

The Estimation of Potential Output: an Enhanced Methodology for Italy

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Outline of the presentation

- EU Commonly agreed production function approach: why an alternative model for Italy?
- NAWRU vs NAIRU
- Italy's TFP trend estimation: a new labour hoarding index replacing the survey based Capacity Utilisation (CUBS) index
- Output gap and fiscal stance for Italy: implications for the compliance with the Stability and Growth Pact (SGP)

Output gap and potential output estimation

- EU Commonly agreed production function approach unsuitable for Italy because procyclical and counterintuitive results on TFP and NAWRU
- Radical approach: OECD and IMF models based on a Multivariate Filter and Okun law
- Minimalist approach: slightly changes in the commonly agreed production function

EU Commonly Agreed Production Function

$$Y_t = L_t^\alpha K_t^{1-\alpha} TFP_t$$

- Cobb-Douglas-type PF with constant return to scale on capital (K) and labour (L). TFP is total factor productivity, α is the output elasticity w.r.t labour coincident to the wage share.
- Potential output is obtained by replacing in K, L and TFP corresponding to their full or potential utilisation.
- Output gap is the relative distance of actual output Y from its potential

$$\mathbf{OG}_t = \left(\frac{Y_t}{\bar{Y}_t} - \mathbf{1} \right) = \mathbf{TFP} \mathbf{Gap}_t + \mathbf{0.65} * \mathbf{L} \mathbf{Gap}_t$$

$$\mathbf{L} \mathbf{Gap} = f(\mathbf{Unempl} \mathbf{gaps}) = f(U_t - \mathbf{NAWRU}_t)$$

NAWRU vs NAIRU: The models

$$U_t = N_t + C_t$$

$$N_t = N_{t-1} + \rho_{t-1} + \varepsilon_{1t}$$

$$\rho_t = \rho_{t-1} + \varepsilon_{2t}$$

$$C_t = \delta_1 C_{t-1} + \delta_2 C_{t-2} + \varepsilon_{3t}$$

$$\Delta W_t = \alpha + \beta_1 C_t + \beta_2 C_{t-1} + \beta_3 C_{t-2} + \varepsilon_{4t}$$

$$\text{with } \varepsilon_{it} \cong N(0, \text{var}(\varepsilon_{it})) \quad i = 1..4$$

- NAWRU (N) and Unemployment gaps (C=U-N) are estimated through a Kalman filter, with a wage inflation (W) Phillips curve.
- Estimates suffer from several drawbacks, such as: a) procyclicality; b) lack of macroeconomic consistency; c) lack of statistical robustness.
- Alternative Phillips Curve, with CPI inflation (P) and alternative imported inflation (X)

$$\Delta P_t = \alpha + \beta_1 C_t + \beta_2 C_{t-1} + \beta_3 C_{t-2} + \varphi X_t + \varepsilon_{4t}$$

NAWRU vs NAIRU: statistical fit

ESTIMATES OF THE PHILLIPS CURVE: CURRENT VS ALTERNATIVE SPECIFICATION

	NAWRU – Current specification 2016 Spring Forecasts			NAIRU – New Specification 2016 Spring Forecasts		
	Coefficient	Standard Error	T-Statistics	Coefficient	Standard Error	T-Statistics
Constant	-0.0016	0.0033	-0.4813	-0.0005	0.0023	-0.2053
Beta-Lag 0	-0.0353	0.0113	-3.1249	-0.0129	0.0063	-2.0608
Beta-Lag 1	0.0583	0.019	3.0649	0.0207	0.0104	1.9856
Beta- Lag 2	-0.0283	0.012	-2.3702	-0.0079	0.0063	-1.2561
Exogenous variable (imported inflation)	-	-	-	1.3932	0.2117	6.5823
Log-Likelihood	69.4321			88.5933		
R-squared (one step ahead)	0.0113			0.4721		

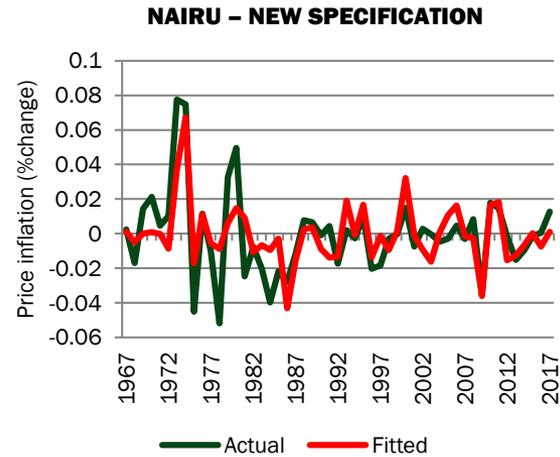
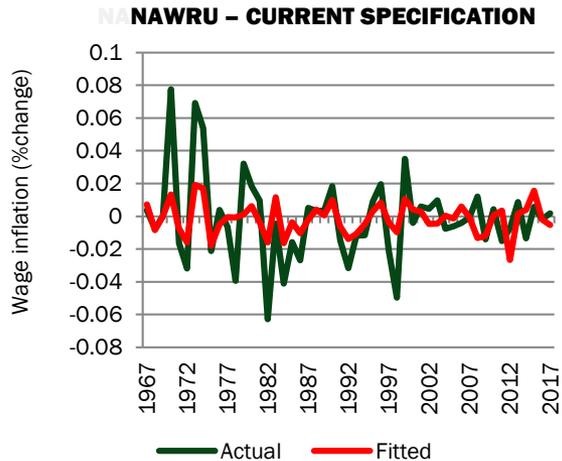
Source: European Commission 2016 Spring forecasts and own elaborations.

PHILLIPS CURVE: STANDARD DEVIATION OF PARAMETERS UNDER ITERATIVE ESTIMATION FROM 2000

	NAWRU – Current specification 2016 Spring Forecasts	NAIRU – New Specification 2016 Spring Forecasts
AR1	0.16	0.19
AR2	0.13	0.08
beta - Lag 0	0.04	0.01
beta - Lag1	0.07	0.01
beta - Lag 2	0.04	0.01
Exogeneous variable (imported inflation)	-	0.03
RMSE Average 1967-2000	0.41	0.30

NAWRU vs NAIRU: results

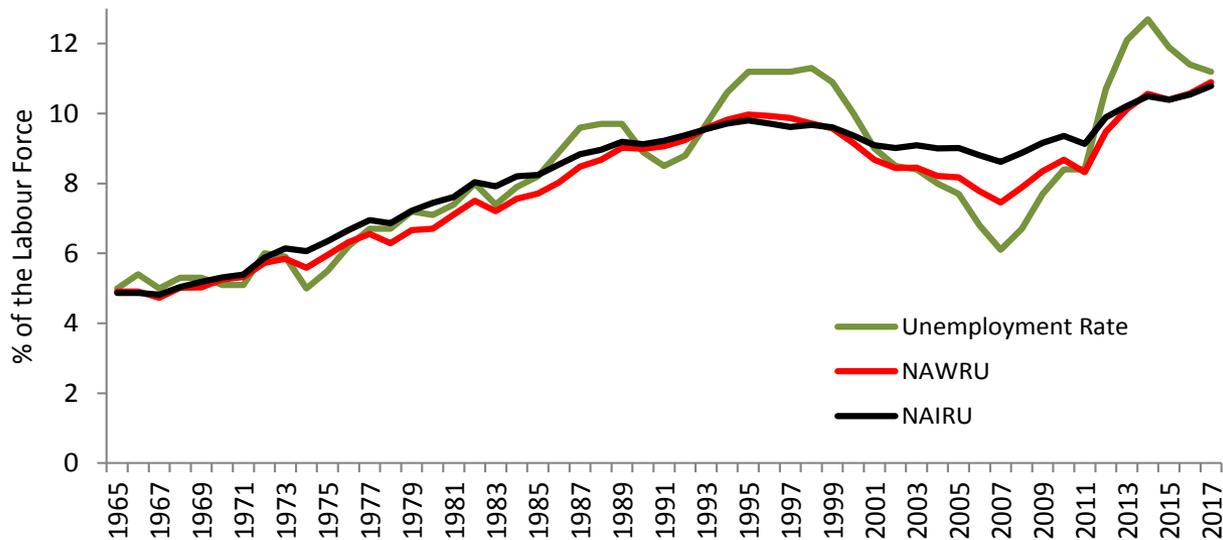
PHILLIPS CURVE: THE IMPROVED FIT OF THE NEW SPECIFICATION



Source: Commission Services, 2016 Spring Forecasts.

Source: Own elaborations on Commission Services, 2016 Spring Forecasts

UNEMPLOYMENT RATE, NAWRU AND NAIRU



Source: European Commission 2016 Spring forecasts and ⁷ own elaborations

NAWRU vs NAIRU: summing up

- Phillips Curve based on Price inflation instead of Wage inflation
- Introduction of an exogenous variable able to capture the effects of import prices in line with the OECD model and other works (e.g. Blanchard et al. 2015)
- Lower residual variance in the Phillips Curve suggesting improvement in specification and proper identification of the inflation series
- The slope of the Phillips curve is lower and more in line with recent studies (e.g. Prometeia 2016, Blanchard et al. 2015)
- Higher stability of the parameters considering recursive estimation starting from 2000

TFP: a labour hoarding indicator vs CUBS

$$TFP_t = P_t + C_t$$

$$U_t = \mu_U + \beta C_t + e_{Ut}$$

$$e_{Ut} = \delta e_{Ut-1} + a_{Ut} \quad V(a_{Ut}) = V_U$$

$$\Delta P_t = \mu_{t-1}$$

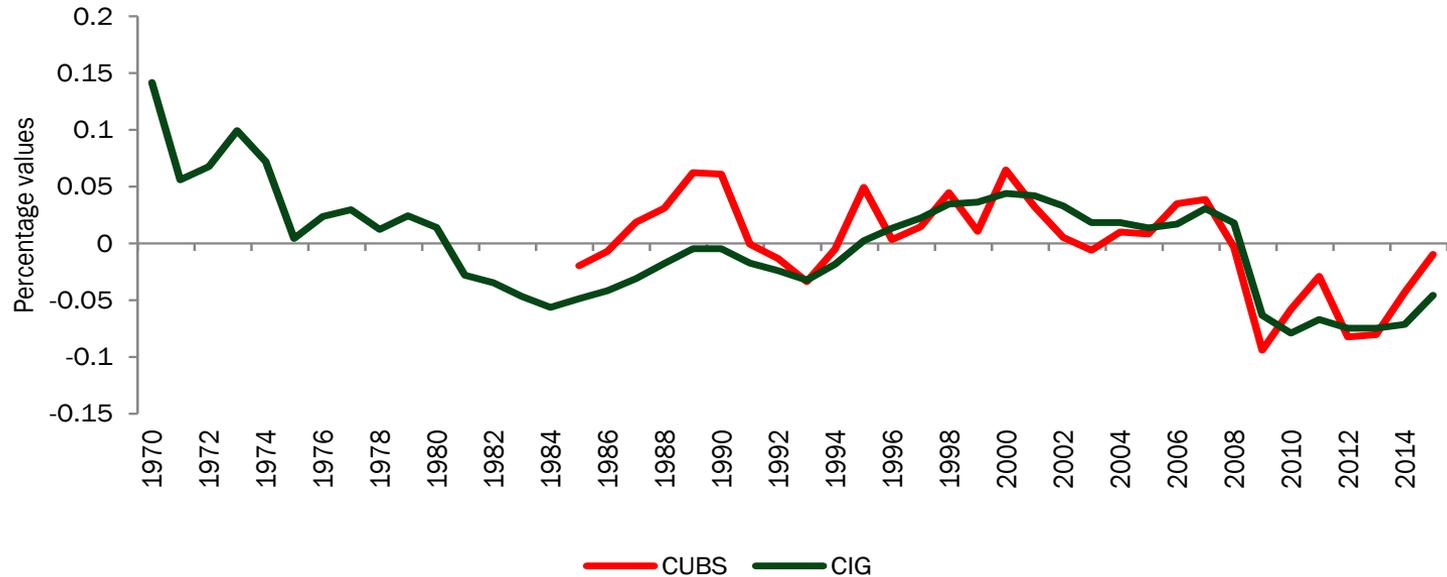
$$\mu_t = \omega(1 - \rho) + \rho\mu_{t-1} + a_{\mu t} \quad V(a_{\mu t}) = V_\mu$$

$$C_t = 2A \cos(2\pi/\tau) \cdot C_{t-1} - A^2 C_{t-2} + a_{Ct} \quad V(a_{Ct}) = V_C$$

- TFP trend (P) and TFP gap (C) are estimated through a Bayesian Kalman filter, using a Capacity Utilisation index (e=CUBS) based on survey data (CU on manufacturing and sentiment indicator for building and service sectors).
- Estimates suffer from several drawbacks, such as: a) protracted negative trend growth; b) huge sensitivity to CUBS outliers; c) disconnection with activity indexes.
- Alternative labour hoarding index to measure capacity utilisation based on Cassa Integrazione (CIG)

TFP: a labour hoarding index based on CIG

HOURS PAID UNDER THE CASSA INTEGRAZIONE GUADAGNI (CIG) AND CUBS INDICATOR



Source: INPS and European Commission 2016 Spring forecasts.

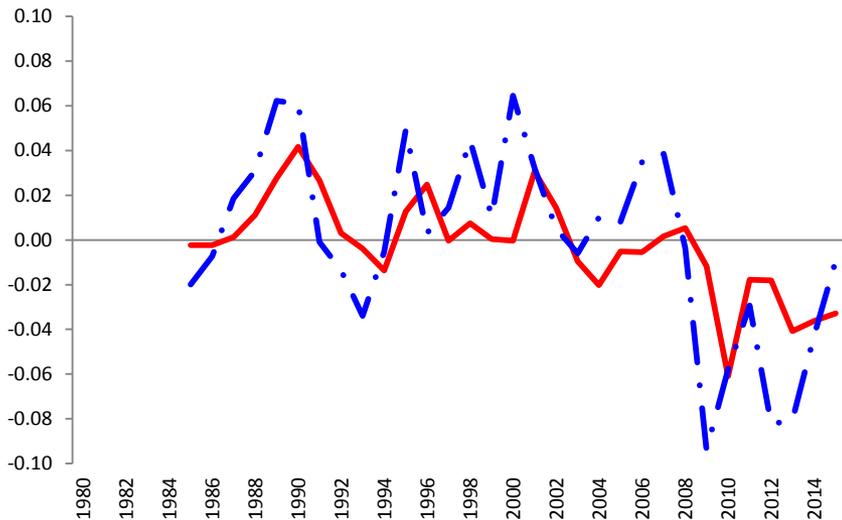
Note: The CIG series is expressed as the log of the difference from the historical average (1970-2015)

- CIG is: 1) a real/administrative variable collected for the whole economy and not a survey based figure; 2) it is collected monthly since 1970, whereas the CUBS only since 1985; 3) it performs relatively well as capacity utilisation indicator as it tracks exactly the turning points of the CUBS index.

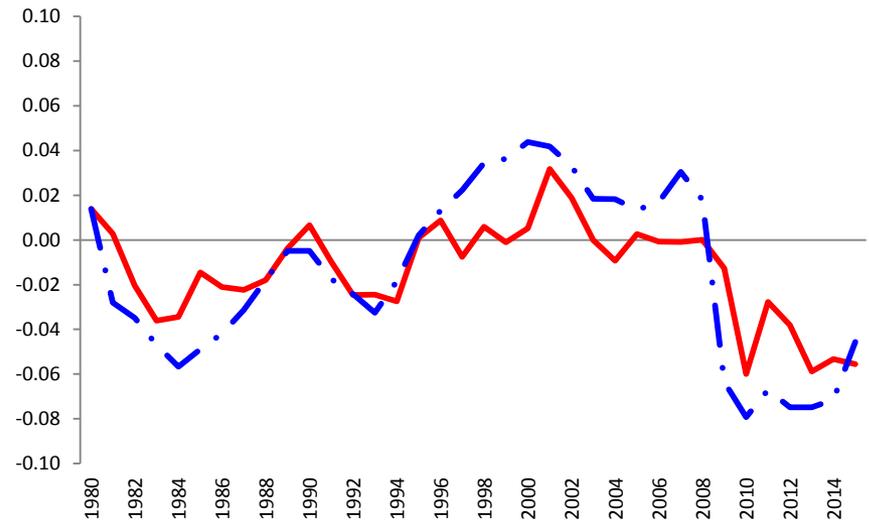
TFP estimates based on CIG vs CUBS

- Good performance of second equation - $cig = F(TFPgap)$
- Increase in the correlation between cycle and cig compared to cubs

CUBS: actual (---) and fitted values



CIG: actual (---) and fitted values

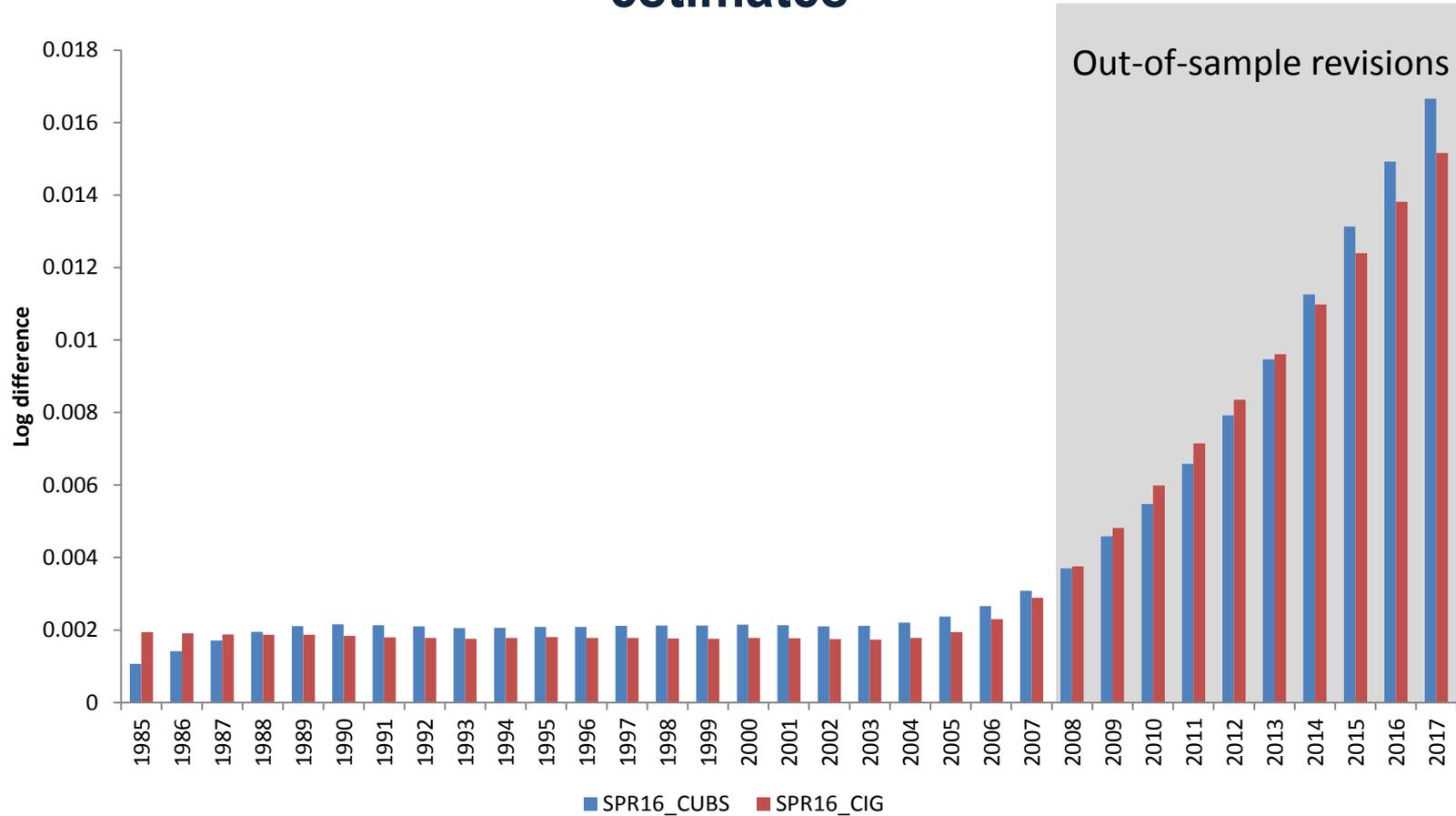


Correlation between cycle estimations and capacity utilization indicators	
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$\rho(\text{cycle, cubs})$	0.933
$\rho(\text{cycle, cig})$	0.944

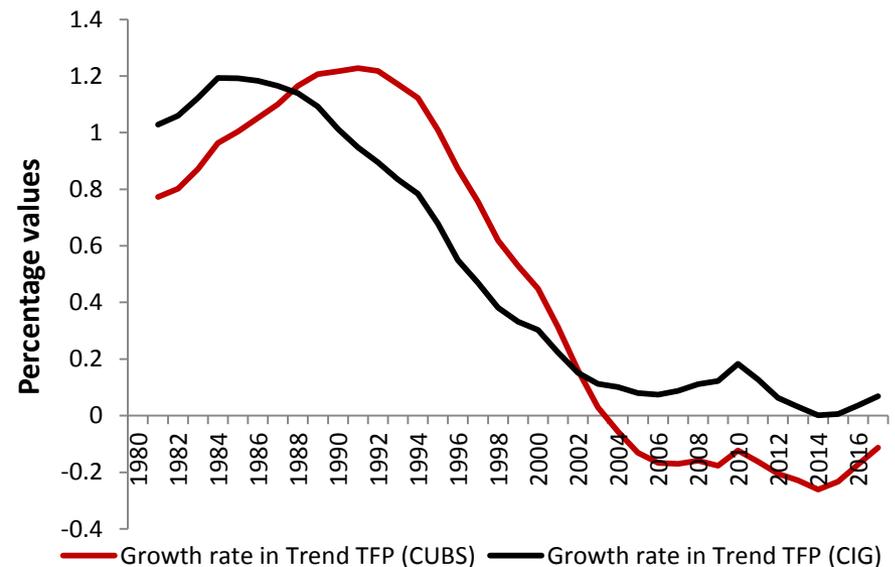
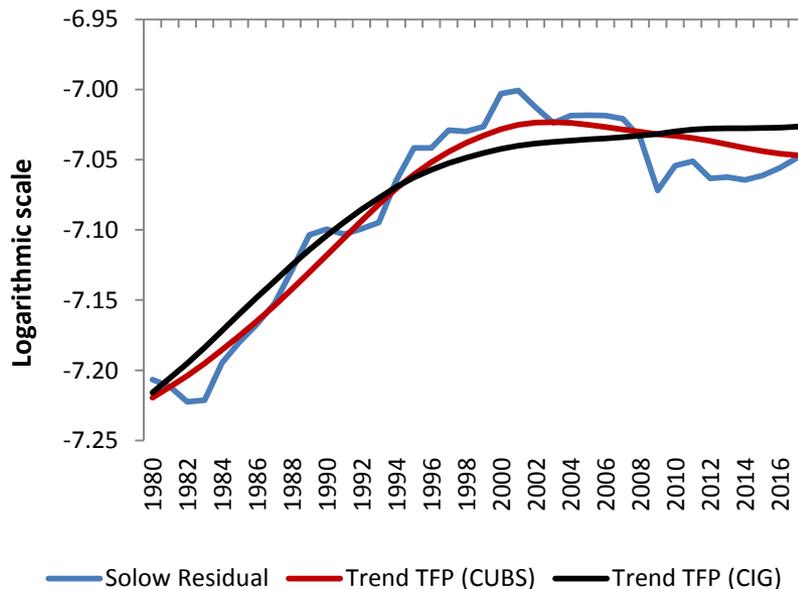
TFP revisions with CIG vs CUBS

Standard deviation of revisions w.r.t real time estimates



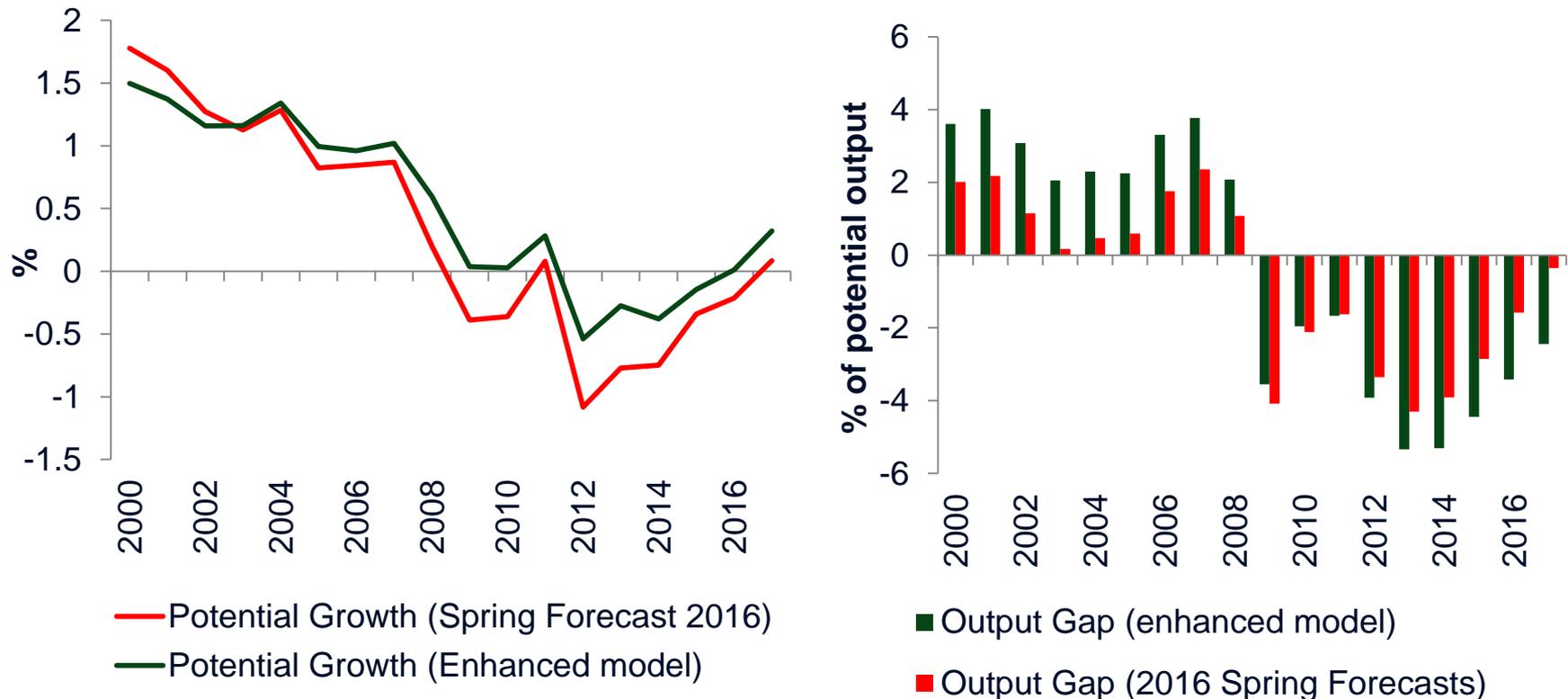
TFP trend levels and growth

- With the alternative methodology the growth rate of the TFP trend has been decelerating fast over the last decades but such a pattern is not exacerbated as in the official Commission estimates
- The use of a real measure of economic activity as the CIG would produce a negative TFP cyclical gap which is not expected to be closed over the forecast horizon.



Enhanced model: OG and Potential growth

- Under the enhanced specification, potential growth is higher and OG significantly wider 2016 Spring Forecasts



Source: European Commission, 2016 Spring Forecasts and MEF elaborations

Enhanced model: compliance with the SGP

OUTPUT GAPS AND STRUCTURAL DEFICITS WITH THE ENHANCED MODEL

	Output Gaps		Structural Deficit	
	2016 Spring Forecasts	Enhanced methodology	2016 Spring Forecasts	Enhanced methodology
2011	-1.6	-1.7	-3.3	-3.2
2012	-3.4	-3.9	-1.2	-0.9
2013	-4.3	-5.3	-0.9	-0.3
2014	-3.9	-5.3	-1.1	-0.4
2015	-2.9	-4.5	-1.0	-0.1
2016	-1.6	-3.4	-1.7	-0.7
2017	-0.4	-2.4	-1.7	-0.6

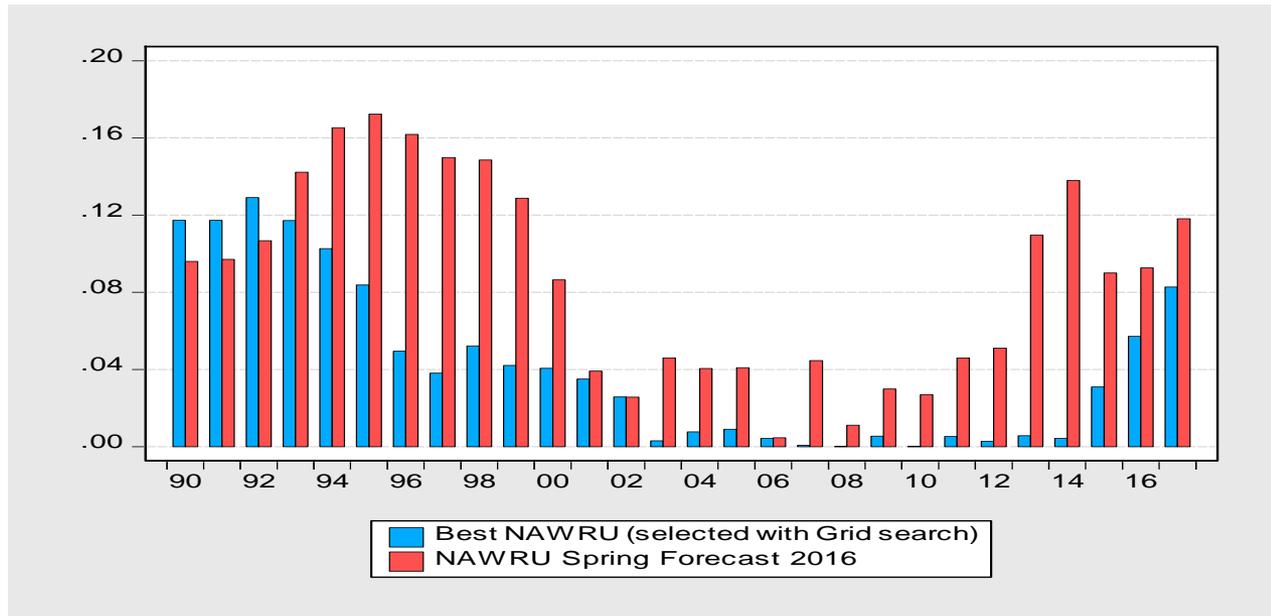
Source: European Commission 2016 Spring forecasts and own elaborations.

- Under the enhanced specification, bad cyclical conditions until 2017
- Structural balance (MTO) reached in 2015 and return in 2019
- Full compliance with Stability and Growth Pact

Thank you for your attention

NAWRU vs NAIRU: induced procyclicality(*)

Distance to the median of the NAWRU estimates distribution



Source: European Commission 2016 Spring Forecasts and own elaborations.

- Problem: Variance bounds are judgemental and produce undesirable procyclicality.
- Solution: automatic grid search (800 iterations) for the selection of the optimal variance bounds

TFP and OG: sensitivity to 2015 CUBS obs(*)

CHANGES IN OUTPUT GAP: 2016 SPRING FORECASTS VS 2015 SPRING FORECASTS

	2014	2015	2016
Total Change in Output gap (t)	0.3	0.6	0.4
<i>of which due to the CUBS observation for 2015</i>	0.3	0.4	0.5
BASE REVISION EFFECT			
Labour gap (t-1)	-0.4	-0.3	0
<i>Unemployment gap (t-1)</i>	-0.1	-0.2	0
<i>Participation rate (t-1)</i>	0	0.1	0
<i>Hours worked (t-1)</i>	-0.2	-0.2	0
TFP gap (t-1)	0.4	0.6	0.6
<i>of which due to the CUBS observation for 2015</i>	0.2	0.3	0.4
GROWTH REVISION EFFECT			
GDP growth rate (t)	0.1	0.2	-0.3
Potential growth (t) (-)	0.2	0.2	0.1
<i>of which due to the CUBS observation for 2015</i>	0.1	0.1	0.1
Potential Growth contributions			
<i>Potential labour growth (t) (-)</i>	0.2	0.1	0
<i>Capital growth (t) (-)</i>	0	0	0
<i>Potential TFP (t) (-)</i>	0	0	0
<i>of which due to the CUBS observation for 2015</i>	0.1	0.1	0.1

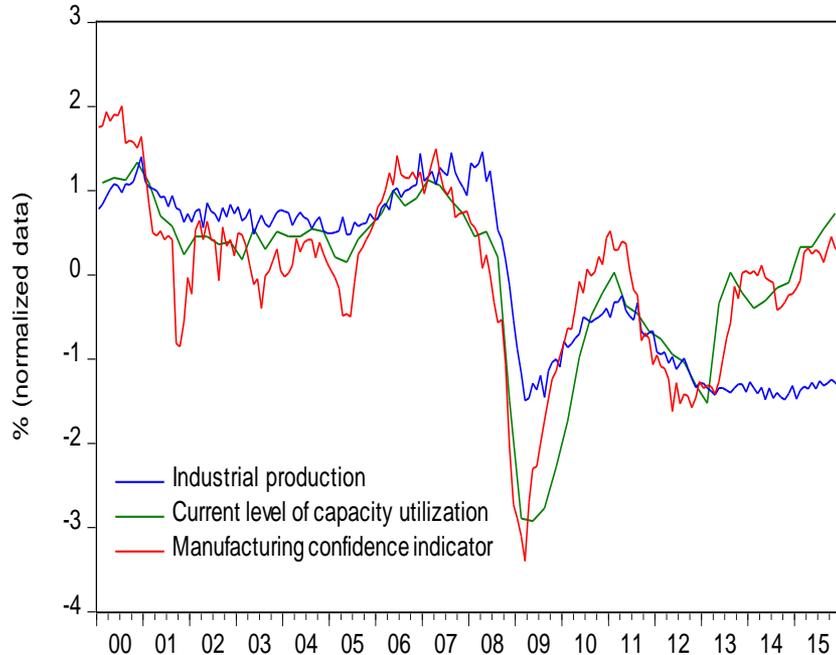
Source: MEF elaborations.

Note: Output gaps in 2014, 2015 and 2016 have been approximated according to the following specification : $OG_t \cong OG_{t-1} + (y_t - \bar{y}_t)$ where y_t and \bar{y}_t are, respectively, real GDP growth and potential growth. In turn, OG_{t-1} can be further decomposed as follows: $OG_{t-1} = 0.65 * (Labour\ gap)_{t-1} + 1.0 * (TFP\ gap)_{t-1}$. Labour gap can be decomposed in unemployment gap, participation rate and hours worked gaps. At the same time, potential growth contribution \bar{y}_t can be decomposed in potential labour growth, capital growth and potential (trend) TFP growth.

TFP cycle: CUBS and real activity indicators (*)

SURVEY-BASED INDICES: RECENT EVIDENCE OF A DISCONNECTION WITH REAL ACTIVITY MEASURES

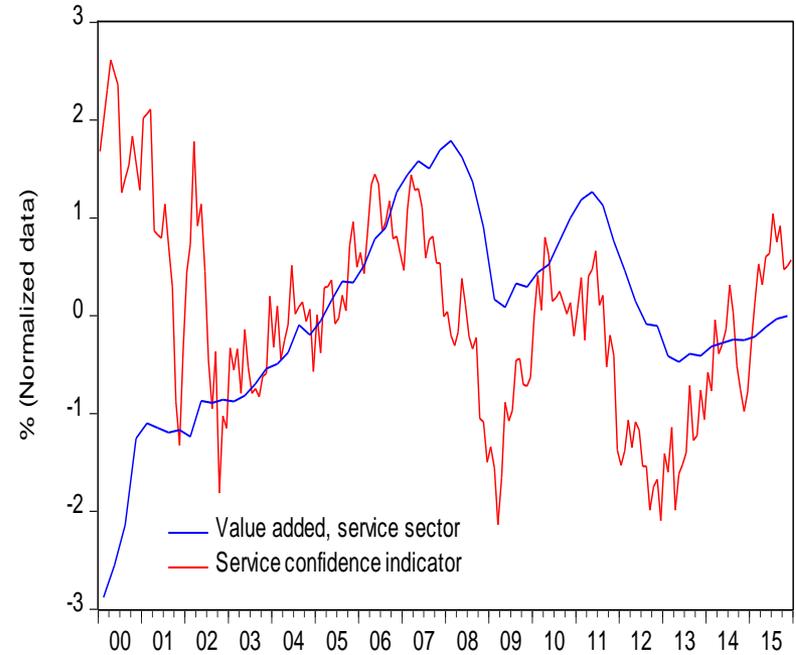
MANUFACTURING



Source: ISTAT

Note: Data with different frequencies, normalized over the considered period. Industrial production index is monthly-based (2010=100)

SERVICES



Source: European Commission

Note: Data with different frequencies, normalized over the considered period. Chain-linked value added series of the service sector with 2010=100

- CU and sentiment indicators do not follow real activity patterns in recent years.