The break-even inflation rate (BEIR) or implied inflation rate, is usually defined as the difference between nominal and real interest rates of securities with similar characteristics. Although it is commonly related to expected inflation – according to Fisher’s hypothesis (1930) – BEIR is composed by other factors.

Among these factors, we have the uncertainty related to: (i) risk premium associated with inflation future path, which is equivalent to the additional remuneration that agents require to compensate for the risk of the realized inflation differ from the expected inflation; and (ii) liquidity premium, defined as the reward due to the difficulty to change a position in illiquidity securities (in the case at hand, real bonds). In addition to these risk premia, a third factor entails the difference between nominal and real interest rates, (iii) the convexity bias, which represents the difference between the implied inflation and inflation expectation in a risk neutral world.

Therefore, the difference between nominal and real interest rates can be decomposed from market price data – though its components are not observable – so that the implied inflation is given by:

\[
\text{Implied Inflation} = \text{Nominal rate} - \text{Real Rate} = \text{Inflation Expectation} + \text{Inflation Risk Premium} - \text{Liquidity Premium} + \text{Convexity}.
\]

Given the importance of the issue to understanding the evolution of expectations and price dynamics, this box uses a pricing model based on consumption that allows the decomposition of the difference between nominal and real interest rates on expectations and premia. Nominal rates are obtained from the National Treasury Bills

1/ This box is based on Vicente and Graminho (2014).
2/ The relation between bonds prices and rates is given by a convex function – the exponential relationship that connects bond prices with rates. Therefore, when taking the expected values of this function, we need to make a correction, due to the Jensen’s inequality which may be stated as: let \( f \) be a convex function and \( X \) a random variable. Then \( \text{E}[f(X)] \geq f(\text{E}[X]) \), where \( \text{E}[] \) represents the expected value.
Real rates are taken from the National Treasury Notes, Series B (NTN-B), which are securities indexed to the Broad National Consumer Price Index (IPCA). The sample covers the period between January 2006 and September 2013, and the rates are for the horizons of 1, 2, 3 and 4 years, interpolated via parametric model of Svensson (1994).

Figure 1 shows the daily evolution of the difference between nominal and real rates for horizons of 1, 2, 3 and 4 years between January 2006 and September 2013. During this period, the difference between the nominal and real interest rates orbited around an average of 5% p.a., with a minimum of 3% p.a. in July 2007 and maximum of more than 6% p.a. in the second half of 2008.

Inflation expectations shown in Figure 2 are obtained by the construction of the term structure via flat forward interpolation. The monthly inflation expectations are extracted from the Focus survey conducted by the Banco Central do Brasil’s Investor Relations and Special Studies Department (Gerin). For horizons of 2, 3 and 4 years the expectations are calculated assuming constant inflation in months not informed.

The convexity bias, derived from the relationship between prices and bonds under certain hypothesis, is calculated as the variance of inflation\(^3\), using an autoregressive process of order 1 (AR (1)) to model the monthly percentage change in the IPCA. As a result, we obtained values close to one basis point (b.p.) for the horizons 1-4 years, similar to the results found by Ang, Bekaert and Wei (2008) for the US market. Thus, the convexity bias presents little relevance when compared to the average bid-ask spread\(^4\) of the NTN-F and LTN, which is close to 3 b.p., and NTN-B, which is about 10 b.p.

The liquidity premium is computed following Pflueger and Viceira (2013), who estimate a model of the difference between nominal and real interest rates on measures of bond liquidity, controlling for the Focus inflation expectation. We used three liquidity measures: the first is based on the average turnover of bonds and

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\(^3\) For this result, there must be no arbitrage and the real stochastic discount factor and the price index are conditionally lognormal variables. Without the assumption of log normality, this relationship is valid until the second order approximation. For details, see Vicente and Graminha (2014).

\(^4\) Estimates of average spreads were obtained based on data provided by ANBIMA. ANBIMA collects every day at 11 AM buying and selling offers
consists on the difference between the turnover of real and nominal bonds, as a proportion of the negotiated bonds; the second captures differences between the buying and selling spreads of nominal and real bonds; and the third follows Hu, Pang and Wang (2013), who define illiquidity as the root mean squared error of bonds prices relative to an interpolated yield curve via the Svensson (1994) model. Evidences indicate that the liquidity difference between the assets is ignored by investors, that is, liquidity premium is not statistically different from zero.

The inflation risk premium (Figure 3) is obtained by simple difference, once the other implicit inflation components are estimated.

The inflation risk premium is positive in most of the sample, that is, nominal bonds positively covary with the economy. Therefore, investors require an additional premium in order to invest in nominal securities. For short horizons, the risk premium is negative in few months, being associated with times of increased volatility in financial markets, as in late 2008 and early 2009.

In order to capture the relative importance of components of the difference between nominal and real interest rates, we estimated a model of BEIR (minus the constant convexity) as a function of Focus inflation expectation; liquidity metrics mentioned above; the covariance of future inflation and changes in consumption; and the volatility of Ibovespa (proxy for uncertainty in the economy). Confirming the previous result, liquidity metrics do not show significant results and the variables that influence the inflation risk premium are significant only for the horizons of 3 and 4 years. The linear coefficient is not significant. On the other hand, the coefficient of inflation expectation is not statistically different from one in all regressions, which is an evidence that agents consider inflation forecasts close to Focus expectation when making their investment decisions.

Therefore, although the Fisher hypothesis is incomplete, by observing the difference between nominal and real

5/ Although apparently counterintuitive, this result may be explained by the preferences of investor in the fixed income market. As Carvalho and Morais (2009) point, NTN-Bs are bonds which are strongly demanded by long term investor and who in general hold these bonds to maturity, which makes the uncertainty regarding lack of liquidity irrelevant.
interest rates is possible to extract information about the future price level, which is relevant input for the formulation and implementation of monetary policy.

References


