM_PER2


200
160
120
80
40
0
5.0
2.5
0.0
-2.5
-5.0
-7.5
-10.0
-12.5
-15.0
180
160
140
120
100
80
60
40
20
DEBT_GDP_PER1___
DEBT_GDP_PER2___
GOV_BALANC_PER1
GOV_BALANC_PER2
EXPORTS_GS_PER1
EXPORTS_GS_PER2



Note: Data not available for EE and PL, period 2004-2007, for Debt/GDP(%) and Government balance(%,+/-)

Source: Eurostat, European Commission, authors' calculations

Another aspect that Table 3 highlights is the issue of the dispersion of the values for the 8 variables in the first and in the second period. According to the standard deviation and the variance, it seems that some variables become less volatile, some remain relatively constant and some become more volatile. This could be interpreted as a tendency of convergence or divergence along specific variables for the EU28 countries. This information is valuable with respect to the picture before and after the peak of the crisis, since it is interesting to see which economic indicators become more homogeneous and which diverge. However, in order to establish the statistical significance of such statements, it is required to test for the equality of variances between the series of the two periods. In order to perform this, the F-test is used.

Table 4. Results of the F-test (F-Test Two-Sample for Variances)

	Real GDP (%)	Output gap (%)	HICP Inflation (%)	Unempl. (%)	Debt/GDP (%)*	Gov. balance (%,+/-)*	Exports (g+s, % of GDP)	Imports (g+s, % of GDP)
F	1.1711794	0.9875021	4.9196225	0.3801618	0.5838774	0.7143705	1.2919044	0.8006993
P(F<=f) one-tail	0.3421754	0.4870869	0.0000457	0.0072645	0.0901080	0.2004903	0.2551432	0.2838063
F Critical one-tail	1.9048230	0.5249832	1.9048230	0.5249832	0.5155969	0.5155969	1.9048230	0.5249832

*Data not available for EE and PL, period 2004-2007, for Debt/GDP(%) and Government balance(%,+/-)

Source: Eurostat, European Commission, authors' calculations

The results of the F-test for all variables are displayed in Table 4. The value of the F-test is greater than 1 when the variance of the first period is greater than the one of the second period, and smaller than 1 when the variance of the first period is smaller than the one of the second period. The risk is depicted by the term *P(F<f) one tail*, and the degree of certainty is (1-*P(F<f) one tail*)*100.

According to the results, most variables do not display a statistically significant difference between the variances of the two periods. These variables are GDP (%), output gap (%), debt/GDP (%), government balance (%, +/-), exports of goods and services (% of GDP) and imports of goods and services (% of GDP). This indicates a similar level of homogeneity in these variables for the EU28 countries across the two periods. This doesn't mean that the average level of the variables remains the same in the two periods, but it shows that the relative distance between countries with respect to these indicators remains similar.

For HICP inflation (%) and unemployment (%), the variances for the first period are statistically different (even at the 1% level) compared to the variances for the second period. This points out the fact that there exists a convergence across countries in the case of HICP inflation (%) and a divergence respectively in the case of unemployment(%). The crisis has determined a more similar behavior across the EU28 countries with respect to inflation and a more differentiated one with respect to unemployment.

4. Conclusion

The article investigates on the long-lasting effects of the recent crisis and on the recovery process for the EU28 countries. The framework of the analysis is multivariate, but restricted to a limited number of relevant variables in order to obtain a synthetic picture of the main evolutions in the countries under scrutiny. Two periods are considered, one before the crisis and one after the crisis start. An important issue is whether it is reasonable to expect a robust return of growth and to see how different the new path is with respect to the one before the crisis. Moreover, an analysis is performed in order to investigate on the relative behavior of the EU28 countries in the context of the recent crisis.

Even though the developments in real GDP are negative for all countries in the second period compared to the first period, not all the evolutions in the other variables are negative. In quite many situations, the crisis can be a period that provides an opportunity to rebalance some variables that are off-track. Several factors from the analysis are expected to slow down the recovery process, in particular the evolutions in unemployment, those in the debt to GDP ratio and government balance, respectively. At the same time, the evolution of exports of goods and services and the overall evolution of trade in goods and services provides a positive influence with respect to the recovery process.

Although the analysis is synthetic and simplified, there is more evidence supporting the scenario that the growth path is considerably affected over the long term and that a new path is likely to have a lower slope than the one before the crisis for the EU28 countries. However, even if a new growth path would be more modest, this can also be seen in a positive perspective, in the sense that the higher level of growth before the crisis was associated with the building up of imbalances.

The results of the correlation analysis indicate that the crisis has produced also a rebalancing of the relationships between variables in the period after the crisis start compared to the period before the crisis. Not only changes in the levels of the variables are visible, but also changes in the nature and intensity of the relationships.

An analysis is performed which indicates that for 6 out of 8 analyzed variables, the relative behavior of the EU28 countries does not change across the two periods, while for 2 variables this is not the case. There exists a convergence in the case of HICP inflation and a divergence in the case of unemployment, meaning that the EU28 countries behave in a more similar way in terms of HICP inflation and in a more differentiated way with respect to unemployment. This brings evidence with respect to the asymmetric effects of the recent crisis across countries.

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