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The NAIRU is a key component of potential output and as such critically affects output gap estimates. In May 2014, the European Commission changed its specification of the NAIRU for several countries and lowered its NAIRU estimates – in the case of Spain from 26.6% to 20.7% for 2015. To test the dependence of the new NAIRU on unemployment versus structural factors, we run counterfactual simulations applying one-standard deviation shocks to actual unemployment and to the structural variable – real unit labor costs. We find that the NAIRU in its new specification is still largely determined by actual unemployment. This calls in question both the interpretation of potential output estimates as barriers to more vigorous inflation-stable economic activity and the accuracy of structural deficit figures.

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Keywords NAIRU, Kalman filter, output gap, euro area, structural deficit

JEL-Code: E23, E24, E31

1. Introduction

The non-accelerating inflation rate of unemployment (NAIRU) is an important factor in determining the potential labor force and thereby potential output.[2] Potential output, in turn, is of great relevance for economic policy makers because it represents a barrier to inflation-stable growth and determines the extent to which a given fiscal deficit is interpreted as cyclical or structural. On average, an increase in the European Commission's (EC henceforth) NAIRU by 1 percentage point lowers the output gap by 0.65 percentage points (EC 2014: 29). A decrease in the NAIRU has the same impact in the other direction.
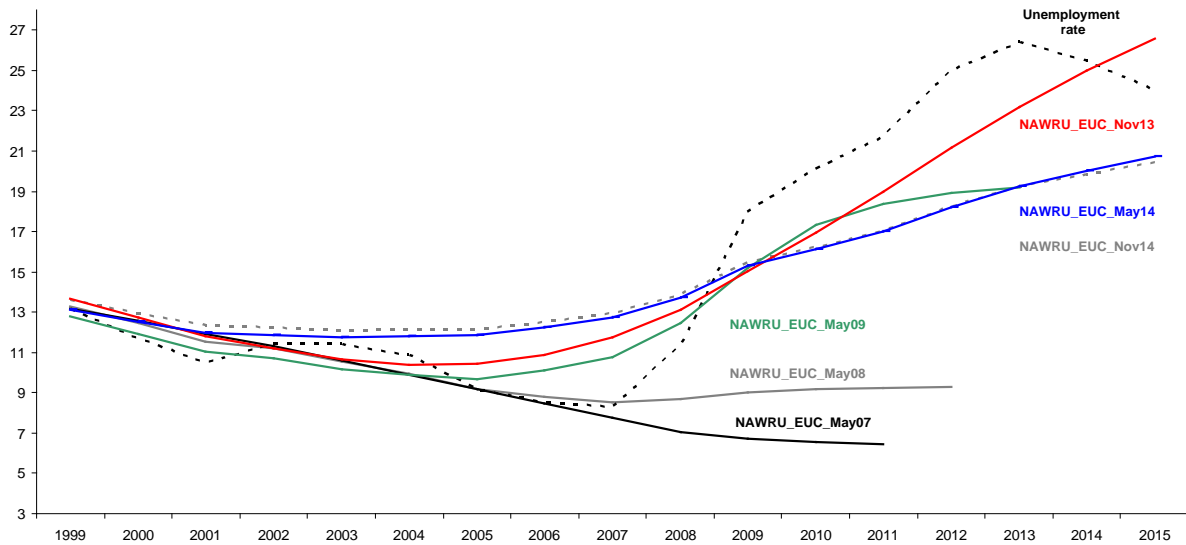
The autumn 2013 forecast of the Spanish NAIRU for 2014 (25 %) almost equaled the unemployment rate in November 2014 (25.8 %). As Spanish unemployment was declining at the time, the unemployment rate was poised to undershoot the NAIRU in 2015 (Figure 1). An unemployment rate of over 20% entailing youth unemployment of more than 50% was thus interpreted labor market tightness. Given this implausible outcome, in the Spring 2014

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[2] The EC uses the term NAWRU (non-accelerating wage rate of unemployment), the *W* instead of the *I* indicating that the wage inflation rather than the price inflation features in the Phillips curve. Throughout the text we use the terms interchangeably.

forecast the EC changed the model specification of NAIRU by substituting its *Traditional Keynesian Phillips Curve* (TKP) approach by a *New Keynesian Phillips Curve* (NKP). Rather than climbing to 26.6% in 2015, the new NAIRU estimate for 2015 was 20.7%. As this figure still constitutes an increase by 7 percentage points since the start of the economic crisis in 2008, it raises the question whether the new specification meets the claim of providing a cyclically adjusted measure.

Figure 1: European Commission's NAIRU estimates for Spain at different publication dates

Source: European Commission, Economic Forecasts, European Economy and CIRCA website

In this paper, we therefore test the dependence of the NAIRU on unemployment versus structural factors. First, we examine the derivation of the old and the new NAIRU and its driving forces as specified by the EC. Second, we run counterfactual simulations for Spain, France, and Germany in order to show the sensitivity of the EC's new specification to changes in structural and cyclical components, respectively. We find that the main driving force of the NAIRU is found in assumptions about the time series characteristics of both NAIRU and unemployment gap, whereas the impact of the structural component variable – captured by real unit labor costs – is rather weak.

2. The EC's old and new NAIRU models

Both the TKP and NKP relation are derived from a labor market model, where workers have full power to set the nominal wage. With marginal productivity given, firms then choose the profit-maximizing labor input accordingly, thus determining the level of (un-)employment (Denis et al. 2006).

In the EC's traditional Keynesian Phillips curve (TKP), the cyclical component – the unemployment gap – is positively related to the change in the growth rate of nominal unit labor costs (NULC). According to EC (2014), the derivation of the TKP

2

$$\Delta^2 nulc = \lambda \left(u_t - u_t^* \right) \tag{1}$$

implies that (a) workers predict productivity growth correctly and (b) set nominal wages in order to achieve a certain real wage based on inflation expectations formed by assuming that current inflation equals lagged nominal unit labor cost growth. This leads to the following interpretation: When nominal wage increases decline due to a severe downturn and wage earners assume that prices adjust at the same pace with a short lag, a low but constant growth rate of NULC would indicate that wage earners want to stabilize real wage growth at its current pace. Starting from a positive unemployment gap, this would imply that actual unemployment becomes structural. A continuous fall in the growth rate of NULC is required to keep the unemployment gap open.

In the novel NKP case, the EC relates the unemployment gap to a change in the growth rate of real unit labor costs (RULC). The specification as applied by the EC (Havik et al. 2014) is as follows:

$$\Delta\, rulc_t = \alpha \Delta rulc_{t-1} - \beta_1 \left(u_t - u_t^* \right) + \beta_2 \left(u_{t-1} - u_{t-1}^* \right) \tag{2}$$

It is said to include workers' rational expectations about price inflation in the sense that their current inflation expectations are based on current year information. In this specification, wage setters can determine real unit labor costs directly. If real unit labor costs grow more slowly, workers' behavior is interpreted as the willingness to reduce unemployment, and actual unemployment is deemed cyclical. Thus, the requirements for unemployment to be interpreted as cyclical are less strict *in the presence of price stickiness*. At constant price inflation, a permanently slower growth of NULC (and with it RULC), instead of its continued deceleration, is sufficient to keep the unemployment gap open.

As seen in Figure 1, the new NAIRU (NAWRU_EUC_May 14) is indeed less pro-cyclical in that it reacts somewhat slower to changes in the unemployment rate in the case of Spain. Nonetheless, as will be shown, the key problem involved in estimating the NAIRU remains: it continues to largely reflect movements in the actual unemployment rate.

3. Predominance of Time Series Properties: Counterfactual Simulations

How strongly is the estimated NAIRU driven by its structural component (RULC) as compared to mere time series properties? In order to test the relative sensitivity of the NAIRU estimate to changes in RULC and changes in actual unemployment, we perform counterfactual simulations. Simulations are run for three different baseline scenarios, where the unemployment gap is by and large closed (Germany), mildly open (France) and wide open (Spain). We employ the EC's official GAP software to estimate NAIRUs with a Kalman filter and use the same data, sample and model specifications as in the official vintage of November 2014. In the case of Germany, the official estimate is still based on the TKP (Havik et al.

2014). For the sake of consistency, we employed the NKP specification with the usual assumptions for Germany as well.

To define the alternative scenarios, first, a comparable shock size for RULC and actual unemployment needs to be chosen. Both variables are technically limited to between zero and one. However, the effective limits are quite different, with the unemployment rate centered on a lower level than RULC, yet with a bigger variance. It would therefore give a distorted picture to compare percentage point or percentage changes. Thus, the best metric is to compare shocks sized to one-standard deviation of the series. However, as both series are trended, one-standard deviations of the growth rate of RULC and of the first difference of the unemployment rate are considered, as otherwise the variance of shocks would be overstated.

Second, the timing and persistence of shocks needs to be determined. The Kalman filtering process in the EC's model only has a very short memory with respect to level changes in RULC as its growth rate enters directly. We run two alternative counterfactual scenarios with a measurable impact. In the first, the very endpoint of the time series is shocked. Other one-off level shocks to RULC at earlier dates do not cause a measurable reaction at all. The second scenario assumes a permanently lower level of the growth rate of RULC from 2009 onwards, indicating a permanent fall in RULC as compared to the baseline. This shock, as argued by EC (2014), should keep the unemployment gap open.

With respect to the actual unemployment rate, we set up analogous scenarios. In the first, the endpoint of the series is shocked. In the second, two reasonable alternatives apply: a permanent level shock from 2009 to 2016 and, alternatively, a permanent shock to the change in unemployment, with the latter having a much more severe impact.

The signs of the shocks are chosen such that they would flatten the estimated NAIRU measure as compared to previous years, i.e. if actual unemployment was increasing in previous years, a negative unemployment shock and a negative RULC shock applies, and vice versa.[3] Results are shown in Figure 2.
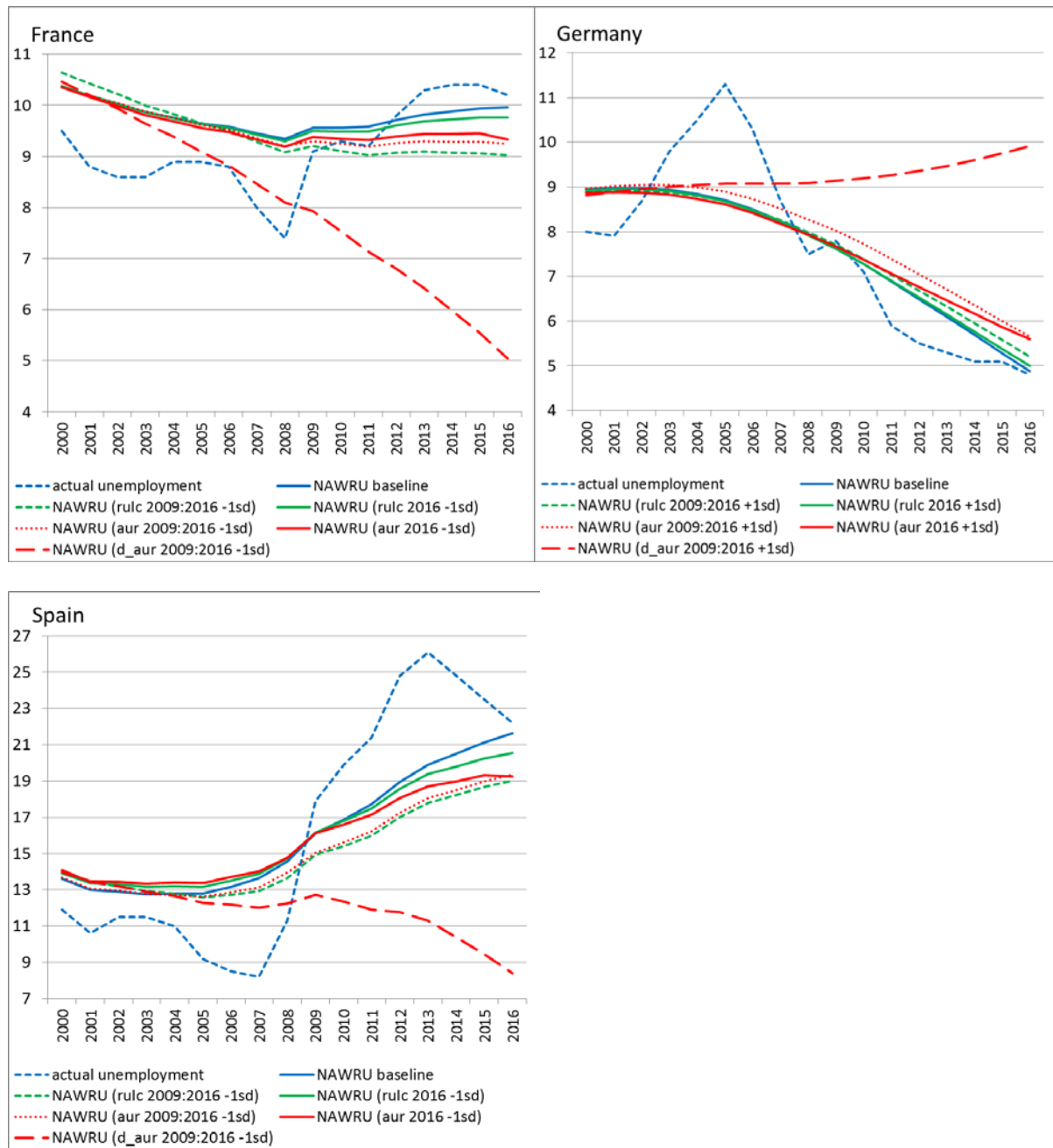
The following results stand out: First, the NAIRU does not seem to be very responsive to changes in RULC growth, as compared to changes in the unemployment rate (aur). In general, endpoint shocks to RULC (rulc 2016 ±1sd) are largely irrelevant, while there is almost a one-to-one reaction to endpoint shocks to actual unemployment (aur 2016 ±1sd). That is, an unemployment shock in the direction towards closing the gap by and large leaves the unemployment gap open and simply alters the NAIRU estimate.

With respect to the permanent shocks, results are more state-dependent: Changing the level of unemployment permanently as compared to the baseline (aur 2009:2016 ±1sd) produces

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[3] Testing the robustness of this choice, the effects turned out to be only weakly nonlinear with respect to the sign of the shock, with slightly more pronounced effects for both shocks in the case of the simulations shown.

cumulative deviations comparable to those of the endpoint shocks, even if deviations plausibly set in at earlier dates. Permanent shocks to the growth rate of RULC (rulc 2009:2016 ±1sd) do not cause much of a reaction when the unemployment gap is closed (Germany), while the effect is more pronounced – comparable to those of a persistent level shock to actual unemployment – when the unemployment gap is open. Permanent shocks to changes in unemployment (d_aur 2009:2016 ±1sd), however, cause a much more severe reaction than any RULC shock, truly changing the slope of the NAIRU.

Figure 2: Baseline vs. counterfactual simulations for NAIRU estimates

Note: Graphs show actual unemployment and NAIRU estimates for the baseline and counterfactual simulations. Official sample sizes are used for the estimation, but only recent years are displayed for convenience.

Note that even a strong and continuous decline in the wage share has limited impact on the NAIRU. In the case of Spain, a RULC growth of -10% in each year from 2009 to 2016 would not have left the NAIRU at pre-crisis levels; given the strong increase in actual unemployment, the NAIRU would nonetheless remain clearly above 13% (results not shown).

Moreover, the bigger the unemployment gap, the more important is the filter's dynamic towards closing the gap. In the case of Spain, even large changes in RULC and unemployment do not help to sustain the gap as there is an implicit closing rule three years after the endpoint of the available sample.[4] Overall, the EC's NAIRU is more sensitive to recent cyclical developments than to its structural component.

4. Conclusion

Although interpreted as structural unemployment unaffected by aggregate demand, the EC's NAIRU turns out to be quite resilient to structural reforms. The estimate is largely driven by actual unemployment.

There is a powerful and increasingly appreciated argument for a dependence of the NAIRU on actual unemployment: hysteresis (OECD 2014, Ball 2014, Kienzler/Schmid 2014, Logeay/Tober 2006). However, the EC does not model the NAIRU to include hysteresis effects – the endogeneity of the NAIRU results from the time series properties of the model. If it were to capture hysteresis effects it would be coincidental.

Consequently, there is little more empirical justification for believing that the current Spanish NAIRU of 20.5% (November 2014) represents a barrier to inflation-free growth than the estimate of 25% (November 2013). This raises serious doubts about the reliability of structural deficit figures and calls in question the focal role they play in formulating consolidation requirements.

Already at the level of theory, the NAIRU faces the conceptual problem of being affected by the magnitude it is thought to limit: the level of production. Consequently, monetary policy uses output gaps as only one of many indicators to determine the appropriate policy stance. Given the intrinsic difficulties involved in robustly estimating potential output, we suggest that output gaps be given less weight in fiscal policy decisions as well.

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[4] The closing rule implies that the projection of actual unemployment adjusts to the NAIRU which is supposed to follow an almost flat path in the medium term projection (Havik et al. 2014).

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