THE GREEK LABOUR MARKET DURING THE CRISIS: UNEMPLOYMENT, EMPLOYMENT AND LABOUR FORCE PARTICIPATION*

Evangelia Papapetrou
Bank of Greece, Economic Research Department
National and Kapodistrian University of Athens, Department of Economics

Dimitrios Bakas
National and Kapodistrian University of Athens, Department of Economics

1 INTRODUCTION

In the almost three years after the outbreak of the debt crisis and the adoption of adjustment programmes, economic activity registered a cumulative decline of about 20%, weighting heavily on the labour market. The unemployment rate showed a substantial increase, with signs of persistence. In the same period, the number of the long-term unemployed almost quadrupled (reaching some 847 thousand in the fourth quarter of 2012) and the unemployment rate of youths below 25 years hit historical highs. Employment fell substantially (around 795 thousand persons from the fourth quarter of 2009 to the fourth quarter of 2012), mostly as a result of the large decline in the male employment rate. During the same period, the labour force participation rate increased marginally, reflecting higher female participation.

Against this background, scientific discourse concerning the relationship between unemployment, employment and labour force participation rates comes again into focus, as the current recession affects participants in ways not seen in past recessions. During past downturns, workers, particularly older ones, withdrew from the market, motivated by negative prospects to find a job, as well as government policies, which in several cases entailed early-retirement schemes (Duval et al. 2011, OECD 2010). The current crisis shows evidence that women and youths enter the labour market to compensate for the loss of family income caused by persistently falling male employment (Mattingly and Smith 2010, OECD 2012).

The change in the behaviour of labour market participants is of particular interest in modern economies and has been the focus of recent

studies (European Central Bank 2012). As regards Greece, a study and analysis of the evolution of unemployment, employment and participation rate after the country was placed under a support mechanism, although significant in economic and scientific terms, has not been conducted yet. After the onset of the crisis, falling demand, in the context of dealing with the problem of the long-term competitiveness and fiscal adjustment of the economy, led to a drop in labour demand, a decrease in employment and an increase in the unemployment rate. In the same period, major changes in labour regulations and a series of reforms in the labour market took place (Bank of Greece 2011, 2012, 2013). Recent legislative reforms increased labour supply, particularly of youths and women. As a result, the unemployment rate rose by 16.6 percentage points, from 7.6% in 2008 to 24.2% in 2012, the employment rate, which had been among the lowest in the European Union, fell substantially by 9.3 percentage points (from 49.4% in 2008 to 40.1% in 2012), and the labour force participation rate declined marginally.

This study examines recent developments in a number of key indicators of the Greek labour market, such as the unemployment rate, the long-term unemployment rate, the labour force participation rate and the employment rate. The examination of these indices is very important, as they are associated with human capital and their evolution affects the productive capacity of the economy, currently and in the

future. The human capital is an important factor of production, and its absence from this process leads to a shrinking of labour and depreciation of human skills, reduces the economy's productive capacity, and inhibits the return of the economy to stable and sustainable growth rates. Moreover, the absence of youths from economic activity has long-term adverse effects on demographics, as it may —among other things— have a negative impact on or delay the decision to start a family, thus decreasing or even inhibiting birth-rates. This study provides evidence of significant differentiation in the relationship between the employment rate, the labour force participation rate and the unemployment rate before and during the crisis. Therefore, hypotheses and proposals which are based on the assumption that there is a linear relationship between these variables, without considering the possibility of it being asymmetric, could lead to wrong conclusions and policy decisions.

The examination of the relationship between the three economic indices is carried out using vector autoregression error-correction model estimation, and aims at examining whether labour force participation and employment rate depend on the size of unemployment. The econometric analysis uses the two-regime threshold cointegration model of Hansen and Seo (2002). The basic assumption tested is whether the relationship between the labour force participation and the employment rate is linear or asymmetric (i.e. depending on the size of unemployment and the country's economic activity). In these models, a long-run equilibrium is achieved in the system, when it either exceeds or falls short of a threshold value or a critical regime. This model determines endogenously two regimes, a "typical" regime, which represents a low unemployment rate, and a second regime, which represents a higher unemployment rate. The estimation is conducted using quarterly data from the Greek labour market for the period between the first quarter of 1990 and the first quarter of 2012. Empirical findings show that the relationship between labour force participation and the

employment rate is not linear and rather depends on the rate of unemployment, and thus on the state of the economy. In particular, the econometric analysis shows that during the first regime, i.e. when the unemployment rate is low, the employment rate increases and the labour force participation rate is a weakly exogenous variable. By contrast, during the second regime of high unemployment rates, such as after the second quarter of 2010 when the Memorandum of Understanding was signed, strong downward pressure is generated on the employment rate, and while the labour force participation rate continues to increase, it is still lower than before the crisis. The results indicate that when unemployment is high, labour market participants have a low probability of employment. Moreover, econometric analysis shows that the unemployment rate in Greece is persistent.

This study is structured as follows. Section 2 briefly reviews the key characteristics of the Greek and the European labour markets through an examination of a number of key labour market indicators. Section 3 describes the methodology used in the empirical analysis and Section 4 presents data and empirical results. The last section summarises the results of this study.

2 THE GREEK AND THE EUROPEAN LABOUR MARKET: KEY CHARACTERISTICS, TRENDS AND RELATIONSHIPS

Despite some distinct characteristics before and during the crisis, the Greek labour market is in many respects similar to those of the other EU-27 countries.

2.1 LABOUR FORCE PARTICIPATION RATE

According to the Labour Force Survey (LFS) data, the labour force participation rate[1] increased continuously from the first quarter of

---

1 The labour force participation rate of people aged 15-64 years is calculated as the ratio of the labour force aged 15-64 to the total population of this age.

Chart 1 Labour force participation rate by gender: Greece, 1998-2012 (ages 15-64)

Source: ELSTAT, Labour Force Surveys.

Chart 2 Employment rate by gender: Greece, 1998-2012 (ages 15-64)

Source: ELSTAT, Labour Force Surveys.
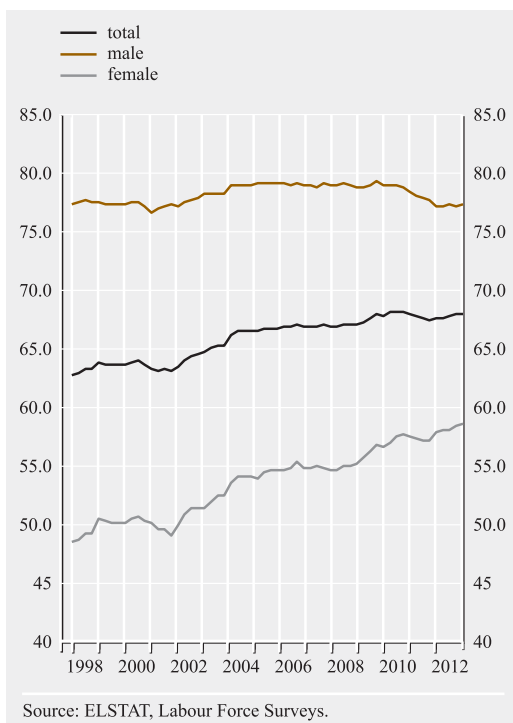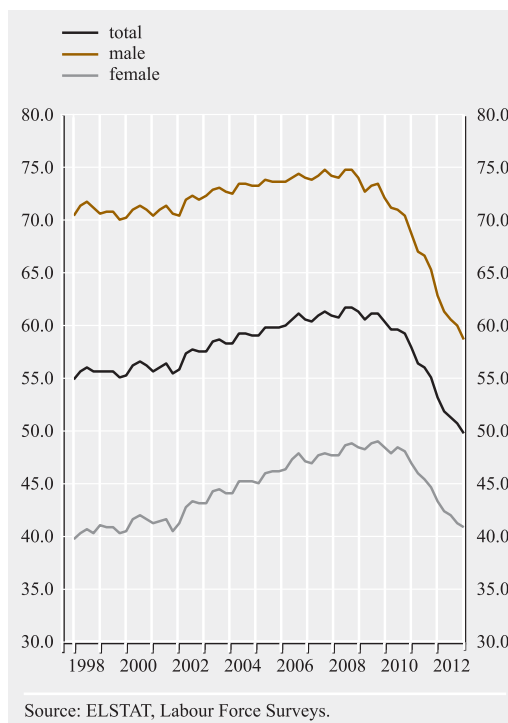
1998 to the third quarter of 2010 (from 62.9% to 68.3%). However, despite a marginal decline during the crisis, the labour force participation rate remains high (see Chart 1).

There is a wide difference between male and female participation rates, as the female participation rate, despite increasing over time, is significantly below the participation rate for men. The labour market gender gap fell from 24 percentage points in 2008 to 19 percentage points in 2012. Despite this substantial decline, it was still the second highest in the EU in 2012 (see Table 1).

2.2 EMPLOYMENT RATE

The employment rate in Greece[2] increased over time from 55.3% in the first quarter of 1998 to 62.2% in the third quarter of 2008 (see Chart 2). This trend was reversed during the economic crisis and the employment rate fell substantially by 12 percentage points (50.2% in

the fourth quarter of 2012).[3] The decline in employment mostly reflects the stronger decrease in male employment compared with female employment. In the current recession, male employment is more sensitive to a decrease in economic activity, mostly because men were employed in sectors that were hit the hardest by the crisis, such as construction.[4] The rate of female employment in Greece falls significantly short of the male rate, and is also considerably below the respective EU rate.[5]

---

2 The employment rate of persons aged 15-64 years is calculated as the ratio of the employed aged 15-64 years to the total population of the same age.

3 Sectors that suffered more job losses during the recent period are construction (due to the decline in private construction activity and the discontinuation of large infrastructure projects), manufacturing and trade (owing to shrinking domestic demand).

4 The male employment rate in Greece, although increasing over time, from 71% in the first quarter of 1998 to 74% in the third quarter of 2009, fell sharply to 59.2% in the fourth quarter of 2012, declining by 14.8 percentage points, thus settling at substantially lower levels than in 1998.

5 The female employment rate in Greece, although rising over time (from 39.9% in the first quarter of 1998 to 49.3% in the third quarter of 2009), fell sharply to 41.2% in the fourth quarter of 2012 (down by 8.1 percentage points).

Table 1 Gender gaps in employment, labour force participation and unemployment, 2008-2012

	Employment/Population					Labour force participation					Unemployment				
	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Austria	12.7	10.5	10.8	11.2	10.6	12.8	11.4	11.6	11.5	11.1	-0.6	0.5	0.4	-0.3	0.0
Belgium	12.4	11.2	10.9	10.4	10.1	12.5	11.9	11.6	11.2	11.1	-1.1	-0.3	-0.4	0.0	0.3
Czech Republic	17.8	17.2	17.3	16.8	16.4	17.1	17.0	17.1	16.5	16.0	-2.2	-1.9	-2.1	-2.1	-2.2
Denmark	7.5	5.3	4.5	5.5	5.2	7.4	6.8	6.6	6.2	5.7	-0.5	1.4	2.0	0.3	0.1
Estonia	7.2	1.1	1.0	5.0	5.3	8.0	6.9	5.7	6.7	7.3	0.5	6.5	5.0	1.1	1.6
Finland	4.4	1.0	2.8	3.4	2.7	4.1	2.3	4.3	4.8	4.0	-0.8	1.5	1.4	1.3	1.2
France	9.3	8.5	8.4	8.4	8.0	9.3	9.0	8.8	8.6	8.7	-1.0	-0.4	-0.7	-0.9	-0.2
Germany	11.6	10.3	10.0	9.7	9.7	12.4	11.9	11.6	10.8	10.7	-0.2	0.8	1.0	0.6	0.5
Greece	26.3	24.6	22.8	20.8	18.8	24.0	22.6	21.3	20.2	19.0	-6.4	-6.3	-6.3	-6.4	-6.7
Hungary	12.4	11.2	9.8	10.6	10.4	13.2	12.8	11.6	12.0	12.2	-0.4	0.6	0.9	0.1	0.6
Ireland	15.1	9.2	7.9	7.1	7.2	17.7	16.4	15.1	14.4	14.5	2.3	7.4	7.3	7.5	7.4
Italy	23.1	22.6	21.9	21.3	19.8	22.8	23.0	22.6	22.0	20.8	-3.0	-2.5	-2.1	-2.0	-1.9
Luxembourg	16.3	16.2	15.9	15.1	13.4	16.0	15.9	15.7	14.2	13.2	-1.7	-1.7	-1.3	-2.4	-1.4
Netherlands	13.1	11.9	10.6	9.9	9.3	13.1	12.3	11.1	10.4	10.0	-0.6	0.0	0.0	0.0	0.1
Norway	5.2	4.0	4.1	3.8	3.9	5.6	4.9	5.2	4.3	4.8	0.3	1.0	1.1	0.4	0.9
Poland	13.9	13.4	12.7	13.3	13.2	14.0	14.0	13.6	13.8	13.6	-1.5	-0.9	-0.7	-1.4	-1.5
Portugal	11.5	9.5	9.0	7.8	6.2	10.6	9.5	8.4	8.7	7.8	-2.4	-1.3	-2.1	-0.3	0.4
Slovakia	15.3	14.8	12.9	13.6	14.0	15.0	15.7	14.7	15.7	15.5	-2.7	-1.5	-0.4	0.0	-1.0
Slovenia	8.5	7.2	7.1	6.8	6.9	8.3	7.7	8.0	7.4	6.8	-0.9	0.1	0.4	0.0	-1.0
Spain	18.9	14.0	12.6	11.3	9.8	18.9	16.5	15.1	13.6	12.4	-3.0	-0.7	-0.8	-1.0	-0.6
Sweden	4.8	3.9	4.9	4.5	3.8	4.7	4.9	5.6	5.1	4.7	-0.6	0.7	0.3	0.2	0.6
Switzerland	11.9	10.8	12.0	12.1	11.5	11.4	10.7	11.9	12.0	11.6	-1.1	-0.7	-0.9	-0.7	-0.5
United Kingdom	11.7	10.1	9.9	10.2	10.4	13.2	13.0	12.4	12.3	12.3	1.0	2.4	1.9	1.4	1.1

Source: OECD, Online Employment Database.

The employment gender gap fell from 26.3 percentage points in 2008 to 18.8 percentage points in 2012, mainly due to the decline in the male employment rate (see Table 1). The male-female employment gap, despite falling, remains particularly high compared with other EU countries (the second highest in the EU-27, following Italy, where the male-female employment gap for 2012 was 19.8%).

2.3 LABOUR FORCE PARTICIPATION, EMPLOYMENT AND UNEMPLOYMENT: BREAKDOWN BY NATIONALITY AND AGE

Before the crisis, foreign nationals had higher employment and participation rates and lower unemployment rates than Greek nationals. This trend was reversed after the onset of the crisis. Specifically (see Table 2):

— Between 2008 and 2012 (fourth quarter), the employment rate of foreign nationals fell much more than that of Greek nationals. In 2012 (fourth quarter), the employment rate of foreign nationals (aged 15-64 years) was lower than the respective rate for Greek nationals. The decline in the employment rate of foreign nationals is attributable to the substantially larger decline in the employment rate of male foreign nationals (larger than the decline in the employment rate of female foreign nationals), as a significant percentage of foreigners worked in construction, which has shrunk substantially during the recent crisis.

— The decline in the employment rate is stronger among foreign nationals than among Greek nationals in all age groups, and the 20-24 age group in particular.

— The unemployment rate of foreign nationals is higher than the respective rate for Greek nationals (36.9% against 25.0% in the fourth quarter of 2012), a trend observed since 2009. The increase in unemployment of foreign nationals is substantial and higher than the increase in unemployment of Greek nationals across all age groups during 2008-2012.

Chart 3 Employment rates in EU countries as a percentage of the labour force, ages 15 and above (June)

Source: Eurostat, Labour Force Surveys (LFS).
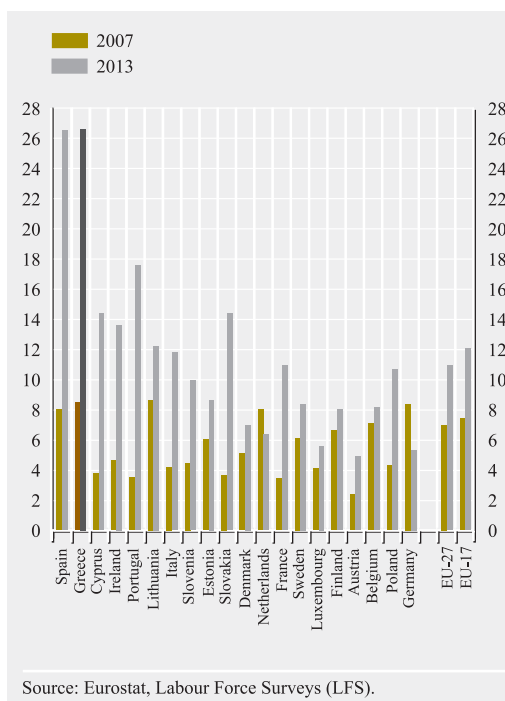
The fall in employment, the increase in unemployment, as well as the strength and the duration of this crisis are factors expected to affect the immigrants' decisions as to whether they should remain in Greece, driving a large share to leave the country (OECD 2013).

2.4 UNEMPLOYMENT RATE

The unemployment rate in the EU is at its highest since the start of the monetary union and the differences observed in unemployment rates among EU countries are substantial. The unemployment rate in Greece (26.8% in March 2013) is the highest in the EU. The gender unemployment gap in 2007-2013 rose substantially in Spain and Greece (by 18.7 and 18.1 percentage points, respectively) and was considerably higher than the corresponding EU-27 average (3.6 percentage points). By contrast, during the same period, the rate of unemployment fell only in Germany (by 3.6 percentage points, from 9% to 5.4% – see Chart 3).

Table 2 Employment, labour force participation and unemployment rates by nationality and age group (2000 Q4 - 2012 Q4)

Age	Employment rate							Labour force participation rate							Unemployment rate						
	2000	2008	2009	2010	2011	2012	2008/12	2000	2008	2009	2010	2011	2012	2008/12	2000	2008	2009	2010	2011	2012	2008/12
Total (all nationalities)	46.3	49.3	48.2	46.1	42.0	39.2	-10.0	52.0	53.5	53.8	53.8	53.0	53.0	-0.5	11.0	7.9	10.3	14.2	20.7	26.0	18.1
15-19	10.3	6.2	6.1	3.9	3.4	2.4	-3.8	15.6	8.8	8.9	7.4	8.3	7.8	-1.0	33.8	29.2	31.5	47.9	59.3	69.0	39.8
20-24	45.9	40.0	36.9	33.5	26.5	22.2	-17.8	62.5	51.3	51.2	51.9	51.3	50.6	-0.7	26.6	22.0	27.9	35.4	48.3	56.1	34.1
25-29	68.6	72.6	71.4	65.0	56.0	52.0	-20.7	82.3	83.4	85.2	84.6	84.8	85.8	2.4	16.6	13.0	16.2	23.2	34.0	39.4	26.5
30-44	74.1	79.1	77.8	75.0	70.3	65.6	-13.5	81.3	85.2	85.8	86.4	86.9	87.5	2.2	8.9	7.2	9.3	13.2	19.1	25.0	17.8
45-64	53.0	58.5	58.0	56.9	52.6	50.5	-8.0	55.8	61.2	62.0	62.4	60.9	61.7	0.5	4.9	4.3	6.3	8.7	13.5	18.1	13.9
65+	5.0	4.2	4.2	3.9	3.2	2.5	-1.7	5.1	4.2	4.2	4.0	3.3	2.7	-1.5	1.3	0.7	0.9	1.6	3.4	6.3	5.6
15-64	56.6	61.7	60.8	58.3	53.5	50.2	-11.5	63.7	67.1	67.9	68.1	67.7	68.1	1.0	11.1	8.1	10.5	14.4	20.9	26.3	18.2
Greek nationals																					
Total	45.9	48.0	46.9	44.5	41.2	38.8	-9.3	51.5	52.2	52.2	52.3	51.7	51.7	-0.5	10.9	8.0	10.2	13.9	20.2	25.0	17.0
15-19	9.9	5.6	5.5	2.8	2.9	2.5	-3.2	15.0	8.0	7.9	6.4	7.4	7.4	-0.6	33.9	29.8	30.3	46.7	60.1	66.7	36.9
20-24	45.7	38.0	34.2	30.6	25.4	22.3	-15.7	62.5	49.7	49.2	50.5	50.3	50.1	0.3	26.9	23.6	30.4	37.0	49.6	55.6	31.9
25-29	68.8	73.0	72.1	64.2	56.1	52.4	-20.6	82.7	84.6	86.3	85.6	86.0	86.9	2.3	16.7	13.7	16.5	23.6	34.8	39.6	25.9
30-44	74.2	79.3	78.3	74.6	70.9	66.8	-12.6	81.3	85.6	86.2	86.7	87.3	87.9	2.3	8.8	7.3	9.2	13.0	18.8	24.0	16.8
45-64	52.8	57.9	57.3	55.9	52.2	50.5	-7.4	55.5	60.4	60.9	61.4	59.9	60.8	0.5	4.8	4.1	5.9	8.3	12.8	17.0	12.9
65+	5.0	4.1	4.1	3.8	3.1	2.5	-1.6	5.1	4.2	4.2	3.9	3.2	2.7	-1.5	1.3	0.7	0.9	1.6	2.4	6.0	5.3
15-64	56.4	61.1	60.2	57.2	53.3	50.5	-10.6	63.5	66.5	67.1	67.4	67.0	67.6	1.0	11.1	8.1	10.3	14.1	20.5	25.2	17.1
Foreign nationals																					
Total	61.5	66.9	65.0	68.4	54.4	45.6	-21.3	70.0	72.4	73.6	73.6	72.8	72.3	-0.1	12.2	7.5	11.7	17.0	25.2	36.9	29.4
15-19	22.5	14.0	12.3	15.6	8.5	2.0	-12.0	33.6	18.9	19.5	19.1	19.0	13.0	-5.9	33.0	26.2	37.1	52.2	55.6	84.9	58.7
20-24	49.7	56.4	56.5	57.6	36.3	22.0	-34.4	62.6	63.8	65.7	63.3	60.3	55.4	-8.5	20.6	11.6	13.9	25.1	39.8	60.3	48.7
25-29	64.7	69.7	66.4	70.7	55.3	47.8	-21.9	75.3	75.1	76.5	77.1	76.0	76.7	1.6	14.0	7.2	13.2	20.3	27.2	37.7	30.5
30-44	72.3	77.1	74.4	77.7	65.1	56.3	-20.7	79.8	82.1	82.8	83.7	82.9	84.1	2.0	9.4	6.2	10.2	15.0	21.5	33.1	26.9
45-64	69.5	73.3	72.1	76.6	60.8	50.5	-22.8	75.1	79.2	81.6	80.6	80.6	79.3	0.1	7.5	7.5	11.6	14.5	24.5	36.3	28.8
65+	8.7	11.3	9.9	12.1	6.0	6.4	-5.0	8.7	11.3	9.9	12.1	10.7	7.7	-3.6	0.0	0.0	0.0	0.0	43.6	17.4	17.4
15-64	62.9	68.3	66.5	70.0	55.8	47.0	-21.4	71.7	73.9	75.4	75.4	74.5	74.5	0.6	12.2	7.5	11.8	17.1	25.2	36.9	29.4

Source: ELSTAT, Labour Force Surveys.

Female and youth unemployment

The female unemployment rate[6] (29.9% in the fourth quarter of 2012) is substantially higher than the male unemployment rate (23.5%) and considerably higher than the average female unemployment rate in the EU. Since the onset of the crisis, the gender unemployment gap in Greece has declined, reflecting the fact that men were more severely hit than women. A significant share of women work in the non-tradables sector (healthcare, education, public administration), which until now has not been badly affected by the crisis, while female participation in construction, which has suffered the largest job losses in the past few years, is small. It is a fact that Greek female workers are worse off relative to their Greek male colleagues and their European female counterparts (Papapetrou 2008).
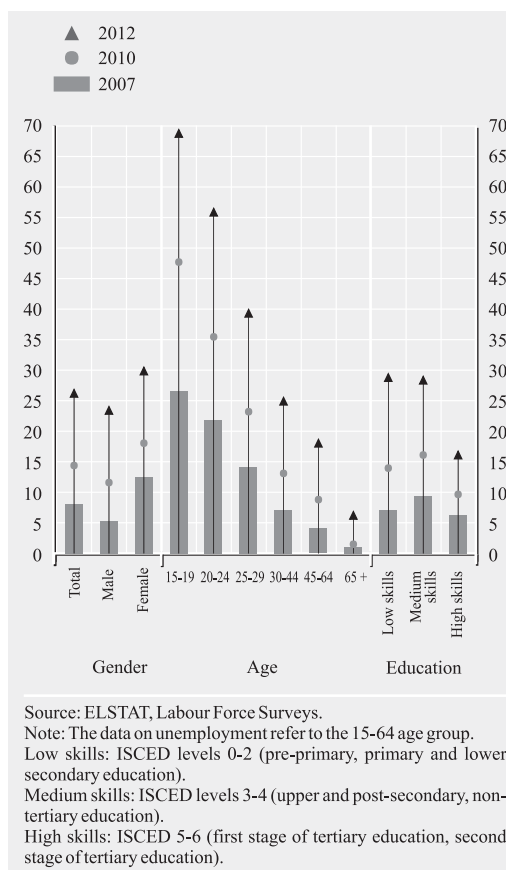
The unemployment rate grew considerably across all age groups between 2007 and 2012 (fourth quarter) (see Chart 4). The strongest increase in unemployment concerns younger ages (by 34.2 and 25.1 percentage points for 20-24 years and 25-29 years, respectively), while older workers (45-64 years) registered the smallest increase (by 14.1 percentage points).

According to Eurostat data, the highest youth unemployment rates for the 15-24 age group are recorded in Greece (56.8%) and Spain (at 54.1%) (fourth quarter of 2012). The youth unemployment gap in 2007-2013 (third quarter) rose substantially in Spain and Greece (by 36.3 and 35.2 percentage points, respectively), which is significantly above the corresponding EU-27 average (8.8 percentage points). At the EU-27 level, the unemployment rate for this age group has grown by almost 50% since the onset of the economic crisis (from 14.9% in the third quarter of 2007 to 23.2% in the fourth quarter of 2012) (see Chart 5).

Unemployment and education level

Unemployment rates grew for all education levels between 2007 and 2012 (fourth quarter)

Chart 4 Unemployment rates by gender, age group and education level in Greece, 2007, 2010, 2012 (Q4)

▲ 2012
● 2010
▬ 2007

Source: ELSTAT, Labour Force Surveys.
Note: The data on unemployment refer to the 15-64 age group.
Low skills: ISCED levels 0-2 (pre-primary, primary and lower secondary education).
Medium skills: ISCED levels 3-4 (upper and post-secondary, non-tertiary education).
High skills: ISCED 5-6 (first stage of tertiary education, second stage of tertiary education).

(see Chart 4).[7] Employees with the highest education level seem to have the lowest unemployment rates and those with the lowest education level have the highest. The mildest increase in unemployment is recorded for the education group with the highest level of education (10 percentage points between the fourth quarter of 2007 and the fourth quarter of 2012) and the strongest increase is recorded for the education group with the lowest level of education (21.7 percentage points in the same period). As a result, the unemployment gap between the low- and high-skilled widened substantially.

---

6 The unemployment rate refers to the 15-64 age group.
7 The importance of education in employment and the decline in unemployment is well established both worldwide and in the case of Greece (Papapetrou 2007, Mitrakos, Tsakloglou and Cholezas 2010).

2007
2012

Source: Eurostat, Labour Force Surveys (LFS).
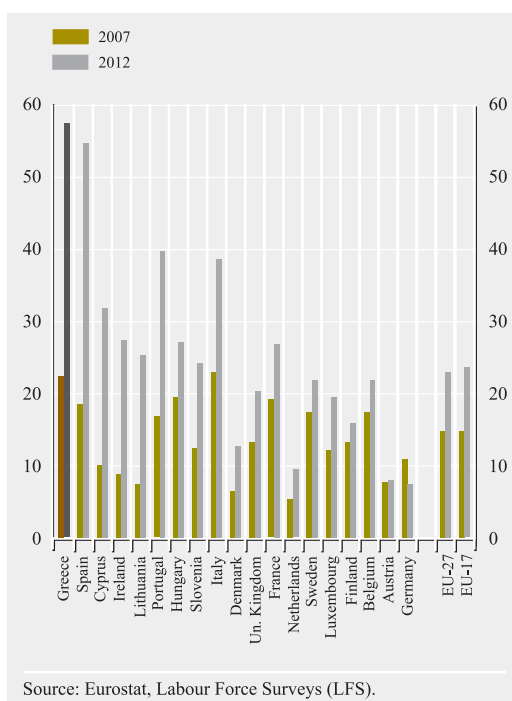
Chart 6 Long-term unemployment as a percentage of the labour force in Greece and the EU-27

EU-27
Greece

Source: Eurostat, Labour Force Surveys (LFS).
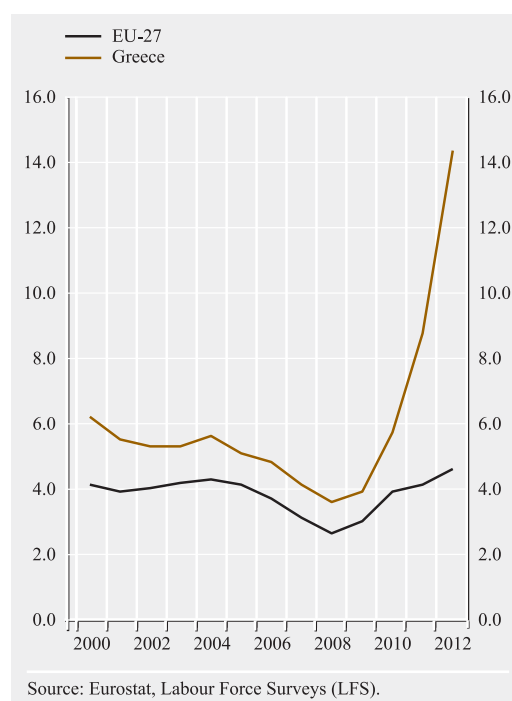
Long-term unemployment

Another aspect of unemployment is its duration. The share of the long-term unemployed (those unemployed for 12 months or over as a percentage of the labour force) in Greece is higher than the average share of the long-term unemployed in the EU-27 (see Chart 6). The share of female long-term unemployment is substantially higher than the respective share for men, and also the highest in the EU-27.

As from the second quarter of 2008, long-term unemployment (over a year) in Greece became stronger. The impact of unemployment —particularly long-term unemployment— is reflected in the labour market, and also in production and social cohesion. Human capital is an important factor of production, and its absence from the production process leads to a deterioration of skills, shrinks the economy's productive capacity, and inhibits the return of the economy to stable and sustainable growth

rates (Hotchkiss 2009, Lolos and Papapetrou 2010). As the duration of unemployment increases, people may be discouraged, stop looking for work and withdraw from the labour market. In Greece, a dramatic aspect of unemployment concerns youths, who find it hard to get their first job and enter the labour market; as a result, their skills deteriorate and they have no chance to gain knowledge and experience from participating in the labour market. The economy is deprived of a large share of one of the most productive and dynamic segments of the labour force, youth and women, which could contribute to the diffusion of innovation and new technology, and support the social security system. Recent data on OECD countries show that the increase in the duration of unemployment spells is largest for Greece and Ireland and, according to a non-recovery scenario, the unemployment spells in Greece and Ireland may last around two-and-a-half and one-and-a-half years, respectively, longer than at the start of the crisis (OECD 2012).

Even before the onset of the crisis, Greece had high unemployment and long-term unemployment rates, reflecting the inherent weaknesses of the Greek economy and the failure of the Greek labour market to provide jobs for the long-term unemployed. The recent economic crisis and the tightening of fiscal and credit policy as a result of the Memorandums of Understanding, economic uncertainty and the collapse of investment have significantly affected the depth and magnitude of the recession in Greece and aggravated the problem of unemployment, particularly long-term unemployment, in the Greek economy.

3 RELATIONSHIPS AMONG EMPLOYMENT, UNEMPLOYMENT, AND LABOUR FORCE PARTICIPATION RATES

3.1 INTERNATIONAL EXPERIENCE

The current crisis affects the labour market in ways not seen in previous recessions. During past recessions, workers, particularly older ones, withdrew from the market, motivated by negative prospects to find a job, and by government policies, which in several cases provided for early-retirement schemes (OECD 2010). During the current recession, female labour force participation has different characteristics compared with previous recessions. Women enter the labour market to compensate for the loss of family income, due to the stronger decline in male employment than female employment (Mattingly and Smith 2010).

Despite falling demand, the labour force participation rate increased in many European countries (e.g. Spain, Germany, Austria, Italy, the United Kingdom). By contrast, other countries recorded lower participation rates after the onset of the crisis (e.g. Ireland, Portugal, Finland, Belgium). In Ireland, the labour force participation rate fell significantly (3 percentage points between the first quarter of 2007 and the first quarter of 2012) as a result of negative developments in the labour market. This was associated with the fact that several Irish

Chart 7 Percentage changes in labour force participation, unemployment and employment rates in selected European countries, 2007 Q4-2012 Q1

(in percentages)

- labour force participation rate
- unemployment/population
- ◆ employment

Source: OECD, Online Employment Database.
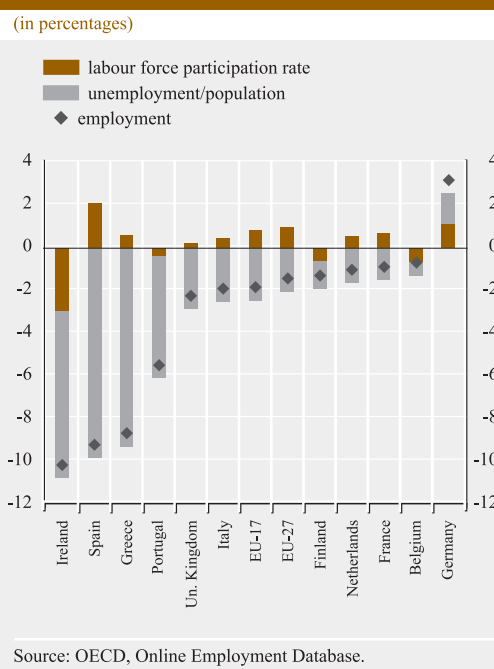
were forced to migrate because they could not find a job (the unemployment rate rose from 5.8% in 2008 to 14.6% in 2011).

The largest decline in employment is recorded in Ireland (10.2 percentage points), Spain (9.3 percentage points), Greece (8.7 percentage points) and Portugal (5.6 percentage points). The decrease in employment in these countries was significantly higher than in the EU (a 1.8% drop between the first quarter of 2007 and the first quarter of 2012 in the EU-17 as a whole). Moreover, the increase in unemployment was much sharper for these countries than for the EU-17 (2.4% between the first quarter of 2007 and the first quarter of 2012). In Ireland unemployment rose by 10.8 percentage points, in Spain by 9.9 p.p., in Greece by 9.3 p.p. and in Portugal by 6.1 p.p. (see Chart 7).

In countries characterised by higher demand, such as Germany and the Netherlands, a higher participation rate is associated with a higher

Table 3 Labour force participation, unemployment and employment rates by gender, 2002-2012 (Q1)[1]

	2002-2012			2002-2008			2008-2012		
	2002	2012	Change	2002	2008	Change	2008	2012	Change
Participation rate									
Total	*63.5*	*67.7*	*4.2*	*63.5*	*66.9*	*3.4*	*66.9*	*67.7*	*0.8*
Male	77.2	77.3	0.1	77.2	79.1	1.9	79.1	77.3	-1.8
Female	50.1	58.1	8.0	50.1	54.7	4.6	54.7	58.1	3.4
Unemployment rate[1]									
Total	*7.3*	*15.5*	*8.2*	*7.3*	*5.6*	*-1.7*	*5.6*	*15.5*	*9.9*
Male	6.1	15.4	9.3	6.1	4.5	-1.6	4.5	15.4	10.9
Female	8.6	15.5	6.9	8.6	6.8	-1.8	6.8	15.5	8.7
Employment rate									
Total	*56.1*	*52.3*	*-3.8*	*56.1*	*61.3*	*5.2*	*61.3*	*52.3*	*-9.0*
Male	70.9	61.9	-9.0	70.9	74.6	3.7	74.6	61.9	-12.7
Female	41.5	42.6	1.1	41.5	47.9	6.4	47.9	42.6	-5.30

Source: ELSTAT, Labour Force Surveys.
1 The unemployment rate refers to the share of the unemployed in total population.

employment rate, according to the assumptions of the "discouraged worker model" (European Commission 2012).

In the current crisis, the increase in the participation rate is associated with the "added worker effect". According to this assumption, when household income declines because the man-primary earner either becomes unemployed or subject to wage cuts, secondary earners in the family, who did not participate in the labour market (e.g. young persons and mothers with children), get affected by the recession. In this case, secondary earners in the family enter the labour market or increase their hours worked in order compensate for the loss of household income.

There is uncertainty about whether the prevalence of high participation rates will continue for much longer or whether this will be accompanied by withdrawal from the labour market in countries where demand remains sluggish or there are no policy interventions aiming to keep the unemployed in the labour market.

3.2 THE GREEK EXPERIENCE

In Table 3 employment, labour force participation and unemployment rate developments in Greece are shown by gender and over time. Given that labour market indices (employment, unemployment, etc.) are affected by fluctuations in economic activity (i.e. whether the economy is in recession or expansion), it was deemed necessary to show developments in two distinct time periods (i.e. before and after the onset of the crisis in 2008). The 4.2-percentage-point rise in the participation rate from 2002 to 2012 (first quarter) reflects the significant increase in the female participation rate by 8 percentage points and the marginal increase in the male participation rate by 0.1 percentage point. Current developments in the labour force participation rate overshadow respective developments during and before the crisis. The total participation rate increased substantially, by 3.4 percentage points, between the first quarter of 2002 and the first quarter of 2008, and by 0.8 percentage points between 2008 and 2012. Male and female participation rates

evolved differently during these two periods. The female participation rate rose significantly both before and during the crisis (4.6 percentage points and 3.4 percentage points, respectively). By contrast, the male participation rate, while rising in the period before the crisis (1.9 percentage points), fell by 1.8 percentage points in 2008-2012.[8]

The unemployment ratio increased considerably (by 8.2 percentage points) from the first quarter of 2002 to the first quarter of 2012.[9] The unemployment rate fell between the first quarter of 2002 and the first quarter of 2008 (1.7 percentage points), but rose significantly by 9.9 percentage points during the crisis.

The employment rate increased in the 2002-2008 period (5.2 percentage points), but decreased substantially after 2008 (9 percentage points). The male employment rate fell substantially compared with the female employment rate during the crisis, while the female employment rate increased further against the respective rate for men in 2002-2008.

The above findings provide substantial evidence that the relationship among employment and labour force participation rates and the unemployment ratio may not be linear. The asymmetric behaviour of these indicators before and during the crisis indicates that using models which assume a linear relationship among these variables could lead to wrong conclusions and policy implications. Further econometric analysis is necessary in this direction, which is the focus of the following section.

4 METHODOLOGY

This section summarises the methodology used to examine the relationship among the key labour market variables: the labour force participation rate, the employment rate and the unemployment rate.

According to the analysis of Congregado, Golpe and van Stel (2011), the relationship between labour market variables is illustrated in the following identity:

$$e_t + u_t = p_t \qquad (1)$$

where p_t is the labour force participation rate, e_t is the employment rate and u_t is the unemployment rate. A restructuring of (1) gives the following relation:

$$u_t = p_t - e_t \qquad (2)$$

Thus, equation (2) can be estimated through a bivariate model between the labour force participation rate series (p_t) and the employment rate series (e_t). In this case, the error correction term is the difference between the labour force participation rate and the employment rate ($p_{t-1} - \beta e_{t-1}$). If β equals 1, then the error correction term equals the unemployment rate (u_t).[10]

The empirical examination of the relationship between key labour market variables uses the vector error correction model (VECM). In particular, this methodology examines whether the labour force participation and the employment rate are dependant on unemployment levels and therefore on the business cycle. The basic assumption tested is whether the relationship between the two variables (labour force participation rate and employment rate) is linear or asymmetric (i.e. depending on the size of unemployment). To test whether there is a non-linear relationship between the participation rate and the employment rate when the level of unemployment changes, the two-regime threshold cointegration model of Hansen and Seo (2002) is used.

To proceed to the non-linear analysis, first a benchmark linear model is presented, which is

---

8 Nicolitsas (2012) examines the factors that influence the participation rate of women in the labour market in Greece.
9 The unemployment ratio between 15 and 64 years of age is calculated as the number of unemployed persons aged 15 to 64 divided by the total population of the same age.
10 Variables are defined as percentages of the population, therefore the unemployment rate variable is defined as the unemployment ratio or the ratio of the unemployed to total population.

a finite-order vector autoregressive model (VAR) of the following form:

$$y_t = \mu + \sum_{i=1}^{k} A_i Y_{t-i} + \varepsilon_t \qquad (3)$$

where $y_t = [p_t, e_t]'$ is a two-dimensional vector containing $I(1)$ variables, where p_t is the labour force participation rate and e_t is the employment rate, A_i is a 2×2 matrix of parameters and ε_t is a 2×1 vector of residuals. This unrestricted VAR model can be written in its vector error-correction representation (VECM) as follows:

$$\Delta y_t = \mu + \Pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \qquad (4)$$

where $\Gamma_i = -\sum_{j=i+1}^{K} A_j$ and $\Pi = \sum_{j=1}^{K} A_j - I$. In the case of cointegration between p_t and e_t, the coefficient matrix Π has rank equal to one and can be decomposed as $\Pi = \alpha\beta'$, where α and β are 2×1 vectors containing the adjustment coefficients and the cointegrating vector, respectively.

The VECM model with one lag order, used as a benchmark, may be analysed as follows:

$$\begin{bmatrix} \Delta p_t \\ \Delta e_t \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \mu_2 \end{bmatrix} + \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} w_{t-1}(\beta) + \Gamma(L) \begin{bmatrix} \Delta p_{t-1} \\ \Delta e_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (5)$$

where $w_{t-1}(\beta) = p_{t-1} - \beta e_{t-1}$ denotes the error correction term (ECT). The elements a_1 and a_2 are the adjustment coefficients in the error correction model and β contains the cointegrating vector.

The typical linear cointegration model assumes a symmetric long-run dynamic adjustment process and, according to Congregado, Golpe and van Stel (2011), it is an incomplete method of testing the relationship between the two variables. To examine whether there is a non-linear relationship between the p_t and e_t variables, the Hansen and Seo (2002) two-regime *threshold cointegration method* is used. The key assumption in estimating these models is that the long-run equilibrium in the system is ensured when it either exceeds or falls short of a critical threshold or a critical regime.

The two-regime threshold cointegration model (TVECM) of Hansen and Seo (2002) is presented as an extension of the linear benchmark model (5) with one lag and can be written as follows:

$$\begin{bmatrix} \Delta p_t \\ \Delta e_t \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \mu_2 \end{bmatrix} + \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} w_{t-1}(\beta) + \Gamma(L) \begin{bmatrix} \Delta p_{t-1} \\ \Delta e_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

if $w_{t-1}(\beta) \leq \gamma$

$$\qquad (6)$$

$$\begin{bmatrix} \Delta p_t \\ \Delta e_t \end{bmatrix} = \begin{bmatrix} \mu_1' \\ \mu_2' \end{bmatrix} + \begin{bmatrix} a_1' \\ a_2' \end{bmatrix} w_{t-1}(\beta) + \Gamma'(L) \begin{bmatrix} \Delta p_{t-1} \\ \Delta e_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t}' \\ \varepsilon_{2t}' \end{bmatrix}$$

if $w_{t-1}(\beta) > \gamma$

where there are two regimes, determined by the value of the error correction term ($w_{t-1}(\beta)$), and γ stands for the value of the critical regime or the *threshold* parameter. Based on model (6), the non-linear mechanism is determined by divergences from the long-run equilibrium of the system, when it stands over or under the critical regime value, and where $\Gamma(L)$ and $\Gamma'(L)$ illustrate the system dynamics for each regime. Similarly, α coefficients show, for each equation and in each regime, the speed of adjustment of this variable back to its long-run value. A statistically significant error correction term (i.e. a significant α parameter) implies long-run causality from the explanatory variables to the dependent variable under consideration for the specific regime (see Congregado, Golpe and van Stel, 2011).

To test for a non-linear cointegration relationship, Hansen and Seo (2002) suggest the implementation of the *Lagrange Multiplier* test (*sup*LM), where the null hypothesis of linear cointegration (i.e. non-presence of different regimes) is tested against the alternative two-regime threshold cointegration hypothesis.[11]

Before estimating the long-run relationship, the order of integration of the series is tested.

---

11 For the analysis, a test statistic is used where $\sup \mathrm{LM}^0 = \sup_{\gamma_L \leq \gamma \leq \gamma_U} \mathrm{LM}(\beta_0, \gamma)$, subject to the assumption that the β value is known (β_0) and equals one, i.e. $\beta = 1$.

To this end, the Dickey and Fuller (1979) (ADF), Elliott, Rothenberg and Stock (1996) DickeyFuller GLS (DF-GLS), and Lee and Strazicich (2004) (LM) tests are carried out, to test for the presence of a unit root. ADF and DF-GLS unit root tests are based on the following equation:

$$\Delta y_t = \varphi y_{t-1} + x_t' \delta + \sum_{j=1}^{k} c_j \Delta y_{t-j} + \varepsilon_t \qquad (7)$$

where y_t stands for the labour force participation rate (p_t), the employment rate (e_t), and the unemployment rate (u_t), respectively, and the x_t matrix may contain a constant or a constant and trend, and ε_t stands for the residual.

Similarly, the Lee and Strazicich (2004) test, which takes into consideration *structural breaks* in the model, can be obtained from the following regression:

$$\Delta y_t = \delta' \Delta Z_t + \varphi \tilde{y}_{t-1} + \sum_{j=1}^{k} c_j \Delta \tilde{y}_{t-1} + u_t \qquad (8)$$

where Z_t is the vector accounting for structural breaks.

Lastly, the findings from the unit root test for all variables are used to estimate a measure of persistence. In particular, the *half-life* measure is calculated as $HL = ln(0.5)/ln(1+\varphi)$, where φ is the estimated autoregressive coefficient from equations (7) and (8), respectively, determining the length of time until a unit shock to a series returns to half of its original value.

5 DATA AND EMPIRICAL RESULTS

5.1 DATA

The empirical analysis uses quarterly data for the labour force participation rate (p_t), the employment rate (e_t) and the unemployment rate (u_t) in Greece for the period between the first quarter of 1990 and the first quarter of 2012. The variable for labour force participation (p_t) is defined as the ratio of the labour force to total population, the employment rate (e_t) is defined as the number of the employed

to total population, and the unemployment rate (u_t) is defined as the *unemployment ratio* or the ratio of the unemployed to total population. Data are drawn from ELSTAT national accounts and based on Bank of Greece calculations.

5.2 EMPIRICAL RESULTS

At the first stage of the analysis, before estimating the long-run relationship, the order of integration of the p_t, e_t and u_t series is tested. In order to test the order of integration of the variables, the aforementioned ADF and DF-GLS unit root tests are used, as well as the Lee and Strazicich (2004) LM test, which takes into consideration structural breaks in the series; their findings are presented in Table 4. All tests were conducted using the test specifications (7) and (8), respectively, with and without trend.[12]

Results in Table 4 show that according to the ADF and DF-GLS tests, the series are non-stationary at the 5% level of significance.[13] The Lee and Strazicich (2004) LM test, which takes into account the presence of *structural breaks* in the series and assumes an endogenous determination of structural breaks, supports the findings of the ADF and DF-GLS tests.[14]

Interesting conclusions are drawn from testing for the presence of a unit root in variables according to the ADF, DF-GLS and Lee and Strazicich (2004) LM tests. In series where the null hypothesis of a unit root cannot be rejected at the 5% level of significance, the half-life measure is calculated. The *half-life* measure is a measure of a series persistence to a unit shock. In particular, it determines the length of time until a shock to a variable dissipates by half (Andrews 1993). Estimates of

---

[12] The size of lags for the specialised test was selected by using the recursive *t*-statistic, specifying a maximum length of $k_{max}=4$.
[13] With the exception of the ADF-GLS test on the employment rate variable (e_t), where the unit-root assumption for the specification without a trend is rejected.
[14] The LM test on the unemployment rate with trend rejects the unit root assumption, but in this case the trend coefficient is not significant, and therefore we employ the specification of the equation without trend.

Table 4 Unit root tests

	ADF test						ADF-GLS test		
	φ	ADF	Prob	Optimal lag	Half-life		φ	ADF-GLS	Half-life
Without trend									
p_t	-0.004	-0.266	0.925	0			0.007	0.527	
e_t	-0.042	-2.206	0.206	4	16.03		-0.043	-2.347*	15.75
u_t	0.027	0.882	0.995	4			0.029	1.013	
With trend									
p_t	-0.115	-2.559	0.300	0	5.65		-0.067	-1.775	9.93
e_t	0.004	0.125	0.997	4			-0.046	-1.964	
u_t	-0.015	-0.404	0.986	4	46.51		-0.051	-2.380	13.12

	Lee and Strazicich LM test					
	φ	LM	Break date	Optimal lag	λ	Half-life
Level						
p_t	-0.067	-1.871	1996Q4	4		
e_t	-0.034	-2.805	1997Q4	4		20.10
u_t	-0.038	-2.961	2009Q4	4		18.09
Level and trend						
p_t	-0.391	-4.500	2003Q3	4	0.6	1.40
e_t	-0.107	-2.838	2006Q1	4	0.7	
u_t	-0.119	-4.995*	2004Q1	4	0.7	

Notes: The ADF 5% critical value is -2.89 without trend and -3.46 with trend. The DF-GLS 5% critical value is -1.94 without trend and -3.07 with trend. The LM 5% critical value is -3.57 without trend. The LM 5% critical values with trend depend on the location of the break, $\lambda=(T_B/T)$, where T is the sample size and T_B is the estimated break point, and are symmetric around λ and $(1-\lambda)$. The critical values for $\lambda=0.7, 0.6$ are -4.45, -4.50, respectively. * indicates rejection of the null hypothesis at the 5% significance level.

half-life show that the employment rate and the unemployment rate are more "persistent" compared with the labour force participation rate. The estimated persistence coefficients for the employment rate range between 15.8 and 20.1 quarters, for the unemployment rate between 13.1 and 46.5 quarters, and for the participation rate between 1.4 and 9.9 quarters. It should be noted that the estimated half-lives of the employment and unemployment rates are more persistent in the model which takes into consideration the presence of structural breaks. Specifically in this model, the half-life of the unemployment rate is around 18 quarters, i.e. it takes around 4.5 years for the unemployment rate to fall to half its level in the model reference period. In conclusion, the half-life of the unemployment rate is particularly high, suggesting a particularly strong persistence of unemployment in Greece and confirming the recent study by Bakas and Papapetrou (2012), who demonstrated that the unemployment rate in Greece is characterised by the *hysteresis hypothesis.*

The second stage of the analysis estimates the vector error correction model (VECM) with one lag, as presented in equation (5), using the methodology of Johansen (1991).[15] The results of the linear model estimation lead to the con-

---

[15] The lag length for the specified model was selected on the basis of the SBC (Schwarz Bayesian) criterion, setting a maximum length of $k_{max}=4$.

clusion that there is no cointegration at a 5% significance level.[16,17]

The long-run relationship between the participation rate and the employment rate can be asymmetric, and therefore the estimation of this relationship on the basis of the linear model may be inappropriate. Thus, the rejection of cointegration between the series may arise from the presence of non-linearity in the relationships between the two variables.

In view of the above, to test for non-linearity, the Hansen and Seo (2002) supLM test is applied and p-values are calculated by two bootstrap methods, i.e. the constant coefficient bootstrap and the residual bootstrap, both calculated on the basis of 5,000 simulation replications. The test results are presented in Table 5 and show that the linear cointegration relationship is rejected in favour of non-linear cointegration.

At the next stage, the two-regime cointegration model (TVECM) of Hansen and Seo (2002) is calculated to analyse the long-run relationship between the labour force participation rate and the employment rate during the recent economic crisis, taking into account the presence of asymmetry, i.e. the dependence on the size of unemployment. Table 6 presents the results of the threshold vector error correction model (TVECM) in the presence of two different regimes. The *threshold* value of the unemployment rate was determined endogenously by the model at $\gamma=0.0786$ and defines the error correction coefficient (w_{t-1}). Therefore, two regimes were estimated: the "typical" regime (accounting for 93.1% of observations), which represents an unemployment ratio below 7.86% and the "extreme" regime, which represents an unemployment ratio of over 7.86% and accounts for 6.9% of observations. This regime covers the period after the second quarter of 2010 (see Chart 8).[18]

The results of the estimation, presented in Table 6, suggest that for unemployment levels below 7.86% (i.e. within the "typical" unem-

Table 5 Testing for threshold cointegration

	*sup*LM⁰	*sup*LM
Cointegration vector	1	0.78
Threshold parameter γ	0.079	0.197
Test statistics	19.629*	22.699*
Fixed regressor 5% critical value	17.946	18.005
Fixed regressor *p*-value	0.018	0.003
Bootstrap 5% critical value	10.338	12.041
Bootstrap *p*-value	0.001	0.000

Note: * indicates rejection of the null hypothesis at the 5% significance level.

Table 6 Threshold VECM estimates (TVECM)

	Regime 1		Regime 2	
	Δp_{t-1}	Δe_{t-1}	Δp_{t-1}	Δe_{t-1}
w_{t-1}	0.0714 (0.0553)	0.1377** (0.0717)	0.0663* (0.0296)	-0.1736* (0.0548)
c	-0.0031 (0.0033)	-0.0078** (0.0043)	-0.0061* (0.0020)	-0.0003 (0.0046)
Δp_{t-1}	0.0958 (0.0716)	0.2896** (0.1496)	-0.2156** (0.1259)	-3.1072* (0.3577)
Δe_{t-1}	-0.1551** (0.0898)	-0.1106 (0.1126)	0.3201* (0.0878)	0.0943 (0.1446)
Capital observations	93.10%		6.90%	

Notes: Eicker-White standard errors in parenthesis. *,** coefficients are statistically significant at significance levels of 5% and 10%, respectively. Regime 1: $w_{t-1} \leq 0.0786$. Regime 2: $w_{t-1} > 0.0786$.

ployment regime) the error correction effect is positive, but it appears to be significant only for the employment equation (at a 10% significance level). However, the non-significance of the error correction term in the labour force participation rate function shows that in the

---

16 The number of lags for the VECM is $k=1$ according to the SBC criterion. The non-linear analysis (TVECM) is based on the same lag length as the linear model. The results of the linear model are not included, but are available from the authors.

17 The non-presence of cointegration between the participation rate and the employment rate is also supported by the presence of a unit root in the unemployment variable, which was defined in equation (2) as the difference between the other two variables.

18 According to the LFS data, the unemployment rate in the second quarter of 2010 was 11.8%.

first regime, i.e. when the unemployment rate is low, the participation rate is a weakly exogenous variable.

By contrast, during the second, "extreme" regime, i.e. when unemployment is high, the results of the estimation suggest that the error correction term is statistically significant (at a 5% level of significance) and negative for the employment equation, and statistically significant (at a 5% level of significance) and positive for the labour force participation equation. The findings of the analysis show that when the unemployment rate is high, such as after the second quarter of 2010, strong downward pressure is generated on the employment rate, and while the participation rate increases, the size of the effect is smaller than before the crisis.

On the basis of the test on the equality of the error correction terms across the two regimes, i.e. the asymmetry test between the error correction coefficients, the null hypothesis of coefficient equality is rejected (the Wald test equals 13.512 at the 1% level) and, accordingly, on the basis of the dynamic coefficient equality in the model, the null hypothesis of coefficient equality is rejected (the Wald test equals 102.566 at the 0% level). These results show that there is asymmetry in the (error correction and dynamic) coefficients between the two regimes.

It is also interesting to examine the effects of the labour force participation rate on the employment rate in both regimes. In particular, the participation rate seems to have a positive effect on the employment rate when the unemployment rate is low (first regime), while the participation rate has a negative effect on the employment rate when the unemployment rate is high. This finding shows that labour force participation during a period of low unemployment rates is accompanied by an increase in the employment rate. By contrast, during a period of high unemployment rates, participation in the labour market does not translate into employment, i.e. enterin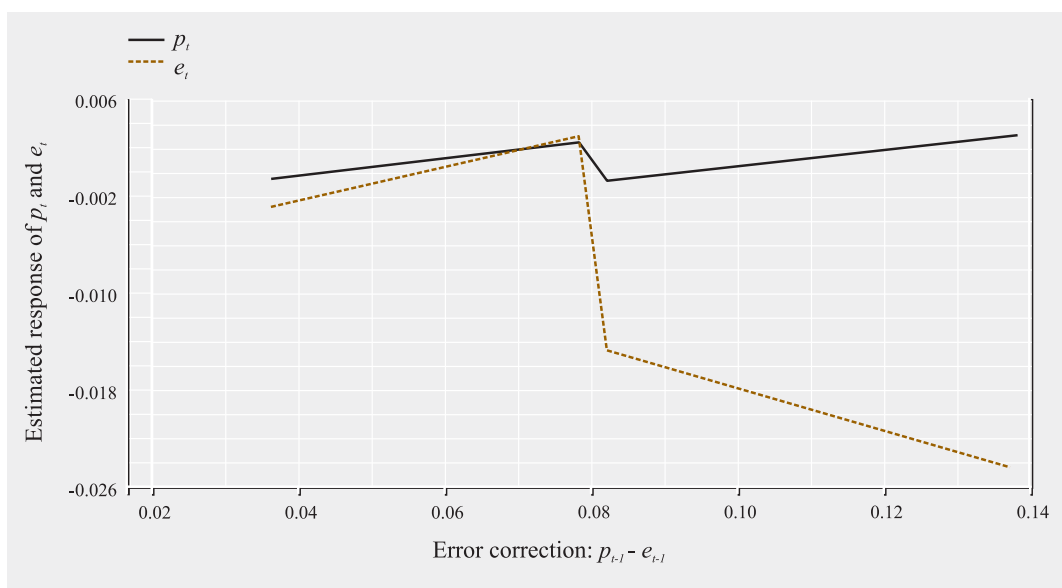g the labour force by no means automatically implies finding a job. Rather, the results show the opposite: when unemployment is high, those entering the labour market have limited employment possibilities.

Finally, Chart 8 presents the evolution of the error correction term, i.e. the estimated response of (changes in) the participation rate (Δp_{t-1}) and (changes in) the employment rate (Δe_{t-1}) to the discrepancy between them (i.e. the unemployment ratio of the previous period). Chart 8 shows that for low employment rates in the "typical" regime, the response of both series is slightly positive. However, in the high unemployment regime, the estimated response of the labour participation rate is positive and the estimated response of employment is strongly negative. The results show that during periods of adverse macroeconomic conditions, as reflected in the high unemployment rate, employment falls substantially and the participation rate increases as income declines and secondary earners enter the labour market to compensate for the loss of household income.

In sum, according to empirical findings, the linear cointegration hypothesis is rejected in favour of a two-regime threshold cointegration model as per Hansen and Seo (2002). Consequently, the two-regime system seems to characterise the asymmetric adjustment of the labour force participation rate to a long-run equilibrium with the employment rate, with the threshold value (i.e. the unemployment ratio) estimated at 7.86%. The "extreme" high-unemployment regime coincides with the recent crisis, as can be seen in Chart 8, while the threshold value coincides with the signing of the Memorandum of Understanding between Greece and its European partners and the International Monetary Fund (second quarter of 2010).

The results of the econometric analysis suggest the need to adopt measures to stop the increase and reduce unemployment in order to correct imbalances in the labour market. In this direction, unemployment could be con-

tained, inter alia through active employment policies, which would increase the employment probability of the unemployed, help employees keep their jobs when they are at risk of losing them, and improve their skills. Moreover, the creation of economic growth is a necessary condition to reduce unemployment. Boosting demand, focusing on productivity and innovation, improving education, combatting tax and contribution evasion, promoting investment, enhancing the effectiveness of public administration, reducing bureaucracy and removing the obstacles and disincentives for starting a business would lead to higher production and employment and ease the unemployment problem.

6 SUMMARY OF CONCLUSIONS

The aim of this study has been to explore developments in key labour market aggregates, such as the unemployment rate, the labour force participation rate and the employment rate, and to highlight the fact that, in the current environment of deep and protracted economic recession, they are very different from

what they were before the crisis. The examination of the labour market indicators in the Greek economy is very important, as they are associated with human capital and affect the productive capacity of the economy, currently and in the future.

The study goes on to explore the econometric relationship between employment (e_t), participation (p_t) and unemployment (u_t) rates. The analysis uses quarterly data for Greece spanning the period between the first quarter of 1990 and the first quarter of 2012. The examination is carried out on the basis of the vector autoregression error correction model, which calculates the degree to which labour force participation and employment rate depend on the size of unemployment. In other words, the basic assumption examined is whether the relationship between the labour market participation rate and the employment rate is linear or asymmetric (i.e. depending on the size of unemployment and the stage of the country's economic activity). To examine whether there is a non-linear relationship between the two variables when the level of unemployment changes, the Hansen and Seo

(2002) two-regime threshold cointegration model is used.

The empirical analysis initially examines the degree of integration of the p_t, e_t and u_t series using various tests for the presence of a unit root. Estimates show that the employment rate and the unemployment rate are more "persistent" than the participation rate, suggesting the persistence of unemployment in Greece.

As a next step, the two-regime threshold cointegration model (TVECM) of Hansen and Seo (2002) is estimated to study the long-run relationship between the labour force participation rate and the employment rate, taking into account the presence of asymmetry, i.e. the dependence of the variables on the size of unemployment. The two-regime system seems to characterise the asymmetric adjustment of the labour force participation rate to a long-run equilibrium with the employment rate, and the threshold value of the employment rate was determined endogenously by the model. The high-unemployment regime covers the period after the second quarter of 2010.

Empirical findings show that the relationship between the labour force participation rate and the employment rate is not linear; rather it shows significant differentiation and depends on the unemployment rate, and thus on the state of the economy. The results of the analysis suggest that during periods of low unemployment rates, positive pressures are exerted on both the employment rate and the labour participation rate. By contrast, during the second regime, when the unemployment rate is high, such as after the second quarter of 2010, strong downward pressure is generated on the employment rate, and while the participation rate continues to increase, it is still lower than before the crisis.

The results of the empirical analysis show that in the period before the second quarter of 2010, when the unemployment rate is low, in line with the findings of the employment equation, the labour force participation rate is a weakly exogenous variable, while the employment rate is an endogenous variable. By contrast, during the second "extreme" regime, i.e. when unemployment is high, strong downward pressure is generated on the employment rate, and while the labour force participation rate increases, it is still lower than before the crisis. The high-unemployment regime coincides with the recent crisis and, more specifically, the period of Greece's entry into the Memorandum of Understanding (second quarter of 2010). The results show that during periods of adverse macroeconomic conditions, as reflected in the high unemployment rate, the employment rate falls substantially and the participation rate increases as income declines and secondary earners enter the labour market to compensate for the loss of household income.

It is also interesting to examine the effects of the labour force participation rate on the employment rate under both regimes. In periods of low unemployment, coinciding with upturns in the Greek economy, labour participation is accompanied by an increase in the employment rate. By contrast, during the current high unemployment period, participation in the labour market does not automatically imply finding a job. Rather, the results point in the opposite direction. In other words, when unemployment is high, persons entering the labour market have a low probability of employment.

REFERENCES

Andrews, D.W.K. (1993), "Exactly median-unbiased estimation of first order autoregressive unit root models", *Econometrica*, 61, 139-65.

Bakas, D. and E. Papapetrou (2012), "Unemployment in Greece: evidence from Greek regions", *Bank of Greece Working Papers*, No. 146.

Bank of Greece (2011), *Annual Report 2010.*

Bank of Greece (2012), *Annual Report 2011.*

Bank of Greece (2013), *Annual Report 2012.*

Congregado, E., A.A. Golpe and A. van Stel (2011), "Exploring the big jump in the Spanish unemployment rate: evidence on an 'added-worker' effect", *Economic Modelling*, 28, 1099-1105.

Dickey, D.A. and W.A. Fuller (1979), "Distribution of the estimators for autoregressive time series with a unit root", *Journal of the American Statistical Association*, 74, 427-431.

Duval, R., M. Eris and D. Furceri (2011), "The Effects of Downturns on Labour Force Participation: Evidence and Causes", *OECD Economics Department Working Papers*, No. 875.

Elliott, G., T.J. Rothenberg and J.H. Stock (1996), "Efficient tests for an autoregressive unit root", *Econometrica*, 64, 813-36.

European Central Bank (2012), "Euro area labour markets and the crisis", *Structural Issues Report*, October, 1-126.

European Commission (2012), "Labour market developments in Europe, 2012", *European Economy*, 5/2012, 1-161.

Hansen, B.E. and B. Seo (2002), "Testing for two-regime threshold cointegration in vector error-correction models", *Journal of Econometrics*, 110, 293-318.

Hotchkiss, J.L. (2009), "Changes in the aggregate labor force participation rate", *Federal Reserve Bank of Atlanta Economic Review.*

Johansen, S. (1991), "Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models", *Econometrica*, 59, 1551-80.

Lee, J. and M.C. Strazicich (2004), "Minimum LM unit root test with one structural break", Working Papers No. 04-17, Department of Economics, Appalachian State University.

Lolos, S. and E. Papapetrou (2010), "Regional Differences and Persistence of Unemployment: Empirical Findings from the Greek Regions, 1981-2008," in *The Greek Labour Market: Features, Developments and Challenges*, Bank of Greece, 57-76 [in Greek].

Mattingly, M.J. and K.E. Smith (2010), "Changes in wives' employment when husbands stop working: a recession-prosperity comparison", *Family Relations*, 59, 343-357.

Mitrakos, Th., P. Tsakloglou and I. Cholezas (2010), "Graduates and labour market: unemployment, wages and private returns to education in Greece", in *The Greek Labour Market: Features, Developments and Challenges*, Bank of Greece, 77-106 [in Greek].

Nicolitsas, D. (2012), "Participation in the Greek labour market: recent developments", Centre of Planning and Economic Research (KEPE), *Greek Economic Outlook,* No. 17, February 2012, 41-49.

OECD (2010), *Employment Outlook, Moving Beyond the Jobs Crisis*, Paris.

OECD (2012), *Employment Outlook*, Paris.

OECD (2013), *International Migration Outlook*, Paris.

Papapetrou, E. (2007), "Education, labour market and wage differentials in Greece", Bank of Greece, *Economic Bulletin*, 28, 51-73.

Papapetrou, E. (2008), "Evidence of the gender wage differentials in Greece", *Journal of Economic Change and Restructuring*, 41, 155-166.