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Greece in Recession: Economic predictions, mispredictions and policy implications

Athanassios Petralias, Sotirios Petros
and Pródromos Prodromídis

GreeSE Paper No.75
Hellenic Observatory Papers on Greece and Southeast Europe

SEPTEMBER 2013

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Acknowledgements

The paper was written in March of 2012 and has benefited from constructive comments offered by an anonymous referee. The usual disclaimer applies.

Greece in Recession: Economic predictions, mispredictions and policy implications

Athanassios Petralias[#], Sotirios Petros[*]
and Pródromos Prodromídis[†]

ABSTRACT

We look into the available macroeconomic figures and the predictions made about the recession in Greece by international organizations, Greek research centers, and the Greek government; and suggest that the predictions regarding the decline in real GDP in recent years were overly optimistic. The same entities predict that real GDP will fall by 4.2-4.6% during 2013. However, by our calculations, the drop may be steeper than the one predicted, even if some of the assumptions made by these institutes or the government materialize. We hope the steps taken will disprove the accuracy of our prediction. To that end we provide some policy recommendations.

Keywords: recession; forecast errors; GDP; Greece

JEL classifications: C22, C33, C52, C53, E65

[#] Postdoctoral Researcher, Department of Statistics, Athens University of Economics and Business (petralia@aueb.gr).
[*] Scientific Associate, Greek Ministry for Development and Competitiveness (spetros@gge.gr).
[†] Senior Research Fellow, Centre for Planning and Economic Research (KEPE); Visiting Associate Professor, Department of Management Science and Technology, Athens University of Economics and Business (pjprodr@kepe.gr, pjprodr@aueb.gr).
Corresponding author: Pródromos Prodromídis, KEPE, Amerikis 11 str., Athens 10672, Greece. Tel: (+30) 210-3676412, Fax: (+30) 210-3630122 or 210-3611136.

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1. Introduction

Caught in the tide of an international economic crisis while having surrendered monetary policy sovereignty for the operation of the euro-zone, and unable because of the high level public debt to engage in prolonged fiscal expansion in order to sustain the gross domestic product (GDP), in May of 2010 Greece accepted bailout loans from other euro-zone countries and the International Monetary Fund (IMF). In exchange, the government pledged to adopt austerity measures to bring the state deficit under control, and to carry out reforms closely monitored and evaluated by the European Commission (EC), the European Central Bank (ECB) and the IMF. Consequently, the mild contractions in real GDP in 2009 and 2010 (by 3.1 and 4.9%, respectively) were succeeded by more severe ones in 2011 and 2012 by 7.1 and 6.4%, respectively[1]. That is a cumulative fall of 19.9% in five years, according to the figures published by the Hellenic Statistical Authority (ELSTAT).

It is generally assumed that the measures taken in 2011 and 2012 were to some or considerable extent based on expert views and expectations regarding the economy's condition and performance. However, a good number of forecasts of how the economy would react or evolve, time and time again

[1] The second figure (regarding 2012) is an official, yet temporary estimate. It is expected to be finalized in October 2013. In a similar fashion, the figure regarding the 2011 recession, which was estimated to about 6.9% in March 2012, when the updated data were released in December 2012, was finalized to 7.1%.

turned out to be widely off the mark. In particular, the early estimates published by the EC, the IMF, the Organization for Economic Co-operation and Development (OECD), and research centers in Greece, namely, the Centre for Planning and Economic Research (KEPE) and the Institute for Economic and Industrial Research (IOBE), as well as the Greek government since October 2010, are found to be overly optimistic. Understandably, while recognizing the challenge to estimate in advance the level of economic activity (especially when the progress of each and every factor involved is surrounded by uncertainty), such incidents cast doubt on the usefulness of the aforementioned reported predictions.

Obviously, the issue is by no means new or limited to early predictions (as opposed to predictions carried out later in the year) or particular to Greece. E.g., Öller and Barot (2000), Loungani (2001), Heilemann and Stekler (2007), Merola and Pérez (2012). Furthermore, the repercussions may be crucial insofar as GDP mispredictions affect the accuracy of budgetary projections and other macroeconomic variables (Buettner and Kauder, 2010). In this context, Strauch et al. (2004) suggest that both GDP growth and budgetary forecasts in the EU range from too optimistic to overly cautious depending, respectively, on policy- makers exercising discretion or abiding by rules; while Jonung and Larch (2006) by linking the accuracy of potential GDP growth forecasts to EU Stability and Growth Pact fiscal policies, find that forecasts in several member-states (Germany, France, Italy) were consistently overoptimistic.

Apparently, the GDP forecasts were also optimistic in the EU from the outset of the recent international economic crisis. According to Alogoskoufis (2012) in the spring of 2008, the European Commission expected the Eurozone's growth rate to reach 1.7% by the end of the year, and 1.5% in 2009; when in fact the

zone's economy slowed to 0.4% in 2008, and fell by 4.4% in 2009. By regressing the forecast error for real GDP growth on forecasts of fiscal consolidation for 23 EU member-states and other European countries, Blanchard and Leigh (2013) maintain that forecasters underestimated fiscal multipliers. As a result growth disappointments were larger in economies that planned greater fiscal cutbacks. The IMF (2013b) goes further by adding that due to a number of idiosyncrasies and events, the private sector in Greece did not react as expected either; and admits that the economy encountered a much-deeper-than expected recession. Pisani-Ferry et al. (2013) spell out a good number of policy mistakes and inconsistencies taking place in Greece and the EU. In addition, they point out that though it is not unusual for IMF programs to disappoint in comparison to initial forecasts, orders of magnitude are usually much smaller. Indeed, an output shortfall as large as the one which occurred in Greece can only be found in one percent of IMF programs. However, as we will show in the next chapter, the IMF was not the only connoisseur that got the recession forecast wrong.

A large number of techniques have been used to obtain short-term GDP forecasts in a range of countries worldwide. These include time series models such as Autoregressive Integrated Moving Average (ARIMA) (e.g., Runstler and Sedillot, 2003; Cushman, 2012; Kiariakidis and Kargas, 2013) and Vector Autoregression (VAR) models (e.g., Runstler and Sedillot, 2003; Cushman, 2012), models that employ larger sets of explanatory variables such as factor models (e.g., Van Nieuwenhuyze, 2005; Schumacher, 2011; Antipa et. al., 2012) and bridge models (e.g., Runstler and Sedillot, 2003; Antipa et. al., 2012; Barhoume et. al., 2012), and mixed data sampling techniques (e.g., Andreou et. al., 2013; Ferrara and Marsilli, 2013) using financial data observed on higher frequencies to forecast GDP. With respect to Greece, Kiariakidis and Kargas

(2013) used time series decomposition, ARIMA methodology, and standard GDP regression techniques to obtain the 2012 GDP forecasts.

Most of the analysts tend to use multiple methodologies to produce GDP forecasts in order to crosscheck and validate the associated figures. With this in mind we employ (a) a straightforward technique that produces GDP forecasts based on alternative scenarios regarding its components in a deterministic way, (b) time series ARIMA models and (c) a macroeconomic formulation that allows GDP forecasting based on different investments and unemployment scenarios. Our primary purpose is not to obtain a point estimate of GDP, but to quantify and elaborate on the uncertainty involved in GDP predictions, even if one adopts the scenarios suggested by the aforementioned organizations and entities.

The rest of the paper is organized as follows: Section 2 looks into the early predictions made about the recession in Greece in 2011, 2012 and 2013 by several international organizations (EC, IMF, OECD), the Greek government and Greek research centers prior to or at the beginning of each year. Sections 3 and 4 proceed to re-estimate the predictions pertaining to 2013 via different statistical and macroeconomic models. To the extent the new forecasts are not very encouraging, Section 5 supplies a number of proposals. The final section (Section 6) provides the conclusions.

2. The issue of early predictions and mispredictions

Table 1 lists the predictions made in late 2010 and early 2011 by the EC, IMF, OECD, KEPE, IOBE, and the government about the evolution of basic macroeconomic variables in the course of 2011, and (in the last column) the corresponding final figures published by ELSTAT. It turns out that while the

predictions regarding the fall in real GDP were in the range of 2.6-3.5%, the recession was much deeper: 7.1% (more than double the one predicted). In looking into the factors behind the misprediction, we note that that though the expected fall in private investments lied between 7.0 and 16.6%, the contraction evidenced in the data was about 19.6%. The exports, which were expected to grow by 3.9-10.7%, barely moved (+0.3%). The unemployment rate, which was expected to lie between 14.5 and 15.5% rose to 17.7%.

Likewise, even though the early predictions made about the fall in real GDP in 2012 were in the range of 2.0-4.7%, the estimates provided by ELSTAT (2013b) suggest the recession was more severe: about 6.4%. (See Table 2.) Again, we note that while the expectations regarding private investments lied between -4.0 and -13.1%, the estimates provided by ELSTAT suggest that in fact private investments shrunk considerably more: by about 19.6%. Imports, which were expected to fall by 2.8-5.7%, and exports, which were expected to rise by 3.2%-6.5% appear to have fallen by 13.8% and 2.4%, respectively. The unemployment rate, which was expected to reach 17.1-20.3%, in the course of the last quarter of 2012 seems to have reached 26.4% (as per ELSTAT's seasonally adjusted monthly data), thus affecting an annual average of 24.4%.

The early predictions made for 2013 prepare the public for a recession of 4.1-4.6%, and come with expectations that private investments will fall by 3.3-9.5%, and the unemployment rate will reach 22.8-27.3% (see Table 3). In some quarters the figures foster optimism that the recession will be mild, about 3.0% (Alpha Bank, 2013). On the other hand, KEPE expressed concern that the unemployment rate may climb to 30.1%. In our view a rate in excess of 28% is quite conceivable bearing in mind the rate's continuous rise for the last couple of years. The Bank of Greece (2013a: 21, 80) appears to share this view.

This begs the question of what would happen if the unfavorable estimate of each GDP component materializes in the course of 2013. That is, if private consumption fell by 8.7%, as conjectured by IOBE; if public consumption fell by 7.2%, as estimated by the Greek Ministry of Finance; if private investment fell by 9.5%, as estimated by the OECD, etc. In this case, the answer is both mathematical and straightforward. The GDP expression which sums the demands of the different sectors of the economy serves as the point of departure. In scientific notation:

$$Y_t = C_t + I_t + G_t + X_t - Z_t + S_t, \qquad (1)$$

where Y_t stands for the GDP, C_t for private consumption, I_t for private investment, G_t for public consumption, X_t for exports, Z_t imports, and S_t for the stocks that reconcile the other figures in year *t*. The percentage change of GDP from year *t-1* to year *t* is given by:

$$\frac{Y_t - Y_{t-1}}{Y_{t-1}} = \left(\frac{C_{t-1}}{Y_{t-1}}\right)\frac{C_t - C_{t-1}}{C_{t-1}} + \left(\frac{I_{t-1}}{Y_{t-1}}\right)\frac{I_t - I_{t-1}}{I_{t-1}} + \left(\frac{G_{t-1}}{Y_{t-1}}\right)\frac{G_t - G_{t-1}}{G_{t-1}} + \left(\frac{X_{t-1}}{Y_{t-1}}\right)\frac{X_t - X_{t-1}}{X_{t-1}} - \left(\frac{Z_{t-1}}{Y_{t-1}}\right)\frac{Z_t - Z_{t-1}}{Z_{t-1}} + \left(\frac{S_{t-1}}{Y_{t-1}}\right)\frac{S_t - S_{t-1}}{S_{t-1}}$$

$$\Rightarrow \dot{Y} = w_1\dot{C} + w_2\dot{I} + w_3\dot{G} + w_4\dot{X} - w_5\dot{Z} + w_6\dot{S}, \qquad (2)$$

TABLE 1: Predictions of basic macroeconomic figures made before or at the beginning of 2011 and final 2011 outcomes

Source	Ministry of Finance	EC	IMF	OECD	KEPE	IOBE	Results ELSTAT
Publication date	**Oct. 2010**	**Jan. 2011**	**Oct. 2010**	**Dec. 2010**	**Jan. 2011**	**Mar. 2011**	
GDP (% change, constant prices)	**-2.6**	**-3.5**	**-2.6**	**-2.7**	**-3.5**	**-3.2**	**-7.1**
Private consumption (% change, constant prices)	-4.5	-6.4	:	-4.3	:	>-4.5	**-7.7**
Public consumption (% change, constant prices)	-8.0	-2.6	:	-6.9	:	:	**-5.2**
Investments (% change, constant prices)	**-7.0**	**-16.6**	**:**	**-10.6**	**:**	**:**	**-19.6**
Exports of goods and services (% change, constant prices)	6.1	10.7	:	3.9	:	:	**0.3**
Imports of goods and services (% change, constant prices)	-6.6	-8.4	:	-10.0	:	:	**-7.3**
Domestic consumer price index (% change)	2.2	:	:	:	:	3.0	**3.3**
Harmonized consumer price index (% change)	:	2.4	2.2	2.5	:	:	**3.1**
GDP deflator (% change)	1.3	0.3	1.3	2.4	:	:	**1.0**
Employment (% change)	-3.0*	-2.6	-3.2	-2.4	:	:	**-6.8**
Unemployment rate (yearly average)	**14.5***	**15.2**	**14.6**	**14.5**	**:**	**15.5**	**17.7**
General government budget balance (% GDP)	-7.0	-9.5	-7.3	-7.6	:	:	**-9.4**
General government gross debt (% GDP)	142.2	157.7	139.3	133.5	:	:	**170.6**
Current account balance (% GDP)	:	-8.3	-7.7	-7.5	:	:	**-9.9**
GDP (million euro, current prices)	232,100	:	232,942	231,532	:	:	**208,531**

Sources: EC (2011), ELSTAT (2013a), IMF (2010), IOBE (2011a), KEPE (2011), Ministry of Finance (2010), OECD (2010).

Note: *The employment predictions are supplied in the government budget and are expressed in terms of national accounts figures.

TABLE 2: Predictions of basic macroeconomic figures made before or at the beginning of 2012 and final 2012 outcomes

Source	Ministry of Finance	EC	IMF	OECD	KEPE	IOBE	Results (some temporary, some final)
Publication date	**Nov. 2011**	**Jan. 2012**	**Sep. 2011**	**Dec. 2011**	**Jan. 2012**	**Dec. 2011**	
GDP (% change, constant prices)	**-2.8**	**-4.7**	**-2.0**	**-3.0**	**-3.4**	**-3.0**	**-6.4**[a]
Private consumption (% change, constant prices)	-4.1	-5.7	:	-5.2	:	-6.5	**-9.1**[a]
Public consumption (% change, constant prices)	-7.5	-11.0	:	-6.6	:	:	**-4.2**[a]
Investments (% change, constant prices)	**-4.0**	**-6.6**	**-13.1**	**-5.5**	**:**	**:**	**-19.2**[a]
Exports of goods and services (% change, constant prices)	6.4	3.2	:	6.5	:	:	**-2.4**[a]
Imports of goods and services (% change, constant prices)	-2.8	-5.1	:	-5.7	:	:	**-13.8**[a]
Domestic consumer price index (% change)	0.6	:	:	:	:	1.2 to 1.4	**1.5**[b]
Harmonized consumer price index (% change)	:	-0.5	1.0	1.1	2.1	:	**1.0**[b]
GDP deflator (% change)	0.4	-0.7	0.3	1.6	:	:	**-0.8**[a]
Employment (% change)	-2.0*	-4.8	-2.6	-2.6	:	:	**-8.0**[b]
Unemployment rate (yearly average)	**17.1***	**19.7**	**18.5**	**18.5**	**20.3**	**18.5**	**24.4**[b]
General government budget balance (% GDP)	-5.4	-7.3	-6.9	-7.0	:	:	**-6.6**[c]
General government gross debt (% GDP)	145.5	160.6	189.1	177.1	:	:	**175.8**[d]
Current account balance (% GDP)	:	-7.8	-6.7	-6.3	-8.2	:	**-2.9**[e]
GDP (million euro, current prices)	212,544	:	217,083	215,048	:	:	**193,749**[a]

Sources: Bank of Greece (2013b), EC (2012a), ELSTAT (2013a,b), IMF (2011), IOBE (2011b), KEPE (2012), Ministry of Finance (2011, 2012), OECD (2011).

Notes: * The employment predictions are supplied in the government budget and are expressed in terms of national accounts figures.
[a] Temporary data ELSTAT (2013b). [b] Final data ELSTAT (2013a) .[c] Budget deficit according to Ministry of Finance (2012), GDP according to ELSTAT (2013b). [d] Gross debt according to Ministry of Finance (2012), GDP according to ELSTAT (2013b). [e] Current account according to Bank of Greece (2013b), GDP according to ELSTAT (2013b).

TABLE 3: Predictions of basic macroeconomic figures made before or at the beginning of 2013

Source	Ministry of Finance	EC	IMF	OECD	KEPE	IOBE
Publication date	**Nov. 2012**	**Jan. 2013**	**Jan. 2013**	**Dec. 2012**	**Feb. 2013**	**Jan. 2013**
GDP (% change, constant prices)	**-4.5**	**-4.4**	**-4.2**	**-4.5**	**-4.1**	**-4.6**
Private consumption (% change, constant prices)	-7.0	-7.7	-6.9	-5.4	:	-8.7
Public consumption (% change, constant prices)	-7.2	-3.5	-7.2	-7.1	:	>-6.5
Investments (% change, constant prices)	**-3.7**	**-4.9**	**-3.3**	**-9.5**	**:**	**-7 to -9**
Exports of goods and services (% change, constant prices)	2.6	2.7	2.7	3.0	:	≥0
Imports of goods and services (% change, constant prices)	-5.2	-5.9	-6.2	-4.3	:	-10
Domestic consumer price index (% change)	-0.8	:	:	:	:	1
Harmonized consumer price index (% change)	:	-0.8	-0.8	-0.2	1.6	:
GDP deflator (% change)	-1.2	-1.2	-1.2	-0.5	:	:
Employment (% change)	-2.1*	-3.5	-3.9	-5.9	:	:
Unemployment rate (yearly average)	**22.8***	**27.0**	**26.6**	**26.7**	**30.1**	**27.3**
General government budget balance (% GDP)	-5.2	-4.6	-4.5	-5.6	:	:
General government gross debt (% GDP)	189.1	175.6	178.0	188.6	:	:
Current account balance (% GDP)	:	-4.3	-1.2	-4.6	-0.7	:
GDP (million euro, current prices)	183,049	:	185,000	184,569	:	:

Sources: EC (2013), ELSTAT (2013a), IMF (2013a), IOBE (2013), KEPE (2013), Ministry of Finance (2012), OECD (2012).

Note: * The employment predictions are supplied in the government budget and are expressed in terms of national accounts figures.

TABLE 4: Relative weights of the expenditure components in real GDP (%)

Year	Private consumption (w_1)	Public consumption (w_2)	Private investments (w_3)	Exports of goods and services (w_4)	Imports of goods and services (w_5)	Change in stocks (w_6)
2000	69.06	19.68	20.94	24.96	-37.00	2.36
2001	69.57	19.03	21.07	23.95	-35.92	2.30
2002	70.45	19.72	22.30	21.21	-34.29	0.61
2003	68.67	18.45	23.54	20.60	-33.33	2.05
2004	68.32	18.30	22.64	23.16	-33.74	1.32
2005	69.79	18.10	20.73	23.21	-32.50	0.67
2006	69.02	17.68	22.58	22.95	-34.22	1.99
2007	69.06	18.29	26.78	23.74	-37.85	-0.02
2008	72.16	17.85	22.99	24.19	-38.27	1.09
2009	73.33	19.33	20.48	20.12	-31.52	-1.73
2010	72.32	18.57	18.31	22.26	-31.12	-0.35
2011	71.84	18.96	15.84	24.05	-31.04	0.34
2012	69.78	19.40	13.67	25.06	-28.59	0.68

Note: Calculations based on quarterly data of GDP and its expenditure components as published by ELSTAT (2013b) until the last quarter of 2012.

TABLE 5: Estimates of three international organizations and of the Greek government about the evolution in 2013 of real GDP based on predictions regarding the expenditure components

Source	Ministry of Finance	EC	IMF	OECD
Publication date	**Oct. 2012**	**Jan. 2013**	**Jan. 2013**	**Dec. 2012**
Real GDP estimate (% change) (calculations based on items 1-6 and the 2012 weights w_i *of Table 4)*	**-4.65**	**-4.36**	**-4.21**	**-4.46**
Published prediction of real GDP (% change)	**-4.5**	**-4.4**	**-4.2**	**-4.5**
1. Private consumption ($\dot{C}$)	-7.0	-7.7	-6.9	-5.4
2. Public consumption ($\dot{G}$)	-7.2	-3.5	-7.2	-7.1
3. Investments ($\dot{I}$)	-3.7	-4.9	-3.3	-9.5
4. Exports of goods and services ($\dot{X}$)	2.6	2.7	2.7	3.0
5. Imports of goods and services ($\dot{Z}$)	-5.2	-5.9	-6.2	-4.3
6. Change in stocks ($\dot{S}$)	*	0.0	0.0	*

Note: * Since the Ministry of Finance and OECD have not published their estimates concerning the change in stocks this was taken as equal to zero for the calculations of real GDP, as in the EC and IMF predictions.

with the dotted terms standing for the percentage changes in GDP and its expenditure components, and the w_i-terms standing for the relative weights of these components during the previous year. (It goes without saying that $w_1 + w_2 + w_3 + w_4 - w_5 + w_6 = 1$.) The relative weights, including those pertaining to 2012, can be easily calculated from the annual data published by ELSTAT (Table 4).

Thus, by replacing the 2013 predictions for $\dot{C}$, $\dot{I}$ etc., made by each national or international expert or the government, and by using the 2012 weights in equation (2), we are in a position to:

- confirm each 2013 real GDP forecast and, thus, the internal consistency of each expert's model or the government's model; and
- estimate what happens if the (a) worst, (b) best, or (c) middle case scenario prediction of each real GDP component occurs.

The computations show that each set of predictions is internally consistent (Table 5). That is, if the individual GDP components evolve in the manner expected by each expert or the government, then, indeed, the GDP ought to lie at the level reported[2]. In addition, if the worst case predictions for the GDP components came about (Table 6), we ought to expect real GDP to contract by 5.9%; and if the best case predictions occurred, the recession to be around 2.9%.

[2] A minor divergence in the prediction made by the Ministry of Finance (-4.65% vs. -4.5%) may be attributed to the omission of stock figures from the 2013 budget.

TABLE 6: Predictions of real GDP for 2013 based on the 2012 relative weights of its components (Table 4) and the different scenarios regarding the evolution of GDP's components (as per the predictions provided in Table 3). Juxtaposition to outcomes of the previous years

Basic macroeconomic figures	Scenarios (% change)			Results (% change)	
	Worst	**Best**	**Middle**	**2011**	**2012**
Real GDP estimate ($\dot{Y}$)	**-5.91**	**-2.92**	**-4.57**	**-7.10****	**-6.38****
1. Private consumption ($\dot{C}$)	-8.7	-5.4	-7.1	-7.7	-9.1
2. Public consumption ($\dot{G}$)	-7.2	-3.5	-6.3	-5.2	-4.2
3. Investments ($\dot{I}$)	-9.5	-3.3	-5.4	-19.6	-19.2
4. Exports of goods and services ($\dot{X}$)	0.0	3.0	2.2	0.3	-2.4
5. Imports of goods and services ($\dot{Z}$)	-10.0 *	-4.3	-6.3	-7.3	-13.8

Notes: * Although it is the worst scenario we use the largest drop in imports (which in facts increases real GDP), since it is in accordance with the predicted decrease of private consumption and investments. If the smallest predicted decrease of imports is used (-4.3), then the resulting real GDP change is -7,5%.

**The estimated change of real GDP in 2011 and 2012 (based on equation (2) and the relative weights) is in accordance with the latest data published by ELSTAT (2013b).

The range of potential outcomes underscores considerable uncertainty; while the prediction of a moderate fall in private investment (a critical GDP determinant) of about 9.5% in 2013, may be seen as exceedingly optimistic compared to the average decline of 19.4% observed in the previous couple of years.

3. Two predictive models of real GDP based on time series

In view of the above we now attempt two purely technical forecasts about the evolution of real GDP in the course of 2013. Both are based on the quarterly data provided by ELSTAT (2013a, b) from the first quarter of 2000 (i.e., 2000

Q1) to the fourth quarter of 2012 (i.e., 2012 Q4). More specifically, we make use of ARIMA (autoregressive integrated moving average) time series models to estimate and predict the GDP based solely on its history, without resorting to assumptions about its components or other economic variables. That is, the forecast is based only on the dynamics of the series and does not take into account other factors, such as future policy measures, broader developments etc. Understandably, some degree of uncertainty has to be tolerated insofar as the models must predict four quarters ahead under the limitation that the published data regarding 2012 have not yet been finalized[3].

The first model uses quarterly GDP data from 2000 onwards, and the second model quarterly GDP data from 2005 onwards[4]. Yet, both provide similar forecasts (Table 7). According to the first model, the 2013 recession is estimated to about 6.08%, with a possible range of ± 2.16% (due to the increased uncertainty in the multiple period ahead forecasting); and according to the second model the recession is estimated to about -6.18%, with a possible range of ±1,72%. In our view it is encouraging that both models yield GDP forecasts of -6.7% and -6.4%, respectively, for 2012, i.e., similar to the outcome of -6.4% announced by ELSTAT. Last but not least, both models display a high degree of fitness: R^2 = 98.2% (See Diagram 1.)

[3] As already mentioned in footnote 1, a good indication of the direction the GDP in 2013 will be available when the revised 2012 national account figures are finalized (i.e., the autumn of 2013), and, perhaps, when data regarding the first quarter of 2013 are known. This said, if due to the urgent and pressing fiscal pressures experienced in Greece, and/or the need to (re)design economic development and social cohesion policies, an early prediction is required on the basis of available data; then, with due caution, it might be better if the prediction were carried out via more than one models.

[4] Often the use of the most recent data provides a better forecast since it takes into account the most recent history of the series. On the other hand, estimated parameters are less robust, due to the limited number of observations.

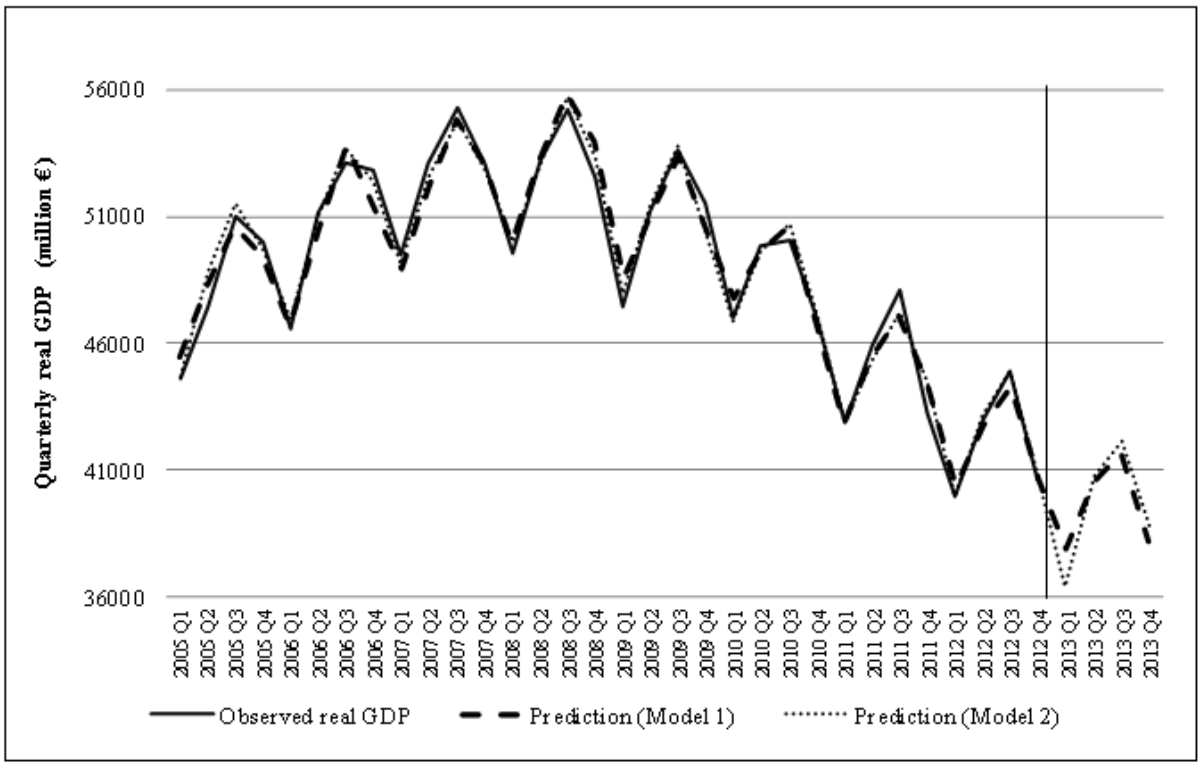
TABLE 7: Real GDP predictions based on time series models

	Model 1		Model 2	
Dependent variable: Quarterly GDP in constant prices (2005)				
Real GDP forecast 2013 (standard error of forecast)	**-6.08% (1.08%)**		**-6.18% (0.86%)**	
Real GDP forecast 2012* (standard error of forecast)	-6.69% (1.09%)		-6.37% (0.86%)	
Sample period	2000 Q1 –2012 Q4		2005 Q1 –2012 Q4	
Explanatory variables:	**Coefficient****	**p-value**	**Coefficient****	**p-value**
Constant	38512.12	0.0000	42067.54	0.0000
Time trend	453.96	0.0000	333.39	0.0000
Dummy 1st quarter	-2876.24	0.0000	-3489.32	0.0000
Dummy 2nd quarter	114.31	0.7821	191.76	0.8076
Dummy 3rd quarter	2203.69	0.0000	2362.64	0.0027
Dummy crisis period (2009 Q1-2012 Q4=1)	39947.12	0.0000	37326.29	0.0000
Dummy crisis period x Trend	-1168.49	0.0000	-1064.50	0.0000
Moving average 1 period	0.293	0.0315	0.471	0.0087
Moving average 3 periods	:	:	-0.317	0.0149
Moving average 5 periods	-0.463	0.0001	:	:
Seasonal moving average 6 periods	-0.440	0.0059	-0.708	0.0013
R^2	*0.982*		*0.982*	
αdj R^2	*0.978*		*0.975*	
F-stat p-value	*0.000*		*0.000*	
Durbin-Watson stat	*1.900*		*1.786*	

Notes: * The 2012 forecasts of the two models were re-estimated based on the observations until 2011 Q4, and out of sample forecasts for the period 2012 Q1- 2012 Q4 were obtained. ** White heteroskedasticity corrected coefficients.

Sources: The analysis is based on the latest data released by ELSTAT (2013b). The explanatory variables considered include: trend, trend^2, trend^3, dummies for each quarter, a dummy for the crisis period (taken also as a multiple of Trend, Trend^2, Trend^3), moving average terms of 1 up to 6 periods, seasonal moving average terms of 2 up to 6 periods. Autoregressive terms were not used so as to be able to perform static forecasting several quarters ahead. Model selection was based on the predictive ability of the models and the correction for statistical significant autocorrelations and partial autocorrelations of several periods.

DIAGRAM 1: Observed quarterly GDP in constant prices (2005) and predictions on the basis of the two alternative time series models (2005 Q1 - 2013 Q4)



4. Predictions based on a typical macroeconomic model

Having approached the issue of real GDP growth via its past values, we now endeavor to estimate its evolution by turning to the factors which by and large determine real GDP, namely the variables that (a) enter the production function (and hence the aggregate supply); and (b) affect the equilibrium in the goods and services market, the money market, and the country's financial integration with the rest of the world (and, hence, the aggregate demand).

To that end we outline a conventional, reduced form framework for an economy that is not in full employment (e.g., Ackley, 1961; Parkin, 1984; Mankiw, 2003), the expressions of which are also illustrated via graphs in Diagram 2.

The equilibrium in the money market is given by:

$$r=f(M, Y, P, \text{constant terms}), \quad (3)$$

where *r* stands for the interest rate, *M* the quantity of money, *Y* the real GDP, *P* the average price level.

The equilibrium in the goods and services market is given by:

$$r=g(Y, G, B, I_1, Y^*, P, \text{constant terms}), \quad (4)$$

where *G* stands for public expenses, *B* for transfers, I_1 for private investments attributed to expectations over the future level of *Y*, *Y** for the income of foreign trading partners (in this context: the total GDP of OECD countries). Typically, indirect taxes are also included, but here by and large replicate the time series of *Y*.

At the same time the financial integration with respect to the rest of the world is given by:

$$r=h(Y, Y^*, P, \text{constant terms}) \quad (5)$$

under flexible exchange rates. However, *r* is inflexible in the case of fixed exchange rates.

So, the Aggregate Demand is derived on the basis of the expressions (3)-(5):

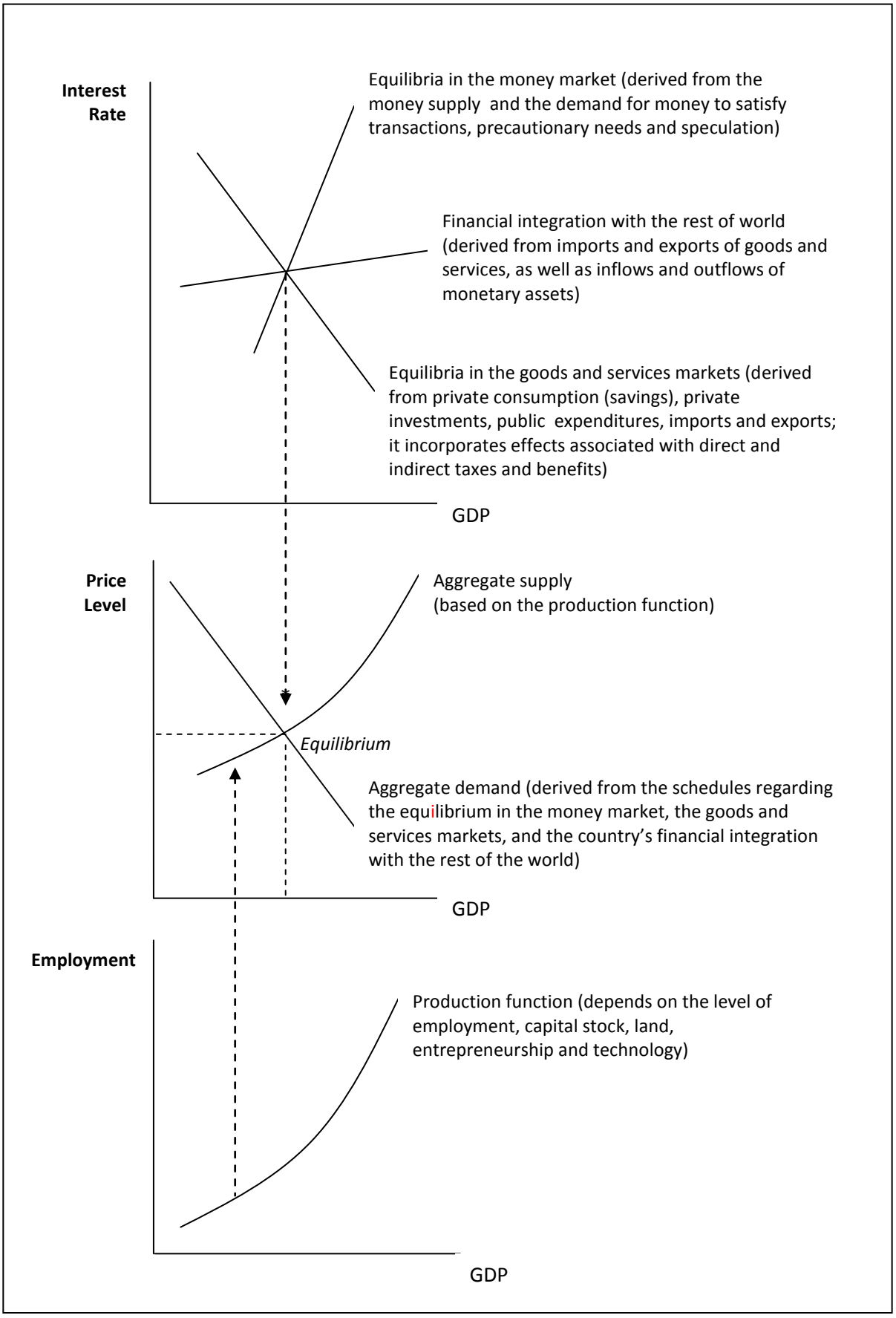
$$P=j(Y, M_1, G, B, I_1, Y^*, \text{constant terms}). \quad (6)$$

In addition, the Aggregate Supply is given by:

$$P=\omega(L, K, A, \text{constant terms}), \quad (7)$$

where *L* stands for the number of people employed in paid work activities, *K* for the capital stock, *A* for entrepreneurship and technology. The amount of land is taken as constant.

DIAGRAM 2: The economy in terms of graphs regarding the factors that determine the level of GDP



So based on equations (6) and (7), the real GDP level may be written as follows:

$$Y=y(M, G, B, I_1, Y^*, L, K, A, \text{constant terms}). \quad (8)$$

In order to empirically estimate and predict the real GDP level we consider the time series of the (a) annual 1960-2011 national accounts published by ELSTAT; (b) monthly 1980-2012 monetary aggregates supplied by the Bank of Greece (2013b); (c) annual 1988-2001 drachma to US dollar and 2002-2013 euro to US dollar exchange rates, and (d) annual 1960-2012 five-year government bond yields supplied by Eurostat (2013). Then, after testing the interpretive ability of these regressors and taking into account the currency changeover, and weighing up the need to preserve degrees of freedom[5], we estimate the following variant of equation (8) for the 1981-2011 period:

$$\text{Change in real GDP}_{1981\text{-}2011} = \underset{(3‰)}{0.027}*\Delta L + \underset{(2‰)}{0.639}*\Delta I_1, \quad N=31, \quad R^2=43.39\%, \quad (9)$$

with ΔL standing for the annual change in the number of actively employed people, and ΔI_1 for the annual change in the value of private investments attributed to expectations over future income and demand (in billion euro at constant 2005 prices)[6]. The aforementioned regressors prevail over other available explanatory variables. The estimated coefficients, obtained via a robust variance estimator, are statistically significant. (The probabilities of error (p-values) are supplied in parentheses below the estimates.)

[5] Understandably due to the paucity of observations (32-52 years) we do not use many explanatory variables. Among those considered is the technology-entrepreneurship vector supplied in Diagram 4.III. It is empirically estimated (as a residual) from the production function $Y = L^{0.567}k^{0.942}$ recovered from the 1960-2011 data. (*k* is the orthogonal variant (residual) of capital with respect to labor, *L*. R^2=99.54%. The estimated output elasticities of labor and capital are statistically significant at the 1‰ level.) A more detailed estimate of the technology-entrepreneurship variable across regions in Greece has been carried out by KEPE (2010).

[6] The size of I_1 is empirically estimated from the residuals of $I_{1960\text{-}2011} = 6.455 - 0.420*r + 0.198*Y$. R^2=90.68%. The coefficients are statistically significant at the 1‰ level.

It goes without saying that it is important to verify the equation's predictive capacity for 2012. Indeed, for an employment (job market) contraction of about 371 thousand people and a private investment contraction of about 5.5 billion euro (as per the 2012 national account figures published by ELSTAT)[7], according to expression (9) we should expect a fall in real GDP of about 6.6%. According to the official statistics, indeed, in 2012 the contraction was about that. (See Table 2.)

Likewise, in order to engage in predictions for 2013, we incorporate the figures pertaining to 2012, and re-estimate the relationship. It turns out that:

$$\text{Change in real GDP}_{1981\text{-}2012} = \underset{(<1‰)}{0.026}*\Delta L + \underset{(2‰)}{0.666}*\Delta I1,\ N=32,\ R2=50.91\% \qquad (10)$$

So for an additional contraction in employment of about 250-300 thousand people (i.e., a contraction smaller than the one observed in 2012)[8], and private investment of 4.7 billion euro (i.e., four fifths of the one observed in 2012), *ceteris paribus,* real GDP is estimated to shrink by 5.6-6.4%[9]. More if the contraction in employment in larger. See Table 8. This is consistent with (and by and large corroborates) the findings of the two technical predictions. On the other hand, if in the course of 2013, private investment falls as much as in the

[7] The 5.5 billion contraction in private investments corresponds to the 19.2% drop which is supplied in the last column of Table 2.

[8] If these people do not migrate or withdraw from the workforce then the unemployment rate will climb to 28-29%.

[9] If we incorporate the figures associated with 2012, then the investment expression takes the form: $I = 6.329 - 0.377*r + 0.192*Y$. R^2=87.15%. The estimated coefficients are statistically significant at the 1‰ level. Accordingly, I_1 is estimated from the residuals as follows: $I_1 = I - (6.329 - 0.377*r + 0.192*Y)$, hence $\Delta I_1 = \Delta I + 0.377*\Delta r - 0.192*\Delta Y$. As a consequence, the 2013 GDP prediction is calculated in conjunction with expression (10) and is a follows: $\Delta Y = 0.026*\Delta L + 0.666*\Delta I_1 = 0.026*\Delta L + 0.666*(\Delta I + 0.377*\Delta r - 0.192*\Delta Y) \rightarrow \Delta Y = (0.026*\Delta L + 0.666*\Delta I + 0.251*\Delta r) / (1.128)$. To estimate the change in real GDP all one has to do is to substitute the values of *ΔL*, *ΔI*, *Δr*. See Table 8.

scenarios listed in Table 6, then the recession will be milder and real GDP may shrink by 4.4 to 5.5%[10].

TABLE 8: Forecasts of real GDP change during 2013 based on scenarios

A. If the private investments in Greece decrease by	B. If the number of employed persons (as measured in the national accounts) decreases by			
	200 thnd.	250 thnd.	300 thnd.	350 thnd.
1.2 billion euro in constant 2005-prices (or by 5.4% of the value of investments of 2012): middle scenario of Table 6	-3.6%	-4.4%	-5.1%	-5.9%
2.2 billion euro in constant 2005-prices (or by 9.5% of the value of investments of 2012): worst scenario of Table 6	-4.0%	-4.7%	-5.5%	-6.3%
4.7 billion euro in constant 2005-prices or by 19.4% of the value of investments of 2012 (i.e. the average contraction observed in the course of 2011 and 2012)	-4.9%	-5.6%	-6.4%	-7.2%

Notes: No significant changes were observed for changes of the interest rate of magnitude ±1.5%.

In this context, the simultaneous presence of a recession and relative price stability witnessed in the second half of 2012 (Ministry for Development and Competitiveness, 2013)[11], ought to be attributed to leftward shifts of the aggregate supply and aggregate demand schedules (See Diagram 3)[12].

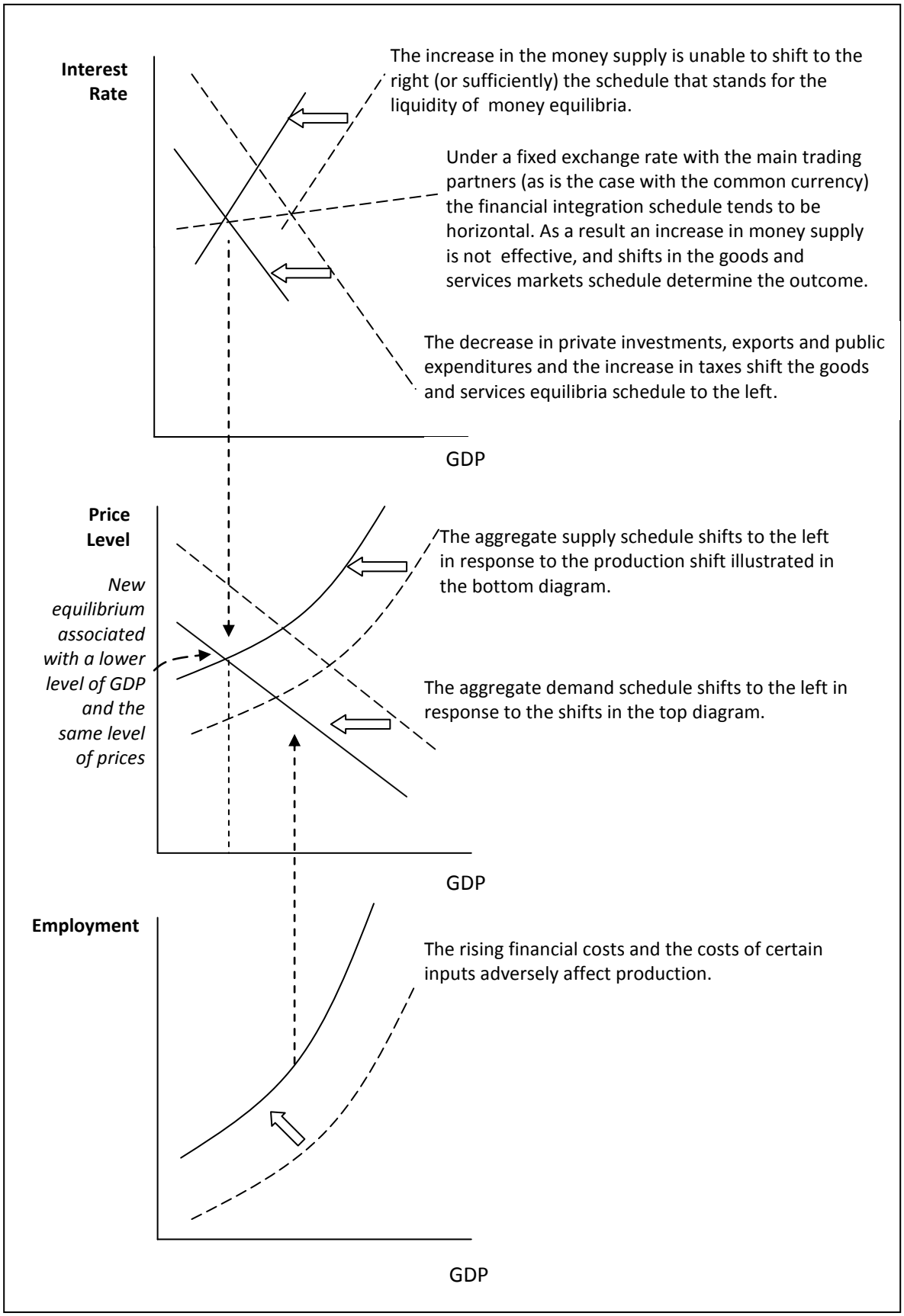
This suggests that initiatives to end the recession may be carried out on either front. So we turn our attention to the options at hand.

[10] To provide a measure of comparison to the private investment figures involved, suffice it to say that the annual value of depreciation in the private sector is estimated to be 13-15 billion euro. It corresponds to a depreciation rate of 6% for a capital of 230-250 billion euro (in terms of 2005 prices).

[11] On the basis of the consumer price index. We are aware of the deflator estimate supplied in Table 2.

[12] For a decrease in the general price level of goods and services to occur in the future, the aggregate demand schedule would have to contract more than its aggregate supply counterpart.

DIAGRAM 3: A presentation in terms of graphs of the empirical findings regarding the determination of the GDP



5. Some options

First of all we ought to take into account that the current economic crisis is the longest and most severe the country has experienced in the last sixty years (see Diagram 4.I). The closest historical parallel may be found in 1974, a year marked by political instability and regional tension as the Turkish invasion of Cyprus brought Greece to the brink of war with Turkey. However, the similarity is superficial. In economic terms, the current situation is clearly worse both in magnitude and length (five consecutive years, not counting 2013). Last but not least, whereas (up until recently) it was possible to deal with negative growth rates by resorting to tried, tested and effective fiscal and monetary interventions, as mentioned in the Introduction, these basic policy instruments are no longer at the government's disposal. As a result, the options are limited. Like:

a) Encourage foreign demand for Greek products and services, and attract investments in all sorts of projects (whether above or under the ground or water, whether tangible or intangible assets). An improved economic climate in the euro-zone and/or worldwide may be helpful[13]. Yet, the effort should be made even if conditions abroad became unfavorable or the creditability of other EU member-states were downgraded, confidence in the security of deposits in the euro-zone at large undermined etc[14]. Unfortunately the

[13] Our econometric analyses of macroeconomic (national account) figures suggest that *ceteris paribus:* An increase (decrease) in incomes by 1% in OECD-countries will positively (negatively) affect Greek exports by 0.55%. A decrease (increase) by 1% of relative prices in Greece vis-à-vis OECD countries is expected to stimulate (reduce) the volume of tourism services from foreign countries by 0.87%. A decrease (increase) in the real effective exchange rate by 1% is expected to stimulate (reduce) Greek exports by 0.32%.

[14] For instance, the EC-ECB-IMF proposition in mid-March to seize a part of insured deposits in Cyprus (though eventually rejected by the Cypriot legislature) and a large portion of deposits over 100,000 euro, is likely to prevent potential investors from engaging in businesses (for which this kind of large bank account are needed) in other euro-zone countries in which the EC, the ECB and the IMF collectively have a say.

euphoria of 2007-2008 about the country's prospects has been succeeded by disappointment (see Diagram 4.II). For the psychology to change a succession of consistent signals by the authorities and the public that build faith in doing business in Greece is needed. May the long-awaited resumption of work on the expansion and modernization of the transportation network, privatizations, and the achievement of a budget surplus be in that direction.

b) Increase the quantity and/or velocity of money in order to reduce the cost of borrowing and facilitate monetary transactions. This may be advanced in a number of ways: By recapitalizing the banking sector, by enabling the state to pay the money owed to private sector suppliers and VAT returns to other businesses, by deregulating Sunday shopping among small retailers etc.

c) Deregulate markets and remove distortions in competition (in agriculture, trade, services, everywhere) so as to reduce prices and raise the level of output.

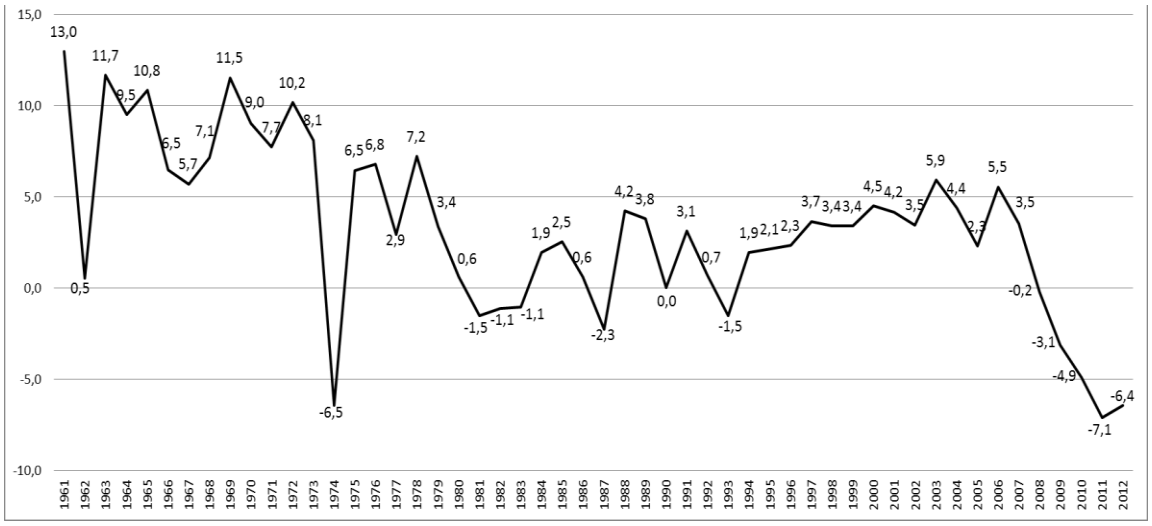
d) Promote the overall state of technology and entrepreneurship, a pair of essential production inputs which currently seem to be at an all-time low (see Diagram 4.III); and set up a friendlier business environment (see Vima, 2011).

e) Absorb and utilize the funds earmarked for economic development by the EU via the Greek National Strategic Reference Framework (NSRF), in areas and sectors associated with significant multipliers. Unfortunately, several NSRF operational programs lack a strategic focus, while planning and implementation are often based on (i) broad regional averages with little or no consideration for intra-regional heterogeneity and spillovers or (ii)

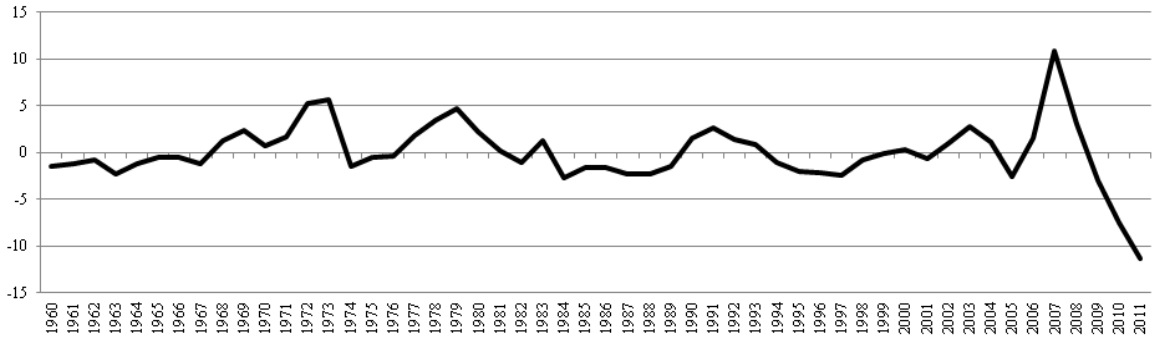
subordinate criteria, which, in turn, weaken the overall effect on real GDP. (Prodromidis and Tsekeris, 2011; Prodromidis, 2012). These flaws ought to be addressed.

DIAGRAM 4: Evolution of real GDP and some rarely quantified figures (1960-2012)

I. Annual growth rate of the Greek economy (% change of GDP in terms of constant 2005-prices)

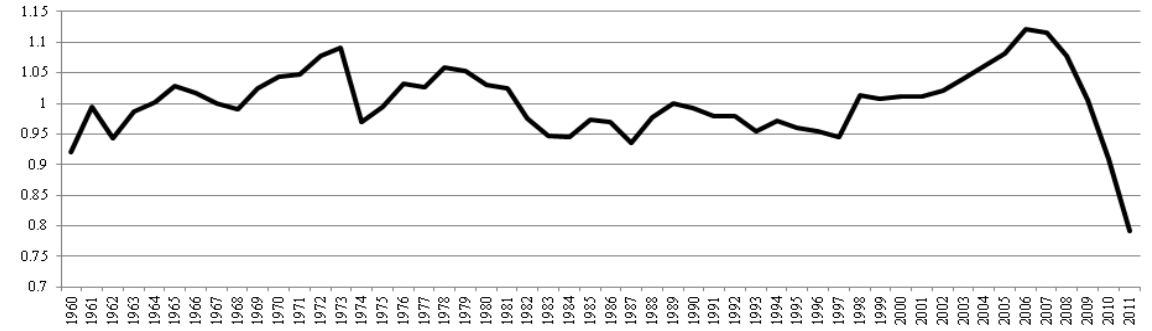


II. The size of investments associated with expectations over future income (on the demand side)



Calculation details are given in footnote 6

III. The size of entrepreneurship and technology (on the supply side)



Calculation details are given in footnote 5

6. Conclusions

The early estimates of a number of international organizations, the Greek government, and the country's research institutes in 2011 and 2012, suggested the recession would range between 2.6-3.5% and 2.0-4.7%, respectively, when in fact real GDP decreased by 7.1% in 2011, and 6.4% in 2012 (according the temporary data of ELSTAT (2013b)). Similar forecast errors are observed for individual GDP components. Insofar as the early 2013 estimates provided by these institutes and the government point in the direction of a 4.2-4.6% recession, we are concerned that they may be overly optimistic as well. Maybe it is better if we treated these projections with caution.

According to alternative models which we estimate based on different methodological approaches and temporal frequency, we find that any prediction for the actual GDP growth contains a high degree of uncertainty. The recession can lie in the range of 2.9-7.2%, possibly 4.4-6.4%, if the unemployment rate climbs to 28-30%. So it is best to avoid any complacency and to keep on taking steps towards improving the variables which contribute to growth as if the likelihood of last year's recession has not gone away. The situation is sensitive and stabilization has not yet occurred. As much as we all hope for the best, and that the measures taken by the policy-makers and the mobilization of society at large may halt the downward economic trend of recent years and even disprove the contractionary economic forecasts, it is important to have (prepare) alternative or additional plans in the direction of economic development, financial and social cohesion if the optimistic scenarios do not materialize.

As the above lines were printed, ELSTAT announced a smaller the expected decline in real GDP during the second quarter of 2013: Specifically, that the

5,6% drop in the first quarter (vis- à-vis the respective quarter of 2012) was succeeded by 3,8% drop in the second quarter. Beyond illustrating our basic point regarding the uncertainty of early projections, coupled with a general impression that the tourist season went exceptionally well in the third quarter (thus hindering a rise in unemployment), this may be a sign that the economy is inching toward the lower end of the estimated range provided above. The argument regarding complacency holds.

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