Potential Output, Output Gap and Fiscal Stance: is the EC estimation of the NAWRU too sensitive to be reliable?

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Potential Output, Output Gap and Fiscal Stance: is the EC estimation of the NAWRU too sensitive to be reliable?

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Abstract: EU fiscal governance builds on the concept of Potential Output, the highest level of production an economy can sustain without incurring in inflationary pressure. Unfortunately, Potential Output is not observable and must be estimated. There are many techniques to obtain a guess value of the potential of an economy, each of which with pros and cons. The methodology adopted by the European Commission and EU Member States, while consistent with most of the recent economic and econometric theory, is still not robust enough to give a unique and irrefutable measure on which to base EU's fiscal framework. Should the fiscal governance continue to be based on this concept, further extension of the methodology must be implemented in order to obtain more robust estimates.

1. Introduction

Potential output (PO), the highest level of production an economy can produce with the full utilization of available resources without incurring in inflationary pressures, is a key concept in the European Union (EU) economic governance. Its estimates are the starting point to assess the cyclical conditions of Member States (MSs) of the EU and to derive structural deficits which are key to evaluate the compliance with the EU fiscal framework and in particular with respect to the Stability and Growth Pact (SGP). Once PO has been estimated the cyclical position of a country, the output gap, can be calculated as a difference between actual and potential output (in percentage of PO). The output gap, together with the semi-elasticity of the budget balance to the cycle are first used to net-out headline budget balance (BB) from the cyclical components. Then, to obtain the Structural budget balance (SB) which is the reference measure of the fiscal position of a MS, temporary measures (one-offs) are also subtracted from the headline deficit. In formula:

$$SB = BB - \varepsilon \cdot OG - oneoffs \quad (1)$$

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where ε is the semi-elasticity of the budget balance to the cycle and $OG = \frac{Actual\ GDP}{PO} - 1$. While all the elements in (1) but the PO are measured or estimated from observable phenomena,[2] PO is not observable and different techniques can be used to make a guess of the potential of an economy. Unfortunately different techniques can - and most of the time do - produce very different estimates of PO and, as a consequence, different results for the fiscal position of a MS can obtained. Furthermore, even the same technique and representation of the unobserved process describing PO can produce quite different results depending on assumptions on initial conditions, number of observations, software program and many other tiny technical details.

This is what actually happens with the methodology in use by the European Commission and by all the MSs[3] and this is the focus of this chapter.

2. The evolution of the EC methodology to the estimation of output gap

a. Legal background

The Stability and Growth Pact was introduced in 1997 with the Amsterdam Resolution of the European Council to strengthen the monitoring and coordination of national fiscal and economic policies with the goal of enforcing the deficit and debt limits established by the Maastricht Treaty. The original public finance targets of the SGP were set on observable headline budget balance and debt (3% and 60% respectively). In 1998 two council regulations[4] modified the preventive and corrective arms of the pact to take into account the cyclical position of MSs and in 2005 two additional regulations[5] changed the main target variable of the surveillance process to a country-specific Medium Term Objective (MTO) expressed in structural terms. In particular the country specific MTO takes into account: *i)* the debt-stabilizing balance for a debt ratio equal to 60% of GDP; *ii)* a supplementary debt-reduction effort for in case the debt ratio exceeds 60% of GDP; *iii)* a fraction of the adjustment needed to cover the present value of the future increase in age-related government expenditure.[6] The SGP has been recently modified and reinforced by the Six-pack in 2011 and the Two-Pack (2014).[7] The Treaty on Stability, Coordination and Governance (TSCG) (2013) has further reinforced the commitment, for those countries who signed it, for sound public finances, leaving the structural balance as the main reference target.

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[2] For the estimation of the semi-elasticity of budget balance see Mourre *et al.* (2014) and Price *et al.* (2014).
[3] Given the relevance of the object, a dedicated working group, the Output Gap Working Group of the Economic Policy Committee, was set back in that days to develop a common analytical framework.
[4] COUNCIL REGULATIONS N. 1466/1997 and 1467/1997.
[5] COUNCIL REGULATIONS N. 1055/2005 and 1056/2005.
[6] For additional details on the calculation of the MTO see the code of conduct on the "Specifications on the implementation of the Stability and Growth Pact and Guidelines on the format and content of Stability and Convergence Programmes" available online http://goo.gl/I2itxd.
[7] For an overview of the EU Fiscal Governance see http://goo.gl/mKFAhx.

The compliance with the SGP's deficit criterion is now based on two pillars: the MTO and the expenditure benchmark. To make a long story short, for those MSs who signed the TSCG the MTO corresponds to a SB not lower than -0.5% of GDP and, the expenditure benchmark, a growth rate of real primary expenditure not exceeding the 10-year average growth rate of potential GDP.[8]

As can be seen, the estimation of potential output is key in monitoring the fiscal compliance to the SGP.

b. Technical background

Several methodologies can be used to calculate potential output, from pure statistical filtering to structural time series models as shown for example in Cerra and Saxena (2010).[9] The European Commission and MSs adopt the production function approach.[10] Potential output is supposed to be a function of capital (*K*), labour (*L*) and total factor productivity (*TFP*). The production function is a Cobb-Douglas with constant return to scale with labour share *a*=0.65. In formula:

$$Y = TFP \cdot L^{\alpha} \cdot K^{1-\alpha}$$

The single factors of PO are calculated in the following way:

- Potential capital is assumed to be equal to actual capital and is obtained using the perpetual inventory method. For older MSs, the initial condition is $K_0 = K_{1960} = 3 \cdot GDP_{1960}$. The assumption that potential capital is equal to actual capital is justified by the fact that in every year investment is just a tiny fraction of capital and the actual value of this latter is already smooth;
- Smoothed TFP is obtained using a Bayesian bivariate Kalman filter. Starting from actual TFP obtained as a Solow residual, trend TFP is extracted using a trend-cycle decomposition in which the univariate structural model for TFP is augmented with an equation relating TFP and an indicator of capacity utilization as described in Planas *et al.* (2013);
- Labour is the (smoothed) total amount of hours worked, obtained as:

  $$L = (POPW \cdot PARTS \cdot (1 - NAWRU)) \cdot HOURS$$

  where *POPW* is the working age population in 15-74, *PARTS* is the smoothed participation rate, *HOURS* is the smoothed average of per-capita hours worked and *NAWRU* is the non-accelerating wage rate of unemployment. *PARTS* and *HOURS* are forward extended for six years first using a simple ARIMA model and then smoothed using the Hodrick-Prescott filter. *POPW* is taken as it is.

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[8] These targets are further qualified depending on whether MSs are at the MTO or converging toward it and whether the business cycle is in normal or not. For further details see European Commission (2016a) and European Commission (2015).
[9] For an application to the specific case of Italy see Bassanetti *et al* (2010)
[10] See Havik *et al.* (2014).

NAWRU is computed estimating, via maximum-likelihood, a bivariate Kalman filter in a trend-cycle decomposition augmented with economic information coming from the Phillips curve.

- On top of the extensions above, a set of rules to allow the output gap to close in the three years after the last year of forecast is added to the procedure.

The main data source is AMECO, the Annual Macro-ECOnomic database of the European Commission's DG-ECFIN containing both historical and forecasted variables. PO calculation takes as given both historical data coming from Eurostat and forecasted values. For these latter, each forecaster uses its own forecast. In what follows the generic term "data" is used to refer to the set containing both historical and forecasted value. *POPW* is taken from the Eurostat Population Projection (Europop2013).[11]

3. EC methodology for the NAWRU

To analyse the sensitivity and reliability of PO I now limit the focus on the calculation of *NAWRU* for three main reasons: *i)* many critiques to the estimation of *NAWRU* are also valid for *TFP*; *ii)* the pre-estimation setup of *NAWRU* is more frequently changed than the one of *TFP*; *iii)* despite its complexity, the estimation of *NAWRU* is tractable with commercial software, while for *TFP* this is almost impossible without excellent programming skills. In fact, EC uses a software developed in-house named "GAP" which interacts with an Excel interface to make the estimation process user-friendly. For TFP, the Bayesian estimate makes the process extremely complex and in need of additional inputs and procedures.[12]

To enrich the analysis with a practical example a country-specific exercise will be developed and discussed, without loss of generality. Italy will be the guinea pig.

The trend-cycle decomposition for unemployment via the Unobserved Component Model is supposed to be of the form:

$$u_t = T + C = u_t^* + (u - u^*)_t \quad (2)$$

where u_t^* represents the trend-*NAWRU* and $(u - u^*)_t$ the cycle-unemployment gap. Trend unemployment is supposed to follow a second-order random walk of the form:

$$u_t^* = u_{t-1}^* + \mu_{t-1} + a_{pt} \text{ were } \mu_t = \mu_{t-1} + a_{\mu t} \quad (3)$$

with a_{pt} and $a_{\mu t}$ being white noise disturbances with variances V_p and V_μ respectively. The cyclical component evolves according to an AR(2) process:

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[11] Eurostat produces new population projection every 3 years.

[12] See Planas and Rossi (2015).

$$(u-u^*)_t = \varphi_1(u-u^*)_{t-1} + \varphi_2(u-u^*)_{t-2} + a_{ct} \quad (4)$$

and a_{ct} is, again, a white noise with variance V_c. Stationarity condition requires that $\varphi_1 > 1$ and $\varphi_2 < 0$.

This univariate model is augmented with the accelerationist version of the Phillips curve:

$$\Delta\pi_t = \mu_\pi + \beta_0(u-u^*)_t + \beta_1(u-u^*)_{t-1} + \beta_2(u-u^*)_{t-2} + a_{\pi t} \quad (5)$$

where $\Delta\pi_t$ is the change in the wage inflation rate[13] and $a_{\pi t}$ is the usual white noise disturbance with variance V_π. (5) can be extended with additional components, i.e. exogenous variables, lagged unemployment growth, AR or MA terms, but these latter are not usually incorporated because of their lack of statistical significance. Furthermore, both trend and cycle can be modelled in some other ways,[14] but in the rest of the paper (2)-(5) are used, because this is the special case adopted for Italy, with little loss of generality.

The state space representation of (2)-(5) is:

$$\text{State equation} \begin{bmatrix} u_t^* \\ (u-u^*)_t \\ (u-u^*)_{t-1} \\ (u-u^*)_{t-2} \\ \mu_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 \\ 1 & \varphi_1 & \varphi_2 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_{t-1}^* \\ (u-u^*)_{t-1} \\ (u-u^*)_{t-2} \\ (u-u^*)_{t-3} \\ \mu_{t-1} \end{bmatrix} + \begin{bmatrix} a_{pt} \\ a_{ct} \\ 0 \\ 0 \\ a_{\mu t} \end{bmatrix}$$

$$\text{Measurement equation} \begin{bmatrix} u_t \\ \Delta\pi_t \end{bmatrix} = \begin{bmatrix} 0 \\ \mu_\pi \end{bmatrix} + \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & \beta_0 & \beta_1 & \beta_2 & 0 \end{bmatrix} \begin{bmatrix} u_t^* \\ (u-u^*)_t \\ (u-u^*)_{t-1} \\ (u-u^*)_{t-2} \\ \mu_t \end{bmatrix} + \begin{bmatrix} 0 \\ a_{\pi t} \end{bmatrix}$$

The state space model is estimated by maximum likelihood via the Kalman recursion using the diffuse Kalman filter for the initialization.[15]

The likelihood function is rarely well shaped and many local maxima can be found. The usual way to proceed for the estimation is to start with an initial guess (starting values) of the parameters to be estimated based on previous studies and experience. Furthermore, some restrictions are usually imposed on the bounds of the variances. A solution adopted by most studies is to fix the signal-to-noise ratio (i.e. the ratio of the variance of the residuals of the transition and the measurement

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[13] More specifically, the underlying variable in the AMECO database is the nominal compensation per employee, total economy (HWCDW).

[14] In particular trend can even be modeled as first order random walk or damped trend, cycle can also be modeled as AR(0) AR(1) or AR(2) with complex roots.

[15] See the reference in footnote 7.

equation) in order to have a smooth NAWRU, as suggested by Gordon (1997) and applied for example by Richardson *et al.* (2000) to the OECD countries and Fabiani and Mestre (2004) to the euro area.

The EC follows a different, and more invasive, approach. A first loose constraint is that variances cannot be greater than 1.2 times the variance of the reference variable.[16] Then, variance bounds are further restricted - both from above and from below - to reach three main goals: *i)* minimize the RMSE between the most recent estimate of the NAWRU time series and the previous estimate of the same time series based on older data; *ii)* obtain a good level of significance of β_0 in (5); *iii)* maximize the log likelihood. This procedure is a mechanical iterative procedure implemented "by hand".[17]

4. Too sensitive to be reliable

The problem of the accuracy of PO estimate is well known in literature. For example Proietti *et al.* (2004) extensively analyse the sensitivity of PO to model specification. Another source of estimation uncertainty is data revision. If the underlying data change potential output changes as well, as documented in Fioramanti *et al* (2015). In addition, the filtering procedure is also applied by the EC and MSs to the forecasted data which, in most of the cases, are not the same between the EC and MSs. The elements above are sources of *macroscopic* uncertainty and their natural consequence is that PO estimate is different or changes over time because the underlying data are different. Here the focus is on the *microscopic* sources of uncertainty in the EC's approach which rises even if the underlying data and the model specification are the same. In particular, this uncertainty is the result of: *i)* difference in the forecast horizon; *ii)* small change in the upper and lower bounds of the variances; *iii*) initialization of the Kalman filter. These are "micro" sources of uncertainty because small changes can produce very different results and, as a consequence, policy implications.

Using the most recent EC data, from the winter 2016 forecast,[18] how small changes can produce relevant differences will be shown. The policy implications will be discussed in the next section.

a. Forecast horizon

The EC forecast horizon is usually from time *t* up to *t+1* (winter and spring) or *t+2* (autumn). The code of conduct of the Stability (and Convergence) Program (SCP) requires the MSs to submit to the EC the forecast for a large number of economic variable at least up to *t+3*.[19] Usually, the Italian government presents his Stability Program in April with forecast up to *t+4*.

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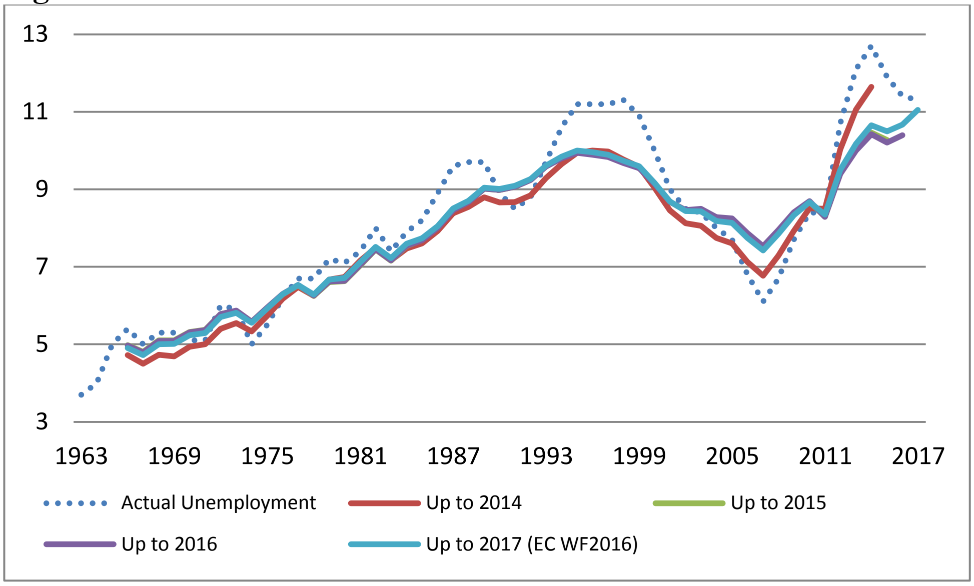
[16] That is $V_{\Delta u}$ for V_p, V_μ and $V_c, V_{\Delta\pi}$ for V_π.
[17] For a tentative of automatization of the procedure via a grid-search algorithm see Ministero dell'Economia e delle Finanze (2015) 18-22.
[18] European Commission (2016b).
[19] See footnote 6.

Figure 1 shows the different NAWRU estimates obtained using the same underlying data - from the European Commission (2016b) -, model, program and variance bounds, but using different forecast horizons. Let's suppose we are in 2013, but we have 4 different forecast horizon from *t+1* to *t+4*. The forecast for unemployment and inflation are the same two series for all the smoothing procedure, but they are recursively used to smooth unemployment up to *t+1*, *t+2* and so on up to *t+4*.

Figure 1: NAWRU at different forecast horizon



Source: Author's calculation on European Commission data

As can be seen from the figure, even using the same dataset, but with different horizons, produces large differences in NAWRU. In particular, the larger difference is in 2014 comparing NAWRUs obtained from forecast up to 2014 and up to 2016, with a difference of 1.2 percentage points (pps). Given the rule of thumb that 1 pp more of NAWRU translates in 1/3 more of structural balance,[20] the difference above converts in 0.4 pp of SB. Why this is so? Because actual unemployment peaked in 2014 and then started decreasing. Using the full sample of forecasts, the smoother anticipates the change in the direction of actual unemployment from 2015 onward and starts smoothing the NAWRU well before 2014 (in 2011). Nothing is going wrong here and the filter is correctly doing is job flattening the series of unemployment around the turning points. On the other hand, using data up to 2014 provides no information to the Kalman filter on the turning point in 2015. Comparing NAWRU estimates coming from two different forecasters with different forecast horizon (i.e. EC and the Italian Ministry of Economy and Finance) can give quite different results even if the underlying forecast for the unemployment are the same where the two forecast horizons overlap.

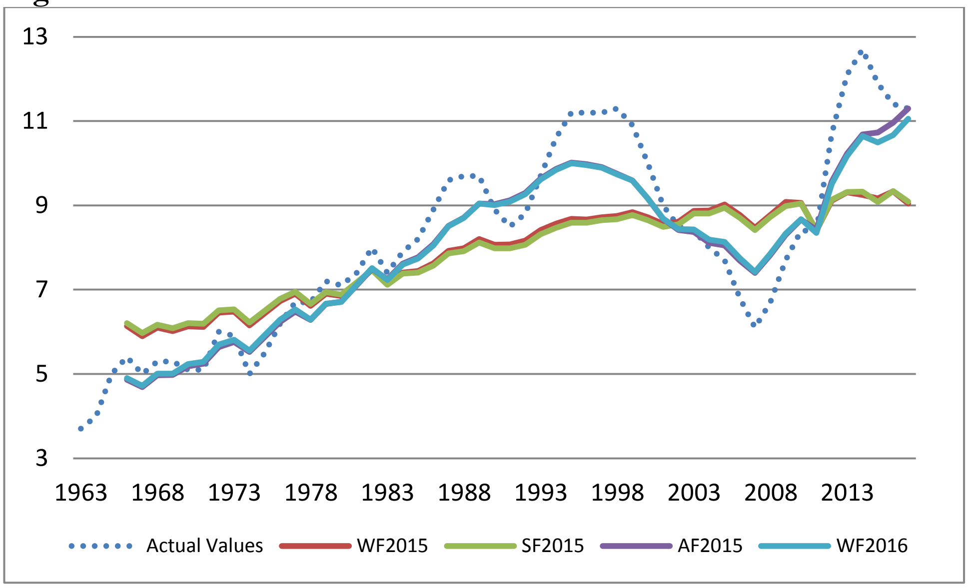
[20] This is the results of multiplying labour elasticity in the Cobb-Douglas (0.65) by the semi-elasticity of the budget balance to the cycle (0.54).

b. Variance bounds

In reviewing the performance of the PF methodology used by the EC, McMorrow *et al.* (2015) state that "(…) the PF methodology is superior to both the HP filter and the methods used in other international organisations. This vindicates the decision to adopt it for estimating output gaps as the 'commonly agreed' reference method to be used in EU fiscal surveillance procedures".[21] The metrics to assess the quality of the estimations are the size of the revisions and the real-time reliability. As for the revisions, there seems to be a circular reasoning here: as stated in section 3, having a small RMSE between the current and previous estimates is one of the goals. Minimizing revisions in PO, TFP and NAWRU are thus *constraints* imposed to the procedure and not a genuine property of the technique.

To give evidence on this issue, Figure 2 plots actual unemployment coming from the latest EC winter forecast and different estimates of NAWRU using the same underlying data, but applying different variance bounds and in particular those used in different forecast rounds by the EC itself, from winter 2015 to winter 2016 and reported in Table 1.

Figure 2: NAWRU with different variances bounds



Source: Author's calculation on European Commission data

The larger difference in the last part of the sample is found in 2017 comparing the NAWRU obtained using the parameters from winter 2015 and autumn 2015 and the result is a difference of 2.2 pps; using the usual 1/3 rule of the thumb produces a difference in the SB of 0.7 pp. As can be seen from Table 1 this huge difference is produced by a mere 0.001 difference in V_μ and by 0.01 difference in V_c upper

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[21] Pg. 19.

bounds.[22] These upper and lower bounds are very critical because they determine the degree of smoothness of the NAWRU (V_c), the possibility of jumps in the NAWRU (V_p) and the degree of non-linearity of the trend of the NAWRU (V_μ) and especially because in most of the cases the bounds are binding. In this special case, what is even more puzzling is the fact that all the statistics related to the goodness of fit (t-values, log-likelihood and R-squared) would have favoured the adoption of the Spring 2015 variance bounds also in Winter 2016. On the other hand, this choice would have produced a flat NAWRU with little cycle and a very large RMSE with respect to the previous estimate. This evidence suggest that the minimization of the RMSE was the driving criterion for the choice of the bounds in Winter 2016.

Table 1: Variance bounds in different forecast rounds

		Lower Bound	Upper Bound
Winter 2015	Vp	0.00	0.080
	Vμ	0.00	0.020
	Vc	0.00	0.115
	Vπ	0.00	8.1614E-04
Spring 2015	Vp	0.00	0.080
	Vμ	0.00	0.021
	Vc	0.00	0.121
	Vπ	0.00	8.1614E-04
Autumn 2015	Vp	0.00	0.080
	Vμ	0.00	0.021
	Vc	0.00	0.105
	Vπ	0.00	8.1614E-04
Winter 2016	Vp	0.00	0.100
	Vμ	0.02	0.035
	Vc	0.00	0.110
	Vπ	0.00	8.1614E-04

In the special case of the choice of variance bounds the issue of EC's time consistency has a central role. Suppose the EC has a procedure which disregards the RMSE criterion and only takes into accounts goodness of fit measures such that at every forecast round variance bounds are chosen according to these measures. Let's now suppose that at time *t* the EC opens an Excessive Deficit Procedure (EDP) for a country because, according to the estimates of *NAWRU->PO->OG-> SB,* this country had an excessive deficit in *t-1*. After a couple of years, with a possible turning point in the forecast horizon, new estimates show that in *t-1* that country, in fact, did not experience an excessive deficit. What would then be the reaction of the country in question? Would the EC be still credible in the future? All in all, the fine tuning of the variance bounds to minimize the RMSE seems to be a shield protecting the EC's time consistency rather than a technique to improve the estimate of potential output toward the "true" value.

c. Software packages

So far all the estimation have been implemented in GAP. Another source of micro sensitivity is related to the software packages used to estimate the NAWRU and in particular in the way the Kalman filter is initialized. Figures 3 to 5 report actual unemployment and NAWRU estimates using 4 different

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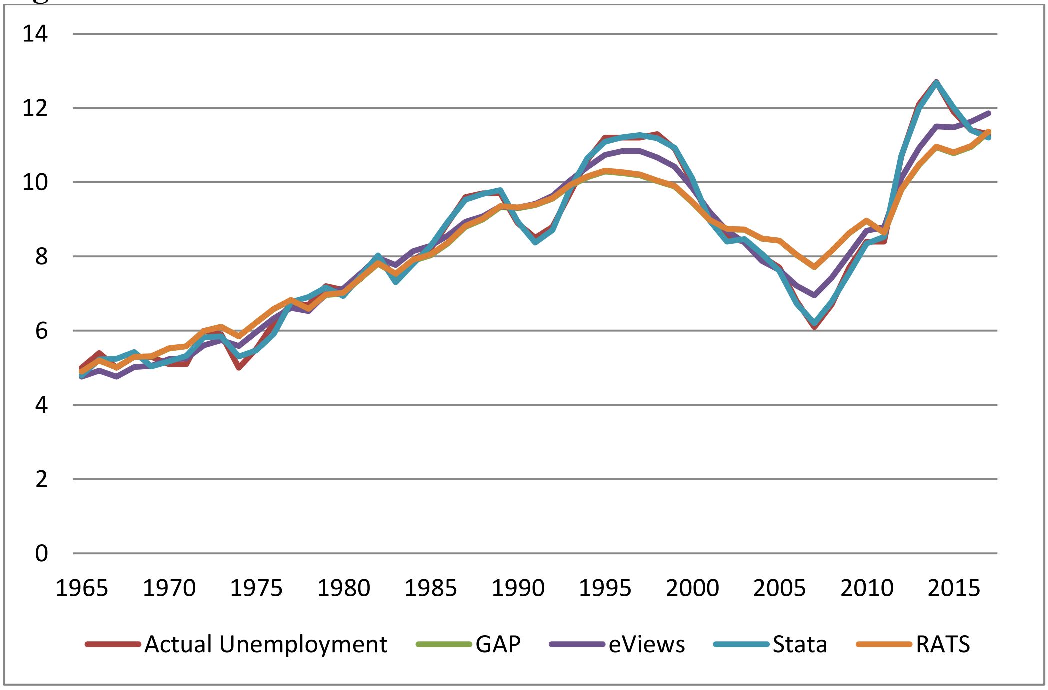
[22] In both cases the upper bounds are binding.

software packages, that is, the one provided by the EC and 3 commercial programs.[23] As in the previous exercises, also in this case the dataset is the same – coming from winter Forecast 2016. Because the likelihood can be very irregular with many local maxima, once the estimates from GAP have been obtained, estimated parameters and/or variances from GAP are used as starting values in the other three commercial programs and, where possible,[24] inequality constraints for the variance bounds are imposed (Figure 3).[25]

Figure 3: NAWRU unconstrained estimates



Source: Author's calculation on European Commission data

In addition to this initialized and "loosely" constrained implementations, two sets of additional replications are implemented. In the first set, in addition to starting values and inequality constraints, the parameters other than variances are constrained to be those obtained from EC's software, while variances are freely estimate in the range defined by the upper and lower bounds (Figure 4). In the second set of estimates, NAWRU is estimated using EC's starting values, constraining variances to those obtained using GAP and leaving all the other parameters free (Figure 5). Except for RAT and GAP which produce almost the same estimate, and hence the overlapping lines in the figures, given the constraint and starting values, Figures 3 to 5 show that estimated NAWRU can be very different depending on the software program used and this difference is exacerbated around turning points.[26]

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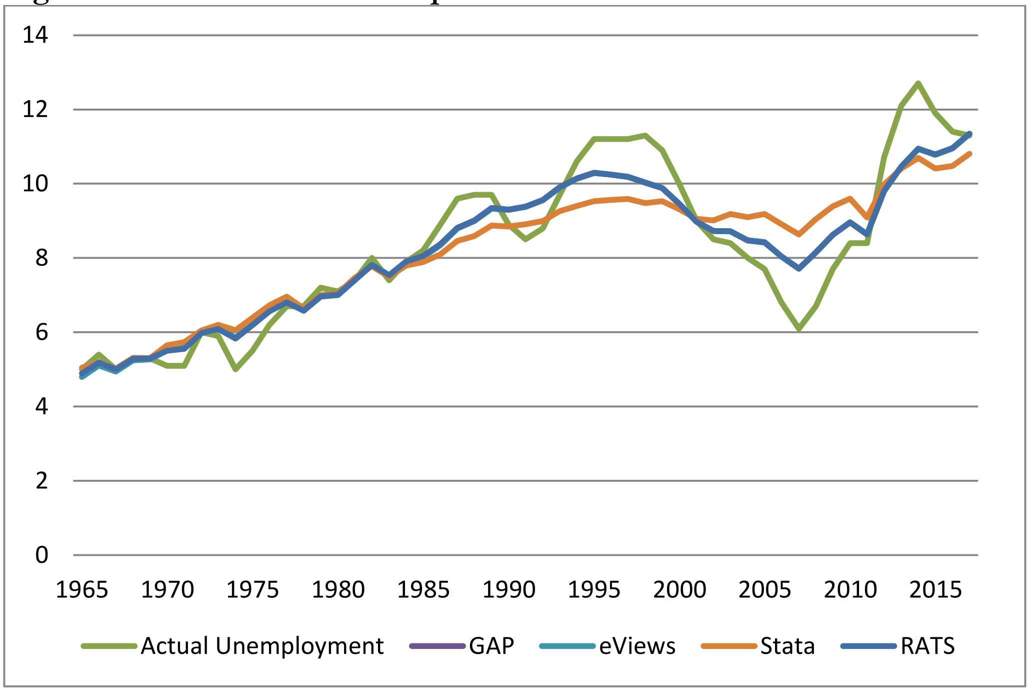
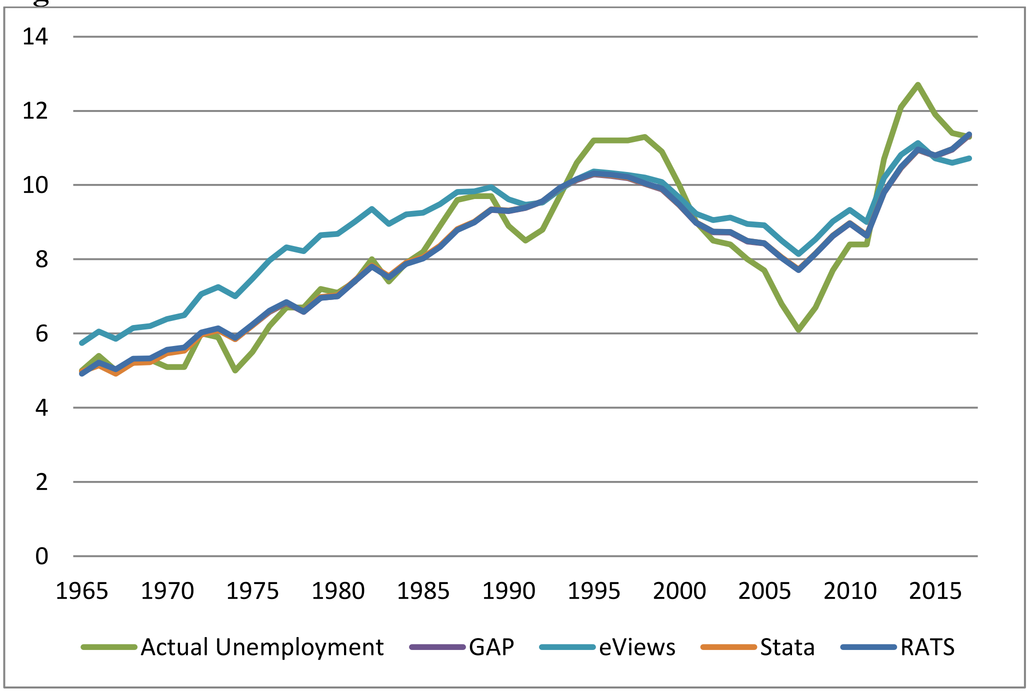
[23] The four software and versions are GAP 4.4, Stata 14.1, RATS 8.2, eViews 9.5.
[24] In Stata inequality constraints are not permitted in the pre-defined procedure.
[25] Inequality constraints are those in Table 1 WF2016.
[26] The lack of a visible line in the Figures means that the results from two or more software programs overlaps almost perfectly.

Figure 4: NAWRU constrained parameters



Source: Author's calculation on European Commission data

Figure 5: NAWRU constrained variance



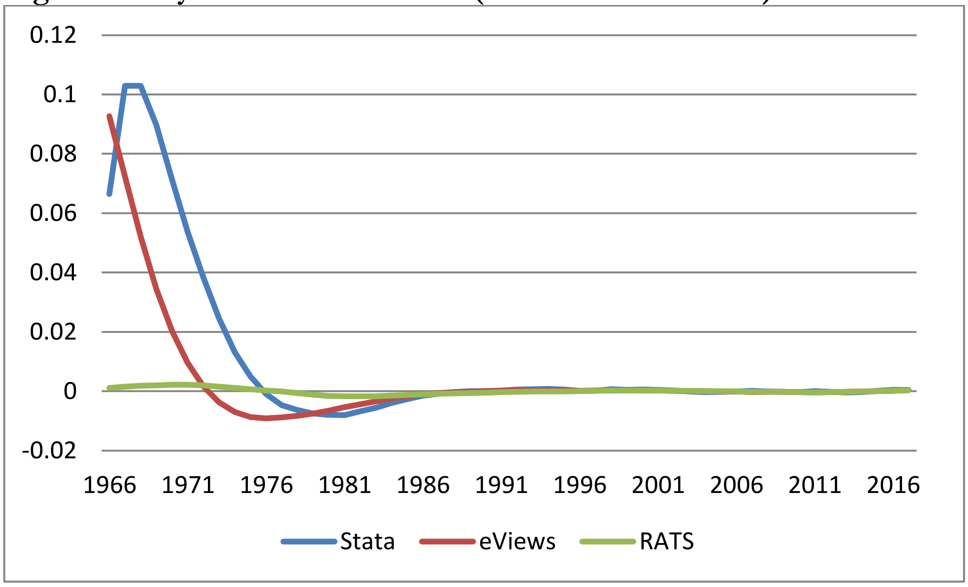
Source: Author's calculation on European Commission data

The source of these differences is, very likely, the way the Kalman filter is initialized. GAP uses the diffuse Kalman filter, the same as RATS and this is very likely the reason why the two programs produce the same results. eViews and Stata use a slightly different implementation.[27] Figure 6 shows the

[27] For technical details refer to the software manuals.

differences in NAWRU estimates between the three commercial programs and GAP with all the commercial software package's parameters and variances constrained to equal those coming from GAP.[28] Except for RATS, at the beginning of the sample/smoothing process the differences with GAP can be significant even for a fully constrained model. The point is not that EC and MSs could use different software and get different results. GAP is freely available and is actually the official program to use for PO estimates. The point is that all the measure of the NAWRU we have seen are equally reasonable.

Figure 6: fully constrained models (difference from GAP)



Source: Author's calculation on European Commission data

5. Policy implications and conclusions

We have seen that there are a lot of possible sources of *microscopic* differences which can produce quite large consequences in terms of policy implications. These microscopic differences add to the uncertainty coming from *macroscopic* differences – i.e. data revision, differences in forecast and model specifications. The implementation of the Stability and Growth Pact, with the preventive and corrective arms, hinges on the calculation of the structural balance and, hence, potential output and the output gap. But potential output and its components, like the NAWRU, are not observable and must be estimated. Furthermore these estimates are based not only on historical data, but also on forecasts. Potential output is a very useful concept and is a powerful tool to understand in which direction the economy is taking. Nonetheless, its unobservability and sensitivity to even small changes in underlying data, model assumptions, horizons and initial conditions make it a very weak and not reliable tool for fiscal surveillance in the European Union in which even a decimal point in SB can make the difference.

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[28] Stata needs at least one parameter or variance to be free.

It is worth to emphasize that what really matters for the fiscal governance for those countries which are not at their MTO but along the path toward the MTO is not the SB per se, but the *change* in the SB that must satisfy the convergence criterion. Large differences in the estimates of the SB can be associated with small differences in the estimated change in SB. Nonetheless, having a more robust measure of the cyclical position of a country implies less uncertainty around the estimate of the change in the SB.

How can the EC methodology be improved? Some recent researches have shown some possible paths. Blanchard *et al* (2015) stress the possibility that in the latest twenty years or so the inflation-unemployment relation, the Phillips curve, has moved back to a "level Phillips curve" rather than an "accelerationist Phillips curve", with an increasing importance of the inflation target set by central banks and a weakening in the relation between inflation and the unemployment gap. They also stress the possibility that, during and after the financial crises, hysteresis and super-hysteresis[29] have characterized the post-recession period. Possible roles for anchored expectation and hysteresis are also confirmed by Rusticelli *et al* (2015) and Rusticelli (2015), with the latter stressing the effect of a long lasting unemployment on workers employability.

Some progresses in these directions have been made during recent years in the EC methodology. In 2014 the EC has introduced the possibility to move to a New-Keynesian Phillips curve in which rational expectations on price development replace adaptive expectations. The motivation behind this change is that "rational expectation avoids producing excessively pro-cyclical NAWRU (…)".[30] The issue of the excess of pro-cyclicality has been raised by many authors and commentators,[31] but apparently in the wrong way. The point is not that the NAWRU is too pro-cyclical, it is that the pro-cyclical behaviour is not estimated, but the consequence of the fine tuning on the bounds of the variances. Long-lasting unemployment and/or supply shocks can produce hysteresis and pro-cyclicality, but the EC methodology has no tool (variable in the Phillips curve equation) to capture this phenomenon. For example, introducing the effect of long term unemployment might improve the week economic relation between inflation and unemployment registered during the latest decade. The proof of this weakening in the relation is in the EC owns estimates: in recent years in the special case of Italy the R^2 of the estimate has always been under 0.1.

Changing the methodology is a very demanding process because every change has to be endorsed and adopted by the EC and all the MSs in the Output Gap Working Group of the Economic Policy Committee. Nonetheless, the effort is necessary to restore the credibility on the EU's fiscal governance framework and to guarantee a fair treatment of all MSs.

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[29] While hysteresis affects the level of output, super-hysteresis affects the *rate of growth* of output.
[30] European Commission (2014), box 1.1.
[31] See for example Fantacone *et al* (2016) in this volume and Boitani and Landi (2014).

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