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The Natural Rate of Interest II: Empirical Overview

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The concept of the natural rate of interest (NRI) dates back to Wicksell (1898) and has since then been highly debated in the economic literature. In practice, estimates of the NRI can be employed as a versatile tool for macroeconomic analysis and are a core element within the popular neo-Wicksellian (or New-Keynesian) framework. The real rate gap, i.e. the difference between the actual interest rate and the NRI, provides valuable information about the state of the economy and can help policy makers to adjust the monetary policy stance. However, the NRI cannot be directly observed and has to be calculated from other economic data. While the empirical literature provides various estimation approaches, all of them are subject to serious measurement problems and yield fairly uncertain estimates. This Roundup reviews the advantages and shortcomings of the most popular measurement methods and presents an estimation of the NRI and the real rate gap based on the Laubach and Williams (2003) model.

Measuring the natural rate of interest

A precise estimate of the natural rate of interest and its future path would provide policy makers with valuable information for monetary policy analysis. Even though a vast number of research has been dedicated to this topic, existing approaches are plagued by a number of different shortcomings. While simple models for estimating the NRI oftentimes lack a proper theoretical foundation, theoretically more sophisticated approaches have to rely on a number of debatable assumptions. An introduction to this problem and a general overview can be found in Weber et al. (2008). The basic theoretical concept behind the NRI is reviewed in Chervyakov and König (2017).

Weber et al. (2008) discuss the usefulness of the natural rate of interest concept for monetary policy. As the NRI is a latent variable, i.e. it cannot be directly observed, point estimates have to be obtained from within a model. However, specifying a detailed framework requires an identification of the numerous driving factors behind it. This is a challenge on its own, as factors like the discount rate of private households are themselves latent variables. Thus, estimation approaches for the NRI have to rely on a simplified framework and produce point estimates that are heavily dependent on the specific assumptions employed. In addition, most data that is used to estimate the NRI is subject to frequent revisions and is published with a significant time lag. This makes it especially hard to employ the NRI as a leading indicator for current policy decisions.

The most well-established estimation approaches are classified by Laubach and Williams (2016) into three categories: (i) univariate filtering methods, (ii) multivariate structural econometric models, and (iii) fully-fledged equilibrium models with a microeconomic foundation.

Univariate filtering approaches represent the most simplistic way of estimating the natural rate of interest. Weber et al. (2008) summarize the main idea behind the method as follows: after all shocks to the actual real rate have died out in the short-run, the real rate should converge to its long-run equilibrium path – namely the NRI. This approach does not require a specific model and a first estimate can be already obtained by calculating the sample mean of a time series of the actual real interest rate. However, since supply and demand conditions – and consequently the NRI - change over time, moving averages instead of a constant mean should be computed. The obtained time series should be interpreted as a compilation of the local averages of the natural rate, i.e. a smoothed version of its actual path. Another solution to eliminate the short-run disturbances is filtering. Approaches such as the Hodrick-Prescott filter (Hodrick and Prescott, 1997) or the band pass filter (Christiano and Fitzgerald, 1999) smooth out short-term variations while preserving the long-term trend component of the series. The same can be achieved by employing the unobserved components stochastic volatility (UC-SV) model from Stock and Watson (2007) where the variance of the short-run shocks is assumed to follow a random walk.

Even though univariate filtering methods are relatively easy to implement, Weber et al. (2008) and Laubach and Williams (2016) reach the same conclusion: estimates can only be interpreted as fairly rough, since they heavily depend on the choice of the actual real rate of interest and the moving average window. Different rates of interest can be paired with different measures of inflation (expectations), leading to a variety of different point estimates. Moreover, univariate methods only take into account the actual real interest rate and are thus a very simplified way of identifying the NRI. Controlling for other factors in the estimation of the NRI is not possible due to a lack of a more detailed model, implying that univariate filtering methods are only useful for getting a first intuition about the data.

In contrast to the univariate approach, multivariate methods set up a simple model to determine the natural rate of interest. In particular, movements in inflation, output, interest rates and other variables are explicitly taken into account. As such, multivariate approaches include structural relations between the observable variables and the latent NRI inside the model. Moreover, one can tune the particular model with a variety of specifications and include additional ad hoc assumptions. Compared to the univariate case, a much closer connection to the theoretical foundation behind the NRI can be established.

The most prominent specification of a multivariate model can be found in a paper by Laubach and Williams (2003). The authors formulate a small scale macroeconomic framework, which is based on a Phillips-curve and an IS-curve. This allows for a simultaneous estimation of the natural real interest rate, together with the potential output and trend growth. The three unobservable variables are filtered out from the observable data via the Kalman filter (Kalman, 1960). The procedure itself can be broken down into two steps. First, in the so-called prediction step, current observations of GDP and inflation are employed to compute forecasts for the next period. Afterwards, the small scale macroeconomic model is used to obtain estimates for the NRI, potential output and trend growth based on the previously derived forecasts. In the second step, when new realizations of inflation and GDP become available, the predictions from the first step are compared with the actual outcomes. If the forecasted values differ from the actual realizations, estimates for the unobservable variables are accordingly updated. This procedure is also called a two-sided filtering method, as in-sample forecasts are employed to fine-tune the estimator for the natural rate of interest. The original Laubach and Williams (LW) model is calibrated to fit the US economic data. A more recent version of their estimation can be found in Laubach and Williams (2016). Variations of the LW model for the euro area are discussed in Mésonnier and Renne (2007) or Garnier and Wilhelmsen (2009).

All in all, the LW framework still assumes a fairly general structure of the whole economy. In particular, Weber et al. (2008) point out that it is impossible to explicitly identify the individual driving forces behind the movements of the natural rate of interest. Moreover, interlinkages among economic variables are difficult to interpret and can be only accessed in a more detailed framework. Laubach and Williams (2016) emphasize another issue that is directly attributed to the Kalman filter: using in-sample forecasts as future data points results in a lagged time-series, making the two-sided estimation procedure an undesirable option for policy makers. A one-sided estimation of the LW-model, i.e. estimating the model without fine-tuning the parameters, is possible, but leads to an increase in estimation uncertainty. However, the method is easy to employ and does not require very strong assumptions. As shown in Laubach and Williams (2016), one-sided estimates of the NRI only slightly deviate from the two-sided results and can be still employed in other macroeconomic models.

The third approach, namely estimating a fully-fledged equilibrium model, tackles most of the previously discussed issues since a more detailed structure of the economy is specified. The macroeconomic interlinkages are complemented with a microeconomic foundation, especially by taking into account the intertemporal optimization problems of households and firms. The main workhorse of this approach is the so-called dynamic stochastic general equilibrium (DSGE) model. One of its first specifications for the euro area can be found in a paper by Smets and Wouters (2003). Generally speaking, a DSGE model allows estimating and forecasting the evolution of economic variables such as GDP, consumption, investment, prices, wages, employment, and interest rates. Under the assumption of several frictions such as sticky prices, sticky wages, credit frictions etc., the adjustment path of variables to different types of shocks can be modelled. Here, the natural rate of interest is equal to the real interest rate level that prevails in the absence of all nominal frictions and shocks in the framework.

Giammarioli and Valla (2004) provide an estimation of the NRI for the euro area. The authors specify a DSGE model with different monetary policy rules and access the consequences of taking into account the level of the natural real rate of interest. However, a policy rule augmented with the actual NRI is found to only slightly improve the overall stability of the economy. Nevertheless, they detect a correlation between lagged values of the real interest rate gap and inflation. This implies that the NRI could be employed as a leading indicator for inflationary pressure in the euro area. This idea is further discussed in a work by Neiss and Nelson (2003). In another paper, Andrés et al. (2009) suggest that real money balances contain valuable information that might help forecasting future innovations of the natural rate of interest. Obtaining a measure for expected values of the NRI is especially interesting for policy makers, as it can help mitigating the data availability problem.

Compared to the other two approaches, a DSGE model allows to identify the driving forces behind the NRI and to forecast its future values. Weber et al. (2008) point out the main advantage of this framework: factors such as technology innovations, changes in government spending or a different tax system can be taken into account and their influence on the path of the NRI can be modelled. However, specifying a DSGE model requires a lot more assumptions about the underlying frictions and parameters than any of the other frameworks do. Those are not always easy to calibrate, as they might change over time or be impaired during a crisis period. The authors conclude once again that estimates for the NRI are heavily dependent on the assumed structure of the economy and are subject to model uncertainty.

Summing up, a trade-off between easy model implementation and a well anchored theoretical foundation can be noted for all of the discussed approaches. On the one hand, while univariate methods can be calculated easily, the resulting estimates are very uncertain and will likely overlook important dynamics in the economy. On the other hand, a fully-fledged equilibrium model makes it possible to analyze the factors influencing the path of the NRI in greater detail, but comes at the cost of having to specify a very elaborate framework based on numerous assumptions. The multivariate approach and more specifically the Laubach-Williams model offers a well-balanced alternative: structural relations are assumed inside a small scale macroeconomic framework without the need of explicitly specifying them. A more detailed discussion of the LW model will be presented hereafter, together with estimates for the NRI and the real rate gap in the euro area.

A Laubach-Williams estimate for the natural rate of interest

The Laubach and Williams (2003) model is one of the most commonly used approaches to estimate the natural rate of interest. In particular, it consists of a structural framework that takes into account movements in inflation, output and the interest rate. The NRI itself is defined by a state of the economy, where neither inflationary nor deflationary pressure is present.

Figure 1 shows an estimate for the natural rate of interest in the euro area, taken from a paper by Holston, Laubach and Williams (2016). In the period from 1979Q1 to 2015Q4, the obtained time series is characterized by a number of significant fluctuations. Especially the global financial crisis and the European debt crisis seem to have had a very pronounced impact on the level of the NRI. In 2008, the year when the global financial crisis reached its climax, a sharp decreased of roughly 2.2 percentage points can be observed. After a slight recovery, lasting until 2011Q2, the interest level continued to drop and even fell below zero in 2013Q1. The authors find similar patterns for the UK, US and Canada, concluding that declining natural rates are an international phenomenon.

Weber et al. (2008) point out, however, that the level of the NRI by itself does not allow drawing any strong conclusions about the actual state of the economy. This is one of the previously mentioned shortcomings of the LW-model: the driving forces behind a change in the NRI cannot be attributed to a single factor. For example, an upward movement of the NRI can be caused by an increase in productivity growth but could also stem from the need of financing lager social security deficits, which in terms would lead to higher real interest rates due to rising inflation risk premia. Other possible factors that could influence the NRI are discussed in ECB (2004). Laubach and Williams (2016) point out that recent downward movements in the NRI are caused by a combination of two developments: a global slowdown of economic growth, together with very low and partly negative real interest rates in the euro area. However, the non-recovering and low level of the natural rate of interest in the recent years poses a puzzle to many economists. Even though economic growth and inflation have picked up again, the NRI remains negative and only exhibits a slight upward trend. This phenomenon is oftentimes referred to as secular stagnation and its implications for monetary policy is highly debated in the literature (see Baldi (2016) for a discussion of secular stagnation).

Figure 1:

The Natural Rate of Interest in the Euro Area

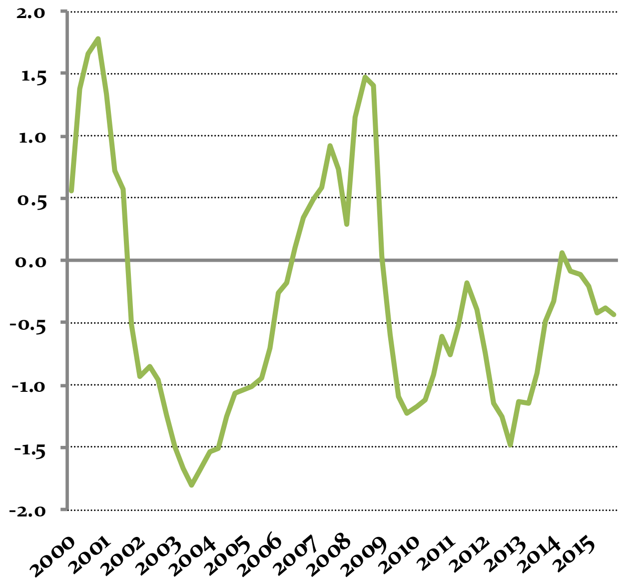
(in %)

Source: Holston, Laubach and Williams (2016).

Figure 2:

The Real Rate Gap in the Euro Area

(in %)



Source: Holston, Laubach and Williams (2016), ECB, OECD, own calculations.

Figure 2 shows the so-called real rate gap in the euro area, based on NRI estimates in Figure 1. The gap is defined as the difference between the actual real interest rate and the natural rate that is derived from the LW model. The real rate gap is a key variable within any New-Keynesian model and an important indicator for analyzing monetary policy: values below zero signalize an overall stimulative economic environment, while everything above zero indicates a contractionary impact of monetary policy. Assuming that no cost-push shocks are present, a real rate gap equal to zero would stand for the absence of inflationary pressure, i.e. price stability. The real rate gap reversed its sign from positive to negative in 2008Q4. After nearly closing in 2011Q3, it again widened in the aftermath of the European debt crisis. The variations in the gap largely stem from the employed measure of inflation expectations which significantly dropped over the past two years, thereby raising the real interest rate. Holston, Laubach and Williams (2016) stress that declining natural rates of interest are a global phenomenon. The estimations allow to conclude that monetary policy had a stimulating effect on the euro are economy in the aftermath of the crisis.

Concluding remarks

The natural rate of interest is an important variable in modern macroeconomic models. Moreover, its difference to the actual real interest rate offers policy makers valuable insights about the state of the economy. Estimates for the latent NRI can be obtained via different univariate and multivariate methods, all of them being subject to model uncertainty and possible measurement errors. Furthermore, data availability and revisions impede the use of the NRI as a leading indicator for policy decisions. However, reliable estimates for ex-post monetary policy analysis can be obtained from models such as Laubach and Williams (2003) – still making it an interesting concept for researchers. The NRI and the real rate gap can help providing an intuition about current monetary policy developments, but should be always employed together with other indicators.

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