Dániel Baksa, Dániel Felcser, Ágnes Horváth, Norbert Kiss M., Csaba Köber, Balázs Krusper, Gábor Dániel Soós and Katalin Szilágyi: Neutral interest rate in Hungary*

Central banks primarily achieve their inflation targets by changing their key instrument, the central bank base rate, to the required extent and with careful timing. If the inflation outlook deteriorates and the forward-looking inflation rate exceeds the target, monetary policy raises interest rates to cool the economy and reduce inflation. In the opposite scenario, the bank cuts interest rates to stimulate the economy and raise inflation. In order to decide whether the prevailing rate of interest stimulates or slows the economy, it is necessary to know where the interest rate threshold is for expansionary versus contractionary monetary policy. We call this point of reference the neutral interest rate or the natural rate of interest. Similar to potential output, the neutral interest rate is a theoretical equilibrium concept, not an observable variable. It is therefore difficult to grasp empirically and its point estimation is surrounded with a great degree of uncertainty. This essay looks at the individual factors influencing the neutral interest rate and gives an estimate for the range in which it may move in Hungary.

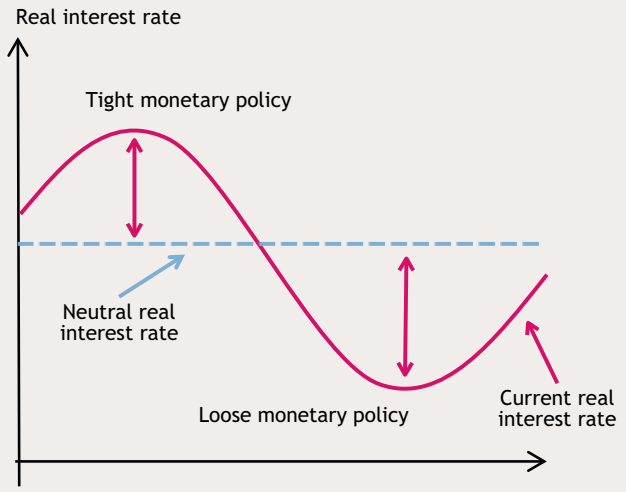
WHAT IS THE NEUTRAL INTEREST RATE?

The neutral interest rate is the focal point for medium-term monetary policy. A rate of interest reaches its neutral level if (1) the economy develops in accordance with demand and supply capacities (the output gap is closed), (2) there is no medium-term inflationary pressure, forward-looking inflation is on target, and (3) the risk premium is also in line with the medium-term target. In such a situation, monetary policy need not change the base rate for any reason, be it inflationary considerations, the real economy or stability.[1]

Just as the nominal interest rate equals the sum of the real interest rate and the expected rate of inflation, the same formula applies to the longer-term equilibrium values of these variables as well: the neutral nominal interest rate is equal to the sum of the neutral real interest rate and the medium-term inflation rate. The latter depends on the inflation target set by the central bank under inflation targeting:

Neutral nominal interest rate = neutral real interest rate + inflation target

Chart 1
The monetary policy stance

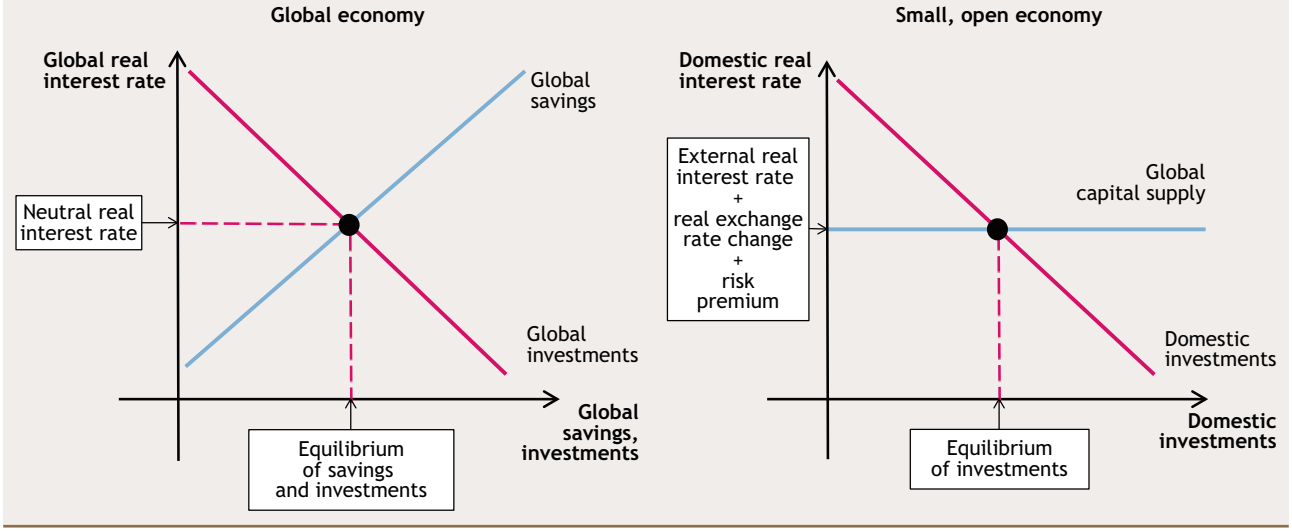


Since the behaviour of economic agents is influenced by the real interest rate rather than the nominal interest rate, the impact of monetary policy on aggregate demand (and therefore the medium-term inflation outlook) depends on the relationship between the current real rate of interest and the neutral real rate of interest (Chart 1). If the current

* The views expressed in this article are those of the author(s) and do not necessarily reflect the offical view ot the Magyar Nemzeti Bank.

[1] A similar, but wider concept, the long-term equilibrium interest rate is dependent on structural factors such as technological development and population growth. In this context, the neutral interest rate is more of a short-term concept.

Chart 2
Investments and savings – determinants of the neutral real interest rate



real interest rate is higher than the neutral real interest rate, then monetary policy becomes tight and constrains domestic demand, with a disinflationary effect. If the current real interest rate is lower than the neutral real interest rate, then monetary policy becomes loose and stimulates domestic demand, pushing towards higher inflation. In the following, we will focus on the neutral *real interest rate* at a given inflation target.

DEFINITION OF THE NEUTRAL INTEREST RATE — THEORETICAL CONSIDERATIONS

To start, we look at the factors determining the equilibrium real interest rate in a closed economy or across the global economy as a whole (Chart 2, left panel). The real interest rate can be understood as the price of borrowing necessary to finance capital expenditures. Within this framework, the neutral real interest rate is an increasing function of the propensity to invest (the higher the demand for credit, the higher its price) and a decreasing function of the propensity to save (the higher the supply of credit, the lower its price). Propensity to invest rises as productivity or business sentiment improves and economic uncertainty falls. The propensity to save is influenced by, for instance, precautionary considerations and demographic trends.

The equilibrium (neutral) level of the real interest rate in a small, open economy reliant on external funds is determined by the yield expectations of the international capital market (Chart 2, right panel). In other words: the price of capital is given for a small, open economy; at this given price, however, the country can attract unlimited amounts of funding. In such cases, the neutral interest rate can be derived from the so-called interest parity, which formulates the arbitrage condition that, at equilibrium, the yields available domestically and abroad should be even. According to this condition, the differential between domestic and foreign interest rates must cover the risk premium of domestic assets versus foreign assets, plus the expected real appreciation of the domestic currency. This means that investors expect higher yields for their greater risk in a more vulnerable country. However, if they expect the domestic currency to appreciate, they will be willing to accept lower rates of interest.

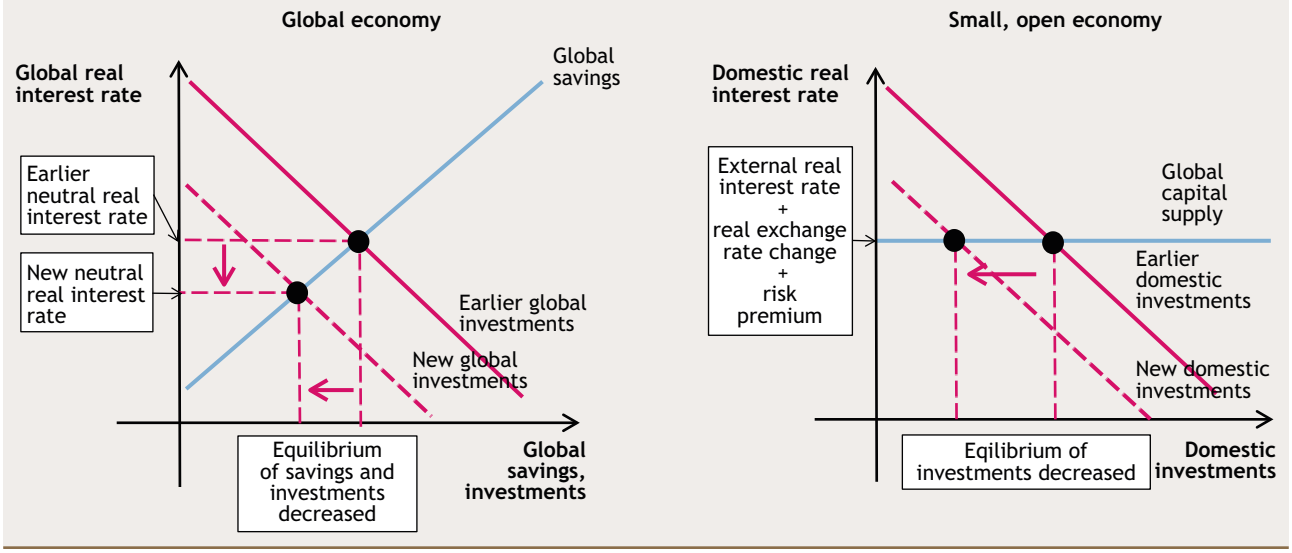
CHANGES TO THE NEUTRAL REAL INTEREST RATE IN THE CRISIS

The neutral real interest rate can change over time. Liquidity increased considerably at the global level before the crisis, due in part to the opening-up of the developing economies to the capital market. The increasing global capital supply was coupled with a very low level of the neutral real interest rate.[2]

The neutral real interest rate decreased further globally during the financial crisis (Chart 3, left panel). The weakening profit prospects of companies and the increased uncertainty in the expected economic path persistently

[2] Moreover, in what is called the period of Great Moderation starting in the mid-1980s, equilibrium rates of inflation tended to decrease globally, which further reduced the neutral *nominal* interest rate level. As a part of this process, the neutral interest rate decreased in the euro area compared to the preceding 10 to 15 years, thanks to the elimination of exchange rate risk by the common currency and the price stability achieved (ECB, 2004).

Chart 3
Neutral real interest rate before and after the crisis



reduced investments, which exerted downward pressure on the neutral real interest rate (the investment curve in the chart shifts to the left). At the same time, the propensity to save was subject to opposite effects. Precautionary motives intensified during the crisis, making households more likely to save. However, the major emerging economies also shifted towards a growth model which was more reliant on domestic demand, thus reducing the global propensity to save. Overall, the neutral real interest rate might have decreased during the crisis, mainly due to the fall in propensity to invest.

Several mutually opposing impacts affected the level of the neutral real interest rate in Hungary during the crisis (Chart 3, right panel). A decrease in the global real interest rate would, by itself, result in a lower domestic real interest rate. However, the risk premium on domestic assets increased during the crisis, pushing them in the opposite direction, towards a higher neutral real interest rate. The combined result of these impacts was that the neutral level of the real interest rate was not able to shift significantly.

EMPIRICAL RESULTS

It is difficult to quantify the neutral interest rate, as it is a non-observable variable. Accordingly, its value cannot be measured, only estimated. In light of the medium-term definition of the neutral interest rate, it appears an obvious choice to calculate the historic average of a real interest rate time series, which is a simple method for filtering out the cyclical factors affecting the real interest rate. However, this method treats the neutral interest rate level as a constant, whereas economic theory and international estimates suggest that it is better to consider it as a variable. Furthermore, this method disregards structural breaks, regime switches and other special events. Different methods are used in the literature to estimate the neutral interest rate (which changes over time); a frequent approach is to use the Kalman filter, which is also used in potential GDP calculations or quantification of the flexible-price real interest rate within the DSGE model framework, widely used by central banks. It is important to underline that there is no single "best method" for calculating the neutral interest rate and that the different methods will return different results, which is a sign of the uncertainty surrounding the quantification.

To determine the neutral level of the Hungarian real interest rate, we started with the real interest rate parity mentioned above, i.e. we looked at the stylised facts describing the changes in the key factors determining the real interest rate in Hungary (external neutral real interest rate, the pace of real appreciation, risk premium trend). The neutral real interest rate can decrease if the neutral level of the foreign (global) real interest rate falls, if Hungary's medium-term convergence outlook improves or if the perception of the risk of Hungarian assets improves in a sustained manner.

Euro-area real interest rates ranged between 0 and 2 per cent in the decade before the crisis (Chart 4). The European Central Bank (ECB) implemented significant easing during the crisis, which has pushed real interest rates below zero in recent years. Although the neutral level of the real interest rate may have also decreased during the crisis as argued above, we consider the decrease in the current real

Chart 4
Neutral real interest rates and historical averages in the euro area before and after the crisis

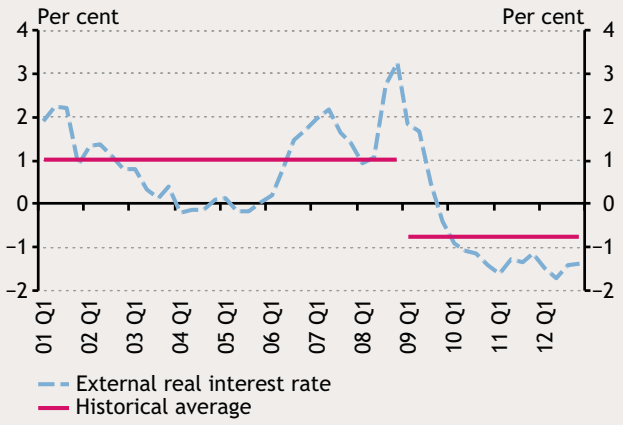
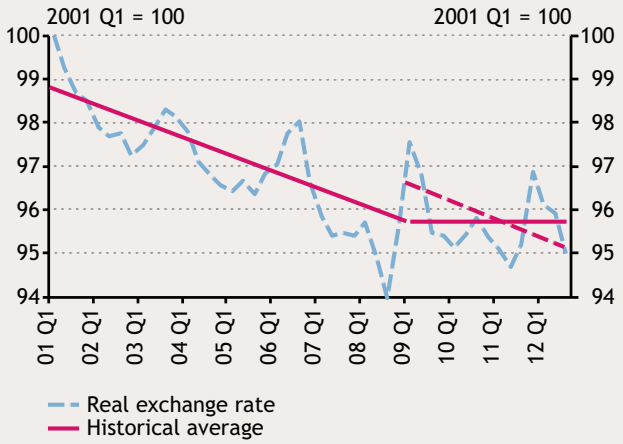


Chart 5
Real exchange rate and historical trend before and after the crisis

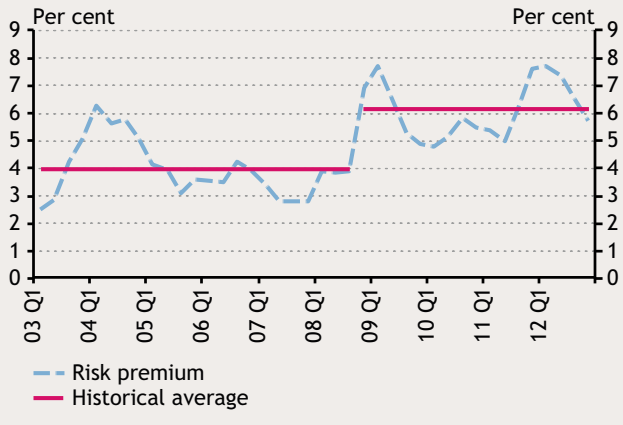
(downward shifts represent appreciation)



interest rate mostly as a change in the cyclical component. In other words, the neutral real interest rate may have decreased to a smaller degree than the actual real interest rate.

The convergence of the Hungarian economy has been coupled by a convergence in price levels. This is reflected by the sustained trend appreciation of the real exchange rate prior to the crisis (Chart 5). Although a structural break can be seen in the real exchange rate path at the beginning of the crisis, it is currently impossible to ascertain whether real appreciation has halted permanently or whether it will restart at a similar speed at some time in the future. This is illustrated by the two scenarios (the continuous and the dotted lines) in Chart 5.

Chart 6
Risk premium and historical averages before and after the crisis



Risk premium is the third factor determining the level of the Hungarian real interest rate. The premium was around 4 per cent in the period preceding the crisis (Chart 6).[3] Its long-term value may be lower than this, because in the period analysed the Hungarian economy was subject, in well-identifiable episodes, to a number of typically upside risk premium shocks (e.g. the shift in the exchange rate band in 2003). Risk premium increased considerably during the crisis; this can be interpreted in part as an increase in its trend component.

Thus, compared to the pre-crisis level, the external equilibrium real interest rate decreased and real appreciation may have slowed down, while the long-term risk premium increased. Table 1 summarises the stylised facts and presents the likely changes in the components of the neutral interest rate during the crisis; these are also indicated by arrows. This shows that there are arguments for both a lower and a higher neutral real interest rate as compared to before the crisis, and that there appears to be a rather wide band for the Hungarian neutral interest rate.

Beyond the stylised facts, we also relied on modelling to estimate the neutral interest rate. To do so, we used a simplified version of the Monetary Policy Model (Szilágyi et al., 2013), which captures the most important channels of the transmission mechanism of Hungarian monetary policy.

[3] Rather than a directly observable variable, the indicator shown in the time series in the chart is derived using several time series capturing developments in the risk premium. The various shifts can nevertheless be interpreted as percentage point changes because the indicator was established by calibrating the average level and spread on the basis of the *ex ante* risk premium time series calculated from historical exchange rate expectations.

Table 1
Components of the neutral real interest rate

		Before the crisis	After the crisis
↓	External real interest rate	1	(−1)−0
↔	Real appreciation	−1	(−1)−(−0.5)
↑	Risk premium	3	3.5−5
↔	**Domestic neutral real interest rate**	**3**	**1.5−4.5**

Chart 7
Estimated neutral (real) interest rate using Kalman filter

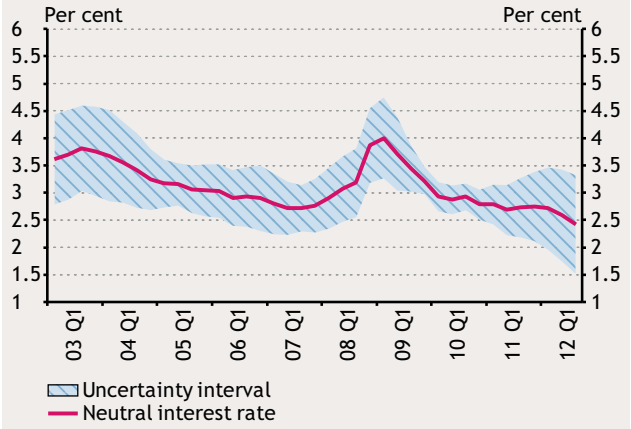
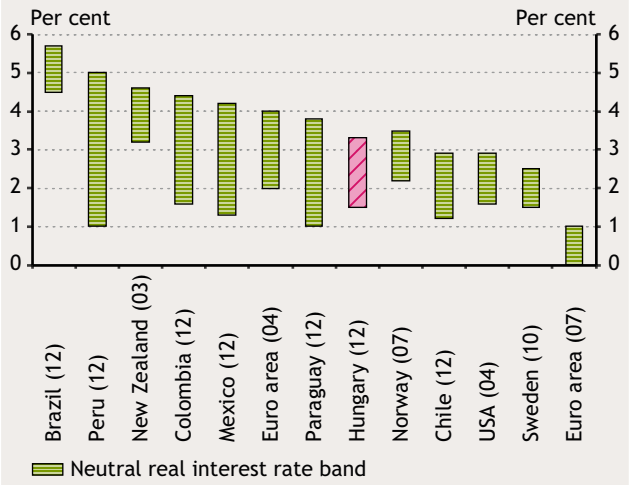


Chart 8
International estimates of the neutral real interest rate



Note: the numbers next to the names of the countries denote the date of the estimation, e.g. 07 = 2007.
Sources: Bernhardsen and Gerdrup (2007), Crespo Cuaresma et al. (2005), Labuschagne and Vowles (2010), Magud and Tsounta (2012), Mesonniera and Renne (2007), Sveriges Riksbank (2010).

The model-based Kalman filter allows for determination of the non-observable (latent) variables such as the neutral interest rate. We used neutral interest rate estimates based on vintage data to demonstrate the estimation uncertainty (Chart 7).[4] The estimate for the second half of 2012 is a band approximately between 1.5 and 3.5 per cent, which is not significantly different from the result in Table 1, but is a somewhat narrower interval. At the same time, we can see that the neutral interest rate is lower than its level 10 years ago. As we show below, research into other countries has also shown decreasing neutral interest rates.

We compared our estimate for the domestic neutral interest rate with the results for other countries (Chart 8). The intervals represent the ranges of neutral real interest rates calculated with different methodologies, also reflecting model uncertainty. The point estimates for Latin American countries using different methodologies are on average within a band of 200 to 250 basis points for the individual countries (Magud and Tsounta, 2012). A single methodology was used for the estimation for Hungary, where the interval reflects the historical uncertainty of this method (cf. the end of the period in Chart 7).[5]

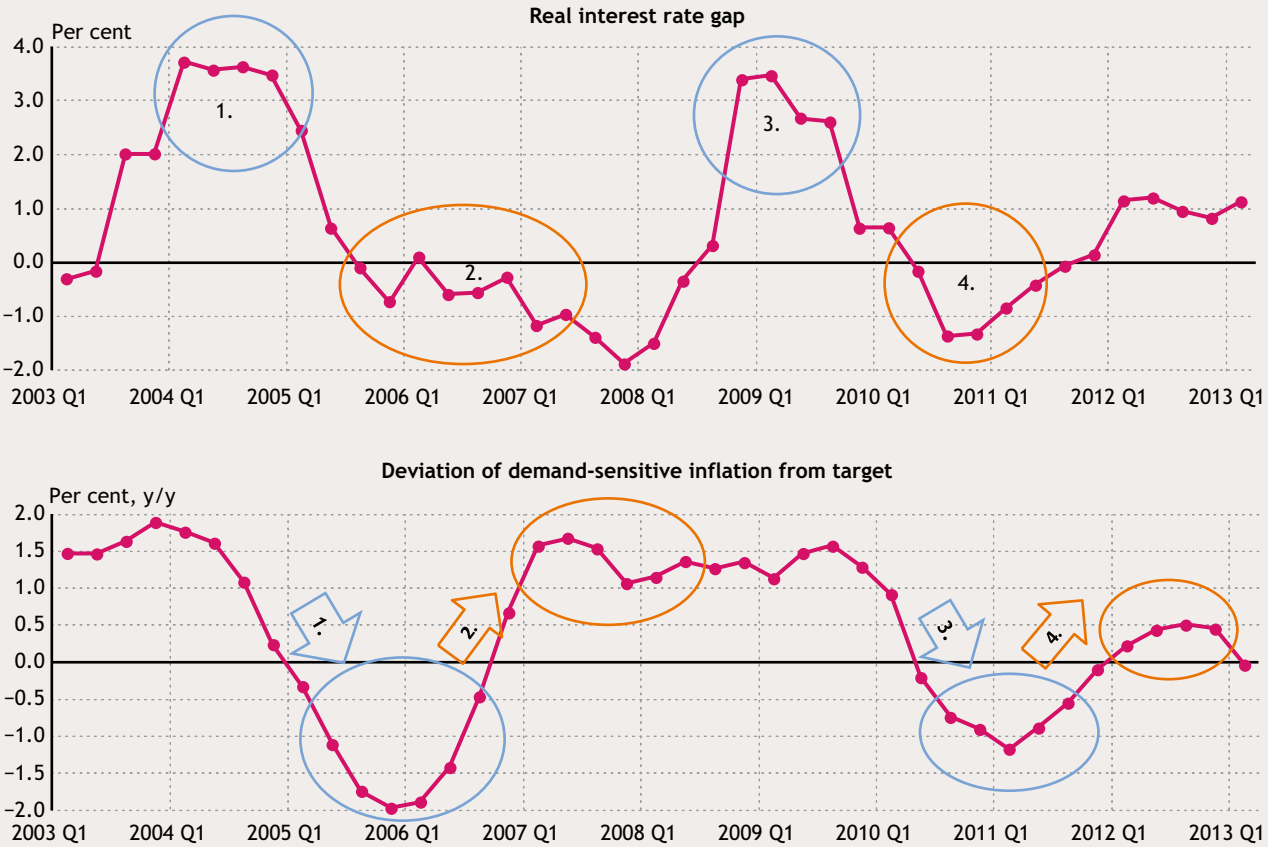
The chart shows that the 1.5–3.5 range estimated for Hungary appears typical in an international comparison. Lower neutral interest rates are found mostly in advanced economies, whereas most of the emerging economies expect similar or higher neutral real interest rates.

Given the high degree of estimation uncertainty, caution is recommended when applying the neutral interest rate in monetary policy decisions and communications; however,

[4] The model produced the real-time estimate for every quarter in the period from the third quarter of 2001 to the fourth quarter of 2012 based on the information available until that point in time. The two-year moving average of the neutral interest rate deviation can be calculated on the basis of the revisions compared to the estimate belonging to the last observation. We use the resulting time series to represent the uncertainty surrounding the point estimation. We defined the neutral real interest rate as the differential between the neutral nominal interest rate and the *ex ante* expected inflation target.

[5] Even within a single methodology, the degree of uncertainty may be rather large. For example, the estimation by Garnier and Wilhelmsen (2005) for a euro-area neutral real interest rate for 2004 has an interval of −2 to 5 per cent.

Chart 9
Historical analysis of the monetary policy stance



Note: The lending rates relevant for the economic agents are not equal to the interest rate level set by monetary policy. If the interest rate spread determined by the financial intermediary system changes to a significant degree, then the actual stance perceived by economic agents may differ to a certain extent from the deviation of the base rate from the neutral interest rate.

the rate may still be informative both for decision-makers and economic agents. The neutral interest rate is an important indicator of the monetary policy stance. Research indicates that the real interest rate gap (the differential between the real interest rate and the neutral real interest rate) is strongly correlated with future inflation, i.e. the indicator of the monetary policy stance carries information regarding future inflation (Neiss and Nelson, 2003; Horváth, 2009). Analysing the historical relationship between the real interest rate gap and the inflation gap on Hungarian data,[6] we find that tight monetary policy, exercising its impact via the transmission mechanism, was typically followed by lower inflation with a certain lag, whereas monetary easing led to higher inflation (Chart 9). Underlying inflation also helps deduce the relationship between the neutral and the current interest rate. For example, a strong undershooting seen in underlying inflation might be a sign of monetary policy being too tight in the sense that if monetary policy were to overestimate the neutral interest rate, then the rate of interest would be higher than "optimal" in the economy. Communication within a band and robustness testing with different methods may help manage estimation uncertainty. However, explicit references to the neutral interest rate are still rare in the communication of international central banks.

It is important to emphasise that the desirable base rate may persistently and significantly deviate from the neutral rate. The base rate is at its neutral level if inflation is in line with the target, the risk premium is at its trend level, the

[6] We calculated the real interest rate as the difference between the nominal interest rate and the expected inflation adjusted for taxes. Deflating with inflation adjusted for taxes results in real interest rate conditions that are relevant for the corporate sector. Given the significant changes in VAT, household real interest rate conditions are lower across the entire horizon. We calculated the inflation gap as the difference between the current and the equilibrium values of demand-sensitive inflation. (Further information about underlying inflation indicators can be found on the website of the MNB.)

output gap has been closed and the economy is expanding in line with its potential. This theoretically straightforward situation is rare, because economies are repeatedly subject to shocks that trigger responses by monetary policy, therefore the actual interest rate is rarely equal to the neutral rate. If there are major unused capacities within the economy, unemployment is persistently above the level determined by structural factors and there are no inflationary pressures, then the current interest rate must persistently and even significantly fall short of the neutral rate in order to reach equilibrium. If the economy is characterised by output above the potential level and inflation above the target, then an interest rate above the neutral level may be justified. The concept of neutral interest rate will not constrain decision-makers and is solely intended to help assess the monetary policy stance.

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