AN ESTIMATE OF THE EQUILIBRIUM INTEREST RATE IN THE UNITED STATES AND GERMANY

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Introduction

In most countries the stability objectives of monetary policy are pursued through the control of an interest rate. Thus in the presence of factors that generate inflationary pressure, a central bank tends to tighten monetary conditions to counteract those pressures. To do this, the interest rates controlled by it are set above the value they would have in a neutral or equilibrium scenario. This neutral level is known in the literature as the *natural rate of interest* or *equilibrium interest rate* and, although the concept was introduced more than a century ago by Wicksell (1898), it has recently acquired greater relevance, as reflected in theoretical studies on optimum monetary rules and by empirical applications aimed at estimating it.

The natural rate of interest is not directly observable and depends on factors, such as the potential growth of the economy or the preference of individuals for future consumption with respect to present consumption (known as the intertemporal discount factor), whose measurement is complex. The literature contains different methods of estimating the natural rate of interest, including those based on the statistical properties of ex-post real interest rates and those that depend on complex economic models of general equilibrium. The results of these studies are, however, rather heterogeneous and difficult to compare.

This article presents an estimate of the natural rate of interest based on a methodology that shares elements of the aforementioned approaches, since it combines the exploitation of the statistical properties of series with a simple theoretical economic model. Specifically, in the model, the behaviour of the natural rate of interest depends primarily on changes in the potential growth of the economy, which is estimated subject to the requirement that it be consistent with the periods of growth and recession established by various institutions for the countries considered. This type of approach enables the variability over time of the natural rate of interest to be observed and, as a result, the monetary policy stance to be assessed more accurately than with models in which the natural rate is constant.

This methodological feature is particularly important at the present time, when new technologies and demographic developments in the United States and Europe may have affected differently the potential growth, and therefore the natural rate of interest, in the two areas.

The article is structured as follows. The following section describes the concept of natural rate and briefly looks at the various empirical approaches available for estimating it. The third section sets forth estimates of the natural rate of interest and of potential growth in the United States and Germany in the period 1964-2003, analyses the changes in its level and volatility in recent decades and assesses the monetary policy stance of the two areas in the light of the results obtained. Finally, the last section presents the main conclusions of this work.

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1. This article is based on more extensive research conducted by the authors, the basic results of which are set forth here for divulgation purposes.

The natural rate of interest: definition and different approaches to estimating it

The natural rate of interest is a classic concept in economic literature that was introduced by Wicksell (1898)[2]. The pre-eminent role of interest rates in monetary policy implementation by central banks and the growing use by analysts of the so-called Taylor rule – the formulation of which calls for the calculation of an equilibrium interest rate – have reawakened interest in this concept in both the theoretical and empirical fields. In fact, Wicksell's original definition has recently been enriched by the introduction of certain changes.

The natural rate is generally interpreted as the interest rate consistent with a level of output equal to potential and with a stable inflation rate (Bomfim, 1997). This definition, used among other authors by Woodford (2003) and Blinder (1998), is a somewhat analogous concept to the natural rate of unemployment (Friedman, 1968).

This definition is implicit in a wide range of theoretical economic models, although its interpretation varies depending on the formulation chosen for their empirical estimation. Thus there are approaches that focus on how the natural rate of interest fluctuates around an average value that is considered to be constant, such as those developed by Rotemberg and Woodford (1997), Neiss and Nelson (2001) and Andrés et al (2003). Other approaches, such as that proposed by Laubach and Williams (2003), are more general in that they aim to estimate both the fluctuations in the natural rate and the possible changes in its level.

In this article, the estimate of the natural rate of interest is based precisely on this more structural concept. Use is made of the method proposed by Laubach and Williams (2003), which allows this variable to fluctuate over time depending on changes of a permanent nature. Specifically, the framework used for estimation consists of a small system of equations characterising the behaviour of economic growth and inflation. In the first, economic growth is explained in terms of its lags and of the difference between the prevailing real interest rate and the natural rate. In the second, inflation depends on its past behaviour, on economic growth and on a variable reflecting the effect of energy prices. The system is completed by a relationship that links the natural rate of interest to the potential growth of the economy, together with a weakly restrictive statistical specification for the behaviour of unobserved variables. The estimation procedure used is the Kalman filter, which enables the values of unobserved time-varying components – potential growth and natural rate of interest – to be estimated.

Estimates of the natural rate of interest and of potential growth

Charts 1 and 2 show the estimates obtained of the natural rate of interest, in real terms, and of potential growth for the United States and Germany, respectively, along with their confidence bands. Since these results are sensitive to the order of the lags and to the initial values of the model's parameters, those chosen are the ones that best approximate the economic cycles defined by the NBER, in the case of the United States, and by the Economic Cycle Research Institute, in the case of Germany. As can be seen, both the natural rate and the potential growth tend to decrease somewhat in recessions, a feature noted in numerous empirical studies. As pointed out by Kim and Murray (2002), among others, periods of negative growth may be accompanied by a deterioration in a country's productive capacity, insofar as some firms have to make permanent adjustments.

There are some notable differences in the natural rate of interest in the two countries. For the last two decades, this variable has been higher in the United States than the estimated level in

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2. Wicksell refers to the natural rate of interest as "a certain rate of interest on loans which is neutral in respect to prices, and tends neither to raise nor to lower them".

UNITED STATES
Estimates of natural rate and of potential growth

CHART 1

a. Areas shaded in orange indicate US recessions as estimated by the National Bureau of Economic Research. Broken lines represent confidence bands of 1 standard deviation around the point estimate.

Germany, and its volatility has also been higher (see top panels of Charts 1 and 2). These results seem consistent with the larger increases in productivity recorded in the US economy and with the greater variability of its economic growth.

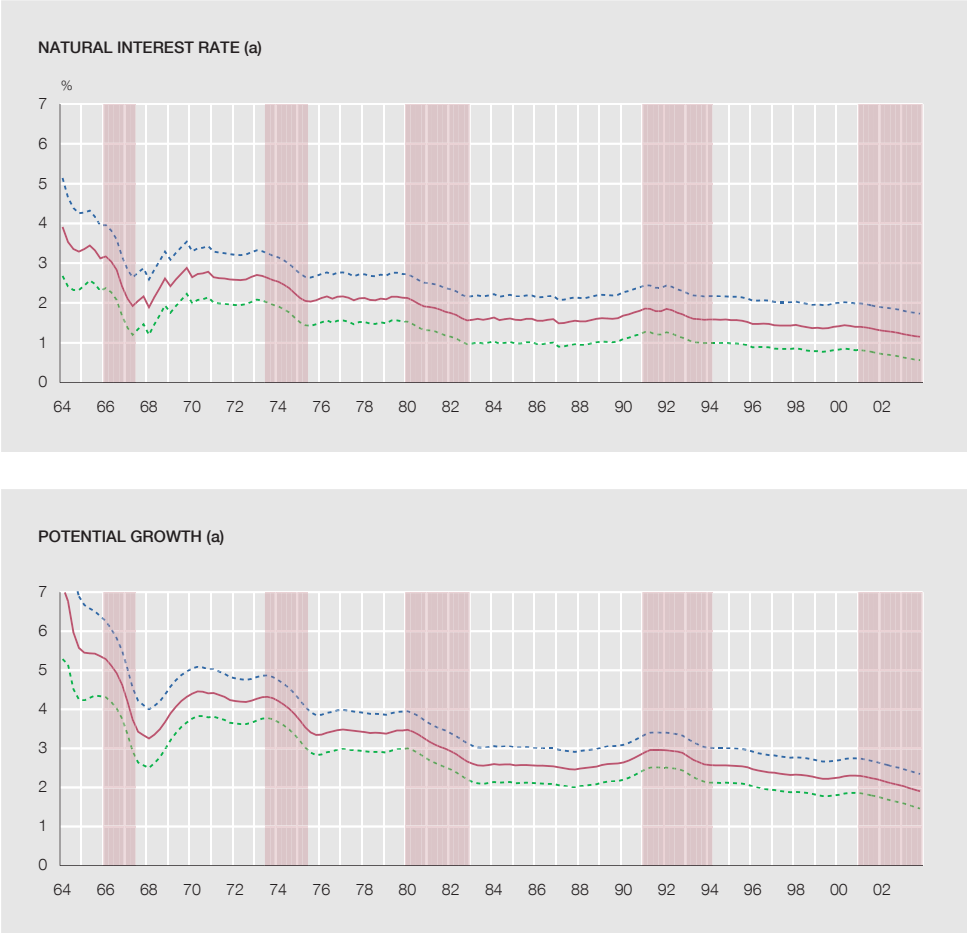
Despite this differing behaviour of the natural rate of interest, there are certain common features in the two countries. Thus, in both cases the current level of this variable is less than half the average for the period analysed[3], mainly as a result of a certain decrease in the potential growth and despite the effect that new technological advances in this period may have had. That said, it seems that the natural rate of interest and potential growth have been more stable in the last decade. These changes may be partly due to the success of monetary policy in establishing an environment of stable economic growth and low inflation.

To distinguish these patterns more clearly, Table 1 presents, for different subperiods and for the two countries being studied, the average and the standard deviation of the natural rate of interest and of potential growth. It can be seen that the level and the volatility of these variables

3. In ECB (2004) a similar result is reported for the euro area as a whole.

GERMANY
Estimates of natural rate and of potential growth

CHART 2



a. Areas shaded in orange indicate German recessions as estimated by the Economic Cycle Research Institute. Broken lines represent confidence bands of 1 standard deviation around the point estimate.

tend to decline in both economies. Also, the natural interest rate differential between the United States and Germany rose on average from 90 basis points in the period 1964-1980 to 120 basis points in the 1990s; this rise seems consistent with the divergent productivity behaviour, which is possibly linked to the different impact of the technological revolution and population growth in the two areas in that decade.

Table 1 also shows the standard deviation of the difference between potential and observed output (output gap) in the two countries for the same subperiods. Although this study does not aim to characterise the business cycle precisely, a reasonable estimate of it is vital in the process of identifying the natural rate. In this respect, the results, in addition to reproducing the recessions established by independent organisations, show a reduction in the volatility of the cycle, a phenomenon that has been reported in various studies in the case of the US economy – see MacConnell and Pérez-Quirós (2000) – and that recently Stock and Watson (2003) have also found in the cycle of various countries, Germany among them.

Finally, as mentioned above, these results can also be used to assess the monetary policy stance in the two areas, although this has to be done with due caution because the estimated level of the natural rate of interest is particularly sensitive to the choice of estimation method and,

NATURAL RATE OF INTEREST AND OUTPUT GAP TABLE 1

%

		NATURAL RATE		POTENTIAL GROWTH		OUTPUT GAP
		AVERAGE LEVEL	VOLATILITY (a)	AVERAGE LEVEL	VOLATILITY (a)	VOLATILITY (a)
US	1964-2003	2.9	0.68	3.4	0.79	2.79
	1964-1981	3.3	0.74	4.0	0.84	2.62
	1981-1992	2.5	0.45	2.9	0.51	2.22
	1993-2003	2.6	0.27	3.1	0.32	1.41
GERMANY	1964-2003	1.9	0.53	3.2	0.88	0.80
	1964-1981	2.4	0.04	4.0	0.69	1.02
	1981-1992	1.7	0.15	2.7	0.26	0.61
	1993-2003	1.4	0.10	2.4	0.17	0.41

a. Sample standard deviation.

as seen in Charts 1 and 2, is obtained with some uncertainty. Taking this into account, the results indicate that at end-2003 the monetary conditions in the United States seemed very lax. The natural rate of interest in this economy fluctuated between 1.6% and 3.3% (see Chart 1), which was fairly distant from the US short-term real return of -0.6% at that date. For its part, Germany's natural rate of interest stood between 0.5% and 1.7% (see Chart 2), which means that, since the short-term *ex-post* real interest rates then observed were close to 0.3%, its monetary policy was also expansionary, although somewhat more moderate than in the United States.

Conclusions

The natural or equilibrium rate of interest is a classic concept in economic theory that defines the level at which interest rates should be held by the monetary authorities for their actions to be neutral from the standpoint of inflation and the business cycle. This article presents estimates of this variable for the United States and Germany in the last four decades. The results, which should be viewed with the caution required in this type of exercise, suggest that the average natural rate of interest in the most recent stage has stood, in both economies, below its historical average. This downward trend has been more marked in Germany, so its negative differential with the United States has widened, which is consistent with the evidence available on the behaviour of the growth potential in the two areas. Another notable result of this study is that over the last decade the variability of the natural rate of interest, potential economic growth and the *output gap* has been lower than its historical average.

Additionally, the results of this study are also useful for assessing the monetary policy stance in these countries. If can be inferred from this analysis that in both cases the monetary policies were expansionary at the end of the period, although relatively more so in the United States.

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