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Economic growth in Greece: Medium term trends and future prospects

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Οικονομική μεγέθυνση στην Ελλάδα: Μεσοπρόθεσμες τάσεις και μελλοντικές προοπτικές

Σωτήρης Παπαϊωάννου

ΠΕΡΙΛΗΨΗ

Η ελληνική οικονομία αντιμετωπίζει σήμερα μια δομική κρίση, η οποία αποτυπώνεται στη ραγδαία υποχώρηση των βασικών οικονομικών μεγεθών και στην επιδείνωση των προοπτικών. Κύρια χαρακτηριστικά της κρίσης είναι το μεγάλο δημοσιονομικό έλλειμμα, το τεράστιο χρέος, η ανεργία αλλά, κυρίως, η ραγδαία μείωση του Ακαθάριστου Εγχώριου Προϊόντος (ΑΕΠ). Σύμφωνα με τα αναθεωρημένα στοιχεία των Εθνικών Λογαριασμών της ΕΛΣΤΑΤ (2011), η πραγματική οικονομία έχει εισέλθει από το 2008 σε καθεστώς ύφεσης με το ΑΕΠ να συρρικνώνεται κατά 0,2% το 2008, κατά 3,2% το 2009, κατά 3,5% το 2010 και κατά 6,9% για το 2011. Η βαθιά ύφεση των τελευταίων ετών έχει ως επακόλουθη συνέπεια την επιδείνωση των βασικών δημοσιονομικών μεγεθών.

Σε αυτά τα πλαίσια, μια αποτίμηση των μελλοντικών προοπτικών της ελληνικής οικονομίας θα ήταν χρήσιμη για την άσκηση πολιτικής προς την κατεύθυνση της ταχύτερης επίτευξής της οικονομικής μεγέθυνσης. Αυτό μπορεί να επιτευχθεί μέσω του εντοπισμού των συνιστωσών εκείνων που αποτελούν τις κινητήριες δυνάμεις για τη μεγέθυνση της ελληνικής οικονομίας.

Η παρούσα μελέτη έχει ως βασικό στόχο να παράσχει μια εκτίμηση της μεσοπρόθεσμης τάσης του ρυθμού μεταβολής του ΑΕΠ για το χρονικό διάστημα 2011-2015. Επιπλέον, η κύρια συνεισφορά της παρούσας εργασίας είναι η συστηματική ανάλυση των στοιχείων, ώστε να εξαχθούν ποσοτικά συμπεράσματα κατά τρόπο που δεν εξαρτάται από κάποιο συγκεκριμένο θεωρητικό πλαίσιο.

Η παρούσα μελέτη στηρίζει την ανάλυσή της στην ταυτότητα του ΑΕΠ, η οποία αποσυνθέτει το πραγματικό ΑΕΠ μιας χώρας στην παραγωγικότητα της εργασίας, στις ώρες εργασίας ανά εργαζόμενο, στο ποσοστό απασχόλησης, στο ποσοστό συμμετοχής του πληθυσμού στο εργατικό δυναμικό και στον πληθυσμό. Σύμφωνα με αυτή την ταυτότητα, οι μεταβολές σε αυτές τις πέντε συνιστώσες είναι ικανές να εξηγήσουν τη μακροχρόνια τάση της μεταβολής του παραγόμενου προϊόντος.

Κάθε επιμέρους συνιστώσα της ταυτότητας του ΑΕΠ αποσυντίθεται στην τάση και στον κύκλο της έτσι ώστε να αποτιμηθεί η μεσοπρόθεσμη τάση της. Για την εκτίμηση των τάσεων των επιμέρους συνιστωσών, χρησιμοποιούνται δύο εναλλακτικές τεχνικές. Οι τεχνικές αυτές είναι το φίλτρο των Hodrick-Prescott (φίλτρο HP) καθώς και το φίλτρο Kalman. Αφού έχει εκτιμηθεί η τάση κάθε επιμέρους μεταβλητή της ταυτότητας του ΑΕΠ, στη συνέχεια εκτιμάται και η μεσοπρόθεσμη τάση του ρυθμού μεταβολής του προϊόντος.

Τα δεδομένα που χρησιμοποιούνται για τις οικονομετρικές εκτιμήσεις αφορούν στην περίοδο 1995-2010 και είναι σε τριμηνιαία συχνότητα. Τα στατιστικά στοιχεία για το ΑΕΠ προέρχονται από τους Εθνικούς Λογαριασμούς της ΕΛΣΤΑΤ, ενώ τα στοιχεία για τις ώρες εργασίας παρέχονται από τους Εθνικούς Λογαριασμούς της ΕΛΣΤΑΤ για την περίοδο 1995-1999 και από τη Eurostat για την περίοδο 2000-2010. Τα στατιστικά στοιχεία για το μέγεθος της απασχόλησης, το μέγεθος του εργατικού δυναμικού και το μέγεθος του οικονομικά ενεργού πληθυσμού προέρχονται και από τις Έρευνες Εργατικού Δυναμικού της ΕΛΣΤΑΤ.

Η εκτίμηση της τάσης του ρυθμού μεταβολής της παραγωγικότητας διαμορφώνεται στο 0,16%, ενώ η εκτίμηση της μεσοπρόθεσμης τάσης των ωρών εργασίας ανά εργαζόμενο διαμορφώνεται στο 0,12%. Η τάση του ποσοστού της

απασχόλησης εκτιμάται στο -2,5%, του ποσοστού συμμετοχής του πληθυσμού στο εργατικό δυναμικό στο 0,57% και του πληθυσμού στο 0,01%. Έτσι, η εκτίμηση της μεσοπρόθεσμης τάσης του ρυθμού μεταβολής του ΑΕΠ διαμορφώνεται στο -1,65%, ως το άθροισμα των επιμέρους συνιστωσών. Σημειώνεται ότι η εκτίμηση του -1,65% ρυθμού οικονομικής μεγέθυνσης υπονοεί ότι αυτή θα είναι η μεσοπρόθεσμη δυναμική του παραγόμενου προϊόντος εφόσον οι υποκείμενοι παράγοντες που το καθορίζουν, δηλαδή η παραγωγικότητα της εργασίας, οι ώρες εργασίας ανά εργαζόμενο, το ποσοστό της απασχόλησης, κοκ, συνεχίσουν στο μέλλον να μεταβάλλονται με τον ίδιο ρυθμό.

Η εργασία χωρίζεται σε επτά ενότητες. Η επόμενη ενότητα παρέχει μια σύντομη επισκόπηση των βασικών χαρακτηριστικών της ελληνικής οικονομικής μεγέθυνσης. Οι ενότητες 3 και 4 παρουσιάζουν την οικονομετρική μεθοδολογία που θα ακολουθηθεί και κάνουν μια σύντομη παρουσίαση των στατιστικών δεδομένων. Η ενότητα 5 παρουσιάζει τα εμπειρικά αποτελέσματα, ενώ η ενότητα 6 συζητά για τη σημασία της παραγωγικότητας στην οικονομική μεγέθυνση και παρέχει κατευθύνσεις οικονομικής πολιτικής. Η ενότητα 7 ανακεφαλαιώνει τα βασικά συμπεράσματα της εργασίας.

ABSTRACT

The purpose of this paper is to provide an estimate of the medium term trend growth rate of GDP for the Greek economy, for the period 2011-2015. The analysis is based on the GDP identity, according to which, real GDP is decomposed into five components, that is labor productivity, hours worked per employee, employment rate, labor force participation rate and population. By using the filtering techniques of the HP and Kalman filter, the trend growth rate of GDP is estimated at -1.65%, as the sum of the trend growth rates of its individual components.

JEL classification: O11, O40, O47,

Keywords: Economic growth, Greek economy, Filtering techniques, GDP growth trends

1. Introduction

The Greek economy is currently facing a structural crisis, which is reflected in the sharp decline of economic fundamentals and the deteriorating outlook. The main features of the crisis are the large fiscal deficit, the huge public debt, the high unemployment rate but, also importantly, the rapid decline of Gross Domestic Product (GDP). The real economy has entered into a recession regime since 2008, with GDP shrinking by 0.2% in 2008, by 3.2% in 2009, by 3.5% in 2010 and by 6.9 % in 2011. The rapid decline in economic activity has a consequent impact in the weakening of the main fiscal aggregates.

In this context, an assessment of the future growth prospects of the Greek economy might be used to assist in economic policy. In particular, the findings of this study can be helpful to understand the mechanisms of growth of the Greek economy. The identification of these mechanisms might, in turn, be useful in designing those policies that will be needed in order to attain faster economic growth.

The purpose of this paper is to provide an estimate of the medium term trend growth rate of GDP, over the period 2011-2015, as well as to analyze the sources of growth of the Greek economy. The present study wishes to contribute in this field, since it aims to derive quantitative evidence for economic growth, from systematically analyzing the data and without depending in a certain theoretical framework.

The analysis of this study is based on the GDP identity, according to which, real GDP is decomposed into five components, that is labor productivity, hours worked per employee, employment rate, labor force participation rate and population. According to this identity, changes in these five factors can sufficiently explain future log term trends of real output. Each individual component of the GDP identity is decomposed into its cycle and trend, so as to estimate its medium term trend. To

estimate medium term trends, the econometric techniques of the Hodrick-Prescott (HP) and Kalman filter are employed.

The data used for the econometric estimates are expressed on a quarterly basis and cover the period 1995-2010, so as to include the whole period of high economic growth, during 1995-2007, as well as the recession period between 2008 and 2010. The data for GDP are provided from the National Accounts of the Hellenic Statistical Authority (ELSTAT), while the data for hours worked were taken from ELSTAT (for the period 1995-1999) and from Eurostat (for the period 2000-2010). Finally, the data for the size of employment, the labor force and the size of economically active population were provided from the Labor Force Surveys of ELSTAT.

The final estimate for the growth rate of labor productivity is measured at 0.16%. Similarly, the trend growth estimates for the remaining components of GDP are equal to 0.12% for hours worked per employee, -2.5% for the employment rate, 0.57 for the growth rate of labor force participation and 0.01% for the growth rate of economically active population. Therefore, the trend growth rate of GDP is estimated at -1.65%, as the sum of the trend growth rates of its individual components. It should be noted that the -1.65% estimate of the trend GDP growth rate suggests that this will be the dynamics of future output, provided that the underlying components, that determine its evolution, continue to grow in the future by the same rate.

The rest of this paper is organized as follows. The next section provides a brief overview of the main characteristics of past economic growth in Greece. Sections 3 and 4 discuss the econometric methodology and present some descriptive statistics, respectively. Section 5 shows the empirical results, while section 6 discusses the importance of productivity for the Greek economy and provides directions for economic policy. Finally, section 7 concludes.

2. Experience of past economic growth in Greece

Over the past 60 years, the growth performance of the Greek economy has not been not uniform. Essentially, there have been three phases of economic growth in postwar Greece: the period 1950-1973, which was a period of strong economic growth, with an annual average rate at around 7%, the period 1974-1994, during which GDP growth slowed to an average annual rate of 2% and the period 1995-2007 during which the rate of economic growth returned to an average annual growth rate of 3.5%[1]. As a result, the level of GDP of the Greek economy was formed in 2008 at 190 billion € (measured at constant 2000 prices)[2]. The period from 2008 onwards is a period of recession, where GDP growth rates are negative, with -0.2% in 2008, -3.2% in 2009, -3.5% in 2010 and -6.9 % in 2011.

The rapid growth of the late 50s and 60s was pushed by several economic reforms which helped to improve the external competitiveness of the Greek economy and diminished the existing restrictions. The liberalization of trade relations, as well as the elimination of price controls, were some of the factors that contributed to the impetus of the Greek economy. Other key features of this period were the disciplined fiscal and monetary policy, as well as favorable business conditions and affordable business credit (Gagales, 2006). According to Alogoskoufis and Kalivitis (1999), these factors contributed significantly to the accumulation of public and private capital and gave a significant boost to economic growth of postwar Greece.

[1] The dating of changes in the phases of Greek economic growth is based on the statistical properties of the series of GDP. For example, Bosworth and Kollintzas (2001) report that two structural changes have occurred in the evolution of Greek GDP, the first around 1980 and the second around 1995. However, Alogoskoufis (1995), using as a criterion the changes in economic policy regimes, argues that the first structural change occurred a few years earlier, around 1974. The two dates may not be regarded as incompatible, since, in general, changes in economic policy need time to materialize and affect growth after a time lag. The same argument applies, also, for the second structural change in 1995.

[2] For an extensive survey of studies analyzing the performance of the Greek economy, see Bryant et al. (2001).

The economic slowdown of the period 1974-1994 was due to the large drop in investments from 22% to 18% of GDP, according to Alogoskoufis (1995). Except for the sharp drop in investments, their profitability was significantly decreased, as a result of a series of institutional changes that deteriorated the existing economic climate (Alogoskoufis, 1995). Such changes were the large wage increases, exceeding productivity growth, distortions in the labor market, increasing taxation of investment and expansion of the state, which was accompanied by high deficits and inflation. In a similar spirit, Vassilatos and Kollintzas (1996) concluded that the economic slowdown in Greece was the result of the increased public consumption and the reduction of public investment.

However, Dimelis et al. (1996) argue that, except for the fall in investments, an additional factor that contributed to the significant slowdown of GDP, for this period, was the decrease in total factor productivity (TFP) growth. Bosworth and Kollintzas (2001), also, argue that the slowdown was caused, among other things, by the exposition of the Greek economy to a higher level of competition, due to the entry of the country in the European Economic Community.

Regarding the later period of 1995-2007, it seems that a second structural change has taken place, which led to higher rates of economic growth (Bosworth and Kollintzas, 2001). The prospect of full membership of the Greek economy in Economic and Monetary Union played an important role since several decisive measures were taken towards the control of budget deficits and inflation and the liberalization in some sectors of the economy. Additional factors that contributed to the boom of this period were the rapid credit expansion, as a result of the liberalization of the financial sector, the fall in interest rates (Gagales, 2006) and the

increased investment in public infrastructure, due to increased inflow of European Union (EU) funds (Dimelis, 2004).

In particular, the liberalization of the financial sector and the very low real interest rates (at levels below 1% during 2000-2005) are significantly related to the strong economic recovery of this period, according to Vamvakidis and Zanforlin (2002). Sideris and Zonzilos (2005) show that the reduction of interest rates led to an acceleration of growth by 1% to 1.5%, facilitating easy access to the finance of investment and consumption.

The entrance of the Greek economy into a recession regime in 2008, after 14 consecutive years of growth (1994-2007), led to a termination of a convergence process with the European average. At the end of this period, GDP per capita in Greece was at 89% of the average EU-15, against 74% in 1997.

Noting the recent growth experience of the Greek economy from a critical perspective, it can be argued that the growth rates of the Greek economy were high, but not particularly high. They were quite higher than the average growth rates of most other EU countries, but they lagged behind GDP growth rates of other developed and less developed countries and they were, also, much lower than the growth rates of the period 1950-1975. It is, also, worth noting the observation of Arghyrou and Bazina (2002) that the competitiveness of the Greek economy deteriorated considerably during the decade of the 90s, raising real unit labor costs, leading to lower exports and a deterioration of the trade balance of the country. Moreover, despite the strong GDP growth rates, unemployment could not be reduced significantly, remaining at relatively high levels.

The growth experience of Greece, with long periods of prosperity and long periods of economic slowdown has been observed, also, in other countries. According

to Jones and Olken (2005), there have been similar experiences in other countries with these periods lasting from 10 to 15 years. The analysis shows that the shifts in the growth process are largely due to changes in productivity growth and not to changes in the rate of accumulation of productive factors. Similar conclusions have been drawn by Kehoe and Prescott (2002), indicating that the rate of TFP growth is able to explain long periods of economic recession for several developed economies (for example, USA, UK, Germany, etc.). Prescott (1998), also, argues that TFP growth is the most basic determinant of real incomes differences, among several economies. Similarly, in the case of Greece, Gogos et al. (2012) argue that changes in TFP growth are able to explain both the period of economic slowdown, between 1979 and 1995, as well as the period of economic recovery (between 1995 and 2001).

3. Econometric methodology

3.1 GDP identity

The analysis of this study is based on the identity of GDP. The GDP identity is useful, since we are able to distinguish the individual factors that compose long term GDP. It has been extensively used in the past literature in order to measure the potential growth rate of the U.S. economy (Clark, 1983; Woodham, 1984). A simple version of this identity, as presented by Gordon (2003), decomposes real GDP (Q) into the components of labor productivity, expressed as output per hour worked (Q/H), hours worked per employee (H/E), the employment rate (E/L), the labor force participation rate (L/N), and the size of working age population, from 15 to 74 years (N),:

$$Q \equiv \frac{Q}{H} * \frac{H}{E} * \frac{E}{L} * \frac{L}{N} * N \qquad (1)$$

Real GDP (Q) is expressed in constant 2000 prices. The variable for labor input is expressed in total hours worked (H) since this is considered as a more reliable measure for assessing the contribution of labor to GDP. The variables of E, L and N represent the number of employees, the size of the labor force (employed and unemployed) and the economically active population from 15 to 74 years (employed, unemployed and economically inactive), respectively.

By taking logarithms of equation (1) and then by taking the first differences, we get equation (2), in which the growth rate of GDP is the sum of the growth rates of (i) labor productivity, (ii) hours worked per employee, (iii) employment rate, (iv) labor force participation rate and (v) population:

$$\Delta(Q) \equiv \Delta(\frac{Q}{H}) + \Delta(\frac{H}{E}) + \Delta(\frac{E}{L}) + \Delta(\frac{L}{N}) + \Delta(N) \qquad (2)$$

3.2 Filtering techniques

In order to estimate the medium trend growth rate of GDP, as well as the trend growth rate of its components, we will rely on historical data for these variables (reaching the fourth quarter of 2010). Then, we will assess the medium term growth trend for each component by using two alternative econometric techniques. These techniques are the Hodrick-Prescott filter (HP filter hereafter) and the Kalman filter.

The HP filter is probably the most commonly used method in macroeconomics for decomposing variables into their long-term trend and their cyclical component. This technique uses a moving average procedure to decompose a variable into its trend and cycle (King and Rebelo, 1993). The basic philosophy of the HP filter is to minimize the distance between the trend growth rate and real growth rate of a variable, given a constraint on the trend growth rate, which is expressed through the price of a smoothing parameter λ.

The multivariate Kalman filter (1960) assumes that a macroeconomic time series may be decomposed into its long-term trend, its cycle and a statistical error. This technique is, also, used to assess the long-term trend of the individual components of the GDP identity by employing the following equation:

$$\Delta p_t = \alpha_t + \beta \mathrm{X}_t + w_t \quad (3)$$

where Δp_t is the growth rate of the component for which we wish to estimate its trend (labor productivity, hours worked per employee, employment rate, labor force participation rate). Furthermore, α_t is a time-varying coefficient which estimates the trend growth rate of each component of GDP, it follows a random walk and, in this way, it allows for the variation of the trend growth rate in each period:

$$\alpha_t = \alpha_{t-1} + \nu_t \quad (4)$$

Furthermore, X_t is a set of exogenous explanatory variables which may be included in equation (3), while the terms of v_t and $\mathrm{w_t}$ are the econometric error terms, which are not correlated and they follow a normal distribution with zero mean and constant variance.

The advantage of the Kalman filter is that it allows for the introduction of additional variables (X_t) in equation (3), which may provide us with outside economic information. In this way, equation (3) may incorporate external factors that explain cyclical changes in the components of GDP, while, at the same time, do not affect their trend. In this paper, the variable of output gap, defined as the percentage deviation of actual GDP from its long-term trend, is used as an explanatory variable in vector X.

4. Data and descriptive statistics

The data used for the econometric estimates cover the period between 1995 and 2010 and are expressed on a quarterly frequency. The data for GDP are provided from the National Accounts of the Hellenic Statistical Authority-ELSTAT (expressed in constant 2000 prices), while the data for hours worked were taken from the National Accounts of ELSTAT for the period of 1995-1999 and from Eurostat for the period 2000-2010. Finally, the data for the size of employment, the size of the labor force and the size of the economically active population come from the Labor Force Surveys of ELSTAT.

Table 2 presents the annual growth rates of real GDP, as well as of its individual components, for each quarter between 2001 and 2010. By definition, as shown in equation (2), the sum of the growth rates of the individual components of GDP (labor productivity, hours worked per employee, employment rate, labor force participation rate, population) equals the growth rate of real GDP, shown in the first column.

We may observe that in the last quarter of 2010, GDP was declining by 7.68%, with a substantial contribution from the reduction in output per hour (3.6%), as well as from a decrease in the employment rate (4.45%). Essentially, these two components of GDP can ultimately explain the recent sharp decline in GDP, with the other three components of the GDP identity, that is hours worked per employee, labor force participation rate and population contributing with, relatively, lower rates (-0.02%, 0.35% and 0.05%, respectively).

In the last two lines of table 2, we are able to see the average contribution of each component of GDP, for the two sub-periods of 2001-2008 and 2009-2010. The component of labor productivity, that is output per hour, had a positive contribution

equal to 39.6% of GDP growth for the period 2001-2008, while for the period 2009-2010, it contributed by 43.3% in the reduction of GDP. The component of hours worked per employee had a negative contribution (-19.55%) for the period 2001-2008 and a slightly positive contribution (0.36%), during 2009-2010. The employment rate contributed positively, by 25.5%, during 2001-2008, and appears to have a significant contribution in the reduction of GDP, during 2009-2010, by 87.1%. Both the labor force participation rate, as well as population contributed positively during the period 2001-2008 in the increase of GDP (by 49.5% and 5%, respectively), while for the period 2009-2010, they contributed to the reduction of GDP, by -38% and 7.2%, respectively.

Table 1:
Year on year (y-o-y) growth rates of GDP and its components

	GDP (Q)	OUTPUT PER HOUR (Q/H)	HOURS PER EMPLOYEE (H/E)	EMPLOYMENT RATE (E/L)	LABOR FORCE PARTICIPATION RATE (L/N)	POPULATION (N)
2001 - Q1	3.67%	3.33%	-0.91%	1.23%	-0.73%	0.75%
2001 - Q2	3.59%	3.51%	-0.06%	0.90%	-1.40%	0.62%
2001 - Q3	4.43%	4.38%	0.33%	0.75%	-1.53%	0.49%
2001 - Q4	4.75%	4.50%	1.54%	-0.33%	-1.32%	0.36%
2002 - Q1	3.18%	1.77%	1.41%	-0.19%	-0.09%	0.28%
2002 - Q2	3.18%	1.38%	-0.30%	0.57%	1.25%	0.28%
2002 - Q3	3.58%	1.45%	-0.50%	0.47%	1.88%	0.28%
2002 - Q4	3.58%	1.18%	-1.50%	1.22%	2.41%	0.26%
2003 - Q1	6.26%	3.20%	-0.50%	1.17%	2.16%	0.24%
2003 - Q2	6.08%	3.04%	0.77%	0.65%	1.43%	0.20%
2003 - Q3	5.26%	2.47%	0.79%	0.61%	1.24%	0.15%
2003 - Q4	5.51%	3.20%	0.77%	0.26%	1.14%	0.13%
2004 - Q1	3.87%	3.53%	-0.24%	-1.12%	1.58%	0.12%
2004 - Q2	4.90%	4.98%	-1.10%	-0.96%	1.84%	0.15%
2004 - Q3	4.80%	5.04%	-0.99%	-0.90%	1.47%	0.19%
2004 - Q4	4.49%	4.61%	-1.36%	-0.49%	1.51%	0.22%
2005 - Q1	2.24%	0.97%	-0.50%	1.05%	0.52%	0.20%
2005 - Q2	1.29%	-0.23%	0.34%	0.65%	0.44%	0.09%
2005 - Q3	2.05%	0.41%	0.63%	0.43%	0.59%	-0.01%
2005 - Q4	2.45%	0.82%	0.44%	0.73%	0.59%	-0.12%
2006 - Q1	4.67%	3.57%	-0.62%	0.78%	0.97%	-0.02%
2006 - Q2	5.78%	4.79%	-0.62%	0.96%	0.54%	0.11%
2006 - Q3	5.37%	4.47%	-1.55%	1.48%	0.75%	0.22%
2006 - Q4	4.34%	3.50%	-0.94%	1.02%	0.41%	0.35%
2007 - Q1	5.30%	4.47%	-0.54%	0.69%	0.42%	0.27%
2007 - Q2	4.11%	3.30%	-0.68%	0.73%	0.55%	0.22%
2007 - Q3	3.84%	3.04%	-0.20%	0.50%	0.35%	0.15%
2007 - Q4	3.53%	2.73%	-0.47%	0.77%	0.42%	0.08%
2008 - Q1	1.58%	0.46%	0.00%	0.89%	0.18%	0.05%
2008 - Q2	1.47%	0.45%	-0.35%	0.93%	0.41%	0.02%
2008 - Q3	0.97%	0.16%	-0.30%	0.74%	0.36%	0.01%
2008 - Q4	0.06%	-0.42%	-0.28%	0.14%	0.62%	0.00%
2009 - Q1	-1.14%	-0.99%	0.42%	-1.18%	0.91%	-0.30%
2009 - Q2	-2.69%	-2.07%	0.48%	-1.81%	1.01%	-0.30%
2009 - Q3	-3.56%	-2.44%	-0.03%	-2.30%	1.51%	-0.30%
2009 - Q4	-2.08%	-0.43%	0.05%	-2.60%	1.20%	-0.29%
2010 - Q1	-2.89%	-0.59%	-0.94%	-2.64%	1.29%	0.00%
2010 - Q2	-3.15%	-0.27%	-0.53%	-3.27%	0.91%	0.02%
2010 - Q3	-4.18%	-0.71%	-0.40%	-3.46%	0.36%	0.03%
2010 - Q4	-7.68%	-3.60%	-0.02%	-4.45%	0.35%	0.05%
% CONTRIBUTION OF EACH VARIABLE						
2001-2008*		**39.60%**	**-19.55%**	**25.51%**	**49.47%**	**4.98%**
2009-2010*		**43.27%**	**0.36%**	**87.10%**	**-37.96%**	**7.23%**

Source: ELSTAT, National Accounts and Labor Force Surveys.
* *Note:* Period averages.

5. Empirical results

5.1 Econometric Estimates

This section presents the estimates of GDP trends, as well as the estimates of trends of the individual components of GDP, which have been produced by using the filtering techniques of the HP and Kalman filter[3]. It should be noted that trends estimated with the use of the HP filter have been derived after using a value of the smoothing parameter λ equal to 1,600, as frequently used in the macroeconomic literature (Hodrick and Prescott, 1997).

To estimate trends in the components of GDP with the use of Kalman filter (equations 3 and 4), the additional explanatory variable of the output gap has been included in equation (3), defined as the percentage deviation of real GDP from its long-term trend, derived by the HP filter. In this way, trends produced by the use of the Kalman filter, incorporate outside information, included in the variable of the output gap, something which is not possible with the use of the HP filter.

As we can notice from table 2, the estimated trend of output per hour (Q/H) is equal to 0.63%, when using the HP filter and equal to -0.31%, when using the Kalman filter. Similarly, the trend growth rate of hours worked per employee (H/E) is equal to -0.28% when using the HP filter and equal to 0.51%, when using the Kalman filter, while the trend estimate of the employment rate (E/L) is equal to -1.17% (HP filter) and -3.83% (Kalman filter).

Regarding the growth rate of the labor force participation rate (L/N), it seems that there is no difference in the estimated trends derived from the HP and Kalman filter. The estimated trend of this component is equal to 0.57%. Column 5 of table 2 shows the long term trend growth rate of population (N), which has been produced

[3] Trends of GDP, as well as of its individual components, have been estimated in the logarithms of variables.

with the use of the HP filter. Notably, the trend estimate of this component has not been derived with the use of Kalman filter, since population is not considered as an endogenous variable, while its behavior is not expected to have been influenced by output gap. The trend growth rate of population is equal to 0.01%.

Last column of table 2 shows the trend growth rate of GDP (Q), as estimated by the sum of the trend growth rates of its individual components (growth rate of productivity, growth rate of hours worked per employee, growth rate of employment, growth rate of labor force participation, growth rate of population), which, in turn, were estimated by the HP filter, as well as by the Kalman filter. The trend growth rate of GDP, based on the HP filter, was equal to -0.25% in the last quarter of 2010, when the growth rate of real GDP for the same quarter was -7.68%. The trend growth rate of GDP according to the Kalman filter was estimated at -3.05%, in the last quarter of 2010.

Table 2:
Trend estimates of GDP and individual components

	Q/H (1)	**H/E (2)**	**E/L (3)**	**L/N (4)**	**N (5)**	**Q (1+2+3+4+5)**
HP FILTER	0.63%	-0.28%	-1.17%	0.57%	0.01%	-0.25%
KALMAN FILTER	-0.31%	0.51%	-3.83%	0.57%		-3.05%
FINAL ESTIMATE	0.16%	0.12%	-2.50%	0.57%	0.01%	-1.65%
REAL % CHANGE	-3.60%	-0.02%	-4.45%	-0.01%	0.41%	-7.68%

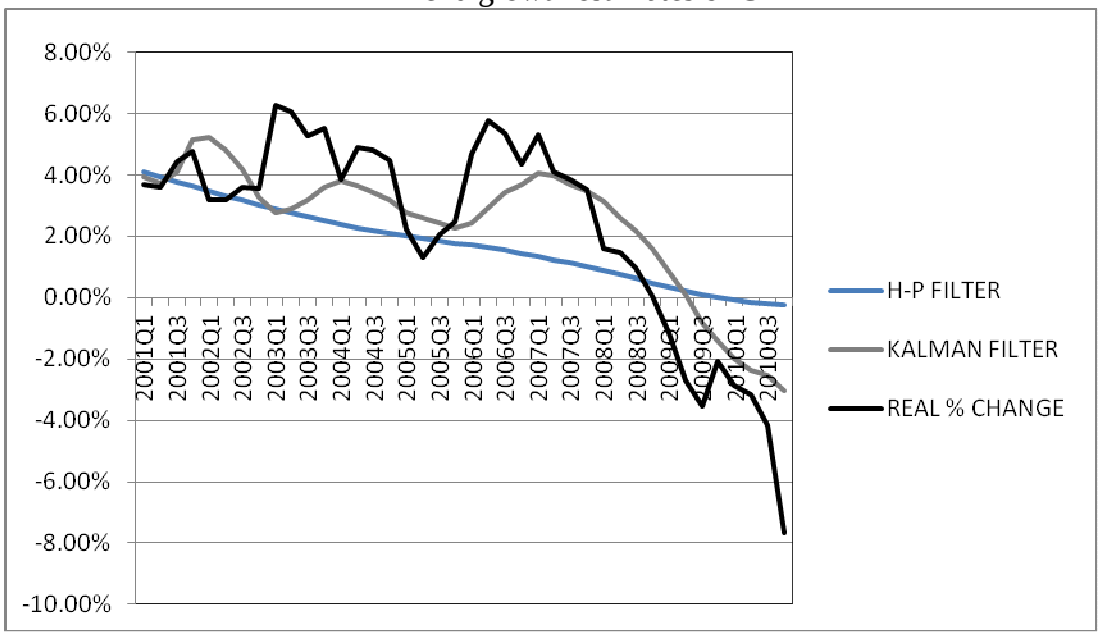
Figure 1 shows the evolution of the trend growth rate of GDP across time, as estimated with the use of the HP and Kalman filter. It seems that the HP filter fails to fully capture the recession of 2009-2010 while, at the same time, the Kalman filter is more able to reflect the current economic shock in its trend estimate for the growth rate of GDP. The GDP growth trends, as estimated by the HP filter, seem to follow a smooth path over time and can not respond directly to rapid changes of GDP growth.

This is because the HP filter is a moving average symmetric filter which uses past, present and future observations to produce a relatively smooth trend. It seems that the HP filter performs well for economic periods which are characterized by a relative stability, rather than for unstable periods, for which it is unable to directly capture the change in the long-term growth trend (Roeger, 2006). Therefore, it appears that the Kalman filter is the most appropriate choice for estimating the trend estimate of GDP growth.

However, as already noted in the literature, there is no clear and objective criteria that favors a particular statistical method in measuring medium term trends (Roeger, 2006). Consequently, this study will follow a method which has already been adopted by Gordon (2003) in order to measure the long term growth rate of GDP for the U.S. economy. Under this method, the trend estimate of the growth rate of GDP, as well as of its individual components, is the average of the estimates of the HP and the Kalman filter.

Therefore, the trend estimate for the growth rate of labor productivity (Q/H) is equal to 0.16% (Table 2). Similarly, the estimates for the remaining trend growth rates are equal to 0.12% for the component of hours worked per employee (H/E), -2.50% for the employment rate (E/L), 0.57 for the growth rate of labor force participation (L/N) and 0.01% for the growth rate of population (N). Thus, the trend growth rate of GDP (Q) is estimated at -1.65%, as the sum of the growth rates of its individual components.

Figure 1:
Trend growth estimates of GDP



5.2 Discussion

It is important to note that these estimates are accompanied by a relative degree of uncertainty, because of their nature, but, also, as the result of increased instability from the current recession. These estimates provide us with an idea of the current productive capacity of the Greek economy and should not be regarded as a forecast of future economic growth but, rather, as an indication of future economic developments in the case that the established trends will be maintained in the future. The final estimate of -1.65% for the growth rate of GDP implies that this is the medium term dynamic of output, provided that the underlying factors that determine GDP (labor productivity, hours worked per employee, employment rate, labor force participation rate and population) continue to grow in the future by the same rate.

A finding which deserves further discussion is the sharp decline in the trend growth rate of employment, by -2.5%, during the last quarter of 2010. There are two possible explanations: the first one is related to the nature of the current economic crisis, caused by lack of liquidity, which leads businesses to increased layoffs. A

second reason is that, during past years, there have been significant changes in labor markets so that the economies are, now, able to respond more quickly to economic downturns, by increasing layoffs and unemployment[4]. It should be noted, however, that, during the recent crisis, there have been differences in the mode of employment adjustment across countries. Several countries like the U.S., Spain, Ireland and the U.K. have responded with higher job losses, while in other countries, like Germany, there has been a decline in hours worked per employee (Phelps, 2010).

Recent forecasts of international economic institutions talk about negative GDP growth rates and slow recovery of the Greek economy in the coming years (OECD Economic Outlook, 2010; IMF, 2011). Factors, such as low investment rates and the increase of unemployment have a negative impact on the two key factors of production, capital and labor, resulting in a sluggish medium term potential supply. According to estimates of OECD, the potential growth rate of GDP will remain at 0.5%, for the five year period of 2010-2015 (OECD Economic Outlook, 2010)[5]. The same estimates show that the medium term prospects for economic recovery of the Eurozone remain anemic[6].

[4] For further discussion see Gordon (2010).

[5] The estimates of OECD for the Greek economy (OECD Economic Outlook, 2010), show that the potential growth rate of GDP stands at 0.5% for the period of 2010-2015, with the growth rate of labor productivity equal to 0.9% (expressed in per worker terms), the growth rate of employment at 0.4%, the growth rate of labor force participation at 0% and the growth rate of working age population at -0.1%.

[6] It is worth noting that similar studies have been performed for the whole EU economy. One of the most recent ones shows that, during the period 2000-2007, labor productivity growth was the key factor of GDP growth across EU-27 (European Commission, 2010). Specifically, during 2000-2007, the average GDP growth rate, for the EU as a whole, was 1.8%, of which 1.4 % (that is 78% of total GDP growth) was due to increased labor productivity and the remaining part was due to employment growth.

6. Growth divergence and policy issues

6.1 Growth divergence

Based on the use of the GDP identity, it would be useful to compare the growth performance of the Greek economy against that of the Eurozone. With this comparison, we might be able to distinguish which components are related with the growth divergence of the Greek economy and, then, discuss policy directions in order to achieve higher growth in the long run.

From the figures presented in table 3, it is evident that the two components of the GDP identity, for which the Greek economy essentially differentiates from those of the Eurozone economy are labor productivity and hours worked per employee. Specifically, during 2010, labor productivity of the Greek economy was 36.74% lower and equal to 63.26% of the average Eurozone labor productivity. Hours worked per employee were higher by 14.32% over the average of the Eurozone, while the employment rate was 2.76% below the Eurozone average. Finally, the labor force participation rate was 3.31% below that of the Eurozone. After comparing the individual components of GDP between Greece and the Eurozone, it can be reasonably explained why Greece ranks in the penultimate position, among other countries of the Eurozone, in terms of GDP per capita. In 2010, GDP per capita in Greece was formed at 15,417 €, when the Eurozone average was formed at 22,682 € (Eurostat, 2011).

Table 3:
Deviation of Greece from the Eurozone average (2010)

	LABOR PRODUCTIVITY	HOURS WORKED PER EMPLOYEE	EMPLOYMENT RATE	LABOR FORCE PARTICIPATION RATE
EUROZONE	28.55	1,924	89.95%	45.90%
GREECE	18.06	2,199.6	87.47%	44.38%
DEVIATION (%)	-36.74%	14.32%	-2.76%	-3.31%

Source: Eurostat 2011

From the figures presented in table 3, it seems that labor productivity accounts for the major part of the growth divergence between the Greek and the Eurozone economy. In a similar spirit, Kollintzas et al. (2012), by using a standard growth accounting framework for Greece and several Eurozone countries, show that the great difference between Greece and other Eurozone countries is the growth contribution of TFP. In particular, while the contribution of TFP in most Eurozone countries was close or exceeded 100% of output growth, during 1975-2010, in Greece it accounted only for 55%. Furthermore, average annual TFP growth for this period was close or higher than 2% in most Eurozone countries, while in Greece was only 0.78%. The general conclusion derived from the authors is that, during this period, no GDP or TFP convergence seems to have occurred, since if this type of convergence had occurred, then Greece would grow faster than other Eurozone countries, with a growth rate of TFP equal or higher than the growth rate of TFP in most Eurozone countries (Kollintzas et al., 2012).

6.2 Policy issues

The component of labor productivity essentially differentiates the current level of economic development in Greece, as compared to that of other developed European countries. As it was shown in previous section, labor productivity of the Greek economy remains at substantially low levels, as compared to those of the Eurozone economy. Acemoglu (2009) argues that persistent differences in policies and institutions may slow down productivity convergence. In a similar spirit Bournakis (2011) has noted that the speed of productivity adjustment has been low in Greece reflecting a number of rigidities existing at the industry and institutional level.

The main areas of importance for the increase of long term productivity are fixed capital investments as well as technological progress, which can be achieved through higher trade and investments brought by other developed countries. However, a major determinant for obtaining such kind of investments is the creation of an attractive institutional environment that facilitates entrepreneurship and reduces the existence of administrative barriers for establishing new firms. There is widespread perception among economists that a stable institutional framework plays an important role in attracting investment and fostering economic growth (Barro, 1998).

In particular, increased investment and productivity could be enhanced by measures that facilitate the entry and exit of firms, as well as by measures that reduce the cost of their actions. However, Greece lags significantly in a number of relevant indicators. For example, the cost of start-up procedures is more than three times higher than that of Eurozone, while the cost of exports is, also, much higher in Greece. The average number of procedures to start a business is equal 15 in Greece, while in the euro area is just over 6, while the time required to start a business is 19 days in Greece, as compared to 14 days throughout the Eurozone.

Table 4:
Business entrepreneurship indicators (2010)

Cost of start up procedures (% income per capita)	GREECE	EUROZONE
	20.7	6.43
Export costs ($ per container)	GREECE	EUROZONE
	1,153	1,071.8
Number of procedures to start up a business	GREECE	EUROZONE
	15	6.25
Time to start up a business (days)	GREECE	EUROZONE
	19	13.94

Source: World Bank Development Indicators (2010).

Another major factor for attracting investments and increasing productivity is the promotion of liberalization and competition in product and service markets. There is plenty of empirical evidence which shows that stronger competition in product and service markets is driving productivity and economic growth. The study of Scarpetta and Tressel (2002) shows that the alignment of regulations in the Greek markets with those of the least regulated OECD countries could reduce the size of the technological gap by 50%. This, in turn, could increase the long term level of total factor productivity by more than 15%, given the low starting point of the Greek economy, in terms of the degree of competition in the product markets. The main argument for increasing competition in the markets is that competition favors the entry of new firms, while, at the same time, forces the existing ones to be more efficient and be more innovative in order to survive, under the threat of competition.

In general, it is necessary for Greece to create a more conducive environment for competition. Greece ranks in the first positions among OECD countries, with regards to several indices related to product market regulation and barriers to entrepreneurship and entry of new firms (table 5).

Table 5:
Indicators of competition in the Greek economy
(2008, index scale of 0-6 from least to most restrictive)

Product market regulation	GREECE	EUROZONE
	2.37	1.36
Barriers to entrepreneurship	GREECE	EUROZONE
	2.75	1.63
Barriers to entry	GREECE	EUROZONE
	1.14	1.02

Source: OECD – Going for Growth (2010).

Finally, it seems that the existence of inefficient public sector as well as poor institutional quality are related with lower growth rates of the Greek economy. Angelopoulos and Philippopoulos (2007) argue that a smaller government share in GDP, the improvement of quality and efficiency of the public sector as well as a reallocation of resources towards public investments could enhance economic growth. Furthermore, Angelopoulos et al. (2010) have estimated that the amount of rent seeking in Greece is almost 8.5% of total GDP, being the highest across the Eurozone. They argue that a small improvement in terms of institutional quality (of 2%) would raise long term total welfare by about 5%.

7. Conclusion

The purpose of this paper was to provide an estimate of the medium term trend growth rate of GDP for the Greek economy, for the period 2011-2015. The analysis of this study was based on the GDP identity, according to which, real GDP is decomposed into five components, that is labor productivity, hours worked per employee, employment rate, labor force participation rate and population. Each individual component of the GDP identify was decomposed into its cycle and trend, so as to estimate its medium term trend. To estimate medium term trends, the econometric techniques of the Hodrick-Prescott (HP) and Kalman filter were employed.

The trend growth rate of labor productivity was estimated at 0.16%. Similarly, the trend growth estimates for the remaining components of GDP were equal to 0.12% for hours worked per employee, -2.5% for the employment rate, 0.57 for the growth rate of labor force participation and 0.01% for the growth rate of economically

active population. Therefore, the trend growth rate of GDP was estimated at -1.65%, as the sum of the trend growth rates of its individual components.

Further analysis, based on the GDP identity, revealed that labor productivity of the Greek economy is substantially lower than that of the Eurozone average. This factor accounts for the majority of GDP per capita divergence between Greece and Eurozone and is expected to be of vital importance in the future for the convergence of the Greek economy towards the Eurozone average.

In the coming years, the main priorities of economic policy should be directed towards enhancing productivity and achieving a sustainable path of economic development. Greece has already launched an ambitious reform program which is expected to affect, in the medium term, the supply side of the economy and, if implemented successfully, will significantly affect future economic growth. Higher economic growth will, in turn, be the key for the exit of the Greek economy from the crisis and the means for achieving a higher level of prosperity for the Greek people.

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