The long-term unemployment adjusted NAWRU estimates for selected European countries (The work is very preliminary)

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Abstract

In this paper, I construct estimates of the NAWRUs for selected European countries, using a state-space Phillips curve model which places a lower weight on the long-term unemployed in line with their weaker ability to influence price and wage dynamics. It can be shown that the long-term unemployed adjusted NAWRU series produced this way are less volatile than the estimated NAWRU series produced by the European Commission. What is also important, this specification provides a stronger relationship between unemployment rate and (wage) inflation. Thus, the approach is better capable of (re)producing the link between these two variables, that is, the classic Phillips curve relationship, which otherwise seems to have been weakened in many Western countries during the last decade. The results also suggest that the output gap is still open in Finland, France and Italy, among a seleceted group of European countries analyzed in the paper.

Key words: NAWRU, Phillips Curve, inflation, unemployment

1   Introduction

The NAWRU, non accelereting wage rate of unemployment, is a much discussed concept, which has been analyzed and debated for decades in economics literature. It has become more important than before during the last decade: it has a crucial role in determining the fiscal stance of an EU member country and then appropriate fiscal policy measures recommended by the EU commission. This manoeuvre is based on the "Fiscal compact", a treaty constituting of fiscal rules that are currently included in the legislation in almost all EU countries. Hence not only is the NAWRU a relevant concept when one is theoretically interested in separating cyclical and structural changes in economy, but even more so in practice, when the EU commission evaluates what kind of fiscal policy is sound and justified in each EU member country.

The idea of NAWRU can be traced back to Phillips (1958) who observed that there is a stable empirical relationship between wage inflation and the unemployment rate. The traditional Phillips curve suggested that the systematic negative relationship between these two variables could be exploited by policy-makers while they could choose between either accepting high inflation with low unemployment rate, or conversely, they could benefit from low inflation but this would come with cost of a higher unemployment rate. Implicititly, the trade-off was based on the assumption of constant inflation expextations.

The traditional Phillips curve was challenged in the 1970s when inflation and unemployment started to increase simultaneously. This phenomenon, known as "stagflation" turned the economists' focus on inflation expectations: the wage settlers would not probably assume that inflation expectations are constat, but instead, the expectations could easily change when the realized inflation numbers or some other relevant information about the economy would change. Hence in the literature, traditional Phillips was followed by an accelerationist Phillips curve (also known as expectations-augmented Phillips Curve) where it was the *change* in wage inflation that was related to the unemployment gap. Finally, this gave birth to the New Keynesian Phillips curve which assumes rational, forward-looking, inflation expectations (see e.g. Gali (2008)).

In their estimation of NAWRU rates the European commission aims at distinguisihing cyclical from structural changes in unemploment (Havik et al. (2014)). The constructed NAWRU estimates are then used to form estimates of potential output and structural budget balances, and using this information, make recommendations for sustainable and appropriate fiscal policy measures for each EU member countries. This task, which is theoretically well-based but empirically very difficult, has also lately become heavily criticised by some economists (see for instance Fioramanti and

Waldmann (2016)). Yet another issue with estimates of NAIRU is the recent observation that the relationship between unemployment and wage growth is somewhat broken. For instance Haldane (2017) states that the Phillips curve relationship has been anything but strong and stable in the UK, and that same flatness in the Phillips curve can be observed in a number of other countries as well.

The European Commission has reacted to critisism regarding its estimates by revising the estimation specification of the NAIRU for several countries. On the other hand, the U.S. government's estimates of NAIRU are based on a much more structural idea of an equilibrium unemployment rate. As a consequence, NAIRU estimates for the US are typically considerably less volatile than those for euro area countries. CBO (Congressional Budget Office), an independent US institution responsible for these calculations, rather uses the concept of "a long-term rate of unemployment", in lieu of NAIRU.

This paper contributes to this topic by providing an alternative, complementary measure for NAWRU rates in European countries. Produced estimates also have some clear advantages when compared to the estimates of the European commission. To improve the previous European estimates of NAWRU, I exploit the idea of Llaudes (2005) according to whom NAWRU can be more accurately calculated with reference to an unemployment rate which places a lower weight on the long-term unemployed. The idea can be explained by stating that the long-term unemployed have probably little impact on wage formation because: (i) they become discouraged from searching for a job, and consequently are less effective in competing wages ; (ii) their human capital is eroded over time leading employers to view long-term unemployment as a negative signal of ability. In other words, the reduced bargaining power of the long-term unemployed leads to restricted influence on wage dynamics.

Hence in this paper, I construct the NAWRU series for selected European countries, using a state-space Phillips curve model which places a lower weight on the long-term unemployed in line with their weaker ability to influence price and wage dynamics. It can be shown that the long-term unemployed adjusted NAWRU series produced this way are less volatile than the standard estimates produced by the European commission. What is also important, this specification provides a stronger relationship between unemployment rate and (wage) inflation. Thus, the approach is better cabable of (re)producing the link between these two variables, that is, the classic Phillips curve relatioship, which otherwise seems to have been weakened in many western countries during the last decade.

The paper is organized as follows. Section 2 analyzes the Phillips curve relationships in selected European countries. Section 3 explains the long-term unemployed adjusted state-space Phillips curve model used in the paper, and compares

the NAWRU estimates of selected European countries produced using the standard estimation method a la European commission, with the novel method presented in the paper that adjusts the series with long-term unemployed. The final section discusses the results gained in the paper.

2 The Phillips curve in selected European countries

The Phillips Curve, ie. the negative association between unemployment and (wage) inflation, has been an important concept in economic analysis over decades. However, what used to be strong and stable relationship between these two variables, has recently become anything but that, as put by the Chief Economist at the Bank of England A. Haldane (2017) in a recent speech. The flatness in the Phillips curve can be observed in a number of countries. This comes clear when we draw a relationship between unempoloyment and wage inflation in a selected group of European countries. The group analyzed here consists of, first, smaller European countries: Finland, Sweden, Denmark, and Ireland ; and on the other hand, bigger European countries: France, Italy, Germany, and the UK.

Figure 1 here

The flatness of the Phillips curve is the most striking in Denmark, UK, and Sweden, in particular. The curve is close to being flat also in Finland, Germany, and Italy. It is only in Ireland and France where the traditional pattern of a clearly negative association between unemployment and wage inflation emerges. That said, in this simple OLS regression the unemployment is still a statistically significant explanatory variable for wage inflation in cases of Denmark, Finland, Germany, Ireland, and France. Yet, of these countries, in cases of Denmark, Finland, and Germany, the R square values in the estimated equations are close to zero.

The negative relationship, reflected in the coefficient between unemployment and wage inflation becomes, however, stronger when the long-term unemployed are cleaned away from total number of unemployed people in each observation point (Figure 2). Larger coefficient values reflecting stronger relationships apply to all countries analyzed here. Also R square values grow in every country, with exceptions of Germany and the UK (for the UK, the Phillips curve is still close to being flat).

Figure 2 here

It can be assumed that the stronger relationship between unemployment and wage inflation observed when using the long-term unemployment adjusted Phillips curve

4

(in Figure 2) is due to the reduced bargaining power of the long-term unemployed, which restricts their influence on wage dynamics. Theoretically, the long-term unemployed have probably little impact on wage formation because: (i) they become discouraged from searching for a job, and consequently are less effective in competing wages ; (ii) their human capital is eroded over time leading employers to view long-term unemployment as a negative signal of ability.[1] Figures 1 and 2 then prove that removing long-term unemplyoed from total number of unemployed could improve our understanding of changes in the Phillips curve.As stated by Llaudes (2005), unemployment duration matters in the determination of prices and wages, and it is very likely that a smaller weight ought to be given to the long-term unemployed.

3 The Model

Time series for NAWRU are computed using a state-space Phillips curve model which places a lower weight on the long-term unemployed. The induced system is estimated with Kalman-filter. Historical NAWRU series are then calculated for selected European countries using this formula with similar parameter restrictions for each country. The model, estimated country-wise, can thus be described as a long-term unemployment-adjusted Phillips curve relationship.

3.1 Long-term unemployment-adjusted Phillips curve

The starting point of analysis is the traditional Phillips (1958) curve relationship:

$$\pi_t^w = \beta(u_t - u_t^*) + c + \varepsilon_t \tag{1}$$

where π^w represents wage inflation, u unemployment rate and u* NAWRU rate, and c is constant. Hence (1) implies a systematic negative relationship between unemployment gap and wage inflation. (1) also implicates that inflation expectations are constant. When inflation and unemployment started both increase in the 1970s, this simple relatioship became criticized. The stagflation episode thus confirmed that wage setters are taking into account information about inflation. As a consequence, the traditional Phillips was replaced with an accelerationist Phillips curve (a.k.a. expectations-augmented Phillips Curve), which takes inflation expectations seriously. According to the accelerationist model, it is the *change* in wage inflation that is related to unemployment gap, to put it formally:

$$\Delta\pi_t^w = \beta(u_t - u_t^*) + c + \varepsilon_t \tag{2}$$

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[1]See Goldman Sachs (2016)**?**. It also exploits this idea in their analysis of NAWRU rates.

where $\Delta\pi^w$ denotes now change in wage inflation. The state-space specification of the Phillips curve requires a few assumptions more. Again, we can start with the above equation, so changes in wages depend on previous period changes in wages and the gap between the unemployment rate and the NAWRU rate. As well as Llaudes (2005), we assume that NAWRU follows a random walk process, hence $E\pi^w_t = \pi^w_{t-1}$ so $\pi^w_t - E\pi^w_t = \Delta\pi^w_t$. In our system, NAWRU is an unknown variable that needs to be estimated: this is done using the Kalman-Filter.

We follow the recent literature by assuming that NAWRU may vary in time (see, for instance, Gordon (1997)), and also, that it follows a random walk procedure. Thus, equation (2) is complemented with a folllowing process for NAWRU:

$$u^*_t = u^*_{t-1} + v_t \tag{3}$$

where v_t is assumed to be i.i.d. normal with mean zero and variance σ^2_v. It is also assumed to be uncorrelated with ϵ at all leads and lags.The equations (2) and (3) can be combined to form the state-space representation of the Phillips curve. Using this system of equations, NAWRU series can be estimated with the Kalman-filter. A modified version of the state-space specification of the Phillips curve is also used by the European Commission: in their version, instead of wage inflation the unemployment gap is related to a change in the growth rate of real unit labor costs (RULC) (see Havik et al. (2014)).

However, in this paper, instead of estimating NAWRU straightforwardly using equations (2) and (3), we split the unemployed in two groups: the long-term unemployed and the rest of unemployed. This can be motivated with the results presented in Section 2 and, also, with the results provided by Llaudes (2005) who shows that NAWRU can be more accurately calculated with reference to an unemployment rate which places a lower weight on the long-term unemployed.

3.2   Estimation issues

In his paper Llaudes (2005) formulates the relevant unemployment concept associated with inflation as and index in which the weights of different unemployment spells sum up to one. He finds that the weight parameter for long-term unemployed varies between 0.03 and 0.46 in his sample of OECD countries. Instead, I give the short-term unemploeyd a weight equal to 1 but for long-term unemployed, I use weights between 0.5 and 0.75. This is done to use an unemployment concept which is closer to real unemployment rate.

Before estimation of the system of equations (2) and (3) with the Kalman-Filter, we need initialize to paramater β in (2) that captures the strength of connection

between unemployment gap and changes in inflation. In his study Llaudes finds quite large estimates for this parameter value, ranging from 0.2 to greater than 2, depending on the country. He estimates these values using unemployment and inflation data starting from the 1960s.

Nevertheless, as Figure 1 and 2 prove, the relationships between unemployment rate and inflation rates have lately become almost flat in many countries. This seems to be the case even after omission of long-term unemployed from the unemployment rate series. To capture this change in behavior, I calibrate β equal to 0.1 for the countries analyzed in this paper. This implicates a modest but still negative link between wage inflation and unemployment, in line with the evidence from Figures 1 and 2.

Boefore estimating the system of equations with the Kalman filter, also the smoothness of the NAWRU must be dealt with. This is determined with the the signal-to-noise ratio paramater captured from the variances of the error terms in equations (2) and (3), formally $\sigma_v^2/\sigma_\epsilon^2$. The larger the ratio, the more volatile the NAWRU is, while if this paramater was zero that would imply a constant NAWRU. Laubach (2001), OECD (2000), and also Llaudes (2005) argue the estimation of the signal-to-noise ratio leads easily to very flat NAIRU estimes. In the following, I first calibrate the signal-to-noise ratio to 0.5. It is higher than the ratio used by Llaudes (2005) who used a value of 0.04, but later in the paper, I also test the sensitivity of the results to a significantly lower value for this paramete, 0.01.

3.3 The Data

Primary data sources for time series used in the paper are the Eurostat and the OECD. More spefically, unemployment data are collected from the Eurostat, wages and the share of long-term unemployed are collected from the OECD database. For Finland, also Statistics Finland as well as the Ministry of Economic Affairs and Emploment have been used as a data source to collect a time seris for long-term unemployed. It is the data for the long-term unemployment which curtails the length of the time series used in the paper: mostly, time series start from the beginning of the 1980s or the 1990s, but for Ireland, they cover a much shorter time period, starting from 1999 Q1. The length of time series wtih respect to each country can be found in footnote X.

4   Results

As explained in Section 3.2. the parameter β is first calibrate to 0.1 for the selected countries analyzed in this paper to capture the weakened link between unemployment and wage inflation observed in many countries. As an assumption of the smoothness of the NAWRU series, the signal-to-noise ratio, $\sigma_v^2/\sigma_\epsilon^2$., is first set to 0.5. As discussed in Section 3.2., the weight of long-term unemployed is first calibrated to 0.5. While the literature is anything but sure about the appropriate values for these parameters I naturally test the sensitivity of the results to alternative parameter values later on.

Figure 3 here

Figure 3 shows the estimated NAWRU rates and 95 percentage points confidence bands for these NAWRU esimates in our seleceted group of European countries, together with observed unemplyoment rates in the same countries. From these it is possible to observe that produced NAWRU rates follow the patterns of the unemployment rate series. In countries such as Denmark, Finland and Sweden the estimated NAWRUs were above the observed unemployment rates at the beginning of the 2000s' and again just before the financial crisisi in 2008, implying that these economies were overheated at that time. The estimated NAWRU series for the UK looks somewhat similar to that of Denmark's, though according to the estimates the UK's economy was close to its potential during the whole period between 1997 - 2005.

The Irish story is slightly different while the results implicate that the economy would have been close to its potential between 2000 and 2007, but during the financial crisis the unemployment first rose much higher than the estimated NAWRU, and then recently has fallen back again close to the estimated equilibrium level represeting the economy's potential output. Nevertheless, maybe the most interesting observation from Figure 3 is that there is still much room for improvement in the French and Italian labour markets. According to the estimates, the only time in the estimation period when the Italian and French economies have been at their potential levels is the year 2007, just before the financial crisis.

As stated earlier, the weight of the long-term unemployed is not estimated but calibrated to 0.5 in these first simulations. To test the sensitivity of the results, I estimate the NAWRU rates for the same countries using different parameterization: the weight of the long-term unemployed is now increased to 0.75, so this should produce results more in line with those of the European Commission, which assumes no separation between long-term unemplyoed and other unemployed.

Figure 4 here

In general, the estimates of the NAWRU rates in Figure 4 are not far from the

estimates presented in Figure 3. Yet some differences can also be found: for instance, Ireland and Germany were close to being overheated already in the second quarter of 2016. On average, the levels of the NAWRU rates are now slightly higher in our selecated group of European countries with some changes in time patterns of the NAWRUs as well. As expected, the output gap implications of these results are close to the output gap estimates provided by the European Commission, see for instance Economic and Financial Affairs (2018). This holds true even if our specification and estimation method are to some extent different than those of the European Commission.

Finally, I test the sensitivity of the results to changes in the signal-to-noise ratio, $\sigma_v^2/\sigma_\epsilon^2$. This parameter, which defines the smoothness of the NAWRU, is now calibrated to 0.01, implying less volatile NAWRU estimates. At the same time, I calibrate β equal to 0.5, hence I assume a stronger link between unemployment and changes in wage inflation. In this simulation exercise, I also set the weight of the long-term unemployed equal to 0.5, the same value as it was in the simulations shown in Figure 3.

Figure 5 here

With this parameterization, the patterns of the estimated NAWRUs are still quite to those shown in Figure 3 and Figure 4. Yet the average levels of estimated NAWRUs are now slightly higher than they were with the previous parameterization. For instance, according to the results the French labor markets would been overheated two times in the estimation perdiod, first at the begginning of the 2000s and later just before the financial crisis in 2008. Also the Italian economy was at its potential level at the beginning of the 2000s, and also, its labor markets were overheated just before the financial crisis according to these estimates. Figure 5 also shows that Denmark's labour markets were slightly overheated in the period 1994 - 2002. Even if this result for the Danish economy is somewhat unrealistic, the NAWRUs for other European countries look more plausible. What is also interesting is that the 95 percentage confidence bands for the NAWRU estimates are now much narrower than with the previous parameterization.

These results of NAWRUs for selected European countries can be compared to estimates produced by the European Commission (see for instance Economic and Financial Affairs (2018) or Havik et al. (2014)). When comparing the estimates presented here to the estimates produced by the EC the first observation is that the historical patterns of NAWRUs look similar. Nevertheless, some differences arise too. First, the estimated NAWRUs presented in this paper are typically less volatile than the European Commision's estimates. Second, the average levels of NAWRUs presented in this paper are slightly lower, leading to larger historical output gaps in

our selected group of European countries.

5   Conclusions

The NAWRU estimates provided by the European Commssion have lately been widely criticized. Another shared worry in the Western countries has been the flatness of the Phillips curve, a phenomenon most clearly observed after the the financial crisis. This paper aims at contributing to this topic by exploiting the idea originally prestented by Llaudes (2005) according to whom NAWRU can be more accurately calculated with reference to an unemployment rate which places a lower weight on the long-term unemployed.

It can be shown that adjusting unemployment with the long-term unemployed (by decreasing their weight) strengthens the connection between unemployment and wage inflation, ie. reasserts the classic Phillips curve relationship. Using this approach in the state-space specification of the accelerationist Phillips curve produces less volatile and less cyclical estimates for NAWRUs when compared to the European Commission's estimates. On average, the estimates are also lower in levels. According to our results, the output gap is still open in Finland, France and Italy among our seleceted group of European countries. This would suggest to postpone fiscal policy tightening in these countries. On the other hand, our results show that the labour markets are probably close to being overheated in Germany and the UK.

The method presented in the paper gives a meaningful alternative way to estimate NAWRUs, and the produced estimates can be seen as complements to the EC's estimates. Nevertheless, some problems remain. While the magnitude of variance parameters and the weight of the long-term unemployed are very diffucult to estimate from the state-space representation of the Phillips curve that is used in the paper, we need to calibrate these parameters. Also the parameter that captures the elasticity of wage inflation to unemployment, ie. the central mechanism of the Phillips curve, is calibrated. In the future work, it would be very useful to estimate these paremeters instead of calibration. Nevertheless, this would demand more complicated estimation methods with possible problems related to stability and robustness of the estimated system. The Bayesian estimation methods with strict priors would probably be the best way forward in this task.

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Phillips, A. W. (1958), The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom 1861–1957. Vol. 25, No. 100 (Nov., 1958), pp. 283-299.
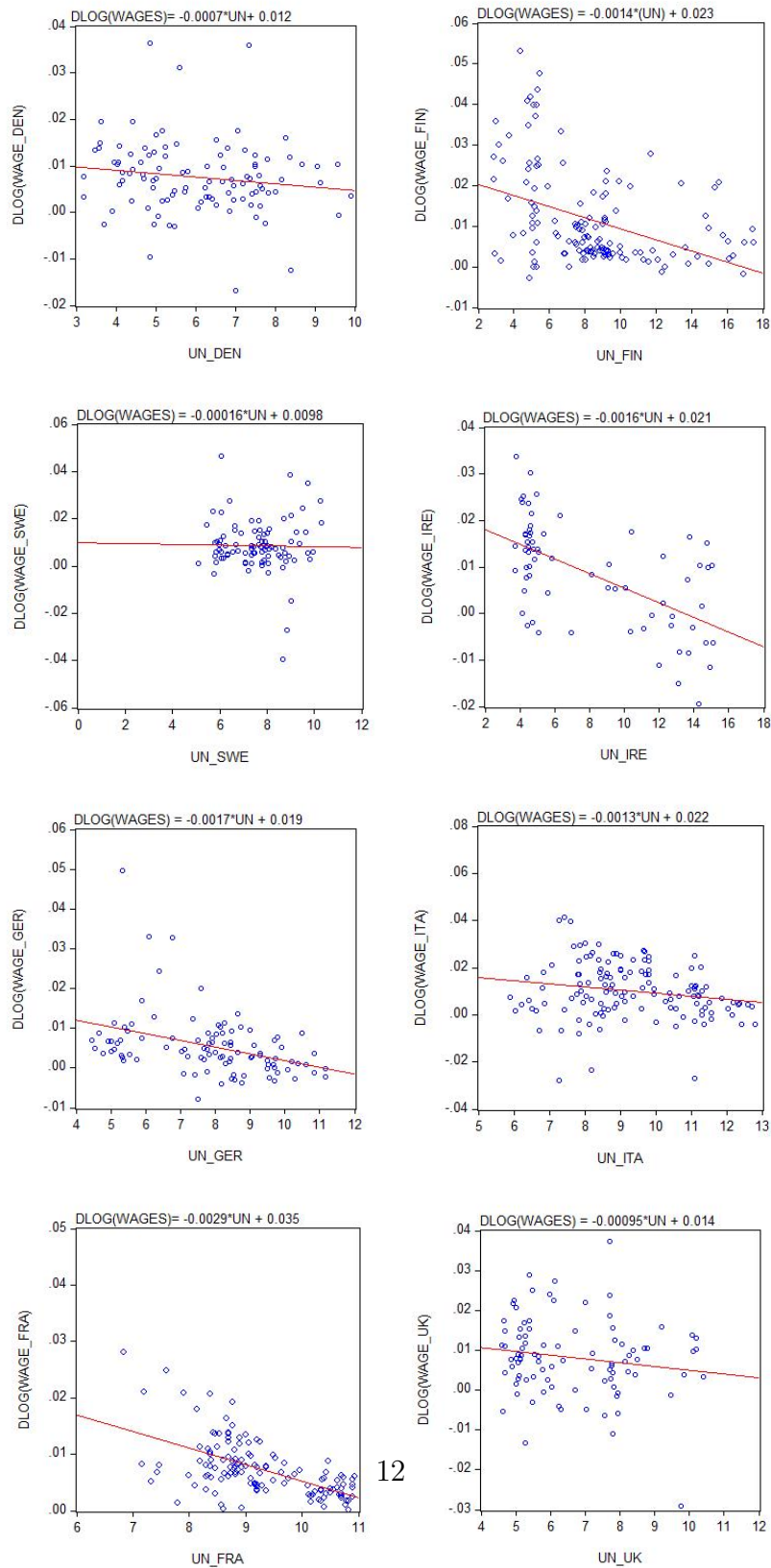
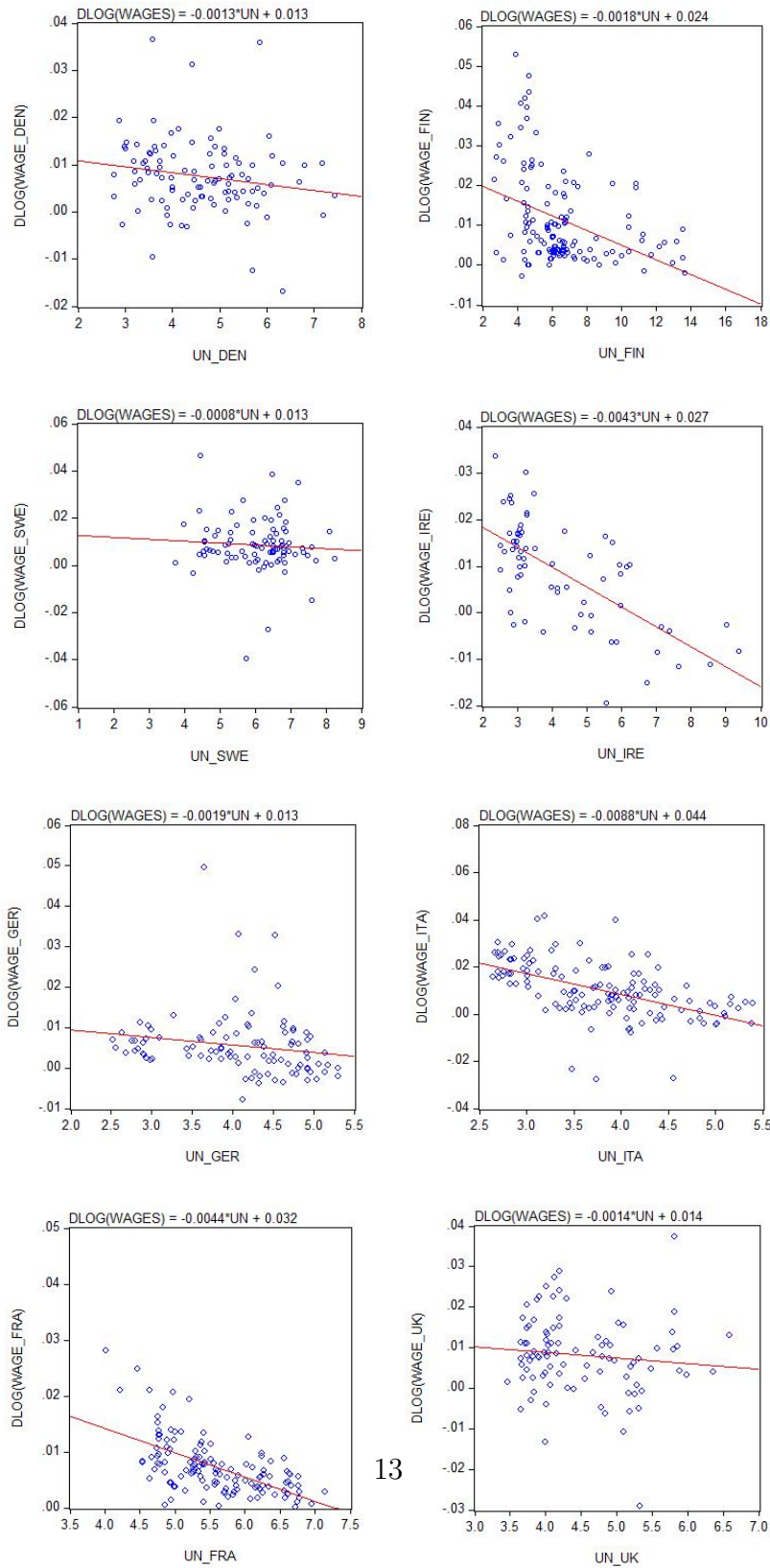Figure 1: The Phillips curve in selected European countries

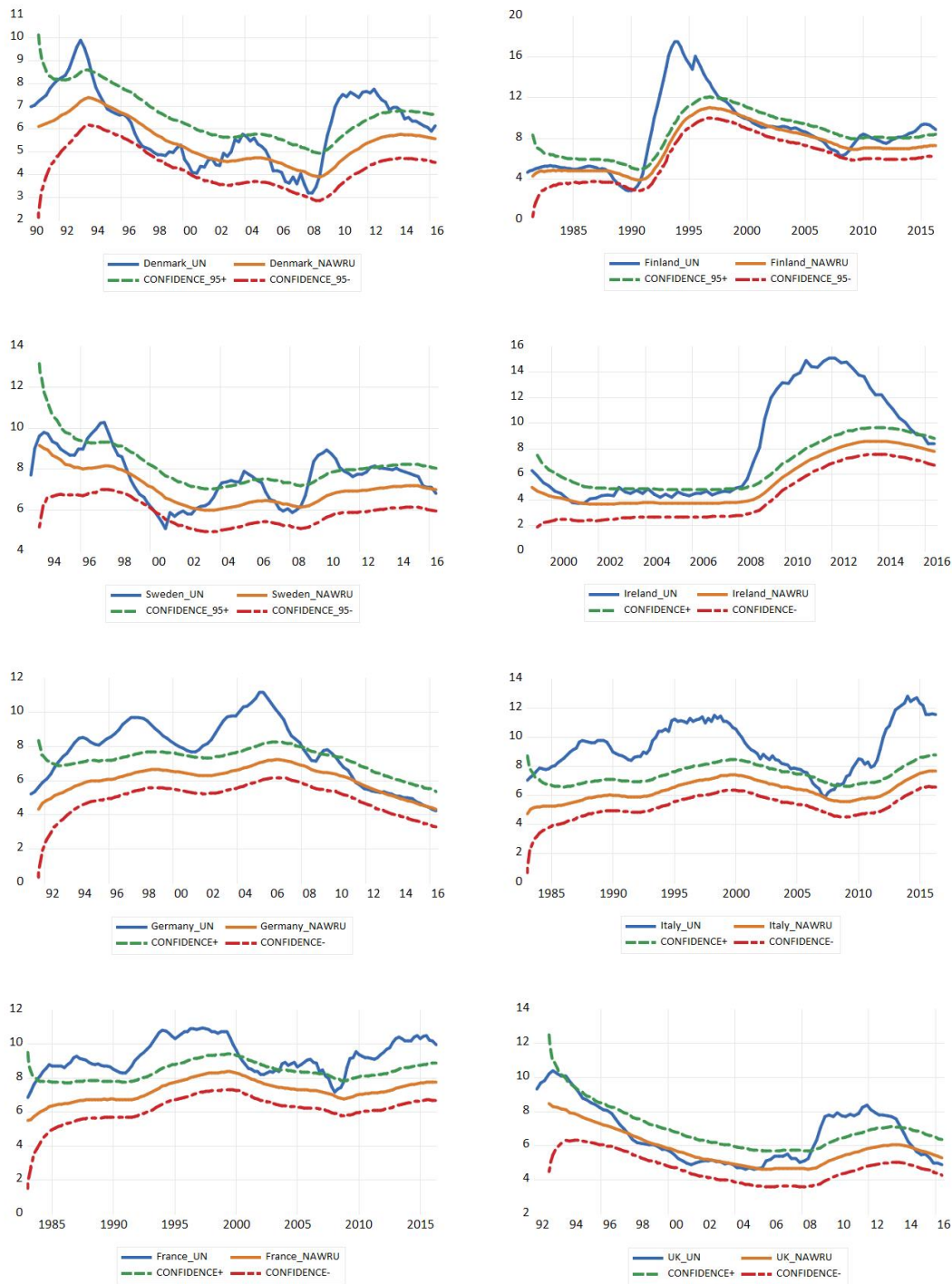Figure 2: The Phillips curve in selected European countries

13

Figure 3: The estimated NAWRUs and unemployment rates for selected European countries. Benchmark parameter val.   14
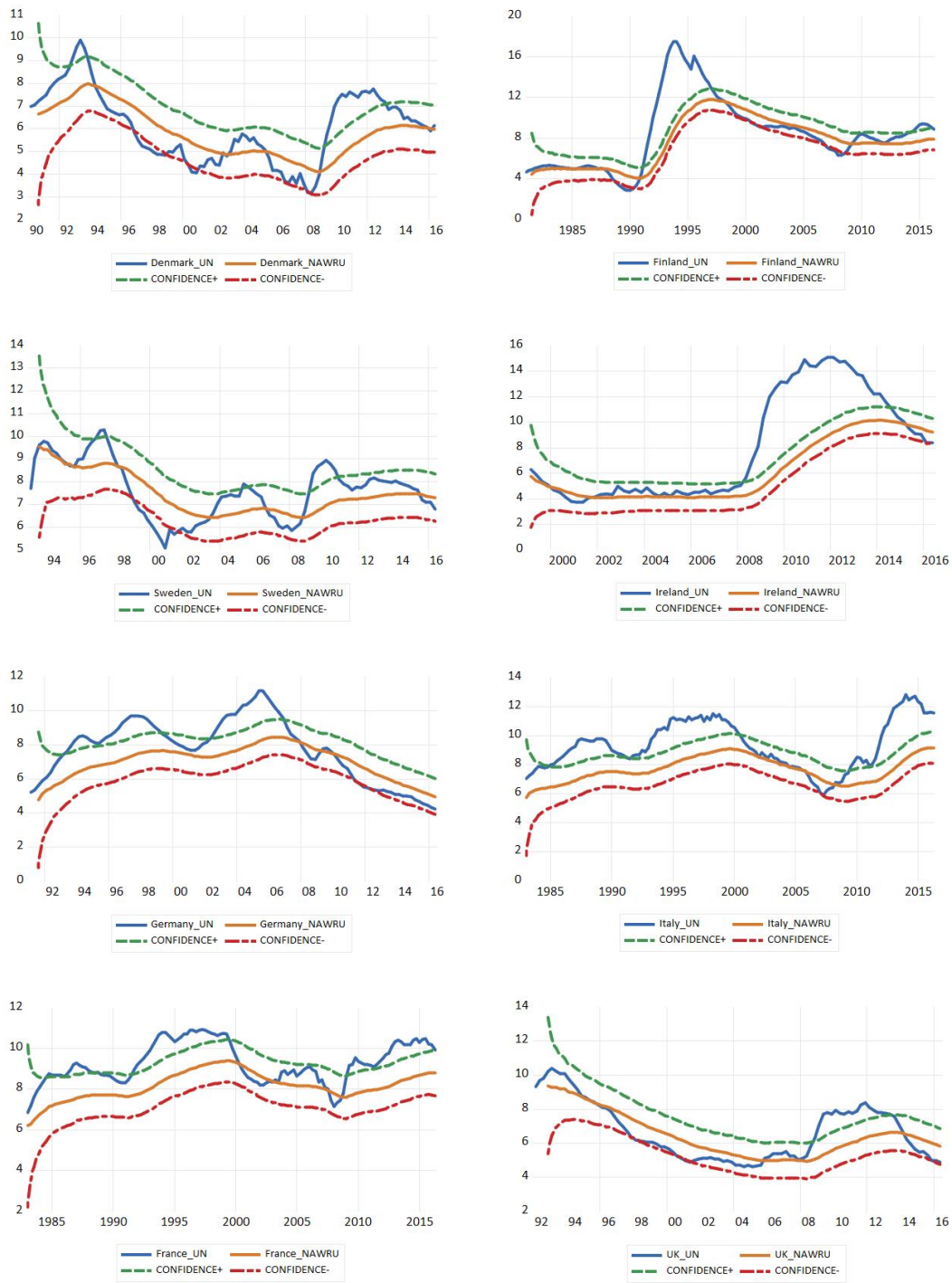
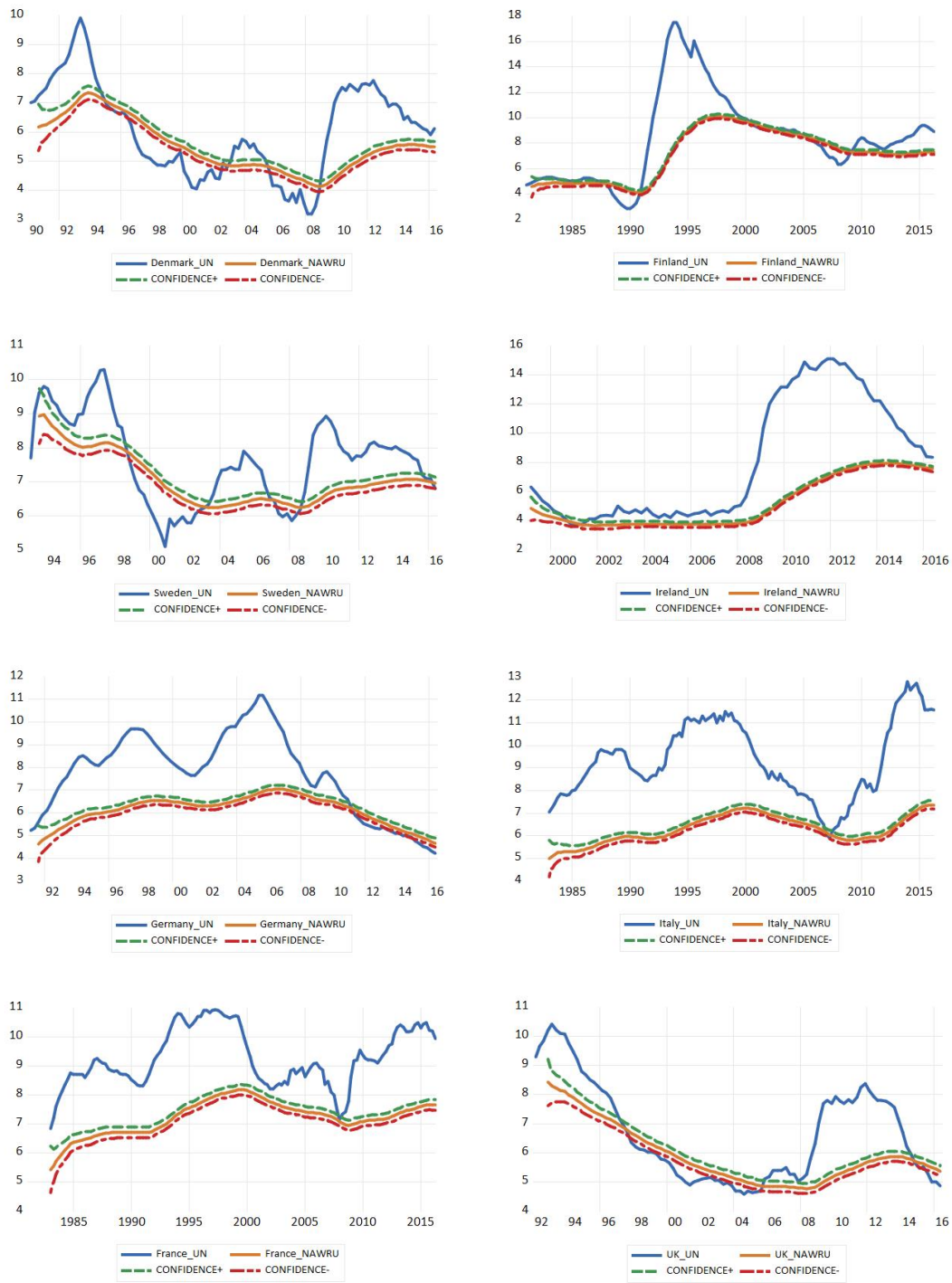Figure 4: The estimated NAWRUs and unemployment rates for selected European countries. Parameter val. 2

Figure 5: The estimated NAWRUs and unemployment rates for selected European countries. Parameter val. 3