

Mantescu, Dorin; Lazar, Dan-Tudor

Article

Estimation of Potential GDP and output Gap. Comparative Perspective

Amfiteatru Economic Journal

Provided in Cooperation with:

The Bucharest University of Economic Studies

Suggested Citation: Mantescu, Dorin; Lazar, Dan-Tudor (2014) : Estimation of Potential GDP and output Gap. Comparative Perspective, Amfiteatru Economic Journal, ISSN 2247-9104, The Bucharest University of Economic Studies, Bucharest, Vol. 16, Iss. 37, pp. 951-964

This Version is available at:

<https://hdl.handle.net/10419/168868>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<http://creativecommons.org/licenses/by/4.0/>

ESTIMATION OF POTENTIAL GDP AND OUTPUT GAP - COMPARATIVE PERSPECTIVE -

Dorin Măntescu^{1*} and Dan-Tudor Lazăr²

¹⁾ *European Commission, Brussels, Belgium and Bucharest University
of Economic Studies, Romania*

²⁾ *Babeş-Bolyai University, Cluj-Napoca, Romania*

Abstract

The purpose of the analysis is to assess the impact of the crisis on the potential output and output gaps, to study their evolution by using a comparative approach for a sample of EU countries that were in majority included recently in financial assistance and macroeconomic adjustment programmes. The potential GDP growth rates calculated using the Cobb Douglas production function and Hodrick-Prescott methodology, decelerated substantially across the board in the countries studied once the international economic and financial crisis hit, recording even negative rates of growth in Cyprus, Greece, Portugal, Italy and Spain. In addition to the specific factors that characterise each country, there is a series of common features that will affect the developments of the potential GDP on a long-term basis, such as the increase of global risk aversion correlated with the reduction of the banking exposures, the slow economic recovery in the EU, and last but not least the incoming ageing process, which will exert an additional negative impact on the growth potential of the EU member states. The article makes a series of economic policy recommendations to promote key measures aiming to increase the flexibility of the goods, services, and labour markets, to improve the prioritisation of public expenditures especially capital spending, and to improve the management of the public assets including real estate and public buildings by promoting a mix of measures including privatisation, monetisation and a wider involvement of the private sector in their management.

Keywords: potential output level, Cobb Douglas production function, structural reforms, output gap

JEL Classification: E32, E60, E65

* Corresponding author, **Dorin Măntescu** – mantescu74@yahoo.com

Introduction

The purpose of the analysis is to assess the impact of the crisis on the potential output and output gaps, to study their evolution by using a comparative approach for a sample of the EU countries, which have been in majority recently included in financial assistance and macroeconomic adjustment programmes.

According to the definition, potential output is the level of gross domestic product that can be produced in a non-inflationary way. On the medium term, the potential GDP depends on the productive capacity of the economy including the endowment with labour, capital, and total factor productivity. Potential GDP is an important, but still not directly observable, macroeconomic variable used by the fiscal and monetary authorities in designing an optimal macroeconomic policy mix.

Measures of potential output are used to estimate the cyclically adjusted budgetary position, which is essential for the assessment of the government budgetary effort along the economic cycle. The cyclically adjusted budgetary position was at the core of the EU budgetary surveillance policy even before the crisis. The importance of this indicator has been reinforced by the recent reforms promoted in the context of the EU semester and renewed efforts to promote structural changes within the EU 2020 strategy framework.

The recent international economic and financial crisis had an important impact on the long-term economic growth rate due to the on-going deleveraging process, the adaptation of some previously booming and oversized sectors to the new economic realities (construction, retail, financial sectors, etc.) and the effect of the budgetary consolidation measures.

An additional long-term factor affecting the potential output developments is represented by the ageing process, which will diminish from a structural point of view the labour supply and will reduce the available space for fiscal policy stimulus.

1. Literature review

There is a good number of papers analysing the impact of the recent international financial and economic crisis on both potential output growth rates and level.

According to an occasional paper published by the European Commission (DG-ECFIN, European Commission, 2009), there are mentioned two transmission channels on the evolution of the potential output with an additional differentiation between the impact on the indicator level or the growth rates. First, the economic and financial crisis will have an impact on the level of the potential output due to the short-term consequences of the crisis on the potential output growth rates and a longer period necessary for the potential growth rates to return to comparable metrics previous to the event. Second, a risk of lower long-term potential growth rate is considered probable due to the increased global risk aversion and financial deleveraging and possible inappropriate policy responses.

In this context, three scenarios are presented regarding the possible evolution of the potential output in the aftermath of the economic and financial crisis. First, there is a "full recovery scenario" where there is no loss of potential output in terms of levels after a certain transition/recovery period. Second, there is a permanent loss in potential output level, but accompanied by a normalisation of the long-term potential growth rates to the

pre-crisis rates after a certain transition/recovery period. Third, there is a permanent loss in the potential output level that widens over time due to the shift to permanent lower potential output growth rates on the long term.

The long run impact of the crisis, especially on the evolution of the growth of total factor productivity, depends on the policymakers' capacity to take the right decisions regarding the policy response and the related mix, sequencing and timing of measures of economic reform.

In a recent monthly bulletin publication of the ECB (2013), it has been demonstrated that the negative impact of the crisis on potential output is concentrated in the labour and capital formation parts explained by both cyclical and structural factors. Building on previous research making a parallel between the performance of the Euro area and the US economies in terms of potential growth, it is pointed that, despite the comparable relative fall in the actual and potential output growth rates in the Euro Area and in the US, the potential output stabilized and reversed the trend in the US while it is still on a slightly downward trend in the Euro area. The better performance of the US economy is explained by a greater economic flexibility in reallocating the available resources.

Based on estimates from the EU Commission, the paper indicates a deceleration of the average potential output growth rates to 0.9% between 2008-2012 compared to an average of 2.2% between 2000-2007 in the Euro area, and from 2.5% to 1.1% in the US during the same periods. Finally, the paper points out the need to promote additional reforms to mitigate the probable long-lasting impact of the structural component of the factors affecting the long-term performance of the potential output growth rates, including the impact of the ageing process.

Furceri and Mourougane (2009), using a univariate autoregressive growth equation estimated on an unbalanced panel of OECD countries over the period 1960 to 2007, find a significant and permanent negative impact of the financial crises on potential output. Financial crises are estimated to lower the potential output by around 1.5 to 2.4% on average reaching in some cases depending on the magnitude of the crisis to nearly 4%, almost twice the amount observed for the average of crises.

Fernald (2012), using reasonable estimates of underlying technology trends and a multisector neoclassical growth model, estimated the potential output growth rate for the US economy at 2.1% on a long-term basis, appearing at the low end of recent estimates for the steady state GDP growth rate.

According to the paper results, the dynamic and shape of the labour and total factor productivity performance during the recent recession and early recovery were in line with previous crisis experiences with peak to trough total factor productivity seeing the sharpest downfall in the post-war period, consistent with labour and capital hoarding.

Given the accumulated fiscal imbalances and the additional impact of the automatic stabilizers, a growing importance is attached to the impact of the fiscal consolidations on potential growth rates. This is a long and ongoing debate with some of the economists arguing for the neutrality of the government spending on the long run and others sustaining that fiscal consolidation measures could hurt the economy on the long term. The hysteresis effect presented by DeLong and Summers (2012) could induce a long-lasting effect of the fiscal consolidation on the potential output growth rate.

As a result of the growing importance of the financial sector imbalances and its key role in triggering the recent international economic crisis, Borio, Disyatat and Juselius (2013) developed a finance neutral potential output indicator, which is built using some financial indicators like credit and property prices. The resulting measure improves the popular Hodrick Prescott methodology by having a more robust and useful approach for policymaking and by yielding more reliable estimates of cyclically adjusted budgetary balances.

Altar, Bobeica and Necula (2010) calculated the potential output growth for Romania by using a combination of methods between production function approach and econometric filtering techniques (Hodrick-Prescott, Kalman, bandpass and wavelet transformation). The potential growth rate has an increasing trend until the third quarter of 2008 followed by a decline in the subsequent quarters because of the effect of the global economic and financial crisis. The contribution of the technical progress declined in relative terms after Q3 2007, while the contribution of the fixed capital had a major contribution in the last period of the studied interval (1998-2008).

Haltmaier (2012) used a panel regression to determine if the characteristics of recession including depth, length, extent of synchronisation between countries/economies, and the existence of a financial crisis or not, can explain the loss of potential output for a cumulative four years period following a recession. According to the results, depth has an important effect on the potential output for more advanced economies, while length has an important effect for the emerging/less-developed economies. The main conclusion is the fact that probably the recent economic and financial crisis had little effect on emerging market trend growth and led to declines of around 3 percentage points in the level of trend output for four years after the recession peak for more advanced economies. Downturns in output even of a temporary nature usually have long lasting effects on the level of potential output as a result mainly of lower capital to output ratio and lower investments.

2. Data and methodology

We used both yearly and quarterly data series for the gross domestic product expressed in constant average prices of the base year 2000. The source for annual data was represented by WEO IMF database, while Eurostat represented the source for the quarterly data. The potential GDP level was assessed by using quarterly data for Romania, while for the rest of the sample countries we used annual data series.

We employed two main methodologies for the assessment of the potential output level: the economic and statistical methodologies. The economic methodology was used to estimate the potential GDP for Romania and is based on the Cobb Douglas production function, while the statistical methodology based on the Hodrick Prescott filter was used for the estimation of the potential GDP for the remaining countries in the sample.

2.1. Hodrick-Prescott filter

The Hodrick–Prescott filter is used especially in real business cycle theory to separate the cyclical component of a time series from raw data. It is used to obtain a smoothed-curve representation of a time series, which is more sensitive to long-term rather than to short-

term fluctuations. The adjustment of the sensitivity of the short-term fluctuations to the trend is achieved by modifying the multiplier λ .

This is the oldest statistical technique used to estimate the output, approximating the potential GDP as a simple deterministic function of time. This is also the most popular detrending methodology that identifies the long-term trend component of output by minimizing a loss function penalizing the gap between actual and trend output and the rate of change of the trend.

$$\text{Min } \sum_{t=0}^T (y_t - y_t^*)^2 + \lambda * (\sum_{t=2}^{T-1} [(y_{t+1}^* - y_t^*) - (y_t^* - y_{t-1}^*)]^2,$$

where λ represents the degree of smoothness of the trend.

As various studies have highlighted it, the Hodrick-Prescott filter has end-sample problems, since the estimates of the output gap at the end of the sample may be subject to substantial revision as new data is available. The most preferred corrective measure to solve this issue is to extend the dataset with forecasts. However, the accuracy of output-gap estimates at the end of the sample is dependent on the accuracy of the forecasts. The choice of λ represents another source of criticism for this filter given its influence on the variance of the trend output estimate. A low value of λ will produce an output that follows more closely the actual output, while a higher value of λ will produce estimates of potential output that are less sensitive to actual output fluctuations. In this study, we employed a smoothness parameter equal to 1600 as originally proposed by the authors Hodrick and Prescott. The shortcomings of the linear trend method have called for alternative detrending methods.

2.2. Economic methodology

The estimation of the potential GDP using the production methodology implies assumptions regarding the type of production function and an evaluation of its parameters, the potential production factors and the total factor productivity.

We used a Cobb-Douglas production function, calculated as a product of the labour and capital input, corrected for the excess capacity and adjusted with the efficiency level. Total factor productivity takes into account the correction for the efficiency level and the excess capacity.

$$Y = (U_L * L * E_L)^{\alpha} * (U_K * K * E^K)^{(1-\alpha)} = TFP * L^{\alpha} * K^{(1-\alpha)} \quad (1)$$

Written in logarithmic transformation, the simple two-factor Cobb Douglas production function takes the following form:

$$\ln(Y) = c + \alpha * \ln(L) + (1-\alpha) * \ln(K) + TFP + e \quad (2)$$

where Y , L and K are the value added, employment and capital stock of the business sector, respectively; TFP , the trend total factor productivity (in log form); c a constant; and e the residual.

With α approximated by the labour's share in value added, the contributions of labour and capital to output can be computed and subtracted from the value added of the business sector. The trend total factor productivity is then derived by smoothing the residuals of the equation.

Potential output for the business sector is consequently computed according to the formula below:

$$\ln(Y^*) = c + \alpha \ln(L^*) + (1 - \alpha) \ln(K) + tfp \tag{3}$$

where L^* is the trend labour input of the business sector.

According to the methodology proposed in 2006 by Dennis at all, we assumed that the GDP to labour elasticity is 0.63 (implicitly the GDP to capital elasticity is 0.37). The potential level of the labour force was determined by using the Hodrick Prescott methodology, while the capital stock was evaluated by using the perpetual inventory method developed by OECD. We started from an initial capital stock level by deducting its depreciation and adding up the gross fixed capital formation¹. The data regarding the gross fixed capital formation was obtained from Eurostat, being based on average constant prices reported for the year 2000.

$$K_t = K_0 + \sum_{j=1}^t I_{j+1} [(1 - \delta_t)^{t-j+1} / \delta_t] \tag{4}$$

Where:

- K_t represents the capital stock
- K_0 - initial capital stock
- I_{j+1} - gross fixed capital formation
- δ_t - capital depreciation rate.

We included eight countries in the analysed sample: Cyprus, Greece, Hungary, Ireland, Portugal, Spain, Italy, and Romania. All of these countries have in common the accumulation of serious external and internal macroeconomic imbalances ahead of the international financial crises and are passing through a period characterised by credit deleveraging coupled with budgetary consolidation in a weak growth external environment.

3. Results

As one can observe in Annex 1, the potential GDP growth rates calculated using the Hodrick-Prescott methodology decelerated substantially across the board in the countries studied once the international economic and financial crisis hit, recording even negative rates of growth in Cyprus, Greece, Portugal, Italy, and Spain. We note the evident trend of a major deceleration in the potential growth rates well ahead of the crisis for Italy and Hungary, two countries well known for their budgetary policy slippages and high public debt levels for long time ago. An additional interesting example is represented by Ireland where the potential growth rates decelerated from a level close to 8% in mid-90's to almost zero currently. The potential growth rates have a decreasing trend for all the countries included in the sample. This decelerating trend is evident also from Table no. 1 with substantially lower average potential GDP growth rates recorded in the last four years after the start of the economic crisis compared to a similar interval ahead of the crisis.

¹ Due to the difficulty of having initial capital figures for the transition economies, an estimate for the initial stock of capital for the Romanian economy was taken from Moisa, Necula and Bobeica (2010).

There is also a high dispersion between the performance of the countries included in the sample with Greece, Cyprus, Spain, and Italy being forecasted to record negative growth rates of the potential output until the end of the interval while Hungary will return to a pattern similar to the pre-crisis characterised by anaemic growth rates.

Table no. 1: Average Potential GDP growth (2002-2006 and 2009-2013)

	Cyprus	Greece	Ireland	Italy	Portugal	Spain	Hungary	Romania
2002 - 2006	3.1	2.5	4.2	0.8	1.2	2.7	2.7	4.1
2009 - 2013	-0.1	-1.3	0.8	-0.3	-0.2	0.2	0.4	2.2

Source: Eurostat statistics database and own computations

In addition to the specific factors that characterise each country, there is a series of common features that will affect the potential growth rates and the ensuing economic recovery. The increase of global risk aversion correlated with the reduction of the banking exposures and the prospects of a gradual, but still uncertain, demand recovery which will reinforce a slow repair of the balance sheets, represents a few factors that will constitute major constraints in the stabilisation, re-launch and consolidation of the potential growth rates. Furthermore, the slow economic recovery at the global level will force the countries to acknowledge the new economic realities, increasing the probability of a need for an exit strategy from the more accommodating policy stance during the crisis and take related budgetary consolidation measures in some of the core member states, which could lead to negative spill overs regarding the goods and services demand from the rest of the EU and the world. These trade-offs will be increased by the incoming ageing process which will exert an additional negative impact on the growth potential of the EU member states by reducing the labour supply and overburdening the already high initial levels of public debt.

There is also evident a correlated increase of the output gaps (see Annex 2) well into negative territory after the start of the crisis compared to positive levels registered between 2005 to 2008 when the global and EU economies sustained one of the longest period of growth. As can be seen from below table, Greece had the highest negative output gap in 2013 followed by Cyprus, Portugal and Ireland. These countries had to implement procyclical fiscal policies being also included in financial and macroeconomic adjustment programmes due to restrictions of access in terms of volume and/or cost to the capital markets.

As can be seen from the below two figures (Figure no. 1 and Figure no. 2), the actual GDP level increased more rapidly than potential GDP level between 2007 and 2008 and the Romanian economy got overheated. The output gap based on a potential output level estimated using Cobb-Douglas production function for quarterly data, increased from an equilibrium level in 2004-2005 to a level close to 8% of potential output in 2008, demonstrating the overheated nature of the economy due to expansionary and procyclical macroeconomic and budgetary policies. The Romanian economy potential GDP growth rate decelerated significantly from an average of 6% between 2002 and 2006 to an average of 1% between 2009 and 2013. However, according to this methodology, there are signs of stabilisation and re-launch at an albeit low growth rate of around 2.5-3% on the long term despite the fact that there is a huge economic potential to tap EU structural funds,

substantial reserve efficiencies in the state owned enterprise sector, a good endowment of the country with natural resources and a still relatively competitive labour force pool. This overall picture is pointing to a slow and unsatisfactory long-term real convergence process to the EU. Despite the fact that the two methods lead to very close estimates of the change in the trend of the potential GDP indicator, the economic based methodology lead to slightly higher potential GDP growth rates estimates for the Romanian economy and associated lower output gaps compared to the Hodrick Prescott methodology. Moreover, the results from the later methodology lead to the well-known problem of reliability of the estimates at the end of the interval (this is why in Annex 2 we reported the results until end 2016).

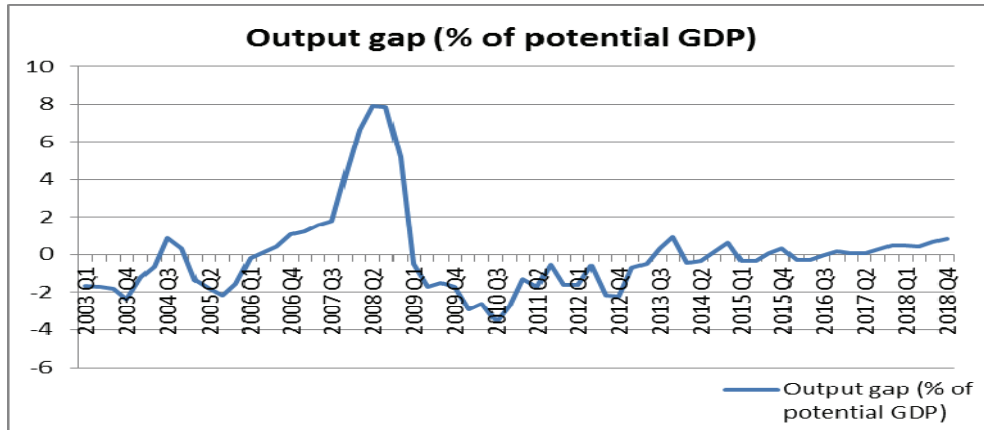


Figure no. 1: Evolution of the output gap-Romania

Source: own calculus

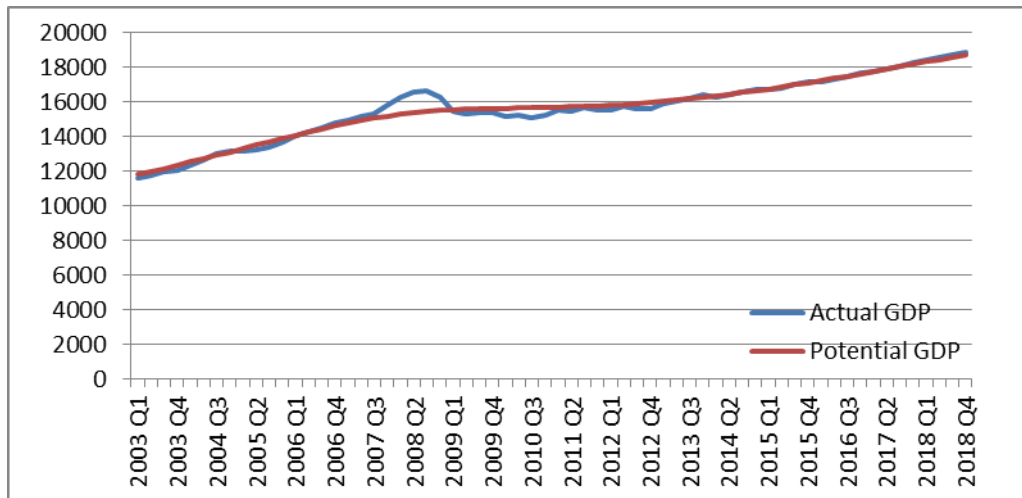


Figure no. 2: Actual and potential output developments

Source: Own calculus

There are three main factors which will complicate the policy dilemmas faced by economic decision makers (Annex 3).

First, the initial level of public debt is high for the majority of member states and for the Euro Area as a whole. There is an overall high dispersion of the public debt level between the member states with Greece, Italy and Portugal having by far the highest ratios of public debt to GDP.

The Euro area public debt increased from 66% of GDP in 2007 to a record level of almost 96% of GDP in 2013 as a result of the functioning of automatic stabilizers, recapitalization of the banking sector and partially due to initial stimulus measures implemented in 2009 after the beginning of the crisis.

Given the need to reduce these ratios to more sustainable long-term trend levels and the lack of fiscal space to promote additional fiscal stimulus measures, the high public debt ratios are representing a major constraint for economic growth on the short and medium term.

Second, the high level of structural deficits are representing an additional constraint on economic growth. Correlated with the high level of public debt, both indicators are limiting the fiscal space to promote key economic policy measures to stimulate demand and thus represent a major constraint for the quick economic recovery. Given the difficult access to sovereign funding from financial and capital markets for certain countries, the consolidation measures represent a necessary condition to restore the sustainability of public finances and to ensure a quick and credible return of available financing.

Third, the equation is even more complicated if we consider the additional impact on public debt involved by the ageing related expenditures. For the Euro area as a whole there are forecasted additional annual expenditures estimated at an average of 4.5% of GDP related to the ageing process between 2010 and 2060 if the current policies are maintained unchanged. Given the current high level of public debt and deficits, the additional ageing related expenditures pressures are pointing to the need of phasing in more medium- and long-term oriented consolidation measures correlated with additional parametric reforms to encourage higher labour participation rates and an improvement of the fertility rates.

Conclusions and economic recommendations

Given the already implemented measures to stabilize and consolidate the public finances and financial systems, there is an appropriate time to move the focus on growth policies by promoting a mix of key structural reforms aiming to increase the flexibility and competitiveness of the economies.

Overall, there is a need to continue and promote credible measures to accelerate the creation of a banking, economic and budgetary union. These are key prerequisites in order to reverse the trend of the national fragmentation of the banking markets and to ensure a recovery of the financing resources inflows in the member states real economies. Furthermore, the additional integration measures will allow a break-up of the vicious link between weak banking markets and overly indebted public sectors.

Additional reforms aiming to increase the flexibility of the labour markets, promoting measures to facilitate the opening of product and services markets and thus allowing more

competition are essential to keep a lid on the prices once the economies are stabilized and start grow again and thus reinforce and preserve economic competitiveness across the economic cycle.

A better prioritisation of public spending within a medium term budgetary framework could ensure an improved efficiency of the investment budget execution by focusing on growth enhancing projects including by ensuring better intermodal links between different modes of transport, promoting energy savings and projects which are more environment friendly. An additional area with efficiency reserves is related to a better targeting of social assistance programmes including unemployment benefits programmes and improving the work related incentives.

Improved asset management in the public sector for both corporate and real estate assets is a must. On a medium- and long-term basis, a new round of privatisations are needed mainly to ease the difficult trade-offs between the objective to contain and reduce public debt levels while on the same time to provide support to the economic recovery process from a short term perspective. Especially for less competitive economies the improved corporate governance practices, better efficiency and additional foreign direct investments are important benefits related to privatisation. Innovative ideas to raise financing including by a better exploitation of public real estate assets (land, public buildings, etc.) could be explored given the huge reserve efficiencies that exist in this often and for so long neglected sector. Within this latter category, a better and more efficient management of the public buildings by externalizing their maintenance activities to the private sector could create an improved quality of the services levels, cut the goods and services costs and thus set free additional resources on a long-term basis needed to sustain other key growth related sectors like health and education.

Last but not least, measures are needed to improve the long-term sustainability of the public finances by moving to an indexation of the retirement age with life expectancy, by creating the right incentives to foster higher participation rates in the labour markets and containing the rapid dynamic of health expenditures by promoting funding diversification, a greater private sector involvement in the provision of services and by putting a higher focus on prevention.

Given the slow growth envisaged for the more developed economies in the following decade, it is a good opportunity for lower developed economies to catch up and reduce the development gap. It has to be seen if the latter will grasp this unique window of opportunity for development and will catch up by promoting the right policy mix to foster a sustainable real convergence process.

Annexes

Annex 1. Evolution of the potential GDP growth rates

	Cyprus	Greece	Ireland	Italy	Portugal	Spain	Hungary	Romania
1998	4,43	3,47	8,05	1,66	2,95	3,66	2,71	0,91
1999	4,27	3,61	7,65	1,60	2,72	3,70	3,04	1,72
2000	4,10	3,65	7,08	1,51	2,43	3,66	3,24	2,53
2001	3,89	3,59	6,40	1,38	2,10	3,53	3,31	3,26

	Cyprus	Greece	Ireland	Italy	Portugal	Spain	Hungary	Romania
2002	3,67	3,41	5,68	1,21	1,76	3,34	3,25	3,82
2003	3,42	3,10	4,94	1,03	1,44	3,08	3,06	4,17
2004	3,14	2,65	4,21	0,83	1,15	2,77	2,76	4,30
2005	2,81	2,09	3,49	0,62	0,88	2,40	2,36	4,22
2006	2,40	1,44	2,78	0,39	0,62	1,98	1,90	3,96
2007	1,93	0,72	2,10	0,16	0,38	1,53	1,44	3,56
2008	1,39	-0,02	1,50	-0,07	0,15	1,07	1,01	3,09
2009	0,81	-0,70	1,06	-0,24	-0,05	0,65	0,68	2,63
2010	0,27	-1,23	0,80	-0,33	-0,18	0,32	0,47	2,28
2011	-0,23	-1,57	0,70	-0,36	-0,25	0,08	0,37	2,07
2012	-0,64	-1,67	0,71	-0,34	-0,26	-0,08	0,34	1,96
2013	-0,92	-1,57	0,79	-0,27	-0,19	-0,16	0,37	1,92
2014	-1,03	-1,31	0,91	-0,16	-0,07	-0,18	0,44	1,93
2015	-1,02	-1,01	1,03	-0,04	0,06	-0,16	0,53	1,97
2016	-0,96	-0,74	1,13	0,05	0,17	-0,13	0,59	2,00
2017	-0,90	-0,57	1,18	0,11	0,24	-0,10	0,64	2,01
2018	-0,88	-0,50	1,19	0,13	0,27	-0,08	0,65	1,99

Source: World Economic Outlook Database and own calculus

Annex 2. Development of output gap (% of potential GDP)

	Cyprus	Greece	Ireland	Italy	Portugal	Spain	Hungary	Romania
2000	-0,12	-2,84	3,76	0,82	2,93	0,10	-1,53	-7,16
2001	0,02	-2,28	2,38	1,31	2,80	0,23	-1,15	-4,98
2002	-1,47	-2,25	2,12	0,55	1,79	-0,38	0,05	-3,82
2003	-2,95	0,45	0,94	-0,52	-0,57	-0,37	0,81	-2,84
2004	-1,92	2,13	0,93	0,36	-0,17	0,11	2,82	1,06
2005	-0,92	2,32	3,45	0,67	-0,27	1,27	4,43	1,00
2006	0,75	6,42	6,20	2,48	0,55	3,35	6,47	4,81
2007	3,88	9,40	9,18	4,04	2,54	5,34	5,08	7,60
2008	6,14	9,19	5,24	2,91	2,38	5,16	4,95	12,05
2009	3,33	6,50	-2,51	-2,51	-0,55	0,47	-2,81	2,01
2010	4,40	2,50	-4,31	-0,51	1,56	-0,05	-1,99	-1,42
2011	5,19	-3,26	-2,92	0,22	0,50	-0,08	-0,74	-1,33
2012	3,30	-7,90	-3,45	-1,82	-2,49	-1,64	-2,78	-2,56
2013	-4,83	-10,36	-3,64	-3,30	-4,02	-2,73	-2,98	-2,49
2014	-7,57	-8,60	-2,84	-2,46	-3,22	-2,39	-2,20	-2,27
2015	-5,62	-4,95	-1,45	-1,38	-1,84	-1,78	-1,21	-1,73
2016	-2,93	-0,65	-0,08	-0,05	-0,24	-0,95	-0,15	-0,84

Source: World Economic Outlook Database and own calculus

Annex 3

Development of public debt (% of GDP)

	Ireland	Greece	Spain	Italy	Cyprus	Hungary	Portugal	Romania	Euro area
1995	80,1	97,9	63,3	120,9	51,8	85,6	59,2	6,6	72,0
1996	72,1	100,3	67,5	120,2	53,1	72,4	58,2	10,6	73,7
1997	63,6	97,5	66,2	117,5	57,4	62,9	55,5	15,0	73,3
1998	53,0	95,4	64,2	114,3	59,2	60,9	51,8	16,8	72,9
1999	47,0	94,9	62,4	113,1	59,3	60,8	51,4	21,7	71,7
2000	37,0	104,4	59,4	108,6	59,6	56,1	50,7	22,5	69,3
2001	34,5	104,7	55,6	108,3	61,2	52,7	53,8	25,7	68,3
2002	31,8	102,6	52,6	105,4	65,1	55,9	56,8	24,9	68,1
2003	31,0	98,3	48,8	104,1	69,7	58,6	59,4	21,5	69,3
2004	29,4	99,8	46,3	103,7	70,9	59,5	61,9	18,7	69,7
2005	27,2	110,0	43,2	105,7	69,4	61,7	67,7	15,8	70,6
2006	24,6	107,8	39,7	106,3	64,7	65,9	69,4	12,4	68,7
2007	24,9	107,3	36,3	103,3	58,8	67,0	68,4	12,8	66,4
2008	44,2	112,9	40,2	106,1	48,9	73,0	71,7	13,4	70,2
2009	64,4	129,7	54,0	116,4	58,5	79,8	83,7	23,6	80,0
2010	91,2	148,3	61,7	119,3	61,3	82,2	94,0	30,5	85,7
2011	104,1	170,3	70,5	120,7	71,5	82,1	108,2	34,7	88,0
2012	117,4	156,9	86,0	127,0	86,6	79,8	124,1	37,9	92,7
2013	124,4	176,2	94,8	133,0	116,0	80,7	127,8	38,5	95,7

Source: Eurostat statistics database

Ageing expenditures (% of GDP)

	2010	2010-2020	2010-2060
Ireland	22.2	2.3	6.8
Greece	25.3	0	3.2
Spain	21.6	0.3	5
Italy	27.9	-1.1	0.2
Cyprus	17.1	1.1	8.5
Hungary	22	-0.5	4.1
Portugal	24.7	-0.2	0.5
Romania	17.6	-0.8	5.6
EU27	25	0.2	4.1
Euro Area	25.7	0.4	4.5

Source: Ageing Report, European Commission, 2012

Structural balance (% of potential GDP)

	Ireland	Greece	Spain	Italy	Cyprus	Hungary	Portugal	Romania	Euro area
2003	0,5	-5,7	-0,8	-5,6	-8,1	-7,9	-5,5	-1,6	-3,4
2004	1,8	-7,7	0,4	-5,3	-5,0	-8,1	-5,6	-2,5	-3,1
2005	1,7	-5,2	0,8	-5,6	-3,0	-10,1	-5,9	-2,2	-2,7
2006	2,0	-7,2	1,5	-4,4	-1,3	-11,5	-4,3	-3,5	-2,1
2007	-1,8	-7,8	1,0	-3,6	2,4	-5,9	-3,7	-4,8	-2,1
2008	-7,8	-9,7	-4,5	-3,9	-0,8	-4,7	-4,5	-7,8	-3,0
2009	-9,4	-14,8	-8,5	-4,2	-6,4	-2,4	-8,6	-9,4	-4,5
2010	-8,9	-8,9	-7,4	-3,7	-5,7	-3,3	-8,8	-6,1	-4,4
2011	-7,7	-5,8	-7,2	-3,7	-6,5	-4,1	-6,5	-3,9	-3,6
2012	-7,6	-1,0	-5,2	-1,4	-6,8	-0,9	-4,1	-2,7	-2,1
2013	-6,7	1,2	-4,1	-0,8	-5,5	-1,4	-3,7	-1,9	-1,5

Source: Annual Macro-Economic Database, AMECO, European Commission

References

- Annual Macro-Economic Database, European Commission.
- Moisa, A., Necula, C. and Bobeica, G., 2010. Estimating potential GDP for the Romanian economy. An eclectic approach. *Romanian Journal of Economic Forecasting*, 13(3), pp.5-25.
- Barro, R., 1990. *Government Spending in a Simple Model of Economic Growth*, Journal of Political Economy, 98(5), pp. S103-S125.
- Borio, C., Disyatat, P. and Juselius, M., 2013. *Rethinking potential output: embedding information about financial cycle*. BIS, Working Papers No 404.
- Congressional Budget Office, 2004. *A summary of alternative methods for estimating potential GDP*. Background Paper.
- Delong, B. and Summers, L., 2012. *Fiscal Policy in a Depressed Economy*. Brookings.
- DG-ECFIN, European Commission, 2009. Impact of the current economic and financial crisis on potential output. *European Economy, Occasional Papers*, 49/June 2009.
- ECB, 2013. *Potential output, economic slack and the link to nominal development since the start of the crisis*. Monthly Bulletin.
- Estevao, M. and Tsounta, E., 2010. *Canada's potential productivity and output growth: a post-crisis assessment*. International Monetary Fund, International Productivity Monitor, No. 20.
- Eurostat Statistics database, Eurostat, European Commission.
- Fernald, J., 2012. *Productivity and potential output before, during and after the Great Recession*. loc: Federal Reserve Bank of San Francisco.
- Furceri, D. and Mourougane, A., 2009. *The Effect of Financial Crises on Potential Output: New Empirical Evidence from OECD Countries*, OECD Economic Department Working Paper No. 699.

- Giorno, C., Richardson, P., Roseveare, D. and van den Noord, P., 1995. *Potential output, output gaps and Structural Balances*. Note to the attention of EPC Output Gap Working Group. Brussels: ECFIN.
- Hall, R. E., 2009. By how much does GDP rise if the government buys more output?, *Brookings Paper on Economic Activity*, Fall 2009, pp. 183-249.
- Haltmaier, J., 2012. *Do recessions affect potential output?*. Board of Governors of the Federal Reserve System, International Finance discussion papers, No. 1066.
- The 2012 Ageing Report, Economic and budgetary projections for the 27 EU member states (2010-2060), *European Economy 2/2012*, European Commission.
- World Economic Outlook, Recovery Strengthens, Remains Uneven, April 2014, IMF.