

Potential output growth in Belgium since the crisis

Lower and more uncertain

June 2015

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Federal Planning Bureau

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Abstract - The uncertainty surrounding the estimates of potential output has risen in the euro area countries since the outbreak of the financial crisis. Moreover, potential growth in the euro area has fallen since 2009. In this working paper we examine both phenomena for Belgium based on potential GDP estimates produced by the Federal Planning Bureau. We also analyse the evolution of the three main underlying determinants of potential growth, namely the contribution of labour, capital and total factor productivity.

Abstract - L'incertitude entourant les estimations d'output potentiel dans la zone euro s'est accrue depuis le déclenchement de la crise financière. Par ailleurs, la croissance potentielle en zone euro s'est effondrée depuis 2009. Dans le présent working paper nous examinons ces deux phénomènes pour la Belgique sur base des estimations du PIB potentiel produites par le Bureau fédéral du Plan. Nous analysons également l'évolution des trois déterminants sous-jacents à la croissance potentielle, à savoir la contribution du travail, du capital et de la productivité totale des facteurs.

Abstract - Sinds het uitbreken van de financiële crisis is de onzekerheid omtrent de ramingen van de potentiële output in de eurozone toegenomen. Bovendien is de potentiële groei in de eurozone sterk teruggevallen sinds 2009. In deze working paper buigen we ons over die twee fenomenen voor België op basis van de ramingen van het Federaal Planbureau van het potentieel bbp. Ook analyseren we de evolutie van de drie onderliggende determinanten van de potentiële groei: de bijdrage van arbeid, kapitaal en de totale factorproductiviteit.

Jel Classification - C5, E1, O47**Keywords** - Potential output, Financial crisis, Revisions

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Executive summary

A first tentative estimation of impact of the financial crisis on Belgian potential GDP was provided in the FPB Working Paper No. 10-9 followed by a more comprehensive computation of the damage of the crisis presented in WP 8-11. In this new paper we do not try to quantify the output loss attributable solely to the financial crisis as in the meantime many other important events have taken place such as the sovereign debt crisis within the euro area. We instead focus on the latest estimates available – based on the May 2015 FPB Economic Outlook – and put them into perspective by providing measures of uncertainty surrounding them.

The analysis reveals that potential GDP growth in Belgium was also severely hit by the crises. Potential output growth declined to less than 1.1% on average in the period 2009-2015 compared to 2% on average in 1999-2008, meaning a drop of almost 1 percentage point. Although impressive, according to the European Commission, the euro area as a whole was struck even harder: the decline amounted to 1.4 percentage points in average annual potential GDP growth (from 2.0% to 0.6%).

In terms of factor inputs, labour has resisted remarkably well in Belgium; its contribution to potential growth was only reduced marginally following the crisis (from 0.6 percentage points in 1999-2008 to 0.5 percentage points in 2009-2015), supported by both a declining NAWRU and a sustained expansion of the potential labour force. Over the same periods, the contribution of capital, as a result of less dynamic investment since the crisis, was almost halved (from 0.7 to 0.4 percentage points). The contribution of total factor productivity diminished even more, going from 0.7 to 0.2 percentage points but it has to be acknowledged that this decreasing trend preceded the outbreak of the crisis.

Uncertainty surrounding potential output stems essentially from two sources. First, since potential GDP is not directly observable, different models and methods tend to produce significantly different estimates (“model uncertainty”). Second, within a particular method, revisions of historical data and forecasts imply that potential output estimates are also revised (“data uncertainty”). To measure this second type of uncertainty, we construct, using all past vintages of FPB estimates available, a “confidence range” by taking for each year the minimum and maximum value for potential growth across vintages. To examine whether uncertainty has increased since the outbreak of the crisis, the sample has been divided into “pre-crisis” vintages going from 2003 to 2008, covering the time period 1999-2012, and “crisis” vintages from 2009 to 2014, covering the full period 1999-2015.

Before the crisis, potential growth estimates oscillated between a minimum of 1.8% and a ceiling of 2.4%, with a maximum annual range of 0.3 percentage points. After the outbreak of the crisis, substantial revisions to potential growth estimates were made for the 2009-2012 period (on average from 2.0% to 1.3%), including for the period 1999-2008 (from 2.1% to 1.7%). Uncertainty increased further in 2013-2015 as the recovery appeared to be short-lived and the euro area entered a new phase of recession. Compared to the pre-crisis estimates, the maximum range has almost tripled (to 0.9 percentage points).

The other type of measure is associated with the uncertainty regarding the methodology used to compute potential GDP. In this case, we take the most recent estimates for Belgium from the three main

international organisations to construct a confidence bound and compare them with our results. According to this range, the current uncertainty related to the method applied seems relatively limited for Belgium. On average, over the period 1999-2012, the width of the range is less than 0.2 percentage points, with a maximum of 0.3 percentage points. It increases only marginally at the end of the sample: in 2015 potential growth ranges from 0.9% (European Commission) to 1.2% (OECD), the IMF estimate (1.1%) being close to that of the FPB. This relative consensus among international organisations regarding Belgian potential output has not always prevailed; for instance, just after the outbreak of the crisis, differences were much larger (see WP 10-9).

Synthèse

Une première tentative d'estimation de l'impact de la crise financière sur le PIB potentiel de la Belgique a été présentée dans le working paper n° 10-9 du BFP suivie d'une analyse plus fouillée des dommages générés par la crise décrite dans le WP 8-11. Dans le présent working paper nous n'essayons pas de quantifier une nouvelle fois la perte d'output liée à la seule crise financière car depuis lors d'autres événements sont intervenus, dont la crise des dettes souveraines en zone euro. Nous nous focalisons ici plutôt sur les dernières estimations disponibles – basées sur les Perspectives économiques du BFP de mai 2015 – et les mettons en perspective en fournissant une mesure de l'incertitude les entourant.

L'analyse révèle que la croissance du PIB potentiel a été lourdement touchée par la crise. Ainsi, alors qu'elle s'élevait encore en moyenne à 2 % sur la période 1999-2008, elle a atteint moins de 1,1 % en moyenne sur la période 2009-2015, soit une chute de près de 1 point de pourcentage. Même si ce recul est important, d'après la Commission européenne, la zone euro dans son ensemble a été touchée encore plus durement, soit un repli de l'ordre de 1,4 points de pourcentage de la croissance potentielle annuelle (passant de 2,0 % à 0,6 %).

En termes de contributions, celle attribuable au facteur travail a remarquablement bien résisté à la crise dans le cas de la Belgique, ne se réduisant que marginalement (de 0,6 points de pourcentage sur 1999-2008 à 0,5 sur 2009-2015). Cette belle résistance s'explique aussi bien par la continuation de la baisse du NAIRU que par une expansion soutenue de la population active potentielle. Sur les mêmes périodes, la contribution du capital est quasiment réduite de moitié (de 0,7 à 0,4 points de pourcentage) suite au ralentissement de la croissance des investissements. La contribution de la productivité totale des facteurs a diminué encore plus, passant de 0,7 à 0,2 points de pourcentage, mais il faut noter que cette tendance décroissante précède l'éclatement de la crise financière.

L'incertitude autour de l'output potentiel a essentiellement deux origines. Premièrement, puisque le PIB potentiel n'est pas directement observable, différents modèles et méthodes tendent à produire des résultats statistiquement différents (on parlera alors d'incertitude liée au modèle). Deuxièmement, à méthode donnée, les révisions des séries historiques ainsi que des prévisions impliquent que les estimations d'output potentiel soient également revues (on parlera alors d'incertitude liée aux données). Afin de mesurer le second type d'incertitude nous construisons, à l'aide de tous les millésimes passés d'estimations faites par le BFP, un « intervalle de confiance » borné pour chaque année par la valeur minimale et maximale de la croissance potentielle à travers les différents millésimes. Afin d'examiner si l'incertitude s'est accrue depuis le déclenchement de la crise, l'échantillon a été divisé en millésimes « d'avant crise », allant de 2003 à 2008 et couvrant la période 1999-2012, et en millésimes « d'après crise », soit de 2009 à 2014, couvrant la période complète 1999-2015.

Avant le début de la crise, les estimations de croissance potentielle oscillaient entre un plancher de 1,8 % et un plafond de 2,4 % avec un intervalle de confiance maximal de 0,3 points de pourcentage. Après l'éclatement de la crise, des révisions substantielles ont été apportées aux estimations de croissance potentielle pour la période 2009-2012 (passant ainsi en moyenne de 2,0 % à 1,3 %), y inclus pour la période 1999-2008 (de 2,1 % à 1,7 %). L'incertitude sur la période 2013-2015 s'est encore accrue suite à la reprise

de courte durée en 2010-2011 et la nouvelle phase de récession en zone euro qui a suivi. Comparé aux estimations faites avant crise, l'intervalle de confiance maximal a presque triplé, passant à 0,9 points de pourcentage.

L'autre indicateur développé consiste à mesurer l'incertitude liée à la méthode utilisée pour calculer le PIB potentiel. Dans ce cas-ci nous prenons les estimations les plus récentes pour la Belgique produites par les trois grandes institutions internationales afin de construire un intervalle de confiance que nous confrontons à l'estimation du BFP. Sur base de cet intervalle de confiance, l'incertitude liée à la méthode appliquée apparaît comme relativement faible pour la Belgique. Sur la période 1999-2012, la largeur de l'intervalle est inférieure en moyenne à 0,2 points de pourcentage avec un maximum de 0,3 points. Cet intervalle ne s'accroît que marginalement en fin d'échantillon : en 2015 la croissance potentielle oscille entre 0,9 % (d'après la Commission européenne) et 1,2 % (d'après l'OCDE), l'estimation du FMI (1,1 %) étant proche de celle du BFP. Notons que ce relatif consensus concernant la croissance potentielle belge au sein des institutions internationales n'a pas toujours prévalu ; par exemple, juste après l'éclatement de la crise financière, les différences étaient bien plus importantes (voir à ce sujet le WP 10-9).

Synthese

In working paper 10-9 van het FPB werd een eerste poging ondernomen om de impact van de financiële crisis op het potentieel bbp van België te ramen, gevolgd door een diepgaandere analyse in working paper 8-11 van de schade die veroorzaakt werd door de crisis. In deze working paper wordt er niet getracht opnieuw het outputverlies als gevolg van de financiële crisis te kwantificeren, aangezien er sindsdien andere gebeurtenissen hebben plaatsgevonden, zoals de soevereine schuldencrisis in de eurozone. Hier wordt eerder gefocust op de meest recente ramingen – die gebaseerd zijn op de economische vooruitzichten van het FPB van mei 2015 – en worden die in een breder perspectief geplaatst door een manier aan te reiken om de onzekerheid te meten waarmee ze omgeven zijn.

De analyse toont dat de groei van het potentieel bbp zwaar getroffen werd door de crisis. Terwijl de groei over de periode 1999-2008 nog gemiddeld 2% bedroeg, viel die terug tot gemiddeld minder dan 1,1% over de periode 2009-2015, of een daling met bijna 1 procentpunt. Hoewel dit een sterke terugval is, werd, volgens de Europese Commissie, de gehele eurozone nog zwaarder getroffen en viel de jaarlijkse potentiële groei terug met 1,4 procentpunt van 2,0% naar 0,6%.

In het geval van België bood de bijdrage van de factor arbeid opvallend goed weerstand tegen de gevolgen van de crisis, en daalde die slechts in geringe mate (van 0,6 procentpunt over 1999-2008 tot 0,5 procentpunt over 2009-2015). Die behoorlijke weerstand wordt zowel verklaard door de aanhoudende daling van de NAIRU als door de sterke toename van de potentiële beroepsbevolking. Over dezelfde perioden werd de bijdrage van kapitaal nagenoeg gehalveerd (van 0,7 naar 0,4 procentpunt) als gevolg van de groeivertraging van de investeringen. De bijdrage van de totale factorproductiviteit viel nog sterker terug, van 0,7 naar 0,2 procentpunt, maar er moet opgemerkt worden dat die dalende trend reeds was ingezet vóór het uitbreken van de financiële crisis.

De onzekerheid over de potentiële output is hoofdzakelijk terug te brengen tot twee oorzaken. Ten eerste, aangezien het potentieel bbp niet direct waarneembaar is, leveren verschillende modellen en methodes statistisch verschillende resultaten op (we spreken dan van modelgebonden onzekerheid). Ten tweede hebben, bij een gegeven methode, zowel de herzieningen van de historische reeksen en van de vooruitzichten tot gevolg dat de ramingen van de potentiële output ook worden herzien (we spreken dan van gegevensgebonden onzekerheid). Om het tweede type onzekerheid te meten stellen we, met behulp van alle door het FPB uitgevoerde ramingen van de voorgaande jaren, een 'betrouwbaarheidsinterval' op, dat voor ieder jaar begrensd wordt door de minimum- en maximumwaarde van de potentiële groei over de verschillende edities van de vooruitzichten. Om na te gaan of de onzekerheid is toegenomen sinds het uitbreken van de crisis werd de steekproef onderverdeeld in edities 'van vóór de crisis' van 2003 tot 2008, die de periode 1999-2012 beslaan, en edities van 'na de crisis' van 2009 tot 2014, die de gehele periode 1999-2015 beslaan.

Voor het begin van de crisis schommelden de ramingen van de potentiële groei tussen een ondergrens van 1,8% en een bovengrens van 2,4% met een maximumbetrouwbaarheidsinterval van 0,3 procentpunt. Na het uitbreken van de crisis werden de ramingen van de potentiële groei aanzienlijk herzien voor de periode 2009-2012 (van gemiddeld 2,0% naar 1,3%), inclusief voor de periode 1999-2008 (van

2,1% naar 1,7%). De onzekerheid omtrent de periode 2013-2015 is nog toegenomen als gevolg van het kortstondige herstel in 2010-2011 en de daaropvolgende nieuwe recessie in de eurozone. In vergelijking met de ramingen van vóór de crisis is het maximumbetrouwbaarheidsinterval bijna verdrievoudigd tot 0,9 procentpunt.

Op basis van een andere indicator wordt de onzekerheid gemeten over de methode die gebruikt wordt om het potentieel bbp te berekenen. In dat geval worden de recentste ramingen van de drie grote internationale instellingen voor België gebruikt om een betrouwbaarheidsinterval op te stellen dat wordt vergeleken met de FPB-raming. Op basis van dat betrouwbaarheidsinterval lijkt er weinig onzekerheid te bestaan over de methode die voor België wordt toegepast. Over de periode 1992-2012 ligt het interval gemiddeld onder 0,2 procentpunt, met een maximum van 0,3 punt. Dat interval neemt slechts miniem toe aan het einde van de steekproef: in 2015 schommelt de potentiële groei tussen 0,9% (volgens de Europese Commissie) en 1,2% (volgens de OESO), terwijl de raming van het IMF (1,1%) dicht aanleunt bij die van het FPB. Merk op dat er binnen de internationale instellingen niet altijd een relatieve consensus omtrent de Belgische potentiële groei is geweest. Dit was bijvoorbeeld het geval net na het uitbreken van de financiële crisis, toen de verschillen aanzienlijk groter waren (zie hieromtrent WP 10-9).

1. Introduction

Although the concept of potential output may signify different things to different people, in this paper it is defined as the level of output that may be achieved in the economy in the medium term without generating inflationary or financial pressures. As such it constitutes an aggregate indicator of the supply-side capacity of the economy. Since potential GDP is not directly observable, it may be computed through a variety of methods and therefore subject to an important degree of uncertainty¹. Even within a particular method, revisions of historical data and forecasts imply that potential output estimates are also revised. According to a recent study, the uncertainty surrounding the estimates of potential output has been greater in the euro area countries since the outbreak of the financial crisis than in the preceding period². Moreover, based on calculations by international organisations, potential growth in the euro area has fallen since the onset of the financial crisis largely due to smaller contributions from capital and labour³.

In this working paper we examine both phenomena for Belgium based on potential GDP estimates produced by the Federal Planning Bureau (FPB). These estimates are computed twice a year since 2003 using the historical database extended with the medium-term macroeconomic scenario produced by the HERMES model⁴. A first tentative estimation of impact of the financial crisis on Belgian potential GDP was provided in Lebrun (2009) followed by a more comprehensive computation of the damage of the crisis presented in Lebrun (2011). In this new paper we do not try to quantify the output loss attributable solely to the financial crisis as in the meantime other important events have taken place such as the sovereign debt crisis within the euro area. Instead, we focus on the latest estimates available and put them into perspective by providing measures of uncertainty surrounding them.

In Section 2 we examine the potential output growth estimates consistent with the May 2015 release of the FPB Economic Outlook (the first to be computed in ESA 2010) and see whether any clear break is visible in 2009. We subsequently analyse the evolution of the three main underlying determinants of potential growth, namely the contribution of labour, capital and total factor productivity. In Section 3 we present two ways to measure uncertainty surrounding potential output. The first type of measure relates to the uncertainty caused by revisions in historical data and forecasts and, using all past vintages of FPB estimates available, we construct a “confidence range” by taking for each year the minimum and maximum value across vintages. The second type of measure is associated with the uncertainty regarding the methodology used to compute potential GDP. In this case we take the most recent estimates from the three main international organisations to construct confidence bounds.

¹ See ECB (2005) or Deutsche Bundesbank (2014).

² Anderton et. al. (2014).

³ See ECB (2013).

⁴ See Bassilière et. al. (2013).

2. Recent evolution in potential growth estimates and components

2.1. The method used by the FPB to compute potential GDP

Most international organisations rely on a method based upon a macroeconomic production function that allows potential output to be broken down into contributions from input factors and total factor productivity. In order to identify the underlying trends, this methodology uses statistical filters to smooth some of the input series. Due to the well-known end-point bias (difficulty of disentangling the cycle from the trend at the end of the sample) a widespread approach consists of applying a filter to a historical series that is supplemented by projected values. Following this approach, the FPB uses the methodology developed by the European Commission⁵ but applies it to its own historical database extended using its medium-term projection⁶. This approach ensures full compatibility between the potential GDP estimates and the medium-term macroeconomic scenario produced by the HERMES model. This procedure also permits computing the so-called output gap which is defined as the percentage deviation of the actual level of GDP from its potential level.

The results presented for Belgium in the following sub-sections are consistent with the May 2015 release of the FPB Economic Outlook⁷.

2.2. Potential GDP growth

Shortly after the eruption of the financial crisis in 2008, a consensus quickly emerged among national and international organizations that, based on past experiences, this crisis would lead, at least, to a temporary slowdown in potential output growth.⁸ Half a decade later, this gloomy prediction appears to be validated by the latest estimates. As shown in Graph 1, potential GDP growth in Belgium was severely hit by the crisis. Potential output growth declined to less than 1.1% on average in the period 2009-2015 compared to 2% on average in 1999-2008, meaning a drop of almost 1 percentage point. For the same periods, actual GDP dropped from 2.3% to 0.7%, a fall of 1.6% percentage points. Although impressive, according to the European Commission⁹, the euro area as a whole was struck even harder: the decline amounted to 1.4% percentage points in average annual potential GDP growth (from 2.0% to 0.6%).

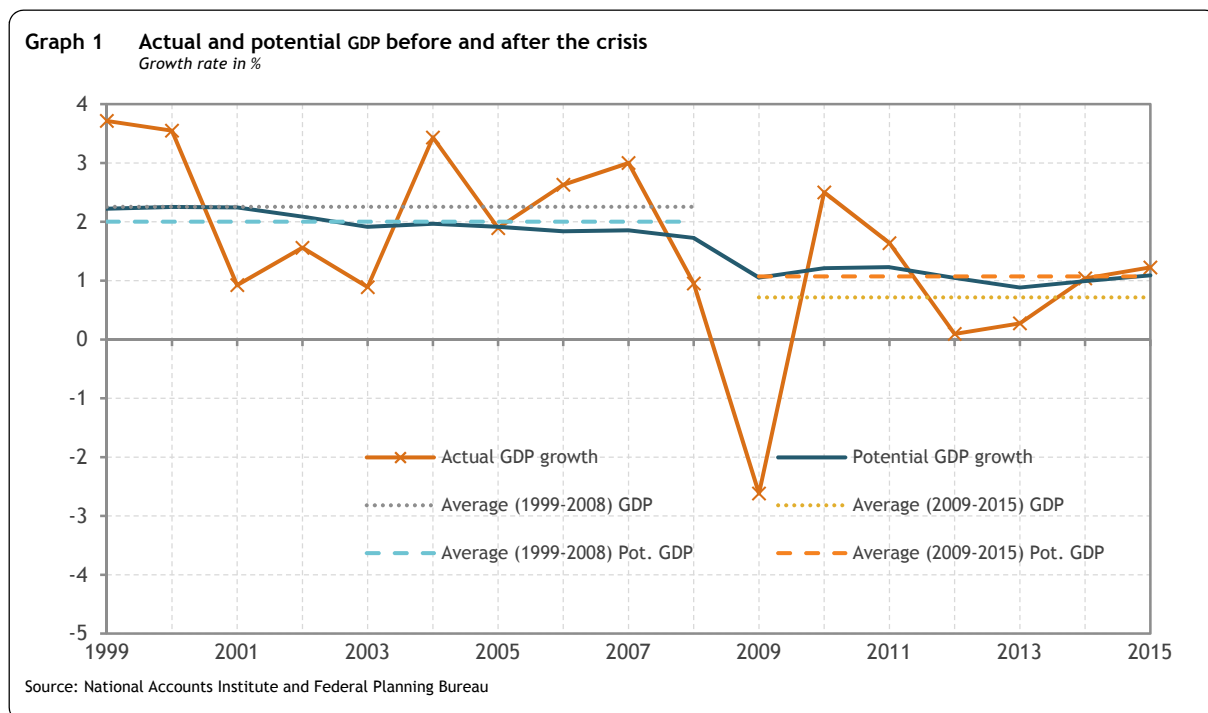
⁵ See Havik et. al. (2014).

⁶ See Lebrun (2011) for a detailed presentation of the method.

⁷ Bureau federal du Plan (2015).

⁸ See ECB (2009) for a discussion on the euro area and Lebrun (2009) for an analysis on Belgium.

⁹ European Economic Forecast, Spring 2015 (CIRCABC).



As a financial crisis could affect medium-term output through different channels, those same institutions acknowledged that the expected magnitude of the adverse effects remained a major uncertainty.¹⁰ A recent paper (Anderton et. al., 2014) reviewed how the recent crisis has affected the contributions to potential growth of the different factor inputs, namely labour, capital and total factor productivity (TFP), for the euro area based on the estimates by the European Commission. The authors mainly concluded that “while TFP has been affected as well, the negative impact on potential output has been concentrated on the capital and labour components, which is accounted for by lower investment rates, demographics and higher structural unemployment”. In the following sections we will review the evolutions of these components for Belgium based on the FPB estimates.

¹⁰ European Commission (2009).

2.3. Labour

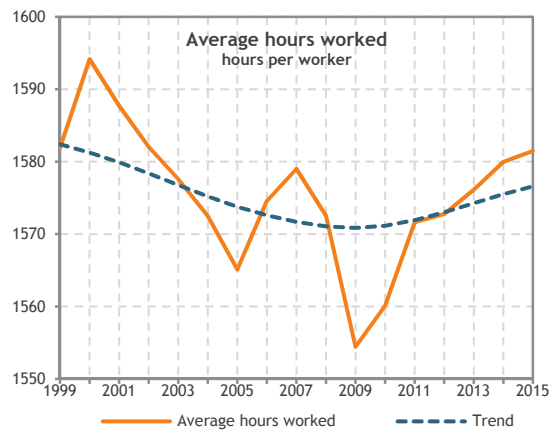
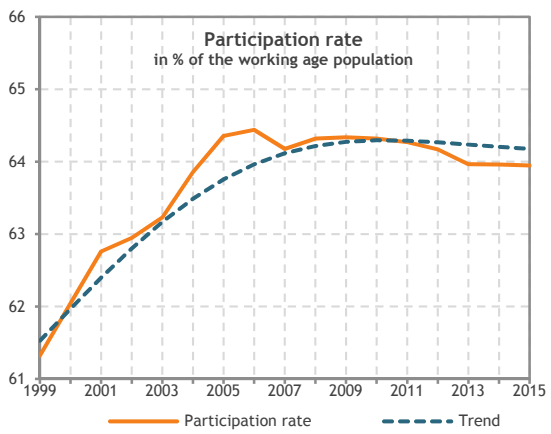
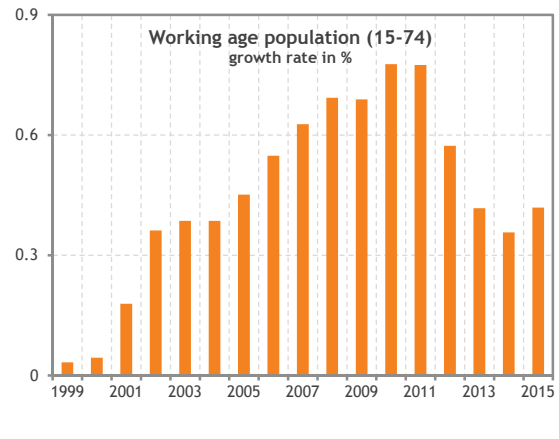
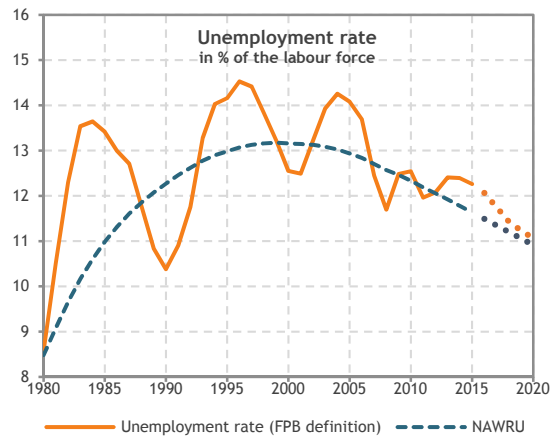
According to the European Commission estimates, the contribution from labour (expressed in total hours worked) in the euro area turned negative in 2009 (-0.2 percentage points) and remained at that level the following years compared to a positive contribution on average in 1999-2008 (0.4 percentage points). As shown in Graph 2, such a phenomenon is totally absent in the case of Belgium, the contribution from labour in 2009 (0.6 percentage points) is similar to the one recorded during the preceding decade. It even increased in 2010-2011, before slowing down in recent years.



As illustrated in Graph 3, this positive contribution has been supported by all underlying determinants of potential employment. Firstly, unlike what several other euro area countries experienced, the unemployment rate in Belgium rose only moderately in the two years following the outbreak of the crisis and has remained pretty stable over the last few years. Based on the latest FPB Outlook, the unemployment rate is assumed to decrease gradually from 2015 onwards. As this decline is accompanied by very limited wage inflation, the specification used to estimate the NAWRU¹¹ will close the unemployment gap slowly. It is important to note that, due to the forward looking nature of the statistical filter used, this positive contribution of the NAWRU to potential employment up to 2015 is obtained conditional on our 2016-2020 scenario. Secondly, the prolonged expansion of the working age population (defined as those aged 15 to 74) over the period 2008-2011, combined with a stable trend participation rate, has also contributed to sustain potential employment growth. Finally, the positive trend in average hours worked has also supported the contribution of labour to potential output.

¹¹ Non-accelerating wage rate of inflation. The NAWRU is being estimated on the basis of a reduced-form Phillips curve linking the change in wage inflation to the unemployment gap and other determinants (see Havik et. al, op. cit.).

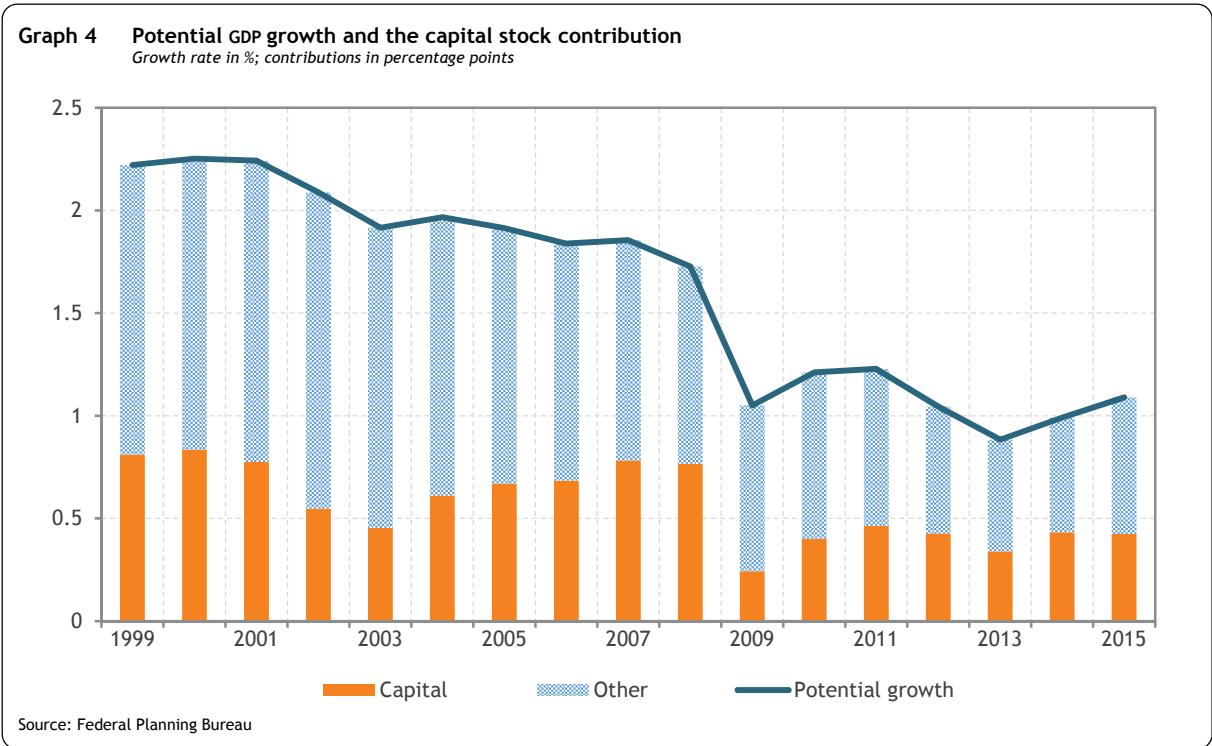
Graph 3 Determinants of potential employment



Source: Federal Planning Bureau

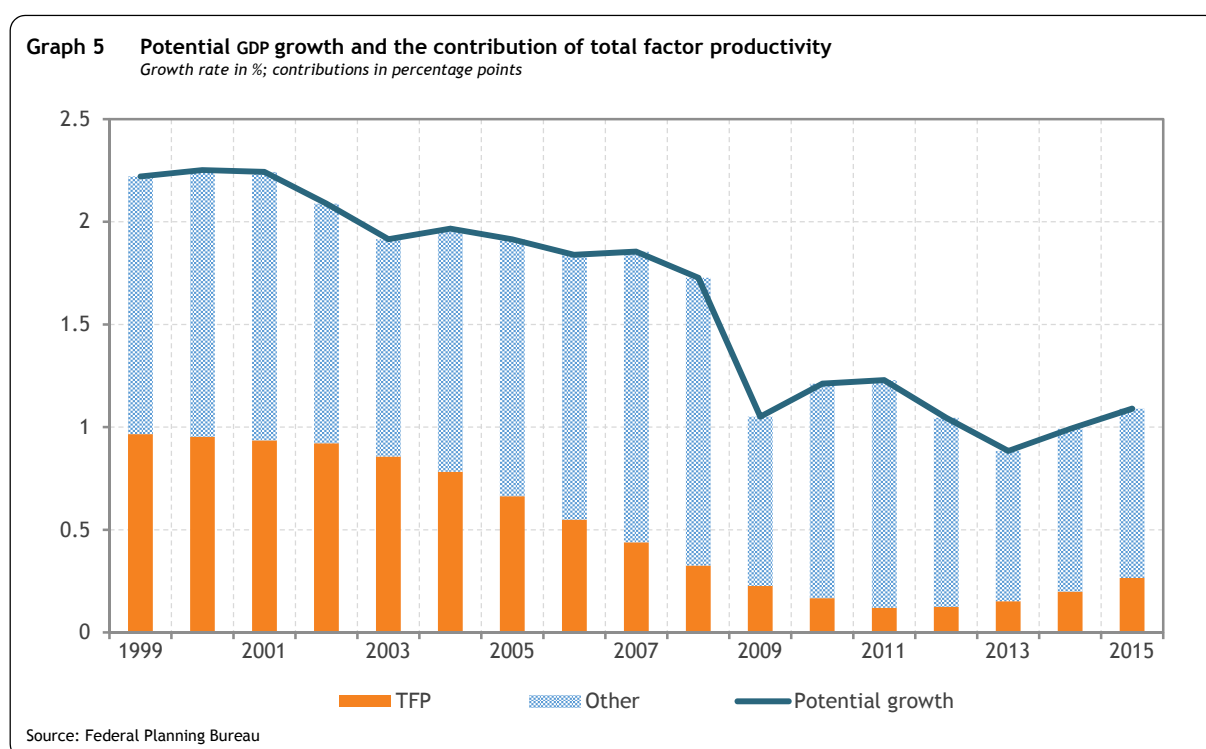
2.4. Capital

For capital, the maximum possible contribution to output growth is defined as the full utilisation of all the existing private and public capital stock in the economy. According to this definition, no smoothing of the capital stock series is required for the computation of potential GDP. As is shown in Graph 4, it explains why the contribution of this component is the most pro-cyclical, being large at the peak of the cycle, as in 1999-2000 and 2007-2008, and small at the trough (2003 and 2009). The contribution of capital to potential output is for that reason also the main factor behind the large drop in potential GDP growth in 2009 and the subsequent limited rebound in 2010-2011. It is also part of the explanation behind the modest recovery in potential output growth in 2014-2015. Compared with the estimates for the euro area, the capital stock contribution to Belgian potential output growth is twice as large in those two years.



2.5. Total factor productivity

The contribution of total factor productivity (TFP) to potential output dropped by 0.1 percentage point in 2009 but this is comparable to the annual reductions recorded since 2003 (see Graph 5)¹². The European Commission estimates for the euro area as a whole point to the same type of result.¹³ The fact that there is no specific impact of the financial crisis on the contribution of TFP is consistent with experience in previous financial crises.¹⁴ Indeed, based on theoretical considerations, the overall impact on TFP is ambiguous. On the one hand, TFP could be permanently affected by a reduction in innovative activity due to lower R&D expenditure. On the other hand, this result could be counterbalanced by a “cleaning-up” effect, as the least productive firms are forced out of the market during downturns and by a shift of resources to more productive uses.



According to the latest FPB Outlook, trend TFP growth started to improve timidly in 2013. However, due to the sensitivity of the filtered series to the end of the sample, this result is conditional on the scenario chosen. As illustrated in Graph 6, the Economic Outlook assumes a very gradual return of the Solow residual's growth rate to the average recorded in the first half of last decade.¹⁵ It is essentially this assumption that generates a turning point in the trend TFP growth rate. Note that although this expected

¹² However, as shown in Graph 6, one has to be aware of the fact that the TFP trend for the years preceding the crisis is dragged down by the drop in the Solow residual (see definition in footnote below) in 2009. Moreover, a reduction of 0.1 percentage point is more severe in relative terms when the contribution amounts to 0.2 percentage points (as in 2009) than 0.9 (as in 2003).

¹³ For tentative explanations on the historical slowdown in TFP trend growth at the euro area level, see van Ark (2014).

¹⁴ See Haugh et. al. (2009).

¹⁵ The Solow residual is defined as the part of GDP unexplained by the capital and labour inputs. In practice it is computed by inverting the production function equation. To obtain trend TFP, the cyclical component of the Solow residual has to be filtered out, see Lebrun (2011).

rebound is based on evidence from studies on past crises¹⁶, the degree of uncertainty surrounding this aspect of the projection is particularly high as will be illustrated in the next section.



¹⁶ See Abiad et. al. (2009).

3. Uncertainty surrounding potential growth and components

3.1. Introduction

Since potential GDP is unobservable, unlike actual GDP that is compiled through the national account system, it can only be estimated with uncertainty. This assessment is not new and has been extensively described in the literature.¹⁷ The uncertainty surrounding potential output stems essentially from two sources. First, there is no agreement on how potential output should be modelled. Different models and methods tend to produce significantly different estimates (“model uncertainty”).¹⁸ Second, within a particular method, revisions of historical data and forecasts imply that potential output estimates are also revised (“data uncertainty”). The fact that potential growth estimates for the past or present period can be altered with a new set of realisations or projections is explained by the high sensitivity to the end of sample. This is caused by the well-known end-point problem, i.e. the difficulty to disentangle the cycle from the trend at the end of the sample. In other words, past and present values of potential GDP are conditional on past but also future realisations of GDP. In the following sections we will illustrate these two types of uncertainties for the Belgian case by constructing confidence ranges as proposed by Ader-ton et. al. (2014).

3.2. Data uncertainty

The FPB produces since 2003 twice a year (spring and autumn) potential output estimates consistent with its medium-term outlook as presented in the previous section. Although small methodological modifications have been made over time following improvements to the EU official method, changes in potential growth estimates in successive vintages reflect primarily revisions in past data and projections.

In the graphs below, the confidence range for each point in time has been constructed by taking the minimum and maximum value across vintages. To examine whether uncertainty has increased since the outbreak of the crisis, the sample has been divided into “pre-crisis” vintages going from 2003 to 2008, covering the time period 1999-2012¹⁹, and “crisis” vintages from 2009 to 2014, covering the full period 1999-2015. The latest estimates based on the May 2015 Outlook and presented in detail in the previous section are not included in the range calculation but identified as a separate line.

3.2.1. Potential GDP growth

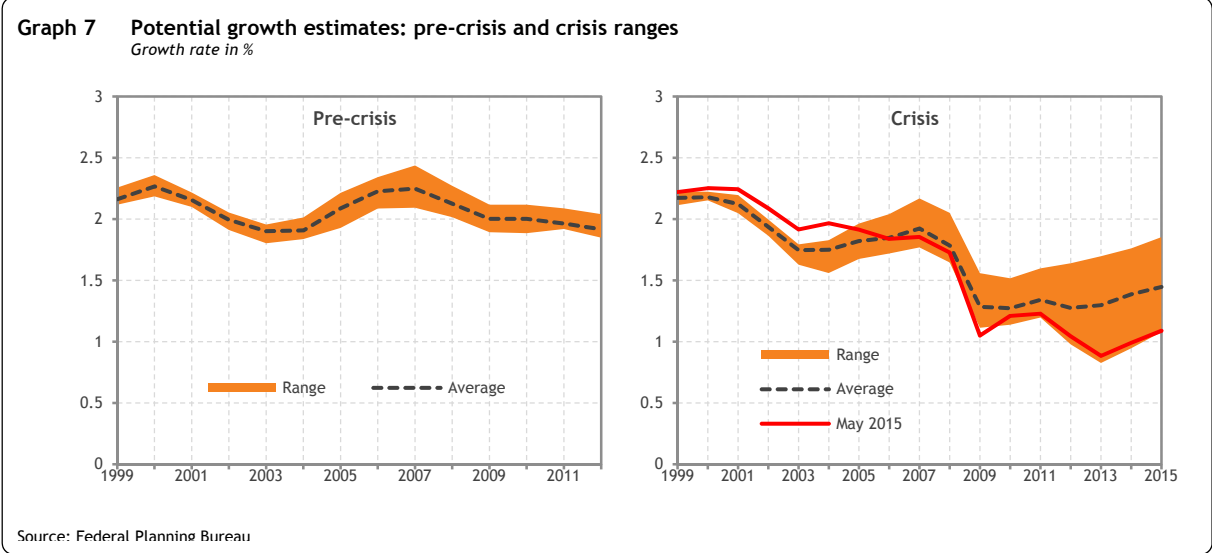
Before the crisis, potential growth estimates oscillated between a minimum of 1.8% and a ceiling of 2.4% with a maximum annual range of 0.3 percentage point as successive vintages of potential output were relatively closely aligned (see the left-hand chart in Graph 7). After the outbreak of the crisis (see the right-hand chart), substantial revisions were made from 2009 onwards (on average from 2.0% to 1.3% for 2009-2012), including for the pre-crisis period (from 2.1% to 1.7% for 1999-2008). The range has also

¹⁷ For an analysis on the euro area see ECB (2005).

¹⁸ For a survey of the different types of methods available see ECB (2000).

¹⁹ Note that from the year 2009 onwards, due to the fact that the projection horizon is limited to t+5, the number of vintages available is reduced by one unit each year, which may influence the width of the range.

considerably increased, confirming that uncertainty has risen since the onset of the crisis. This uncertainty has heightened further in 2013-2015 as the recovery appeared to be short-lived and the euro area entered a new phase of recession. Compared to the pre-crisis estimates, the maximum range has almost tripled (to 0.9 percentage points). Finally, the May 2015 estimates, which are the first to be based on the ESA 2010 methodology, are positioned somewhat above the range for the first half of the previous decade, before dropping and coinciding with the lower bound of the range from 2009 onwards.

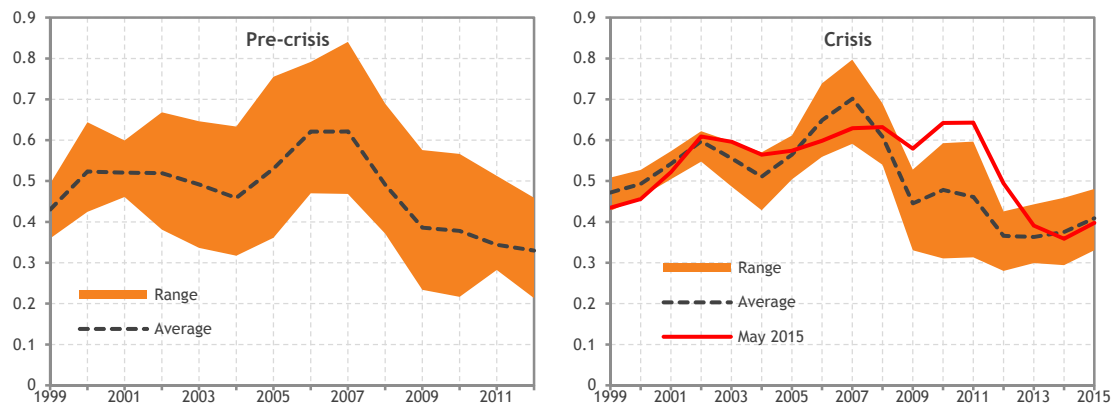


3.2.2. Components

As we did in the previous section, it may be interesting also to analyse how uncertainty has evolved for the three main components of potential output, namely labour, capital and total factor productivity.

As revealed by the comparison between the left and right-hand chart in Graph 8, the uncertainty regarding the labour contribution has surprisingly decreased since the outbreak of the crisis. In the pre-crisis period the range oscillated between 0.2 and 0.4 percentage points while since the crisis it reached a maximum of 0.3 percentage points in 2010-2011 before receding again. Interestingly, an analysis points out that this reduced uncertainty does not originate from the NAWRU estimates - the range being quasi unchanged on average over both periods – but comes from the contribution of the potential labour force. The large range computed with the pre-crisis vintages is essentially due to an underestimation of the growth in working age population in the earlier vintages. Finally note that the May 2015 estimates are outside the historical boundaries formed by the range between 2009 and 2012.

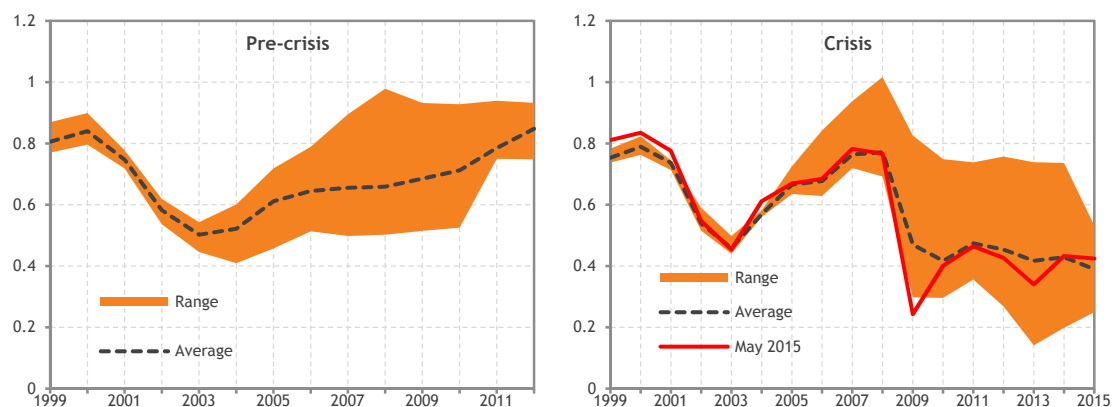
Graph 8 Labour contribution: pre-crisis and crisis ranges
Percentage points



Source: Federal Planning Bureau

Due to the fact that the capital stock is not smoothed in the method used, the wide range reflects the projection error made on investment in the different vintages (see Graph 9). In the pre-crisis era, the latest vintages exhibit an increasing optimism regarding investment growth for the period 2008-2010. The reduction in the size of the range in 2011 is due to the disappearance of results from the earlier vintages that were less optimistic. In the crisis period the range remains around 0.5 percentage points over 2009-2014 essentially due to the initial underestimation of the impact of the financial crisis on investment. In 2015 the decrease in the range size is the consequence to the disappearance of results of the 2009 vintage. The May 2015 estimate, the first to be based on the ESA 2010, falls below the range in 1999 and then returns to the average of the crisis projections.

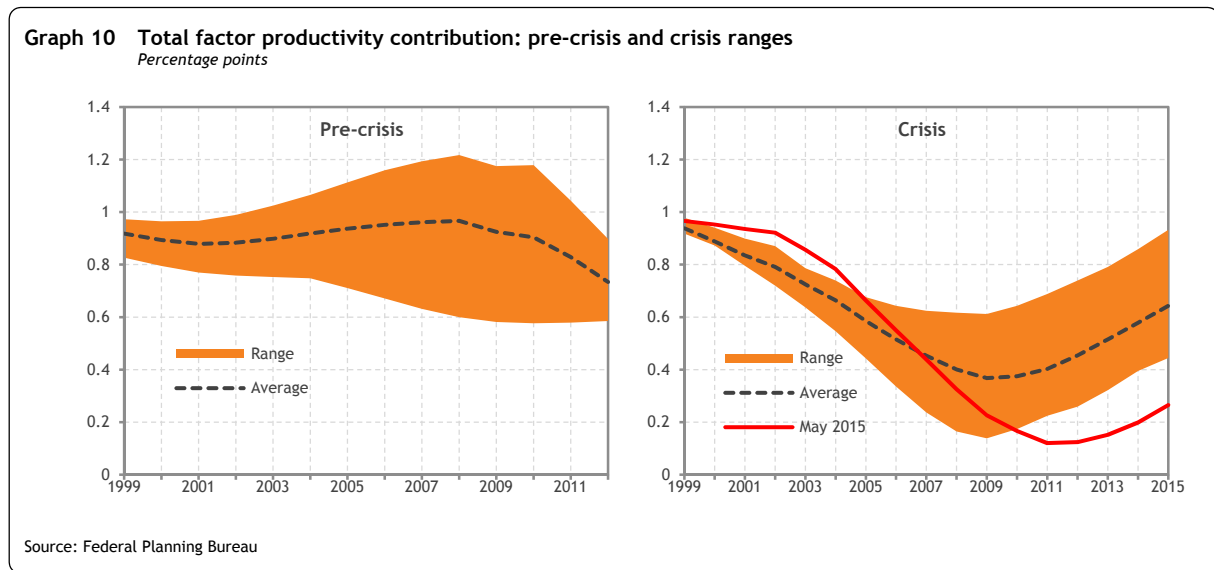
Graph 9 Capital contribution: pre-crisis and crisis ranges
Percentage points



Source: Federal Planning Bureau

The comparison between the average of the pre-crisis vintages and crisis vintages for the contribution of total factor productivity is striking (see Graph 10). In the pre-crisis period, although the range is wide, there is no clear indication of a decreasing TFP trend prior to 2009. Looking at the more recent vintages the picture is totally different with a decreasing trend till 2009 and a recovery thereafter. With the May 2015 vintage the turning point is situated in 2011-2012 and well below the range formed by previous

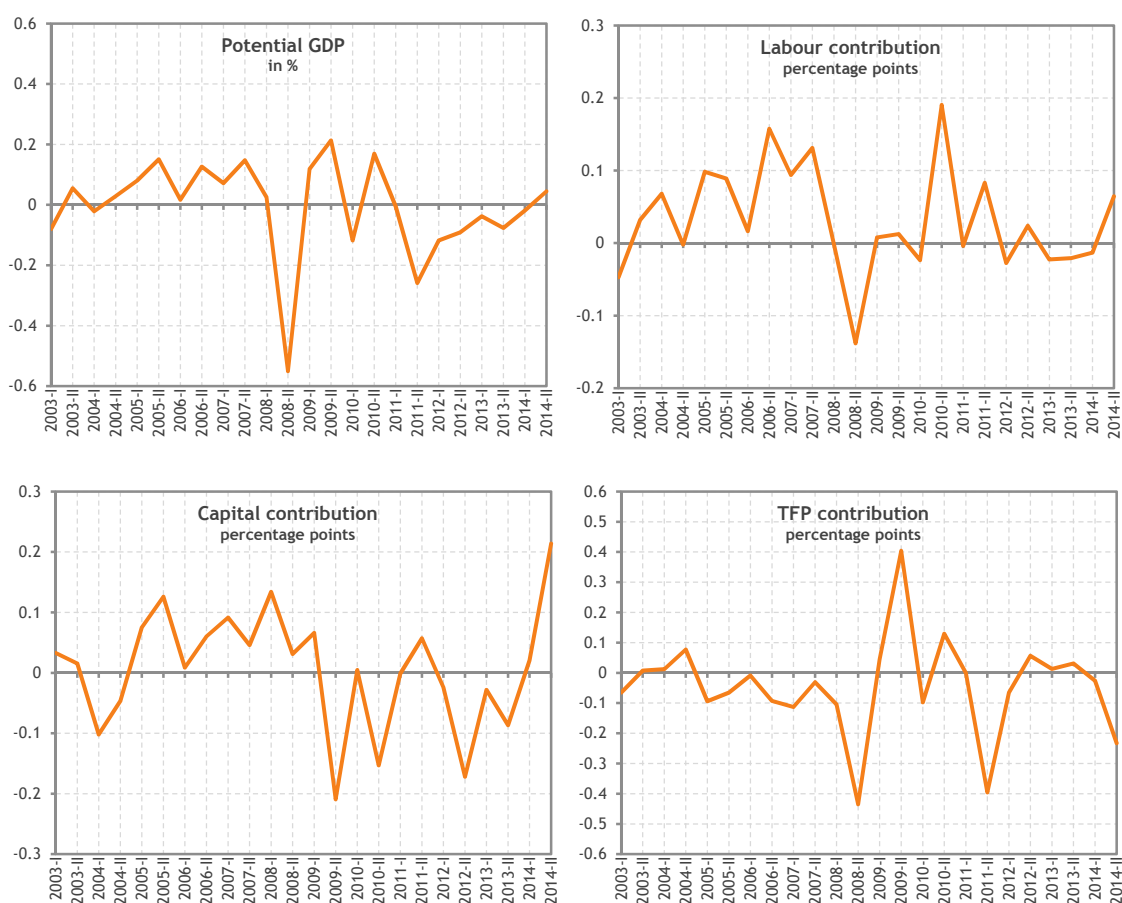
vintages. Even more than the notable size of the range itself, the very different shape of the TFP trend average over the two periods shows the enormous uncertainty regarding the contribution of TFP.



3.2.3. Revisions for the current year

In the previous sub-sections we constructed ranges using subsequent vintages for years both in the past and in the future relative to a particular vintage. Here we will focus exclusively on the two revisions for a given year t based on the estimates produced in spring and autumn of that year t and in spring of following year. For instance revision I for the year 2003 will be the difference between the autumn and spring 2003 estimate and revision II the difference between the spring 2004 and autumn 2003 estimate. Results for potential growth and its contribution are provided in Graph 11. Prior to the crisis, potential growth for the current years has been regularly (although modestly) revised upwards, fuelled by factors that will appear, after the outbreak of the crisis, as having been purely cyclical. A sharp downward adjustment was made to the potential growth estimate for 2008 in spring 2009 when the severity of the crisis became evident. This drastic correction was followed by a period of upward and downward movements but since the second adjustment for the year 2011, all revisions except the latest one have been negative. On average over 1999-2014 revisions have been downwards oriented but this is entirely due to the strong correction made in spring 2009.

Turning to the components, revisions to the labour contribution are on average clearly positive and this outcome is attributable essentially to the potential labour force revisions but also to the NAWRU (decomposition not shown). Revisions for capital are on average close to zero but upward revisions prevailed before the crisis while since the crisis downward revisions dominate. The strong positive second revision for the year 2014 is the consequence of the shift to ESA 2010, compensated by an equivalent negative correction to the contribution of total factor productivity. Negative revisions for the latter clearly dominate over the sample with one large positive second revision for the year 2009.

Graph 11 Revisions in potential GDP growth and contributions

Note: revision I = autumn(t)-spring(t); revision II = spring(t+1)-autumn(t)
 Source: Federal Planning Bureau

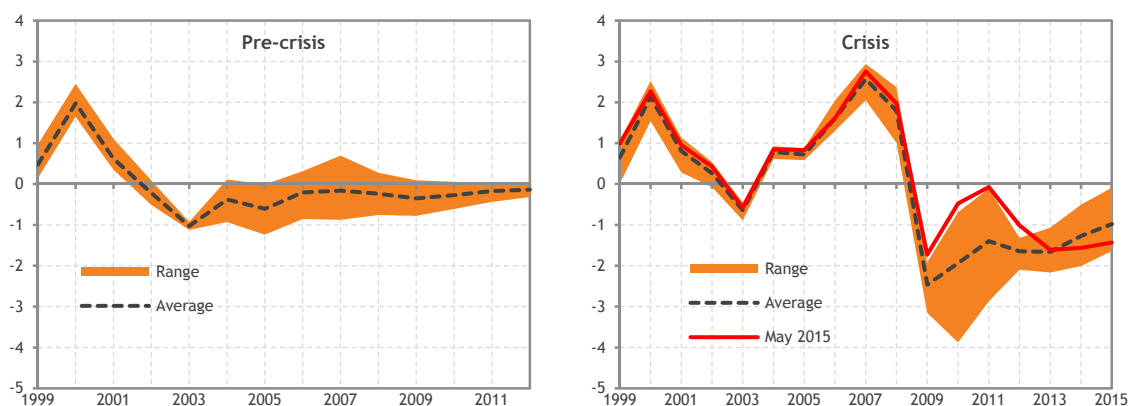
3.2.4. The output gap

The output gap is defined as the difference between actual and potential GDP, expressed as a percentage of the latter, and thus summarises the overall amount of slack present in the economy. In terms of computation of the uncertainty as defined above, it implies that ranges for the output gap contain both the revisions made to potential GDP estimates and to data and forecasts concerning actual GDP.

The average over the vintages condenses the views before and after the crisis concerning the cyclical position of the Belgian economy. Clearly in the pre-crisis period, the output gap was considered to be close to zero for the period 2004-2008 with a maximum range of 1.6 percentage points (see the left-hand chart in Graph 12). After the outbreak of the crisis, history was clearly rewritten with a large positive output gap being estimated for this period.²⁰ As testified by the May 2015 estimates, this view has not changed since. What did change significantly is the size of the output gap estimates for the years 2010-2011 as indicated by the impressive range of around 3 percentage points illustrating the high uncertainty that prevailed just after the outbreak of the financial crisis. For the most recent years the width of the range has been halved but the output gap remains in all cases in negative territory.

²⁰ See Lebrun (2009) for a deeper analysis.

Graph 12 The output gap: pre-crisis and crisis ranges
In % of potential GDP



Source: Federal Planning Bureau

3.3. Model uncertainty

As mentioned previously in the paper, there is no unique approach to estimate potential output. Both the Commission and the OECD rely on a Cobb-Douglas production function but the components are obtained by applying different filters²¹. The IMF has no “official” methodology and the estimates may incorporate judgement by the relevant country desk.

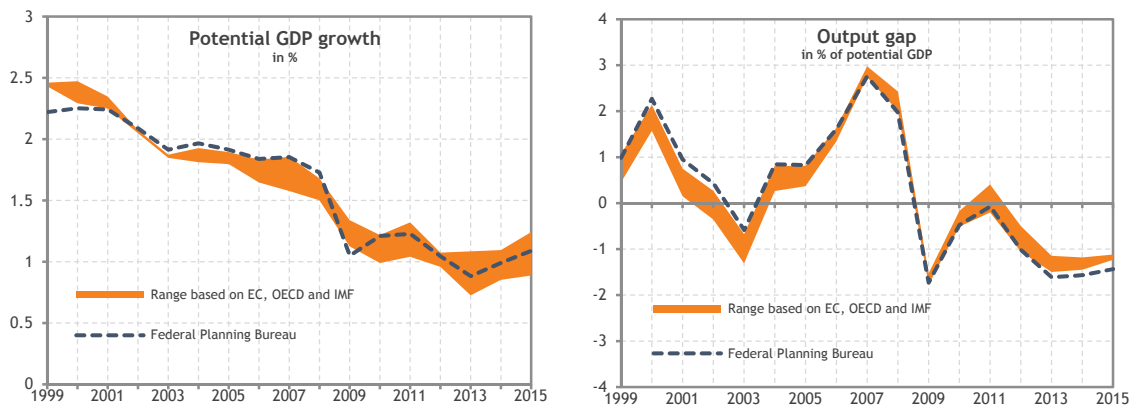
In Graph 13 below, the range is constructed by taking for each year the minimum and the maximum value of the latest potential growth and the output gap estimates for Belgium produced by the European Commission, the IMF and the OECD²². The dotted line represents the FPB May 2015 estimates already presented in previous sections. According to these ranges, the current uncertainty related to the method applied seems relatively limited for Belgium even at the end of the sample. On average over the period 1999-2012 the width of the range is less than 0.2 percentage points with a maximum of 0.3 points. It increases only marginally at the end of the sample: in 2015 potential growth ranges from 0.9% (European Commission) to 1.2% (OECD), the IMF estimate (1.1%) being close to that of the FPB. The output gap, which confronts the actual GDP with potential GDP in level terms, exhibits a range of less than half a percentage point on average over the period 1999-2015 with a narrowing in the most recent years. The FPB has the largest negative output gap of all four institutions in 2015 but still only 0.2 percentage points below the lower bound.

This relative consensus among international organisations regarding Belgian potential output has not always prevailed; for instance just after the outbreak of the crisis differences were much larger (see Lebrun, 2009). For countries severely hit by the crisis like Greece, Ireland, Portugal, Spain or Italy the discrepancies in potential output and output gap estimates remain substantial.

²¹ See Havik et al. (2014) for the European Commission and Ollivaud and Turner (2014) for the OECD approach.

²² Coming respectively from the European Economic Forecast (Spring 2015), the World Economic Outlook (April 2015) and the OECD Economic Outlook (June 2015).

Graph 13 Potential growth and output gap estimates from different institutions



Source: Federal Planning Bureau, European Commission, OECD and IMF

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