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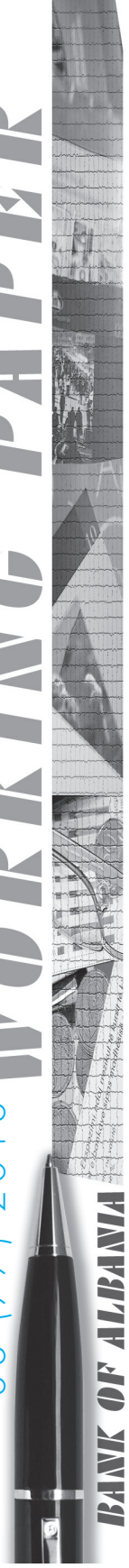

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# POTENTIAL OUTPUT AND GROWTH, OUTPUT AND UNEMPLOYMENT GAP IN ALBANIA – COMPARATIVE ANALYSIS OF RECENT ESTIMATIONS - 2015

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*The opinions expressed in this document are of the authors alone and do not necessarily reflect the views of Bank of Albania on this matter.*

# C O N T E N T

# EXECUTIVE SUMMARY

- *The study project aims to re-estimate potential output, the natural rate of unemployment and the respective gaps based on existing and new approaches available in the case of Albania. Results have confirmed that potential growth has shrank and the natural rate of unemployment has increased since 2009. Re-estimations have validated past medium-term projections and monetary policy decision-making. At the same time, they assist in the orientation for structural reforms towards sustainable and inclusive economic growth.*

- *Estimation results reveal that after 2009, potential growth has not been the same as the pre-crisis period. It has approached 3% in real terms. At the same time, the natural rate of unemployment has fluctuated around 15%. The estimations reflect the weak dynamics of economic and financial indicators and feeble impacts associated with structural reforms.*

- *The study involves a set of updated statistics and methodology tools which enable testing and cross-checking between results.*

- *As the study is first in its kind for Albania and involves all current and new approaches, it helps answer the following questions: Have the estimations yielded correct decision-making inputs? – Are the results solid? – Can the estimations be elaborated further?*

Re-estimations up to 2015 are consistent with past conclusions. Potential growth after 2009 varies between 2.5-3.3% and fluctuates around an average rate of 2.9% (2010-2015). At the same time, it is estimated that the economy has performed below its potential with an average output gap at -1.1%. Potential growth has halved in comparison with the previous period (2003-2009). In the years 2003-2009, the economy had operated above potential reflecting an average output gap at +1.1%.

The presence of unexploited capacities is reflected also in the labour market. Estimations associated with the natural rate of unemployment (NAIRU and NAWRU), based on Labour Force Survey and Administrative data, point to an average rate of 15.1%, compared with the actual unemployment rate of 15.7% in the period 2010-2015. Based on administrative labour market data, NAIRU is estimated at 12% vis-à-vis the actual rate of 13.4%. Both estimations converge towards the presence of a negative gap between natural and factual rates on average terms.

A clear tendency towards gap deepening is observed since 2012 in the case of output and since 2013 in the case of unemployment with further deepening of negative gaps for both indicators in 2014. Across 2015, estimations suggest narrowing trends for both output and unemployment negative gaps.

Re-estimations conducted in the case of Albania up to 2015, advocate that the tendencies reflected in each approach are similar. Growth factors have shifted downwards with capital exhibiting higher sensitivity during the crisis and labour coupled with total factor productivity in the post-crisis.

The general convergence between estimations is further comfirmed by the comparative analysis involving several non-parametric tests.

These estimations involve uncertainties of different sorts resulting from objective-technical factors, generated by the fact that the indicators treated in this study are statistically unobservable/ un-measurable but estimated through different approaches – and also subjective factors (related to the assumptions adopted in the process).

Uncertainties further expand in times of crisis as growth factors sustain inherent shocks. This may shift downwards the level and growth rate trends in the case of both real and potential output for substantial lengths of time. Uncertainties are also present in the eventuality of structural reforms aiming to push up potential and growth levels. The intensity of such effects towards improved

balance of growth factor contributions depends on a large array of issues and processes.

*Keywords:* *Potential output, natural rate of unemployment, monetary policy, non-parametric tests, concordance statistic.*

*JEL classification:* *E23, E24, E50, C10.*

# I. INTRODUCTION

*The macroeconomic importance of the indicators.* Potential output is regarded as the sustainable level of output that an economy is able to achieve by exploiting existing factors close to the maximum level and without enduring additional inflationary pressures. The exploitation of production factors to the point where the economy is not overheated is associated with the optimal combination of labour and capital and their total factor productivity[1]. According to De Masi (1997), the potential output level and its growth rates depend on: - able body of workers and the amount of hours they can work (Labour); length of build and re-build roads, the number of building used as residence or production purposes, machinery and production lines, technology level, invested and exploited infrastructure (Capital); the efficiency of labour and capital exploitation for the purpose of incrementing unit value added (total factor productivity, TFP).

If the exploitation rate stands above or below each factor's boundary, the generated output levels would differ from potential. If both situations persist there is reason to worry as the economy would distance itself from long-term equilibria. Basic macroeconomic objectives associated with inflation, output and employment targets become harder to achieve due to factor exploitation imbalances.

If the economy outstreaches growth beyond possibilities, it would face a demand surpluss and a positive output gap. The presence of a positive outgap gap is manifested in: unemployment rates below natural levels; excessive use of production capacities; additional pressures for wage growth; increasing inflation expectations which may lead to higher inflation rates. This condition dictates for economic policy reaction for the purpose of reducing aggregate demand. The reaction could reflect lower fiscal expenditure and tighter monetary policy stance. Below potential developments would generate a negative output gap, which would manifest in: lower

[1] It is emphasized that optimality represents a different position compared with maximal utilization rate of production factors (usually lower). It involves the exploitation in appropriate proportions and away from imbalances to achieve long-term development of potential output.

employment and investment; weaker incentives for development, innovation and new jobs; less efficiency and productivity in the use of production factors. As a consequence, the economy would face weaker cyclical developments, falling aggregate demand and falling inflationary pressures. This would call for monetary easing and further policies stimulating demand.

Based on standard growth theories, potential output is associated with supply related issues. It is supported on long-term equilibrium levels of capital, labour and the respective productivity levels. Less common are demand oriented theories evolving around investment, capital accumulation and productivity.

Estimations in regard to potential output and the output gap are essential for drafting and implementing appropriate macroeconomic policies. Potential output estimations help towards establishing sustainability in terms of economic growth dynamics and growth factors. On the other hand, output gap estimations inform on the intensity of inflationary pressures suggesting future stances of monetary policy. Both estimations further assist in establishing an indicator related to the government's fiscal structural stance as budget revenues and expenditure are affected by cyclical conditions in the economy (Denis, Morrow, & Roger, 2002). Thus, one may determine the cycle adjusted budget balance[2].

The concept of potential output is closely associated with that of the natural rate of unemployment (NAIRU or NAWRU)[3]. Both indicators are applied to determine equilibria in the economy. These indicators are directly unmeasurable and therefore "unobservable". As a consequence, they are estimated via different approaches which can be simple or highly sophisticated. The debate around estimations sources precisely from the unmeasurable nature of the indicators (Laxton & Tetlow, 1992). Therefore, the estimation of output potential and output gap relates often to the separation of trend (or permanent) and cyclical (transitory) components from

[2] In the case of Albania (Gazidede, 2014) the cyclically adjusted budget balance equals factual budget balance corrected for deviations between actual and potential output. It represents the governement's structural fiscal position.

[3] NAIRU – non-accelarating inflation rate of unemployment; NAWRU – non-accelerating wage rate of unemployment.

the original GDP series (Blanchard & Quah, 1989). In this sense, potential output would reflect the trend estimation whilst output gap would be associated with the cyclical component. Various authors argue that such estimations of the output gap do not necessarily serve as representations of the business cycle although are regarded as such. As a consequence, a given value for the output gap may be debatable whether it is an expansion or contraction (Hodrick & Prescott, 1997).

Presently, there is growing evidence that output and unemployment time series bear characteristics of integrated stochastic components. Therefore, potential output and the natural unemployment rate are not regarded simply as deterministic components. Researchers believe that neither method is perfect. In this regard, there are empirical studies which state that different approaches and assumptions on output and unemployment rate potentials in a country may lead to different results. Nevertheless, in spite of different approaches, trends for unobservable variables and the respetice gaps have to converge across time.

*Structure of the study project.* The stated considerations on the importance of the estimations regarding potential output and the natural rate of unemployment are reflected upon the development of the following chapters. In the second chapter are grouped the various uncertainties pertaining to the estimation according to their nature. Apart from uncertainties related to the unobservable nature of the variables and the various technical aspects of the process, a special emphasis is placed upon additional uncertainties associated with times of crisis. Here we focus on the years of the financial crisis and EU debt crisis (2008). Chapter 3 includes the different methodologies with their pros and cons. Chapter 4 summarizes all findings related to the existing literature on estimation of potential output and the natural rate of unemployment for Albania up to 2013. Chapter 5 includes all re-estimations in regard to potential output and the natural rate of unemployment by exisiting methods and by a new approach up to 2015. Chapter 6 is dedicated to a comparative analysis of the various results based on a set of non-parametric qualitative criteria. This analysis establishes the aspects of convergence across approaches and the fields which

are more debatable. The last chapter concludes on the general trends coming from all approaches. It further emphasizes the need to apply all methodologies in the estimation process suggesting periodical re-estimations and additional advances in empirical research in this field.

# II. POTENTIAL OUTPUT AND THE NATURAL RATE OF UNEMPLOYMENT VERSUS UNCERTAINTIES

The estimation of potential output and employment represents a crucial challenge for economists, modellers and policy-makers. While the importance of such indicators on policy drafting and long-term decision-making is broadly accepted, their estimation is intricated and subject to various uncertainties.

The main difficulty which bears most of the technical related uncertainties is associated with the unobservable and directly unmeasurable nature of these macroeconomic variables. The indicators are estimated indirectly based on the latest time series information applying statistical and econometrical methodologies. The necessity to estimate is the reason for the debate concerning the validity of results. As the varibles are unobservable it is not possible to conduct a standard performance analysis.

Estimations depend on the chosen methodology. Acknowledging the advantages and disadvantages of each approach, researchers filter result through the lenses of economic judgement. On the other hand, method application depends on the length and quality of the database. Certain approaches are very sensitive to particular inputs which may be available through official statistics or not. Such inputs could be included through proxies which further add on estimation errors.

Certain approaches depend on the acceptance or not that the economy is converging towards long-term sustainable equilibrium supported by growth factors or these have shifted to different levels. Uncertainties are further exacerbated when the economy is affected from changes or structural reforms which may aim towards improved balance of growth factor contributions.

Periods of regional and global economic crises add on uncertainties as future trends of production factors are shocked. Has the crisis shifted downwards the long-term trends of potential output

and employment? Were the trends of capital and productivity affected? These questions cannot be answered when the country is about to enter the crisis as policy-makers (especially those related to central banking) have to make real-time medium term decisions. The decision-making process has to account for the output gap even though the potential output is unobservable in real time. Output and potential growth forecasts are affected by the crisis. As far as forecasts are concerned, economic uncertainties become even greater. If considerable shifts are observed, expectations and decision-making confidence are affected. Minimization of such effects is achieved through a comprehensive estimation process and expert judgement on present and expected trends of economic growth in the medium-term.

There are several reasons why growth rate or output potential levels may fall as economic uncertainties increase during periods of crisis. One of the very obvious reasons is that overall investments fall, inflicting a permanent drop of the capital stock level. This impact persists even when investment rebound to pre-crisis level in the aftermath of the crisis. If these developments are further reflected in reduced knowledge, they can negatively affect technological progress. Productivity is also impacted through various channels. As it is established that "demand fosters innovation", when aggregate demand falls, firms would invest less on innovation compared with instances when demand increases. Additionally, falling demand leads to falling employment. If employment falls below capacity, there are less chances of a natural process of "learning on the job".

This situation may have repercussions on the employment rate equilibrium and/or the labour force participation rate. As able bodies turn into long-term unemployed, their skills might weaken. At the same time, newly employed find it harder to quickly attain skills. If labour distributions mismatches are extensive between professions as a result of the crisis, labour force skills might find it difficult to adapt to the new market conditions in the after-crisis. Some workers might turn discouraged and completely exit the labour force.

If recession is synchronized between economies, permanent losses could become tremendous. When a single country enters

recession while the others maintain their production levels, tights could turn in the future as the weak economy can import technical innovation from the growing peers. On the other hand, if all or most of the economies enter recession at the same time, the overall innovation process is halted (Haltmaier, 2012).

Across the financial crisis of 2008, the global economy experienced a lasting weakening of cyclical conditions and a slowdown in productive capacities including potential output. Uncertainties were intensified further after 2008. Potential output and the output gap reflected more substantial deviations compared to projections at the start of the crisis. The following years witnessed reduction in production factors growth and downward shift in the respective equilibria due to structural changes.

Various researchers and reports from international organizations have concluded that during 2011-2013[4], economic growth rate reductions were caused not only from weak cyclical conditions in the respective economies. Weaker growth rates of productive capacities were also a factor. Economic contraction and production slowdown persisted in the years 2012-2015 (Rosnick, 2016). Structural reforms and non-conventional measures had been unable to lift potential output and potential growth to pre-crisis levels. According to (Blagrave & Furceri, 2015), "lower potential growth compared to past forecasts has become a reality". (Blanchard, 2015) would emphasize that the consequences of both crises (global financial crisis and euro area debt crisis) were visible in many countries. Low economic growth rates were having significant reprecussions on feeble financial related processes, debt repayments, the commitment of agents to invest and consume and the banks, intention to credit the economy. Real growth slowdown was a product of long-term factors which affected potential growth at the same time. According to the IMF (2015) potential output and growth dropped during the late years whilst falling potential growth was already visible in developed economies even before the crisis. The main reason for the trend was associated with population aging joined with a slowdown in total productivity. The crises further exacerbated these conditions as investments shrank further adding

[4] (ECB, 2011); (IMF, 2010); (IMF, 2013a); (IMF, 2013b); (IMF, 2013).

to capital growth slowdown.

According to IMF projections, the after-crisis could feature expanding trends for capital. However, population aging and weak productivity growth will still weight down potential growth. These impacts are more emphasized in developing economies where population aging, low capital accumulation and weak productivity growth have combined to produce a lower potential growth in the future. In Central, Eastern and South-eastern Europe, the significant fall in potential growth was driven mostly by lower TFP contributions and weaker investment. At the same time, potential employment was adversely affected by demographic factors as well as lower job creation rates associated with contracting investment. In the period 2015-2016, this perspective was re-enforced by two additional factors affecting the global economy: falling oil prices and large exchange rate fluctuations.

Under these circumstances, estimations and forecasts for real growth, potential growth and the output gap were continuously revised downwards in the years 2011-2015 (IMF, 2016). This tendency demonstrates for the large difficulties that the economies had to face during and in the after-crisis. Secondly, these difficulties have generated additional uncertainties in the estimation of future economic equilibria associated with potential output, potential growth, the natural rate of unemployment and the respective gaps.

*Table 1. Potential growth: before, during and after the crisis based on IMF forecasts*

| | Until 2007 | 2008-2014 | 2015-2020 |
|---|---|---|---|
| Developed countries | 2.25% (2001 -2007) | 1.3% | 1.6% |
| Developing countries | 7.2% (2004-2007) | 6.5% | 5.2% |
| CESEE* | 5.2% (2003-2007) | 1.5% | 2% (2011-2015) |

Source: IMF (2013, 2015, 2016). Note: Countries belonging to Central, Eastern and South-Eastern Europe.

The estimations demonstrate that real economic growth slowdown was only partially related to cyclical conditions. Mostly it was a consequence of potential output slowdown reflecting inherited structural imbalances in these countries.

## III. ESTIMATION APPROACHES

The methodologies applied in the estimation of potential GDP, potential growth rate or the natural/structural rate of unemployment follow three general flows. The first group includes the structural approaches. They are based on a simultaneous modelling of wages and prices where potential output/the natural rate of unemployment are determined as corresponding to a general or partial equilibrium (L'Horty & Rault, 1999). Based on this specification, the unobservable variable is generated after all short-term and long-term impacts are accounted for and is regarded as a long-term growth rate or natural rate of unemployment.

Although the approach takes into consideration the structural relationships between inflation and potential (unemployment), there is a broad debate on the appropriate structural model. Mostly, it concerns the long-term impacts associated with interest rate changes, taxation and productivity over real wage (Rowthorn, 1999). Structural models also include substitution elasticities between capital and labour which are also part of the debate. Lastly, further concern is raised as the same variables are included in both wage and inflation modelling.

Additional problems are associated with specification. Structural models require the availability of a large set of variables able to capture both short-term and long-term shocks making results very sensitive to the set of different combinations (Turner, Boone, & Giorno, 2001). At the same time, the estimation of long-term impacts requires the inclusion of institutional variables which are very hard to express quantitatively and are not regularly reported in long-term statistics. In the estimation of long-term potential and natural unemployment rates, such variables cannot be omitted from the model (Blanchard & Wolfers, 1999). Ultimately, structural methods are unable to produce a precision statistic in the form of error terms. For all the reasons mentioned above, the structural approach is not applied for real time estimations and is characterized by long time lags.

The second group includes purely statistical approaches. These models assume that potential output/the natural rate of unemployment fluctuate around actual levels and self-equilibrating forces are able to bring the actual rate to trend levels. In other words, output and unemployment are subdivided into trend and cycle components (where the trend represents the potential or the natural rate of unemployment). Statistical approaches take the shape of moving average filtrations (Hodrick & Prescott, 1981), linear trend or pure random walk process (Watson, 1986).

A positive aspect of these approaches is associated with the speed and easiness of producing real term estimations. On the other hand, they suffer from considerable shortcomings. First, potential structural relations between inflation and potential (unemployment) are entirely disregarded and only the unemployment rate or the GDP level is applied in generating the trend parameters. Therefore, estimated series are unable to explain inflation developments which is the first indicator demanded from policy-makers. Additionally, the filtration suffers from end-sample bias as the model aims to close the gap between trends and actual figures (this disadvantage can be mitigated by adding some observations beyond the end of the sample). Estimations are also very sensitive to the time series and initial calibration. In the end, as in the case of structural models, statistical approaches are unable to generate an error term.

The third and last group includes reduced form or intermediate approaches (semi-structural or hybrid). These models aim to take the best from both structural and statistical approaches trying to correct as many disadvantages as possible. As in the case of structural models, the relationship between inflation and potential/unemployment is taken into consideration via a Phillips curve equation (with or without expectations included). On the other hand, long-term shocks are omitted generating therefore a short-term series for potential/ structural unemployment and thus correcting many issues associated with the specification of structural models.

The similarity with statistical models is associated with the need to establish a certain path for potential/natural rate of unemployment. A common assumption is the existence of a constant term throughout the years (Estrella & Mishkin, 1999). This practice is applicable when potential and the natural rate are deemed to be very stable across the years but not when sharp differences occur between periods (Setterfield, 1992).

Elmeskov (1993) proposes a reduced form of the Phillips curve in estimating the natural rate of unemployment as related with wage inflation. Although the approach is rather simple and enables consistent real-time estimations, the need to have smoothed wage times series is criticized as it tempers with the inflation-unemployment relationship (Holden & Nymoen, 1998).

An alternative reduced form approach which attempts to correct some of the issues mentioned above is associated with the state-space model incorporating Kalman Filter. It is based upon a Phillips curve equation enabling simultaneously the estimation of the curve equation and potential (natural rate of unemployment). The natural rate of unemployment (potential level) is time variant and is estimated in such way as to explain inflation movements in concordance with initial restrictions. Restrictions are placed on the potential (natural rate of unemployment) path equation including the volatility of the series. Therefore, it is not necessary to accommodate for all variables affecting inflation. The most common approaches include *the pure random walk, random walk with a constant* and the first order autoregressive process [AR(1)].

An important advantage of the reduced form with Kalman Filter is the ability to generate error terms for the estimated series, considering the maximum likelihood technique involved (Staiger, Stock, & Watson, 1997). It is clearly an advantage compared with the other methods. It further enables to differentiate between short-term and long-term potential (natural unemployment). Additionally, the formulation is far simplier compared with structural models as does not require the inclusion of sophisticated long-term impact affecting institutional variables. Compared with statistical models, Kalman Filter eliminates the end-sample bias characterizing HP filter.

Nevertheless, the reduced form does bear disadvantages. The omission of various variables affecting inflation diminishes the general structural relationship. Furthermore, the results are very sensitive (as in the case of structural models) to the set of explanatory variables included and above all to the path and the restrictions placed upon the potential/natural unemployment series (determined in advance).

*Table 2. Summary of estimation approaches*

| Structural models | Purely statistical models | Reduced form models |
|---|---|---|
| • Potential/natural rate estimated as equilibrium conditions<br>• Long-term horizon<br>• Structural model debatable<br>• Substituion elasticities for K & L<br>• Common variables included in both wage and inflation modelling<br>• Large set ot explanatory variables to capture short-term and long-term shocks<br>• Does not generate error term statistics | • Potential/natural rate derived through filtration or random walk process<br>• Easy to use and generate real-time estimations<br>• Structural relationship disregarded<br>• End-sample bias<br>• Estimations sensitive to time series and initial calibration<br>• Does not generate error term statistic | • Hybrid between structural and statistical approach<br>• Inflation-unemployment/ potential relationship considered via Phillips curve equation<br>• Short-term horizon<br>• Path for estimated variable<br>• Error term generated |

Source: compiled by the authors.

# IV. STUDIES INVOLVING POTENTIAL OUTPUT AND THE NATURAL RATE OF UNEMPLOYMENT IN THE CASE OF ALBANIA

*The approaches applied in the case of Albania include statistical and semi-structural methodologies for potential output and/or the natural rate of unemployment. Statistical methods of Hodrick-Prescott (HP) filter and linear trends were the first to be applied. Later, Esmelkov derivation featuring production function were included in two studies. In the recent years, semi-structural approaches in the form of state-space models incorporating Kalman Filter in univariate or multi-variate variations were also applied. Purely structural methods have not been applied as of yet in the case of Albania. These methods represent a clear challenge for the future based on data availability. The different materials are summarized individually and ranked based on coverage time-span and publication time.*

Alternative methods of estimating potential output in Albania (Kota, 2007)

In this material, the author attempts to estimate potential output and the output gap in the case of Albania in the period 1996-2006 based on three methodologies: linear trend, HP filter and production function incorporating a natural rate of unemployment based on the NAWRU concept. In the first two approaches (linear trend and HP filter), only the real quarterly GDP time series is adopted in the process. In the case of the third approach, estimations are based on a Cobb-Douglas production function including labour (as the number of people employed) and capital (as the real capital stock) with calibrated parameters at 0.7 and 0.3, respectively. The inclusion of the real GDP series in the function enables the determination of total factor productivity (TFP) as a Solow residual.

In order to generate the potential series, transformations are applied on the labour and TFP series. In the case of labour, a natural rate of unemployment based on Esmelkov (1993) derivation is estimated outside the production function taking into consideration actual unemployment and the nominal wage. The rate enables to

determine the optimal level of utilization of labour as a condition when the actual rate of unemployment equals the natural one. At the same time, the potential TFP series is derived by applying an HP filter on the actual series derived as residual from the production function. The two indicators are included in the production function to generate the potential GDP. In the end, all series pertaining to potential output and the output gap are compared across methodologies.

Linear trend approach estimates potential growth at 8% on average for the entire sample. On the other hand, the HP filter estimates a potential growth at 5.3% in the early sample (1997) reaching 9.3% in 2002. Across the years 2005-2006, potential growth drops at 7%. According to the production function approach, potential growth stands at 6% in 1998 and reaches 12.6% in 2003. At the end of the sample (2005-2006), potential growth is estimated at around 7.8%.

In terms of the natural rate of unemployment, the method applied estimates the rate at 15% on average across the entire sample and at 13% in the years 2005-2006. Based on these estimations, the actual rate stands above the natural one until 2001. In the years 2001-2005, unemployment stands below the structural level, shifting again above natural unemployment at the end of the sample.

Exploring the main determinants of the potential growth trend in Albania during 2003-2013 (Çeliku, 2014)

Potential output, potential growth and the output gap are estimated applying HP filter, linear trend and production function in the period 2003-2013. Apart from the series *per se*, the material further addresses issues related with structural breaks and the general integration of these estimations with the overall macro-economic analysis. The general inputs include quarterly Gross Value Added and the capital stock. The number of employed and the rate of unemployment are new statistics from labour force survey data published from INSTAT since 2012. Before 2012, the unemployment rate is generated based on the fluctuations of the administrative data on the unemployment rate and applying

a common difference between the two rates as in the years when statistics are available.

In the case of the production function, the same principle as in the case of Kota (2007) is applied. The differences concern two aspects: labour and capital parameters and the method applied in the estimation of the natural rate of unemployment. Three different combinations are applied on the factor parameters: 0.7 and 0.3; 0.8 and 0.2; 0.9 and 0.1 on labour and capital, respectively. The most appropriate combination is deemed the one with parameters 0.8 and 0.2 which is also suggested by the literature on developing countries (Denis, Morrow, & Roger, 2002). Labour rates have been slightly increasing for these countries. One reason that helps explain these developments in Central and South-Eastern Europe (CSEE) is that post-transition years, which often were coupled with correction processes, featured a gradual reduction of the high productivity contributions on economic growth. These "relative losses" in productivity were compensated mostly from relative growth in labour factor contributions. In the same study, the natural rate of unemployment based on the NAIRU concept was generated via the Esmelkov (1993) derivation including the Consumer Price Index. The rate was later applied to determine potential labour utilization rate.

Results indicate that the generally positive output gap in the mid-2000s was reduced gradually in the period 2009 Q3-2011 Q3. Since 2011 Q3, the output gap turned negative and expanded downwards. The average gap rate in the period 2011 Q4-2013 Q4 is estimated at -0.4%.

Structural break tests suggest the presence of such break after 2009 in the case of all three estimated series. At the same time, the joined macro-economic analysis demonstrates that medium-term potential growth will be at most 3% depending on factual and expected trends in production factors. It is argued that potential growth is constrained at such level because: (i) the natural population growth has slowed down; (ii) capital growth is minimal due to mild investment opportunities, financial resources and increased uncertainties; (iii) only limited gains are expected in terms

of innovation and technology as structural and education reforms take time to generate tangible results for real and potential growth.

Natural rate of unemployment – reduced form approach (Çela & Skufi, 2014)

In this study, the natural rate of unemployment based on the NAIRU concept is estimated according to a State-Space model featuring Kalman Filter applied in the years 1998-2012 (quarterly data). The model incorporates a Phillips curve equation with the unemployment gap as one of the explanatory variables of inflation. The natural rate of unemployment path is calibrated as a pure random walk and the model is able to estimate the Phillips curve parameters and determine the NAIRU time series. This series is further incorporated into the MEAM macromodel production function (with parameters for labour and capital se at 0.7 and 0.3, respectively) to obtain potential GDP (only labour deviations affect the differences between potential and real GDP) and estimate the output gap.

According to the results, the unemployment gap (and therefore the output gap) suggests for an economy operating below potential in the early sample (output gap estimated at -3% in the years 1998-2001). The negative output gap has contracted gradually (estimated at -0.6% in the years 2002-2003) to close in the years 2003-2004. The economy has operated above potential in the years 2005-2009 (output gap estimated at 0.4%) reaching slightly higher levels in the years 2006-2008 (0.5%). After 2009, the economy has operated below potential featuring expanding gaps. Output gap is estimate at -0.12% in 2010 and reached -0.4% in 2012.

Estimating Potential GDP during the Crisis: The Albanian Case (Yzeiraj & Abazaj, 2014)

The material attempts to determine the potential in the economy through a State-Space model with Kalman Filter in the years 2000-2012. Differently from the previous contribution, the approach includes multiple filtration processes and a larger set of macro and micro-economic variables.

Results indicate that the economy has operated below potential since 2008 and the negative output gap has expanded. As a consequence, potential growth rate has shrunk and fluctuates around 3% in 2012. At the same time, the unemployment rate stands 2-3 percentage points above the natural rate since 2009 [similar estimations from Çela & Skufi (2014)]. Results confirm that the Albanian economy was affected from the global crisis validating the increasingly accommodative monetary policy stance adopted in the post-crisis years.

# V. RE-ESTIMATIONS BASED ON EXISTING AND NEW METHODOLOGIES

*This chapter involves the update of the respective estimations (for potential output as well as the natural rate of unemployment) based on more recent input time series. In this aspect, the input time series are first described (section V.1) and afterward we proceed with the updated estimations (section V.2). As the natural rate of unemployment in some cases is used as an input for potential output, results pertaining to this indicator are discussed first. Potential output estimations follow. Section V.3 includes results according to a new approach – the direct approach – which has not been treated in the existing literature. According to this approach, potential output and the output gap are estimated based on direct survey data on capacity utilization rates.*

## V.1. DATABASE

### LABOUR MARKET INDICATORS

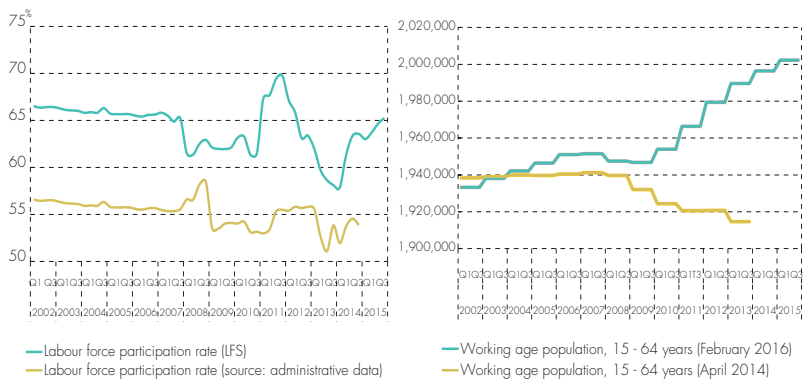
A special emphasis is dedicated to the choice of labour market indicators as official statistics on the labour market are generated from two sources (administrative data and survey based data) which cover different time-spans and are mainly subject to methodological reviews.

The administrative source provides data on the number of unemployed, number of employees (in the public and non-agricultural private sectors[5]) and the unemployment rate on a quarterly frequency. In regard to the most important labour market indicator, the quarterly registered unemployment rate, the approach has the advantage of covering a large horizon (since early 1990s) and therefore, it represents an appropriate indicator for conducting econometric analysis. On the other hand, the time series bears structural breaks due to methodological shifts creating therefore difficulties in generating the output gap.

[5] Data on private agricultural employment are obtained solely from the survey.

The other source of information, the Labour Force Survey (LFS), represent a survey conducted by INSTAT at family level for the purpose of obtaining information regarding labour market developments. It bears certain advantages: the larger array of indicators, data is generated from the same source, avoidance of double-counting, better assessment of employment in agriculture and informal employment as well as the ability to conduct comparisons of the indicators through time and between economies. The Labour Force Database has an annual frequency during the period 2007 – 2011, and has been enriched at a quarterly frequency starting from 2012. Acknowledging that the advantages related to the LFS supersede the shortcoming associated with the time-span, potential output estimations include these data as input.

Chart 1 Labour force participation rate and working age population (15 – 64 years old)




Source: INSTAT and authors'calculations.
*Refers to average annual population which remains constant in all four quarter of each year.

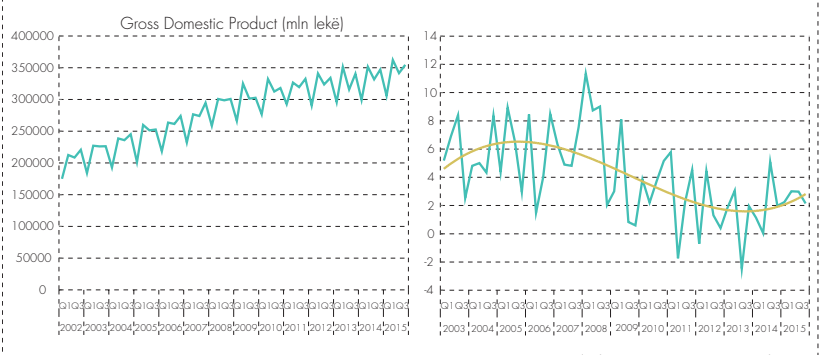
The unemployment rate from the LFS is assessed by INSTAT on an annual basis for the years 2007-2011 and in quarterly fashion since 2012. In order to include this time series in the estimation, before 2012 the indicator is adjusted to reflect quarterly registered fluctuations of unemployment in the series the general gap between the two time series. Another indicator used in the estimation of potential output, which has required judgement and assumptions, concerns the labour force participation rate. As in the case of

unemployment, this indicator is reported on annual basis in the years 2007-2011 and on quarterly basis since 2012. Before 2012, the series in accommodated to reflect fluctuations from the measured quarterly labour force parcitipation rate[6] and the participation gap between the two sources. We further emphasize that according to the 2011 Census of Population and Housing in Albania, the working age population time serie was revised and this was reflected on the labour force participation rate indicator as well.

## GROSS DOMESTIC PRODUCT

In the latest estimations are applied the new quarterly Gross Domestic Product (GDP) time series published by INSTAT since July 2015. Quarterly GDP is reported from the production approach stretching since 2008 for current prices data and since 2009 for real terms data. Prior to 2009, the GDP series has been backcasted applying existing annual GDP data on current and previous year prices, gross values added data to enable quarterly interpolation and chain link annual overlap[7] to maintain consistency with official statistics.

Chart 2 Real GDP and annual changes




Source: INSTAT and authors' calculations.

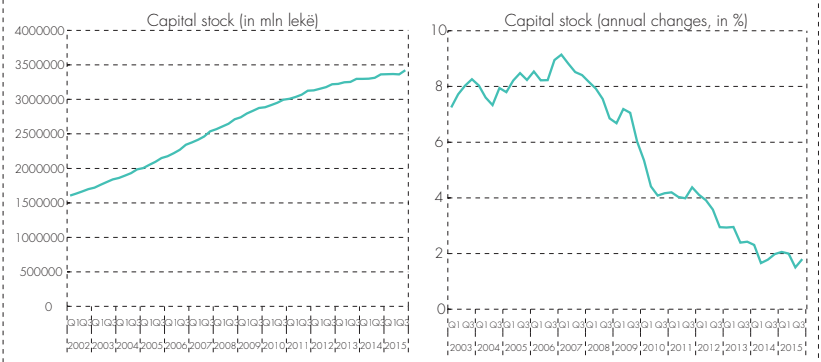
[6] Calculated as the ratio of able registered labour force over working age population. In the absence of working age population the average annual population (based on Census data) was applied constant in all quarters.

[7] "Annual overlap" is applied by INSTAT to achieve quarterly time series chain-link.

### CAPITAL STOCK

The construction of the capital stock serie included the initial assumed capital stock in 1996[8], gross fixed capital formation data (annual data and quarterly data for the period 2009-2015 published by INSTAT since July 2015), proxy indicators and assumptions in estimating a quarterly times serie before 2009 and the assumed annual amortization rate at 2%. The following graph includes the applied capital stock time serie.

Chart 3 Capital stock




Source: INSTAT authors' calculations.

## V.2. RE-ESTIMATION RESULTS

### V.2.1. RE-ESTIMATIONS: NATURAL RATE OF UNEMPLOYMENT AND THE UNEMPLOYMENT GAP

In principle, potential output and the natural rate of unemployment constitute the long-term trends of both indicators. Short-term fluctuations above and below such levels do not constitute substantial problems that put into question long-term equilibria. In addition, these levels are not achieved necessarily at the same time because of the different dynamics characterizing the markets: production of good and services and the labour market.

[8] Referring to the value considered in the study of (Kota, 2007).

The difficult part is the variation in terms of estimations. It is understandable that different approaches produce different estimation outputs from the quantitative point of view. Nevertheless, the trends should somehow converge. Therefore, it is necessary to estimate not only the output gaps[9], but also the unemployment gaps[10].

The latest estimations for potential output, potential growth, NAIRU and NAWRU and the respective gaps point out that in the case of Albania, the cyclical weakness after 2009 has first affected the market of production of goods and service and afterwards the labour market. The potential growth after 2009 is estimated at around 3%; halved compared with pre-crisis years. Therefore, the negative output gap pursued an expanding trend until mid-2014 with this tendency slowing down afterwards. Faced with this development, the labour market was slower to react in first years of the post-crisis. That was due to some relative flexibility associated to the presence of informality in this market.

The unemployment gap first fluctuated around zero and marginal negative values up until the first half of 2012. This conclusion is based on different approaches and different time series on unemployment available from INSTAT[11]. Mild fluctuations in negative territory left way to substantial negative values in the years 2013-2015 (table below). Two of the approaches (according to the Elmeskov derivation - semi-structural or hybrid – columns 2 and 3) suggest a narrowing of the unemployment gap. On the other hand, the multi-variate approach (Kalman filter – column 1), suggests for larger negative gaps without any narrowing tendency.

[9] Difference between actual and potential output as percentage on potential output. Negative/positive gap indicates that the economy operates below/above potential.

[10] As difference between NAIRU or NAWRU with the published unemployment rate. Negative/positive gap indicates that the labour market operates below/above potential.

[11] Administrative and Labour Force Survey unemployment data.

The estimated natural rate of unemployment has grown after 2009, suggesting the need for corrective measures through structural reforms in the labour market.

*Table 3. The natural rate of unemployment and the unemployment gap according to different approaches*

| Year | Factual and estimated intigators related to the labor market | Estimating approaches for the natural rate of unemployment | | |
|---|---|---|---|---|
| | | NAIRU*** (Kalman Filter) (1) | NAIRU ** (Elmeskov non-accelerating inflation) (2) | NAWRU **[1] (Elmeskov non-accelerating wages) (3) |
| 2013 | Natural rate (%) | 12.2 | 15.5 | 15 |
| | Factual rate (%) | 13.5 | 16.4 | 16.4 |
| | Unemployment gap (pp) | -1.3 | -0.9 | -1.4 |
| 2014 | Natural rate (%) | 10.1 | 16.4 | 15.9 |
| | Factual rate (%)* | 13.3 | 17.9 | 17.9 |
| | Unemployment gap (pp) | -3.2 | -1.5 | -2.0 |
| 2015 | Natural rate (%) | 10.1 | 17.2 | 16.9 |
| | Factual rate (%) | 13.3 | 17.5 | 17.5 |
| | Unemployment gap (pp) | -3.2 | -0.3 | -0.6 |

Source: INSTAT and authors' calculations. * INSTAT, actual unemployment rate associated with the age group 15-64 years old according to the Labor Force Survey; ** Authors' estimations of NAIRU and NAWRU based on LFS data for 15-65 years old age group data; *** Estimated on unemployment time serie from administrative data (INSTAT).

[1]NAWRU estimated based on approach advance by (Elmeskov, 1993). It suggests a time varying natural rate of unemployment with short-term equilibrium depending on historical unemployment and wage growth rate. $NAWRU = \phi(L)U - \frac{\phi(L)U - \Delta^3 logW}{\Delta^2 logW}$ (where $\phi(L)$ refers to four quarters lags as labour market developments affect wage level after some time in the future, W denotes average wage index; Δ denots the difference operator; - Hodrick – Prescott filter applied on the series to minimize the impact of transitory shocks on the Phillips curve.

## IV.2.2. RE-ESTIMATIONS: POTENTIAL OUTPUT AND THE OUTPUT GAP

### IV.2.2.1. LINEAR TREND AND HP FILTER

The linear trend approach was applied upon two periods separately: 2001 Q1-2009 Q3; 2009 Q4-2015 Q4. The Chow-Breakpoint test suggests the presense of structural breaks in the GDP

time series: from 2009 Q3. Trend coefficients associated with seasonally adjusted GDP level logarithms, fall from 0.013 in the first sub-period to 0.004 in the second. This approach points out to a more substantial slowdown compared with estimations ending in 2013 (Çeliku, 2014). Results indicate a negative output gap since 2009 (-0.2%). It expands to -0.5% and -0.4% in 2013 and 2014, respectively. As for 2015, results indicate a minor negative gap close to the zero level.

Estimations according to HP filter point towards a situation very similar to linear trend estimations. The output gap turns negative in 2010 (-0.3%) and deepens in the following years to reach -0.9% in 2013. The gap follows a narrowing trend in 2014 (-0.6%), whilst in 2015 reflects a marginal positive value.

*Table 4. Average output gap according to linear trend and HP filter estimations (simple average according to the methods)*

| Period | Average output gap (%) |
|---|---|
| 2003-2008 | 0.4 |
| 2009-2015 | -0.3 |

Source: Authors' estimations.

### V.2.2.2. PRODUCTION FUNCTION APPROACHES

As explained in the research contribution (Çeliku, 2014), the method estimates potential output and growth based on production factor utilization. The approach includes the same assumptions and production function parameters (0.8 and 0.2) with the same derivation of the natural rate of unemployment (NAIRU – Elmeskov). However, it was applied on new set of time series.

The new and revised time series touch upon all potential output factors and auxiliary observable, un-observable and estimated variables. In spite of input data revisions, the fall in potential output level and growth after 2009 is confirmed once again. The output gap turns negative at -0.9% in 2009 and further deepens at -3.5% in 2015.

At the same time, estimations are conducted based on Kalman Filter (Çela & Skufi, 2014) natural rate of unemployment included in the MEAM production function. In this case, the output gap turns negative in 2009 (-0.1%) and expands to -2.5% in 2014. The output gap reflects similar figures in 2015.

*Table 5. Average output gap based on production function approaches*

| Period | Average output gap (%) |
|---|---|
| 2003-2008 | 1.8 |
| 2009-2015 | -2.0 |

Source: Authors' estimations.

*INFORMATIVE BOX 1: FACTOR DISAGGREGATION OF REAL AND POTENTIAL GROWTH: 2000-2015.*

*Production function estimations enable factor disaggregation of potential and real growth*. According to the estimations, potential growth has shrunk substantially since 2009 as a result of falling contributions from all factors. The largest slowdown is reflected in capital stock. Investment decrease coupled with falling capacity utilization rates, transmitted negative signals to the labour market and adversely affected potential employment. The last indicator was affected not only from the growth in the natural rate of unemployment but also demographic developments which halted past growth rates in working age population.*

*The combined factor contribution on real growth dropped by 1.9 percentage points on average between the two sub-periods. This tendency also affected potential growth as the combined factor contribution dropped 1.7 percentage points in the second sub-period compared with the previous one.*

*Table 6. Factor disaggregation of real and potential growth*

| Subperiod | Economic growth (%) | | Factor contributions on real and potential growth (pp) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Capital stock | | Labor | | TFP | | Combined factor* | |
| | Real | Potential | Real | Potential | Real | Potential | Real | Potential | Real | Potential |
| 2000-2008* | **6.1** | 6.2* | **3.0** | 3.0 | **0.9** | 1.1 | **2.2** | 2.1 | **3.9** | 4.1 |
| 2009-2015 | **2.4** | 3.3 | **1.3** | 1.3 | **0.7** | 1.0 | **0.4** | 1.0 | **2.0** | 2.3 |

Source: Authors'estimations. Note: *The higher growth rate of potential GDP compared with real GDP in the years 2000-2008 is attributable to the higher investment (capital) contributions in 2007-2008 (infrastructural investment)

*The fall in combined factor growth was a result of reduced total factor productivity (TFP) contributions both in real and potential terms. The slowdown in TFP trend was already observed in 2002 when the factor no longer spearheaded economic growth as it did prior to the 2000s. Such phenomenon was not constrained only in Albania. Various authors have uncovered falling TFP contributions on economic growth in other transition economies as well. That was due to the gradual fading out of the positive impacts associated with resource re-allocation after the main transition/ converge phase came to a close. As a result, TFP contributions on GDP growth halved after 2000 compared with the previous period (IMF, 2015). Additionally, the two crises – financial and debt in PIIGS – produced supplementary burdens. Incentives for research, development and innovation were substantially constrained in the economies affected by the crisis (including Albania).*

** (Khan, 2004); (Çeliku & Kodheli, 2016); (World Bank, 2009).*

### V.2.2.3.SUMMARY OF RESULTS CONCERNING THE OUTPUT GAP

Estimations results support a common tendency in regard to output gap dynamics. Following a period of performance above potential in the years 2003-2008, the economy has shifted towards a negative output gap since 2009. The negative gap has deepened dropping to an average -1.9% in 2014 (average of all approaches). Estimations suggest that the output gap has shrunk but remains in negative territory throughout 2015 (-1.5% according to all approaches).

*Table 7. Average output gap according to all approaches*

| Period | Average output gap (%) |
|---|---|
| 2003-2008 | 1.1 |
| 2009-2015 | -1.1 |

Source: Authors' estimations

Aside from the general tendencies it is important to emphasize differences in terms of output gap magnitudes. Production function based approaches tend to produce larger margnitudes compared with statistical methods. It is important to remind that semi-structural approaches (production function related) are considered as technically more accurate since they take into account for additional factors compared with statistical approaches. On the other hand, statistical methods tend to follow the tendency of the input serie (real output) and do not take into consideration further factors affecting potential (as prices and wage dynamics).

In terms of potential growth, estimations suggest a drop of the general rate from 6% in 2003-2008 down to 2.9% in 2009-2015. Similar considerations in terms of differences between methodologies apply as in the case of output gap. Statistical methods suggest larger drops in potential growth in the second period (down to 2.7% on average). On the other hand, semi-structural approaches suggest a more contained decrease to 3.2% in the years 2010-2015.

## V.3. NEW APPROACH – SURVEY BASED

The output gap can be estimated through survey data which enable a direct determination of the indicator (omitting models and particular techniques) and are not subject to revisions[12]. The approach follows the guideline provided by Chagny & Döpke (2001) which attempt to estimate potential output based on business survey information on capacity utilization rates. The authors explain that in the short-term, the technology adopted in the production process is not altered. As a result, supply could be limited from capital stock and labour. If output is constrained from capital, it is possible to estimate potential growth from survey data. According to this approach, potential output is determined as the product of actual GDP with the ratio of capacity utilization rate under the absence of frictions in the market of goods and services over the capacity utilization rate derived from survey data[13] (Formula 1).

$$Y_t^* = \frac{CAP^*}{CAP_t} * Y_t \qquad (1)$$

Where, $CAP_t$ - denotes the capacity utilization rate in the economy in quarter $t$; $CAP^*$ - capacity utilization rate under the absence of frictions in the market of goods and services (following Chagny dhe Döpke, even in our case it calculated as the average figure for the entire time period when data on capital utilization rate is available from surveys); $Y_t$ – denotes GDP in quarter $t$; $Y_t^*$ - denotes the estimated potential output.

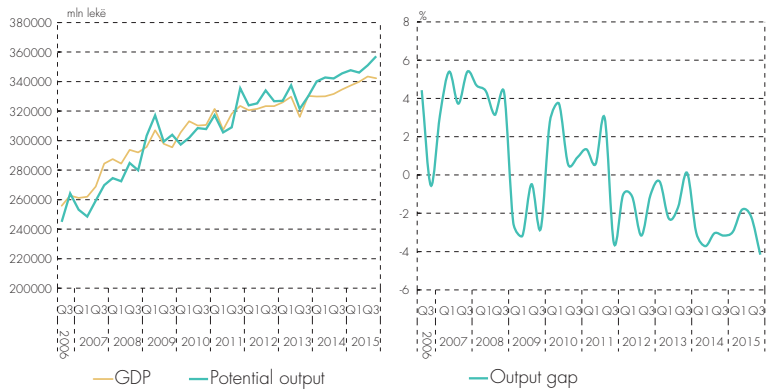
This approach features certain disadvantages. As Chagny dhe Döpke argue, volatility in capacity utilization could be interpreted as volatility in potential output. In our case, as series are seasonally adjusted and the average utilization rate is included as input, volatility is partially smoothed out. The other argument concerns the choice of the utilization rate in absence of frictions in the market of goods and services. Chagny and Döpke highlight that in most empirical studies applying this approach, $CAP^*$ has been

[12] Survey data is not subject to revision.

[13] Estimatios are based on seasonally adjusted time series for quarterly GDP and capacity utilization rate. The capacity utilization rate time serie begins in 2006.

approximated by the average capacity utilisation rate for the period of time under analysis.

Chart 4 Potential output and the output gap according to survey based estimations



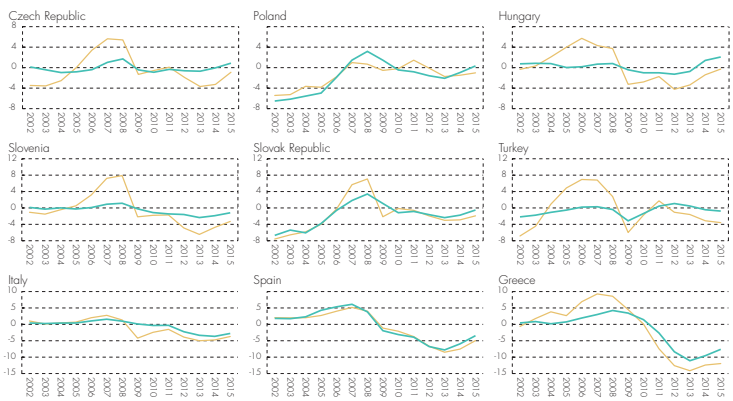

Source: INSTAT, Bank of Albania, Authors' calculations.

Survey based estimations suggest that average potential growth fluctuated around 4.1% on average in the period 2007 Q3-2009 Q4. The rate dropped to 2.4% in the period 2010-2015. As for the output gap, figures fluctuated around negative territory in 2009 and remained persistently so since 2012. Average output gap is estimated at 2.1% in the period 2006 Q3-2009. In the years 2010-2015, the output gap turned into a negative average of 1.1%.

*INFORMATIVE BOX 2. OUTPUT AND UNEMPLOYMENT GAPS IN DIFFERENT COUNTRIES*

*Certain economies were selected from the OECD estimation database to produce a comparative framework on output gap and unemployment gap dynamics* (Chart 5). Estimations demonstrate the presence of negative output gap values since 2009. At the same time, even though economies have operated below potential in the years 2014-2015, the negative output gap has reflected a narrowing tendency. These signals are further confirmed from unemployment gap dynamics**, which suggests the same cyclical weaknesses as the output gap.*

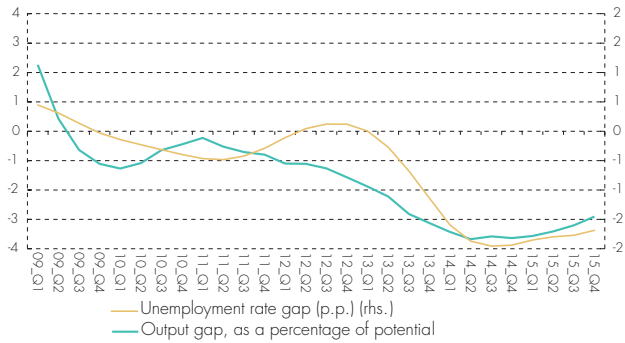
Chart 5 Output and unemployment gap in certain OECD economies




Source: Economic Outlook no. 99 dataset, June 2016. OECD.

*Similar trends are observed in the case of Albania's re-estimations which confirm negative output and unemployment gaps since 2009. In general, the crisis shifted downwards the long-term trends of potential growth and the respective factor contributions, hitting capital accumulation first. Productivity and labour market trends displayed higher sensitivity in the aftermath. The trends shifted downwards pulling down long-term equilibria as well.*

Chart 6 Output and unemployment gap - in the case of Albania (moving average)*




Source: Authors'estimations presented in the Monetary Policy Quarterly Report, 2017 Q1. Average estimations from all approaches. 4 quarters moving average applied.
(*) Fluctuations observed in the period 2012 Q3-2013 Q2 reflect methodological changes in the measurement of the unemployment rate.

** The output gap calculated as difference in percentage between level actual GDP and potential GDP. OECD applies the production function approach incorporating estimations on capital stock, labour supply, total factor productivity and equilibrium unemployment rate (NAIRU – Non accelarating inflation rate of unemployment).*
*** Calculated as the difference between NAIRU (estimated by OECD based on Phillips curve specification incorporating Kalman technique) and the actual rate of unemployment for each economy.*

# VI. A COMPARATIVE ANALYSIS OF OUTPUT GAP ESTIMATIONS IN ALBANIA

Output gap is used in the analysis of economic developments in several aspects. As a result it is difficult to identify a unique criterium for choosing the best estimated series of output gap. At a certain extent the process of selecting one output gap series is a function of the purpose of its use in a time frame horizon. If in the focus of the analysis are economic developments and forecasts in the short term, than generally it is of more importance to look at the estimated output gap in the last period of time. Otherwise, if the analysis examines long term tendencies, there is higher interest in the estimation of output gap in specific sub-periods, shifting the focus from the estimation of recent years.

Output gap series vary in accordance to the methods used in estimation and are vulnerable to specific features of the models, as well as of the time period under which the estimation is carried over. Canova (1998) argues that methods can generate output gaps that are comparable between techniques, but that show considerable differences in the size of the estimated gap. For example, statistical filters assume that on average output gap will be closed along the period under scrutiny. On the contrary, this is not assumed in the production function and structural models, which ensures a relatively more precise estimation of the size of the output gap. However, as also (Dupasquier, Guay, & St-Amant (1997) underline, the output gap amplitude variation in a certain period is lower compared to the uncertainty surrounding the estimation of such unobserved variable. This requires that the model results should not to be interpreted mechanically, pointing out as a result the importance of judgement in the process of using output gap estimations.

The analysis that follows aims to examine potential similarities between various estimations of the output gap in Albania, regardless of the differences between the applied methods[14]. The analysis

[14] In this part of the analysis, the estimated output gap from survey data is not included as it does not cover the same time period. More specifically, in the part that analysis the identification of turning points, the duration of the cycle phases, the severity and symmetry.

follows the work of Scott (2000) in comparing different estimations of output gap. Taking into consideration that output gap represents the key indicator in the analysis of the cyclical position of the economy, the estimated series of the gap are compared based on the non-parametric statistical tests in terms of turning points, average duration of the cycle, symmetry and severity of the cycle, as well as the co-movement of gaps.

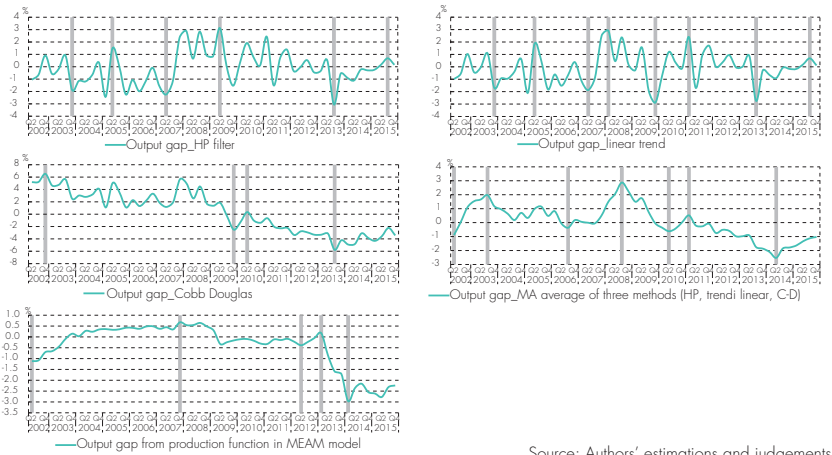
Initially, it will be assessed whether different output gap estimations suggest the presence of the same cycle. For each of the gap estimations are identified the maximum (peak) and minimum (trough) points. The maximum point of the output gap is the highest value during times the gap results positive, and the contrary prevails in the case of minimum points. This rule has been modified for the output gap estimations according to statistical filters and to the estimation as the average of three methods[15], in order to smooth out fluctuations. Chagny dhe Döpke (2001) explain that a high degree of volatility of the output gap poses difficulties in the process of identification of turning points (maximum and minimum values). However, it should be noted that this rule remains subject for discussions regarding the size or the exclusion of certain values of the gap. For example, positive/negative values of the output gap in only one quarter have not been treated as maximum/minimum values. Also, in the cases when maximum/minimum values identified for a quarter have been followed from a minimum/maximum value, the minimum/maximum for the output gap has been considered the one after at least two quarters. In addition, a cycle refers to the period of time that includes an expansion phase (from trough to peak) and a contraction phase (from peak to trough).

Results show that the number of peaks/troughs varies according to the methods applied in estimating output gap, suggesting relatively different cycles during the period 2002 – 2015 (Chart 7). More concretely, the estimated output gap computed as the average of three methods suggests the presence of three cycles, while the estimation based on the Cobb – Douglas production function of

[15] Output gap is estimated as an average of the results from HP filter, linear trend and Cobb – Douglas production function approach, which has been smoothed further through a moving average with 4 terms.

MEAM signals the existence of 2 cycles. The estimated output gap according to these two methods also has the lowest volatility. Volatility is calculated as the standard deviation of the series and results 1.2 for the estimated output gap as the average of three methods and 1.0 for the gap estimated through the Cobb – Douglas production function specified in the MEAM model.

Chart 7 Maximum and minimum values of output gap according to different estimations*




Source: Authors' estimations and judgements.

*The grey columns highlight maximum and minimum values in the respective periods.

The identification of a typical economic cycle is completed with the estimation of the duration and average amplitude of the expansion/contraction phase that characterise cycles in order to further explore the possibility of identifying a typical cycle (Table 8). After identifying the expansion and contraction phases for each estimated result, it is computed the average duration (the length of the expansion/contraction phase in terms of average quarters[16]), average amplitude (the difference in percentage points between the maximum and minimum value of output gap during the expansion phase, and the contrary for the contraction phase, on average terms), average amplitude per quarter (as a ratio of the average amplitude to the average duration).

[16] It is expressed on average terms after identifying several expansion/contraction phases, and in order to compute the average duration, the number of quarters is calculated in relation to the number of the phases.

*Table 8. Descriptive statistics*
*(expansion and contraction phases of the cycles)*

| Methods for estimating the output gap | Expansion phase | | | Contraction phase | | |
|---|---|---|---|---|---|---|
| | Average duration | Average amplitude | Average amplitude per quarter | Average duration | Average amplitude | Average amplitude per quarter |
| | quarter | p.p. | p.p. | quarter | p.p. | p.p. |
| HP filter | 7.3 | 4.2 | 0.6 | 12.5 | -4.9 | -0.4 |
| Linear trend | 4.3 | 4.4 | 1.0 | 8.3 | -4.9 | -0.6 |
| Cobb – Douglas | 2.0 | 2.8 | 1.4 | 20.5 | -7.6 | -0.4 |
| Average of the three methods* | 5.3 | 2.4 | 0.5 | 10.7 | -3.0 | -0.3 |
| MEAM production function* | 11.0 | 1.2 | 0.1 | 11.0 | -2.1 | -0.2 |
| *Average of the results of the above last two methods** | 8.2 | 1.8 | 0.3 | 10.8 | -2.5 | -0.2 |

Source: Authors' calculations.

Based on the estimations, the expansion phase lasts on average from 2 quarters to 11 quarters, whereas the contraction phase from 8.3 quarters to 20.5 quarters. The size of the phases' amplitudes varies on average between 1.2 to 4.4 percentage points during expansion and from -2.1 to -7.6 percentage points during a contraction path. Scott (2000) argues that the volatility of the results mirrors to a certain extent specific features of the applied methods in.

In addition, it can be noticed that the models' results are more comparable during the contraction phase, while they show a bigger amplitude during expansions. More specifically, the estimation of the output gap as the average of three methods suggests that for the period under scrutiny, the contraction phase has a longer duration than the expansion phase. Whereas, the estimation based on the Cobb – Douglas production function specified in MEAM model points to comparable average length of the cycle phases. But their amplitude results smaller in relation to other techniques.

*Table 9. Symmetry and severity of the cycle*

| Methods for estimating the output gap | Percentage of time that output gap results positive | Maximum amplitude during the expansion phase (p.p.) | Maximum amplitude during the contraction phase (p.p.) |
|---|---|---|---|
| HP filter | 45 | 3.1 | -3.1 |
| Linear trend | 45 | 2.9 | -2.9 |
| Cobb – Douglas | 55 | 6.5 | -5.8 |
| Average of the three methods* | 49 | 2.9 | -2.5 |
| MEAM production function* | 42 | 0.7 | -3.0 |
| Average of the results of the above last two methods* | 45 | 1.8 | -2.7 |

Source: Authors' calculations.

Another statistical measure used to compare output gap estimations is the symmetry of the series in terms of duration of the expansion phase (and the contraction phase), as well as the severity (or intensity) of these phases (Table 9). Symmetry is determined by computing the percentage of time output gap is positive in relation to the period under analysis[17], while severity refers to the highest absolute value of the gap during both expansions and contractions.

Results show that output gap estimations are approximately symmetric, and more specifically the gap series estimated as an average of three methods results to be the most symmetric among all the methods used (according to this method in approximately 49% of the time the gap is positive). Regarding the severity of the cycles, methods suggest a higher volatility of the maximum amplitude of the gap during the expansion phase compared to the contraction one. Gap estimations as the average of the three methods and according to the production function in MEAM model do not show volatility of the amplitude in wide intervals. Estimations based on these two methods reveal that the maximum size of the gap varies on average around 1.8 percentage points for quarter during expansions, whilst the minimum values during contractions result -2.7 percentage points in a quarter.

[17] The output gap series is estimated to be fully symmetric when the percentage of time along which output gap results positive amounts 50% of the whole period of time.

*Table 10. Correlation coefficient matrix*

| Methods for estimating the output gap | HP filter | Linear trend | Cobb – Douglas | Average of the three methods | MEAM production function |
|---|---|---|---|---|---|
| HP filter | 1 | 0.92 | 0.22 | 0.37 | 0.11 |
| Linear trend | | 1 | 0.24 | 0.28 | 0.10 |
| Cobb – Douglas | | | 1 | 0.78 | 0.60 |
| Average of the three methods | | | | 1 | **0.71** |
| MEAM production function | | | | | 1 |

Source: Authors' calculations.

In order to examine whether the measures of output gap co-move in a similar way and whether they give the same signals when the economy is above or below potential, correlation coefficients and concordance statistics have been computed. Results reveal that not all the combinations of the correlation matrix show co-movement of the output gap indicator (Table 10). However, the correlation coefficient, around 0.71, between the estimated output gap as the average of the three methods and through the production function of MEAM model points to similar co-movement of the gap based on these measures.

*Table 11. Concordance statistics matrix*

| Methods for estimating the output gap | HP filter | Linear trend | Cobb – Douglas | Average of the three methods | MEAM production function |
|---|---|---|---|---|---|
| HP filter | 1 | **0.85** | 0.47 | 0.60 | 0.45 |
| Linear trend | | 1 | 0.47 | 0.53 | 0.49 |
| Cobb – Douglas | | | 1 | 0.84 | **0.84** |
| Average of the three methods | | | | 1 | **0.75** |
| MEAM production function | | | | | 1 |

Source: Authors' calculations.

Taking into consideration the fact that the correlation coefficient includes both the cycle amplitude and duration, Scott (2000) argues that the covariance between two series might be dominated by the presence of a particularly large amplitude in the estimated series. This shifts the interest in addressing the question whether the estimations signal that the economy is above or below potential at the same time.

In answering this question, helps the concordance statistic that basically computes the proportion of time during which the series are at the same phase, be that an expansion or a contraction.

Pagan & Harding (1999) were among the first that proposed the utilisation of the concordance statistic. For each two series, $x_i$ and $x_j$ of the estimated output gap are generated two new series, respectively $S_{i,t}$ and $S_{j,t}$, that take the value 1 when the output gap is positive and 0 when the gap is negative for each quarter. The concordance degree between them is calculated with the formula: $C_{ij} = T^{-1} * \{\Sigma(S_{i,t} * S_{j,t}) + (1 - S_{i,t}) * (1 - S_{j,t})\}$, where T is the period of time during which the output gap is estimated.

Results show a higher concordance of the output gap estimations through the statistical methods (around 85%), as well as between the average of three methods and the production function specified in the MEAM model (around 75%) (Table 11). This points to the fact that the measures on average signal approximately at the same time when the gap is positive or negative. The concordance statistics for all the measures fluctuates on average around 0.63, a value higher than 0.5, a figure that as confirmed also by Chagny and Döpke (2001) shows that model results are not contradicting each other.

Regardless of the uncertainty surrounding the estimation of the output gap, the comparative analysis of the methods illustrates that the estimation of the gap as an average of the three methods and through the Cobb – Douglas production function in MEAM model provide generally similar signals for the fluctuations of the economy above or below its potential[18]. The correlation statistics show synchronized fluctuations between the different output gap estimations. The concordance statistics confirms also that the methods to not give contradictory signals. More specifically, the correlation coefficient and the concordance statistics result higher for the output gap estimated as the average of three methods and by the *Cobb – Douglas* production function in MEAM model.

[18] Similarly, the estimation of the output gap from survey data has a high correlation with the estimation from MEAM model (a coefficient around 0.68) and the Cobb – Douglas function (a coefficient around 0.72) for the period that starts from the third quarter of 2006, period of time when the estimation of the gap from survey data starts. This indicator shows a high concordance with the other gap estimations (0.74 with the Cobb – Douglas function, 0.66 with the average of three methods and 0.71 with the MEAM model estimation).

However, estimations diverge in specific periods of time in terms of the amplitude of output gap fluctuations and the identified turning points[19]. We emphasize that the uncertainty surrounding the estimations is higher during the end points, which is influenced also from the revision of the GDP series and the enrichment of the database. In order to reduce uncertainty and consistently reflect dynamics in the economy, the estimation of inflationary pressures from developments in the real economy and the estimation of the cyclical position of the economy must be also based in alternative methods and more advanced techniques.

[19] As (Cotis, Elmeskov, & Mourougane, 2005) point out in their study the presence of structural breaks in series might explain at a certain extent differences between results, due to the fact that some of the methods (linear trend or HP filter), do not treat with a special focus these breaks. As long as the series are constraint in generating an output gap that would result zero on average terms during the cycle, the ability of the method to identify persistent structural breaks in the series is lowered.

*INFORMATIVE BOX 3. OUTPUT GAP ESTIMATIONS AND LONG-TERM INFLATIONARY PRESSURES*

*Output gap estimations assist in explaining inflation deviations from the 3% medium-term target. The presence of the output gap signals demand side inflationary pressures reflected mostly on core inflation. In the case of Albania, both headline and core inflation rates have systematically fluctuated below the 3% target in the years 2013-2015, reflecting economic cycle weaknesses. Bank of Albania estimations suggest that the persistence of the negative output gap has kept core inflation rate at historical lows and for quiet some time in negative territory.*

*Empirical results suggest that core inflation deviations from the 3% target are a consequence of output gap developments 2-4 quarters ahead with statistical significance. The output gap per se combines various factors affecting it like the monetary policy stance and other long-term factors, including the unemployment gap. An important factor influencing core inflation is the lagged nominal effective exchange rate gap (2 quarter ahead). The presence of such variable is justified as a large variety of items included in core inflation (nearly 71% of the CPI basket) are affected by exchange rate fluctuations. At the same time, first order and second order inertia factors correct model diagnostics.*

*In this informative box, core inflation is included as "control variable" to assess the various estimations of the output gap. Although core inflation represents an estimated indicator based on a given methodology, the fact that is derived from CPI data, makes it observable in real-time same as headline inflation. Furthermore, since 2006, core inflation serves as one of the top proxies for long-term inflationary pressures. Improvements are reflected each time the CPI basket is updated.*

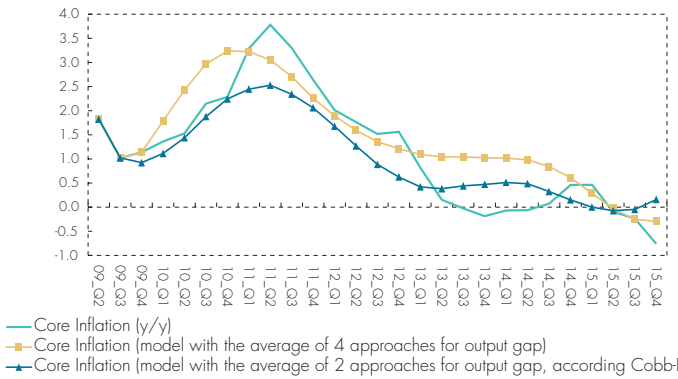
*OLS specifications including core inflation as explanatory variable suggest that the best in-sample explanation is achieved by incorporating average output gap series from the 4 estimations approaches [Trend; HP-Filter; Cobb-Douglas (both methods)]. Four quarters moving average is applied to smooth out output gap volatility aggregate estimations.*

*Graph 8 includes in-sample forecasts according to two models (featuring two different average output gap aggregates) covering the period 2009 Q4 – 2015 Q4. The respective output gap estimations help explain changes in core inflation tendencies. The end-sample period is better explained from the time series averaging all four estimations in terms of moving average.*

*Explanatory variables applied in the respective estimations are able to explain 82% in core inflation variance in the period 2002-2015. The remaining volatility remains unexplained suggesting that additional factors have affected core inflation deviations from the 3% target.*

*Core inflation elasticity to 1 percentage point shifts in output gap is estimated at +0.13pp after three quarters on average.*

Chart 8 Actual core inflation and in-sample forecast based on two models*




Source: Authors' calculations.
*) Moving average on average output gap time series: 4 approaches; 2 estimations according to Cobb-Douglas.

# VII. CONCLUSIONS AND SUGGESTIONS

Estimation and re-estimation results on potential output and the natural rate of unemployment suggest a general increase in unexploited capacities in the Albanian economy since 2009. The negative output gap has deepened whilst unemployment rates stand above natural ones. Certain improvements are observed in 2015 compared with 2014. Nevertheless, the economy remains far from optimal performance levels. In terms of growth, results suggest a shrinking potential compared with the mid 2000s. Potential growth is estimated to have shrunk from the 6.0% average in 2004-2009, to 2.8% in the years 2010-2015. Certainly, performance under potential for relatively long periods of time creates the circumstances to bring down the potential growth rate.

Different estimations between periods (and methodologies) dictated the necessity to conduct periodical updates (at least once a year) according to all approaches. That is also related to the correction of statistical series in some significant cases, particularly with regard to national accounts and employment statistics. At the same time, in the absence of review of the input series estimations can be mutated because of the applied methodologies nature. Such differences are to be closely monitored in order to determine the source: is it the data or the methodology.

In parallel with periodic re-estimations, the literature of our country has to be enriched by new methodologies. Given the current shoratages in this regard, future research work has to focus on pure structural models. Such methods (including the typical WS-PS) will be able to provide long-term empirical estimations for all unobservable parameters. These estimations are superior to both statistical and semi-structural approaches. However, their application in the case of Albania is closely related to certain qualitative time series which are presently unavailable.

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