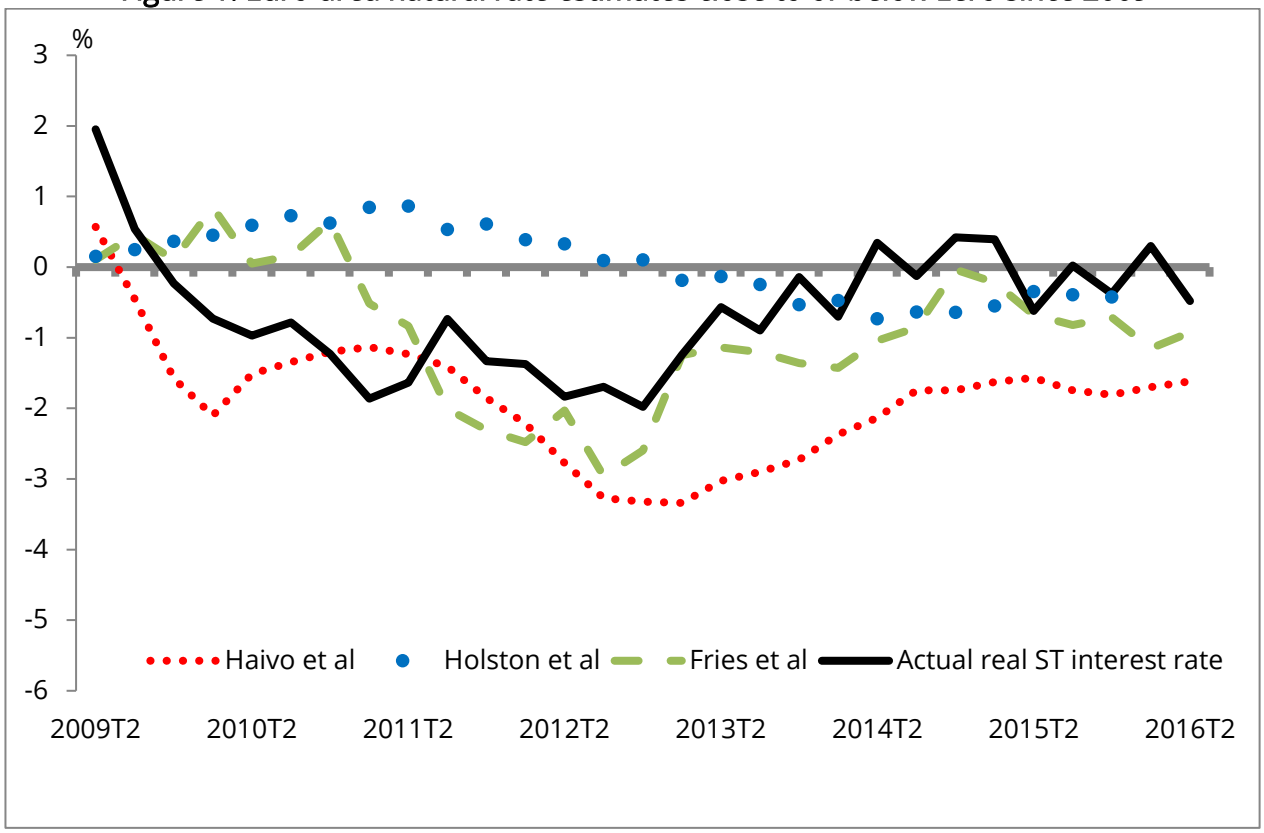
The natural rate of interest: estimates for the euro area

By Adrian Penalver

The natural rate of interest is the theoretical real rate at which inflation neither rises nor falls. Determined independently of monetary policy, it is a benchmark to assess whether policy is accommodative or restrictive. It is unobservable but estimated to be negative in the euro area over recent years. With modest inflation expectations and the effective lower bound on nominal interest rates, conventional monetary policy struggled to raise inflation, explaining the ECB's recourse to non-conventional instruments.

Figure 1: Euro-area natural rate estimates close to or below zero since 2009



What is the natural rate of interest?

The natural rate of interest (NRI) is a concept used by economists to describe the level of real interest rates that would keep inflation steady. It was first described by the Swedish economist Knut Wicksell in his book *Interest and Prices* in 1898. Since

in most economic models, the inflation rate falls when output is below its potential level, the NRI is also the one that keeps output at its potential level. (The real interest rate here refers to the actual interest rate minus the expected inflation rate.)

More technically, in the seminal work of Woodford (2002), the NRI is the real rate of interest that would keep inflation from rising or falling if prices were fully flexible. In this way, the NRI is a benchmark that "sees through" the temporary effects on inflation and output of frictions that prevent prices from adjusting immediately.

Why is the natural rate of interest a useful concept?

It is a standard view of economists that potential output cannot be influenced by conventional monetary policy. Potential output is determined by things like the working-age population, education and skills, technological progress etc. Since monetary policy cannot affect these things, it cannot affect potential output. The NRI is then the real rate of interest that brings demand into line with this potential output by moving demand between periods. For example, if income is expected to grow rapidly because of fast productivity growth in the future, then the NRI will be high to constrain current demand (otherwise people will try to enjoy some of their future income today and this would be inflationary).

The crucial point is that the NRI is independent of monetary policy. In normal circumstances, when the short-term interest rate is the only monetary policy instrument, the difference between the real policy rate and the NRI can be used to assess the stance of monetary policy. If the policy interest rate (in real terms) is below the NRI, then monetary policy is stimulatory and the inflation rate can be expected to rise faster than it otherwise would.

Theoretically, nonconventional instruments work through different channels, but still rely on gaps between expected short-term real rates and their natural counterparts. For example, forward guidance works by committing now to a future path of the short-term nominal rate, which implies an expected gap between the future real policy rate and the future NRI. In theory, demand and inflation are stimulated now in anticipation of the future inflation created by this commitment. This would show up as a rise in currently expected inflation and a more negative real policy rate now.

How low is the current natural rate in the euro area?

As the NRI is not directly observable, it has to be estimated using statistical models. Building a statistical model requires assumptions and estimates of the NRI can vary considerably with different assumptions.

One approach, pioneered by Laubach and Williams (2003), attempts to estimate the NRI directly. They use a very simple economic framework that relates real GDP, inflation and short term interest rates and assume that the implied gap between actual and potential GDP is driven by the difference between the short-term real interest rate and the NRI. This approach assumes that economic shocks are fairly slow-moving and so NRIs estimated using this approach are quite smooth. Figure 2 illustrates an estimate of the path of the NRI for the Euro-area based on the multi-country estimates of Fries et al. (2016) which uses the Laubach and Williams approach. The Euro-area estimate from Holston et al (2016) using the same approach is also illustrated for comparison.

An alternative approach, used by Barsky et al (2014) calculates the NRI using an estimated large-scale macroeconomic model. The NRI is calculated by "turning off" the parameters that slow down wage and price adjustments and shocks to price markups. In effect, the fictional economy with flexible prices can be recreated from the estimated macroeconomic model and the NRI is the one that keeps inflation stable in this case. This type of model assumes that monetary policy can adjust to contemporaneous shocks and needs fairly volatile shocks to replicate macroeconomic data. As a result, estimates of the NRI using this approach are quite volatile and are commonly smoothed for presentation purposes. Figure 2 illustrates an estimate of the Euro-area NRI which uses this approach ("Haivo et al" is an as yet unpublished paper).

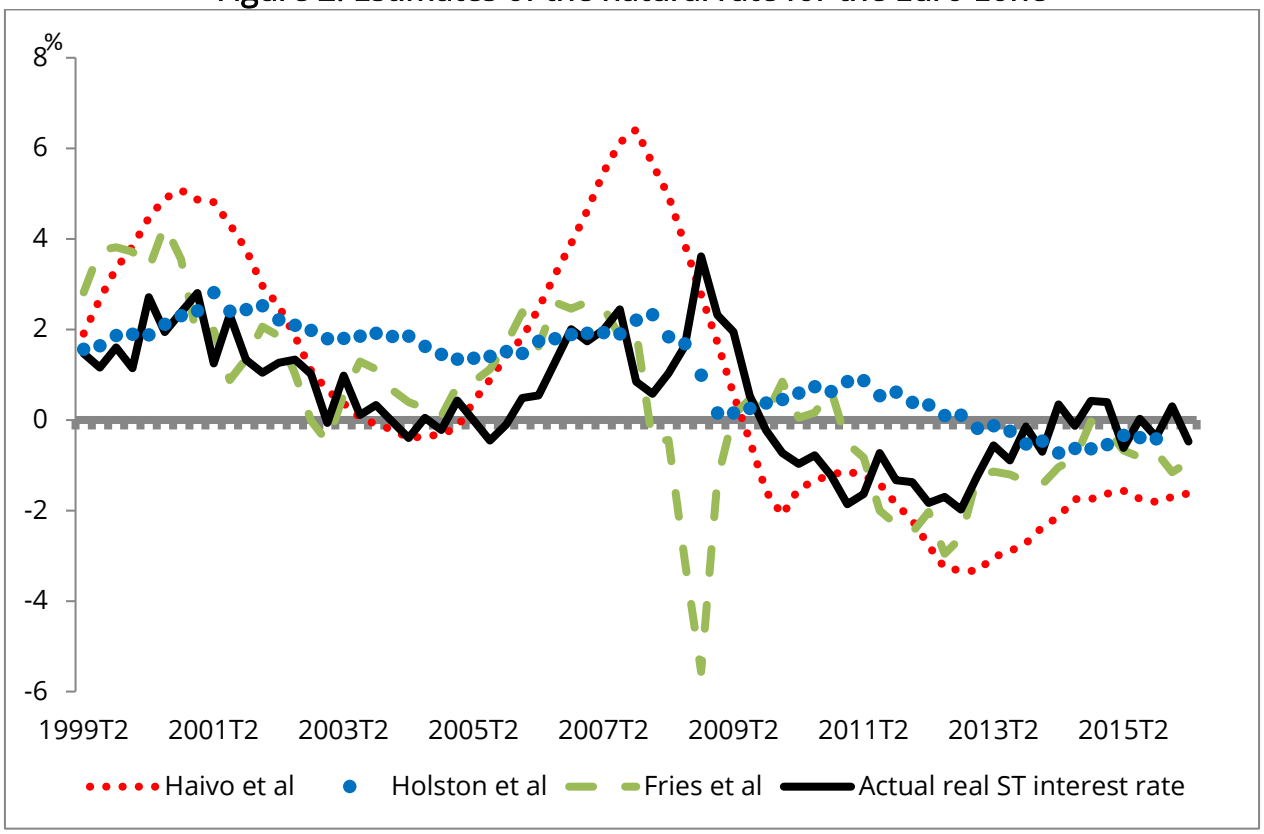
Why does the natural rate move around and can it be negative?

The NRI moves around because there are shocks to the growth rate of potential output and shocks that affect the willingness to consume now relative to the future. Loosely speaking, the NRI changes because of shocks that affect the willingness to save and invest. Longer life expectancy, for example, increases the incentive to save but has minimal effect on the incentive to invest. A slow-down in productivity growth reduces the incentive to invest. Both these shocks would cause the NRI to fall. If shocks increasing the incentive to save and reducing the incentive to invest are sufficiently large, then negative real interest rates may be necessary to equalize the two.

Box: Should the central bank target the natural rate?

In very simple theoretical models, it is appropriate for the central bank to set the policy rate equal to the NRI plus the expected rate of inflation. This is because the NRI "summarises" the effect of shocks on the real interest rate under flexible prices, and the inflation expectations term takes account of the frictions that delay adjustment in prices and output. In more complex models (with wage and price rigidities for example and shocks to mark-ups), the appropriate path for monetary policy depends on the types of shocks hitting the economy and the optimal trade-off between volatility in output and inflation. Nevertheless, tracking the NRI can still be an improvement over simple interest rate setting rules (such as a Taylor rule).

Figure 2: Estimates of the natural rate for the Euro-zone



As can be seen from Figure 2, these estimates all point to significantly negative NRIs in the Euro-area in recent years. There is too much disagreement between the estimates of the NRI for them to be used to fine-tune monetary policy. However, significantly negative NRIs pose problems for conventional monetary. Since the nominal policy rate is constrained in how far it can fall by the effective lower bound

and short-term inflation expectations have been low, there is also a limit on how low real policy rates can go. This framework can therefore provide an explanation why in spite of record low nominal interest rates, conventional monetary policy stimulus has struggled to raise underlying inflation. As a result, the Eurosystem has introduced non-conventional monetary policy measures (see Marx et al. (2017)) in order to try to compensate for the lower bound constraint on short-term nominal rates and to bring money conditions closer to that indicated by these estimates of the NRI.