

II. Special topics on the euro area economy

II.1. New estimates of Phillips curves and structural unemployment in the euro area ⁽¹⁵⁾

The Phillips curve can be used to estimate the non-cyclical part of unemployment. In such models, this estimate is commonly referred to as the ‘non-accelerating wage rate of unemployment’ (NAWRU).⁽¹⁶⁾ The Phillips curve can be specified in various ways, reflecting different assumptions regarding the formation of expectations. DG ECFIN has recently extended its framework to cover rational expectations. This section looks at the sensitivity of the results to alternative expectation assumptions, reporting NAWRU estimates based on Phillips curves produced using rational expectations and those (as used to date) allowing only for static or adaptive expectations.

Our findings show that, for the euro area as a whole, the alternative expectation assumptions yield similar NAWRU estimates. In particular, the NAWRU appears to have increased recently, suggesting a deterioration of labour market performance beyond what could be considered merely cyclical. For Spain, however, the results vary more depending on the assumptions used. The Phillips curve based on rational expectations points to a more moderate NAWRU increase than that used by DG ECFIN to date. However, all estimates point to a substantial post-crisis increase in the NAWRU for Spain.

In interpreting the rise in the NAWRU, it is important to bear in mind that both structural and non-structural factors are driving developments. Analysis shows that, in the presence of rigidities, crisis-related events can have temporary but long-lasting effects on labour market performance. Structural factors can play a role too, as illustrated by the steady decline in the NAWRU in Germany, which appears to be related to structural effects brought about by the Hartz reforms.

⁽¹⁵⁾ Section prepared by Fabrice Orlandi.

⁽¹⁶⁾ The Phillips curve features a relationship between the unemployment gap and an inflation or labour-cost variable. In the case of the former, the non-cyclical unemployment estimate obtained is usually referred to as the ‘non-accelerating inflation rate of unemployment’ (NAIRU), while with the latter it is referred to as the ‘non-accelerating wage rate of unemployment’ (NAWRU).

Introduction

Unemployment rates increased sharply in the euro area in the wake of the crisis and the surge has proved particularly persistent. Assessing this development is of paramount importance to policy-makers’ efforts to find adequate responses to the effects of the crisis.

The non-cyclical part of unemployment play a key role in this assessment, as it identifies the proportion of the deterioration that is likely to last beyond the business cycle. In the EU context, this indicator is particularly important as it is a factor to be fed into the potential output calculations used to compute cyclically-adjusted fiscal figures, important benchmarks for country surveillance under the EU’s fiscal framework.⁽¹⁷⁾

The non-cyclical part of unemployment is not an observable variable, however, and has to be estimated, which means that it is subject to uncertainty. In part, the uncertainty stems from the fact that different estimation models are available. The Phillips curve is commonly used as a key element in estimation models,⁽¹⁸⁾ but can itself be specified in various ways, most notably reflecting alternative assumptions as to the formation of expectations.⁽¹⁹⁾

This section sets out DG ECFIN’s approach to estimating the non-cyclical part of unemployment, in particular in its use of the Phillips curve. We also investigate the sensitivity of the results to alternative expectation assumptions, highlighting the results obtained for the case of rational expectations, the case recently incorporated in DG ECFIN’s estimation framework.

The results presented here focus on the euro area, but results are also reported for Spain and Germany, two countries that have witnessed starkly different non-cyclical unemployment developments

⁽¹⁷⁾ For details on the EU’s SGP framework, see *Vademecum on the Stability and Growth Pact*, European Economy — Occasional Paper, No 151, DG ECFIN, European Commission, May 2013.

⁽¹⁸⁾ For an illustration of structural unemployment analysis based on an alternative concept, see e.g. *Unemployment dynamics during recessions and recoveries: Okun’s law and beyond*, IMF WEO, April 2010.

⁽¹⁹⁾ For details on the Phillips curve, see Fuhrer J., Y.K. Kodrzycki, G.P. Olivei and J. Sneddon Little, *Understanding inflation and the implication for monetary policy — a Phillips curve retrospective*, MIT Press, 2009.

in the recent past. We use long time series, usually starting in 1965, to capture medium-term cycles. The latest DG ECFIN forecasts are also included in the dataset.

Alternative NAWRU models

Non-cyclical unemployment is estimated on the basis of models that pin-down its statistical and economic properties. DG ECFIN's approach relies on an 'unobserved component' model, which features a Phillips curve. The curve links cyclical unemployment (i.e. the unemployment gap) to labour cost developments, while non-cyclical unemployment is assumed not to be affected by labour cost developments. In this setting, non-cyclical unemployment estimates are commonly referred to as the 'non-accelerating wage rate of unemployment' (NAWRU).⁽²⁰⁾

The specification of the Phillips curve reflects particular assumptions made regarding inflation expectations. In the past, DG ECFIN's considered only static and adaptive expectations. More recently, the case of rational expectations has been added, providing a more comprehensive framework (see Box II.1.1).

More specifically, the so-called traditional Keynesian Phillips (TKP) curve based on static or adaptive expectation assumptions a positive unemployment gap ($u_t - u_t^*$) with a fall in the *change of the growth rate of nominal* unit labour cost ($\Delta^2 nulc_t$) (and vice versa):

$$\Delta^2 nulc_t = -\beta(u_t - u_t^*)$$

The new Keynesian Phillips (NKP) curve based on rational expectations implies that a positive unemployment gap ($u_t - u_t^*$) is associated with a fall in the *growth rate of real* unit labour cost ($\Delta rulc_t$). Lagged effects are also relevant because some wage-setters may use *ad hoc* rules and not fully optimise:

$$\Delta rulc_t = \delta \Delta rulc_{t-1} - \beta_1(u_t - u_t^*) + \beta_2(u_{t-1} - u_{t-1}^*)$$

⁽²⁰⁾ For further details on the DG ECFIN approach see D'Auria, F., C. Denis, K. Havik, K. Mc Morrow, C. Planas, R. Raciborski, W. Röger and A. Rossi (2010), *The production function methodology for calculating potential growth rates and output gaps*, European Economy — Economic Paper, No 420, DG ECFIN, European Commission, July 2010.

These alternative Phillips curves thus rely on different labour cost indicators to determine the unemployment gap (and thus also the NAWRU), namely $\Delta^2 nulc_t$ and $\Delta rulc_t$. As explained in Box II.1.1, this does not mean that the models are fundamentally different. Instead, it illustrates the impact of assumptions as to expectation formation on the specification of the Phillips curve.

NAWRU developments

For the euro area as a whole, NAWRU estimates based on the TKP and the NKP show a similar pattern (see Graph II.1.1).⁽²¹⁾ The similarity suggests that, for most countries in the euro area, results are not overly sensitive to the specification of the Phillips curve (i.e. to assumptions as regards expectation formation). In practice, it also suggests that alternative labour cost indicators (i.e. change in unit labour cost (ULC) growth and real unit labour cost (RULC) growth) underwent broadly similar developments in the euro area; this is confirmed by the top chart in Graph II.1.2.

Graph II.1.1 shows that non-cyclical unemployment in the euro area posted a steady increase up to the mid-90s, followed by an improvement that was then halted by the recent crisis. The recent rise in the NAWRU suggests that the increases in unemployment seen in the aftermath of the crisis are, to some extent, likely to last beyond the cyclical upturn.

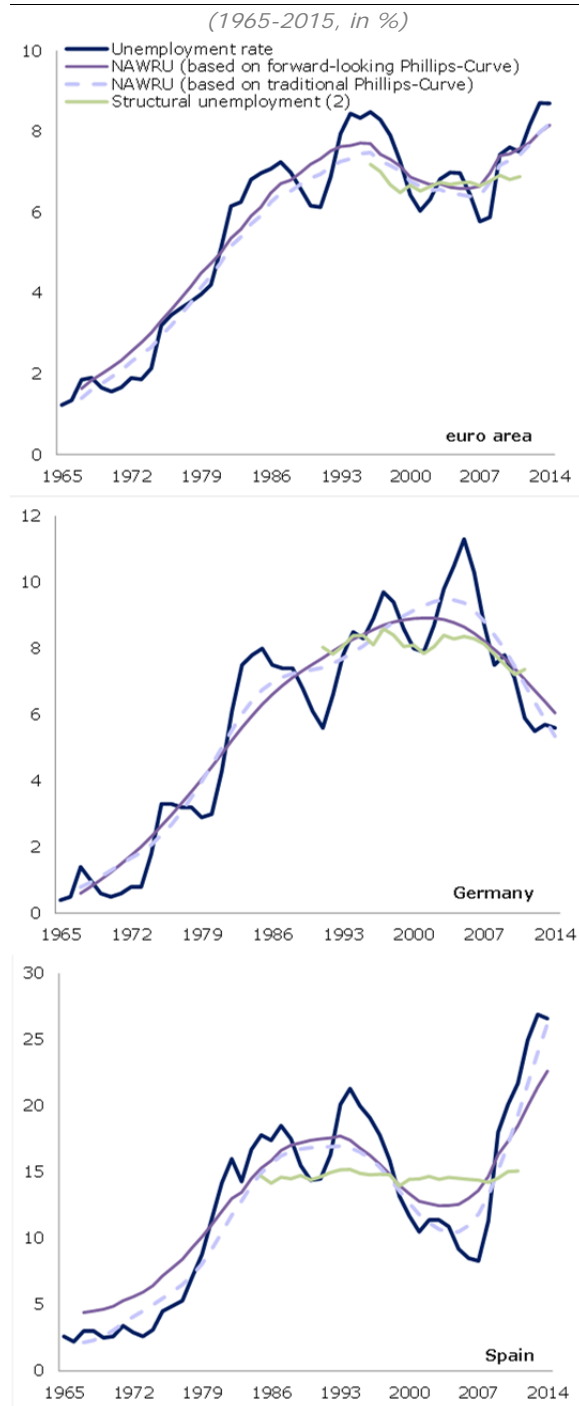
Graph II.1.1 also shows NAWRU developments for Spain and Germany, illustrating the diversity within the euro area. Spain has witnessed developments that have been similar to, though more dramatic than, those in the euro area as a whole. Germany posted a starkly different profile, with its NAWRU falling steadily (from 2002 according to the NKP or 2004 according to the TKP).

As regards sensitivity, the NAWRU estimates for Spain vary considerably depending on the specification. With the NKP, the recent increase is more moderate, with the NAWRU reaching 22.0 % by 2015, while the estimated level with the TKP is 26.4 %. Recent results for Germany are less sensitive to assumptions regarding expectations,

⁽²¹⁾ NAWRUs referred to in this section are those computed for the Commission's 2014 winter forecast. Latest available NAWRUs can be downloaded from the AMECO database: http://ec.europa.eu/economy_finance/ameco.

with the two Phillips curve specifications producing similar NAWRUs. However, around

Graph II.1.1: **Alternative NAWRU estimates, euro area, Germany and Spain (1)**



(1)GDP weighted average of euro-area countries for which alternative NAWRUs have been computed (i.e. AT, BE, DE, EL, ES, FI, FR, IE, IT, NL and PT). For AT, both NAWRUs are based on the backward-looking model, as the forward-looking model yields econometrically unsatisfactory results. (2)Component of the NAWRU explained only by structural determinants (see Orlandi (2012), op. cit.).

Source: DG ECFIN calculations based on Eurostat data.

2005, some difference across the two specifications is observed for Germany, with the NKP producing a relatively less volatile NAWRU. Given that the current NAWRU estimates for Germany, based on the TKP and NKP specifications, do not diverge greatly and taking into account the stability considerations in moving to a new specification, Germany continues to use the TKP specification.

NAWRU differences for Spain depending on the curve specification stem from corresponding differences between the labour cost indicators used. Graph II.1.2 shows that recently RULC growth posted greater and more persistent moderation in Spain than change in nominal ULC growth. For Germany, the indicators have followed more similar paths, over recent years (as they have in the euro area as a whole). More fundamentally, in times of heightened economic volatility and/or big labour market adjustments (e.g. recent crisis, Hartz reforms), the TKP model is likely to yield NAWRUs that are more pro-cyclical, as it does not take full account of the price rigidities that play an important role in the adjustment process of the labour market. These rigidities are better reflected in the NKP model.

To sum up, except in the case of Spain, recent NAWRU estimates for the euro area do not appear to be sensitive to assumptions as regards expectations, with alternative Phillips curve specifications yielding similar results. Overall, results point to a recent increase in the NAWRU across the euro area, with the notable exception of Germany. A rise in the NAWRU points to persistent deterioration in labour market performance. Identifying the causes of the deterioration calls for cautious interpretation, however.

NAWRU versus Structural Unemployment

Understanding the sharp and protracted rise in unemployment in the wake of the crisis is of paramount importance from a policy perspective. What caused the rise? Is it a sign of structural deterioration? Or is it purely cyclical, reflecting the prolonged slowdown? These questions are the subject of lively debate, with views ranging from 'it's all demand'⁽²²⁾ to 'it's all/mostly structural'.⁽²³⁾

⁽²²⁾ See e.g. Krugman, P. (2010), *Debunking the structural unemployment myth*, New York Times, 28 September 2010.

Box II.1.1: Alternative specifications for the Phillips curve

A decomposition of unemployment changes into cyclical and trend components must rely on the statistical properties of the time series and information provided by economic theory. The Phillips curve provides the latter, since it postulates a negative relationship between cyclical unemployment and the expected growth rate of real unit labour costs:

$$\Delta rulc_t^e = -\lambda(u_t - u_t^*) \quad (1)$$

The way expectations are formed needs to be specified to obtain a relationship that can be used for practical purposes. Alternative Phillips curve specifications differ in the way they model such expectations. In early work, the so-called traditional Keynesian Phillips (TKP) curve generally assumed no uncertainty about productivity growth and static or adaptive inflation expectations. Also, it was commonly assumed that workers use lagged nominal unit labour cost growth to forecast inflation. This set up yields the standard ‘accelerationist’ form of the Phillips curve, linking the unemployment gap inversely to the change in the growth rate of nominal unit labour costs:

$$\Delta^2 nulc_t = -\lambda(u_t - u_t^*) \quad (2)$$

Allowing for adaptive expectations, the Phillips curve can be formulated with more lags and other exogenous variables (in particular, labour productivity growth Δy_l). Also, uncertainty as to whether wage-setters are targeting consumer price inflation or the GDP deflator can be addressed by adding a ‘terms of trade’ (*tot*) indicator, resulting in the following more general specification (hitherto used by DG ECFIN):

$$\Delta^2 nulc_t = \sum_i \rho_i \Delta y_{l,t-i} + \sum_i \omega_i \Delta tot_{t-i} - \sum_i \lambda_i (u_{t-i} - u_{t-i}^*) \quad (3)$$

In recent years, the New Keynesian Phillips (NKP) curve has been introduced in the macroeconomic literature. It differs from the TKP, essentially, in the way expectations are formed. Rational expectations and somewhat different assumptions regarding the information set available to wage-setters are introduced (i.e. different timing for wage-setting, relying on a beginning-of-period rather than a middle-of-period concept). While these assumptions imply a different specification, it is important to bear in mind that the NKP still represents an implementation of the same fundamental theoretical relationship shown in equation (1). Considering both the TKP and the NKP can thus be viewed as merely investigating alternative ways of implementing the Phillips curve approach. In particular, reporting results for both specifications provides a more encompassing approach as to how expectations are assumed to be formed in the economy.

The literature on NKP concedes that a purely forward-looking specification, as implied by rational expectations, is not realistic. Therefore, empirical applications often use a ‘hybrid NKP’, allowing for a combination of backward- and forward-looking behaviour. This produces the following specification, which DG ECFIN has recently incorporated into its framework for estimating NAWRU developments:

$$\Delta rulc_t = \beta(s\Delta rulc_{t+1}^e + (1-s) * rulc_{t-1}) - \lambda(u_t - u_t^*) \quad \text{with } \beta \leq 1 \text{ and } 0 \leq s \leq 1 \quad (4)$$

The NKP assumes that wage-setters can use information from the current year and that wages are negotiated during the year. Therefore, unlike the TKP, it does not require expectations to be formed as to current real unit labour cost developments. Expectations as to future real unit labour cost growth, which appear in the NKP specification because wage contracts are assumed to span more than one period, are still needed, however, and these are computed on the basis of rational expectations.² Intuitively, the forward-looking (RULC) component reflects wage-setters’ efforts (in a framework where wages are set in advance) to minimise the extent to which wages deviate from productivity and inflation developments in a framework where wages are set in advance.

Note that equation (4) can be used to stress the link between the TKP and the NKP. In particular, the TKP arises as a special case when $s=0$ (i.e. no forward-looking behaviour), $\beta=1$ (i.e. no positive rate of time preference) and the timing that holds under the TKP is reintroduced, i.e. wage-setters do not use all available

² See in particular Gali, J. (2011), *The return of the wage Phillips curve*, Journal of the European Economic Association, 9(3), pp. 436–461.

(Continued on the next page)

Box (continued)

information in the current period to form inflation expectations, relying instead on static (i.e. $\Delta p_t^e = \Delta p_{t-1}$) or adaptive expectations.

Overall, the TKP and NKP are thus based on identical concepts of the labour market, differing only in terms of underlying timing and expectation assumptions. As it can be difficult to map complex labour market dynamics to a particular set of assumptions, considering TKP and NKP specifications in parallel provide a useful framework for applying the Phillips curve approach.

In particular, changes in the NAWRU are sometimes interpreted as a sign of a structural change. Careful analysis of developments in the NAWRUs produced by DG ECFIN shows that they can be driven by both structural and non-structural factors.⁽²⁴⁾

In particular, crisis-related shocks (e.g. unwinding of unsustainable developments), especially boom-bust episodes in the housing market that can trigger a lengthy process of deleveraging in the construction sector, have a statistically significant impact on the NAWRU. The real interest rate and Total Factor Productivity (TFP) growth, which controls more generally for the presence of such shocks, also play a part in driving NAWRU developments.

At a theoretical level, adding various rigidities (e.g. real wage rigidity, cyclical price mark-ups or sluggish adjustment of the reservation wage) to the traditional labour market model can be shown to yield a NAWRU that is not solely determined by structural factors.

Despite uncertainties, the NAWRU remains a useful policy indicator. It is a well-defined concept that provides useful information on the nature of unemployment rate developments. In particular, it identifies risks of persistent labour market deteriorations that may not always be caused by structural phenomena.⁽²⁵⁾

In this context, it appears useful to distinguish between the NAWRU and a narrowly defined notion of structural unemployment affected only by structural factors, as shown in Graph II.1.1 by

the ‘structural unemployment’ series. The latter represents the portion of the NAWRU that, according to econometric results, appears to be explained by structural features of the labour market. As can be seen, the series has remained broadly stable during the crisis. Except for a notable decline due to structural labour market reforms in Germany, change in the NAWRU in the euro area is not related to structural change. This is also the case in Spain, where structural unemployment has remained broadly stable.

Recent increases in the euro-area NAWRU should therefore not be interpreted as a sign of big structural change at the current juncture. Rather, in most countries, the increases reflect the effects of shocks that, in the presence of various rigidities, have a long-lasting impact on unemployment rates.

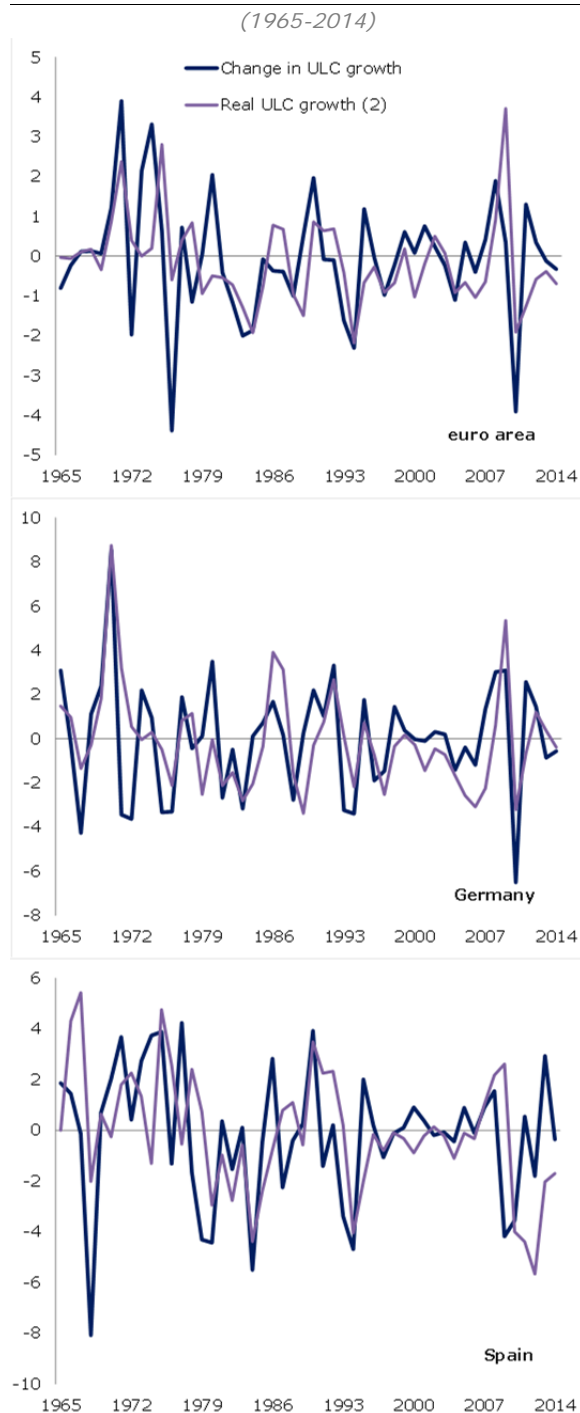
To sum up, the decline in the NAWRU at euro-area level and in countries like Spain in the run-up to the crisis appears mostly attributable to non-structural factors such as unsustainable developments in the housing sector. The build-up and subsequent unwinding of imbalances has caused large economic shocks (e.g. need for sectoral reallocation) which have a persistent effect on the performance of the labour market. However, in some countries, structural factors have also played a role in driving NAWRU developments. In Germany, for example, the decline in the NAWRU seems related to some aspects of the Hartz reforms (e.g. the change in the period of eligibility for unemployment benefit appears to have contributed to a decline of the NAWRU over recent years). This suggests that large-scale reforms, as currently being enacted in some countries, will tend to translate into a gradual lowering of the NAWRU over coming years. For example, recent efforts in Ireland to bring down the labour tax wedge appear to be contributing to more favourable NAWRU developments. A number of countries (e.g. France) have failed to

⁽²⁴⁾ For further details see Orlandi, F. (2012), *Structural unemployment and its determinants in the EU countries*, European Economy — Economic Paper, No 455, DG ECFIN, European Commission, May 2012.

⁽²⁵⁾ For further details see *Cyclical and structural unemployment in the euro area*, in Labour Market Developments in Europe, 2013, European Commission.

post similar improvements in their underlying labour market structures.

Graph II.1.2: **Alternative labour cost signals for the euro area, Germany and Spain (1)**



(1)GDP-weighted average of euro-area countries for which alternative NAWRUs have been computed (i.e. AT, BE, DE, EL, ES, FI, FR, IE, IT, NL and PT).

(2)Private consumption deflated ULC.

Source: DG ECFIN calculations based on Eurostat data.

Conclusions

Alternative Phillips curve specifications based on different assumptions regarding expectation formation point to broadly similar NAWRU results for the euro area. Estimates point to a recent rise in the NAWRU, suggesting that post-crisis unemployment increases are to some extent persistent.

In the case of Spain, alternative Phillips curve specifications yield somewhat different NAWRU results, pointing to the current importance for that country of theoretical considerations regarding expectations. The NKP, which uses rational expectations and relies on RULC growth to identify the unemployment gap, yields a more moderate NAWRU increase over recent years than the TKP (hitherto used by DG ECFIN), which allows only for static or adaptive expectations and relies on the signal provided by the change in nominal ULC growth. While this sensitivity in the results underlines the need for caution in interpreting NAWRU estimates, it should also be borne in mind that all specifications point to an important increase in the NAWRU for Spain at this juncture.

The deterioration in the NAWRU signals difficulties that are likely to last beyond the cyclical upturn. In interpreting those developments, it is important to recognise that changes in the NAWRU can be caused by both structural and non-structural factors. While the improvement in the NAWRU in Germany seems to be caused by structural factors, the deterioration in Spain seems to be caused more by crisis-related events that have persistent effects due to the presence of various rigidities that tend to slow down the adjustment process.