Box 1

The transmission of the Central Bank policy rate to other interest rates

The Central Bank's principal task is to promote price stability, and to achieve this, it applies the policy instruments at its disposal, chief among them the interest rates on its transactions with other financial institutions. By changing these interest rates, the Bank can affect market rates and, in turn, the interest rates generally available to households and businesses. The Bank's interest rates also affect money demand, asset prices, the exchange rate of the króna, and overall demand in the domestic economy. All of these factors then affect inflation. These various channels of monetary policy are generally referred to as the monetary policy transmission mechanism.[1]

How does monetary policy affect other interest rates?

The first stage of the transmission mechanism describes how the Central Bank's policy rate affects other short-term market rates and, through them, long-term market rates. Because short- and long-term market interest rates have an important effect on financial institutions' marginal cost of funding, the effects of changes in the policy rate are ultimately transmitted to the interest rates offered to households and businesses. Pétursson (2001b) examines this stage of the transmission mechanism. As is discussed there, changes in the policy rate should cause a comparable change in short-term market rates. For longer-term financial obligations, however, the situation becomes more complex. According to the expectations hypothesis, long-term rates should by and large be determined by current short-term bond rates and expected short rates over the lifetime of the bond. As a result, the Central Bank can affect long-term interest rates both by changing its current policy rate and by creating the expectation that it will change it in the future. For instance, the Bank can enhance the impact of a rate hike by signalling that additional rate increases can be expected in the near future. By the same token, the impact of a rate hike is diluted if it is expected that the policy rate will be lowered again soon. The ultimate impact of a change in the Central Bank's policy rate on long-term interest rates is determined in no small part by its impact on market agents' expectations concerning future developments in the policy rate. The same applies to the impact on indexed financial obligations. To the extent that a change in the policy rate affects short-term real rates, the impact of monetary policy on real non-indexed long-term bond rates should be transmitted broadly as is described above. Substitutability between indexed and non-indexed bonds then ensures that indexed bond rates change in a manner similar to real rates on non-indexed financial obligations.

The data

The findings from the above-mentioned study show that the Central Bank's policy rate affects short- and long-term market rates as expected. Monetary policy also affects the banks' indexed lending rates, but with a lag of a few months, and policy appears to be transmitted largely through indexed bond rates. This study focused on the pegged exchange rate period during the 1990s, and the financial system has changed markedly in structure since it was carried out. Furthermore, fundamental changes have been made to the monetary policy framework in the interim. As a result, it is appropriate to update the assessment of this stage of the transmission mechanism and examine whether it has changed.

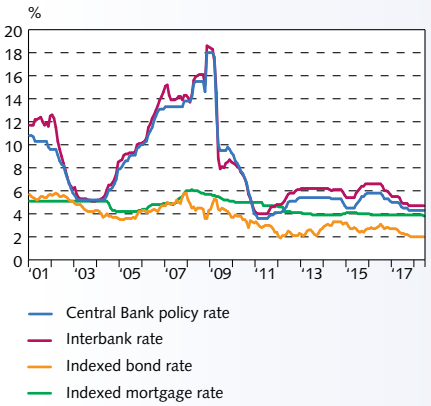
As in Pétursson (2001b), a structural vector autoregressive model (VAR) is used. Structural VARs are commonly used to ana-

1. A general discussion of the transmission mechanism can be found in Pétursson (2001a), and a more detailed analysis of the magnitude of the impact and the time lags in transmission can be found in the Bank's macroeconomic models' handbooks (Daníelsson *et al.*, 2015, and Seneca, 2010).

Chart 1

Central Bank policy rate, market rates and mortgage rates[1]

January 2001 - June 2018



1. The interbank rate used is the three month REIBOR rate. The indexed bond rate is the 10-year rate obtained from estimating the zero-coupon yield curve for indexed bonds. The mortgage rate is the weighted average of mortgage rates offered by the HFF, the commercial banks, and the pension funds.

Source: Central Bank of Iceland.

lyse causal relationships when all of the variables are determined simultaneously. The VAR used here contains two types of short-term interest rates: the Central Bank's policy rate and the three-month interbank rate.[2] The long-term interest rate is the ten-year indexed bond rate, which is obtained by estimating the zero-coupon yield curve for indexed bonds.[3] For mortgage lending rates, the interest rate used is the lowest listed fixed rate on mortgage loans from the Housing Financing Fund (HFF) (with a prepayment penalty from December 2005 onwards and without it before that time), the commercial banks (a simple average of the three commercial banks' rates), and pension funds (a simple average of rates charged by four pension funds before February 2010 and seven pension funds thereafter). The commercial banks first offered long-term indexed mortgage loans in September 2004, although they had offered short-term supplemental loans before then. In addition, no information on indexed mortgage loans issued by pension funds prior to 2004 is available. Therefore, the mortgage lending rate used here is the HFF's lending rate until September 2004 and a weighted average (based on market share) of the rates charged by the HFF, the three commercial banks, and the pension funds from September 2004 onwards.[4] Chart 1 shows developments in these interest rates from 2001 onwards. As can be seen, the interbank rate tracks the Central Bank's policy rate closely, whereas longer interest rates change less and are lower, as they are real rates while the short-term interest rates are nominal.

Assessment of the impact of monetary policy on other interest rates

Chart 2 shows the impulse responses for an unforeseen one-standard-deviation shock to the Central Bank policy rate on the four interest rate series. The VAR is estimated using monthly data (monthly averages) over the period from January 2001 through June 2018. The VAR includes two lags, in accordance with the results of the Schwarz information criterion, and it contains dummy variables for April and October through December 2008, on the one hand, and April through June 2009, on the other. The dummies for 2008 are due to wide swings in short-term interest rates during the financial crisis, and the dummies for 2009 are due to major changes in financial institutions' liquidity, which caused wide swings in interbank interest rates and loosened the monetary stance more than had been intended (see, for example, *Monetary Bulletin* 2009/4).

According to the estimated impulse responses, the policy rate rises immediately by 0.18 percentage points, but the impact on the policy rate peaks about a year later, when it has risen by nearly 0.5 percentage points. As the chart shows, the rise in the policy rate is

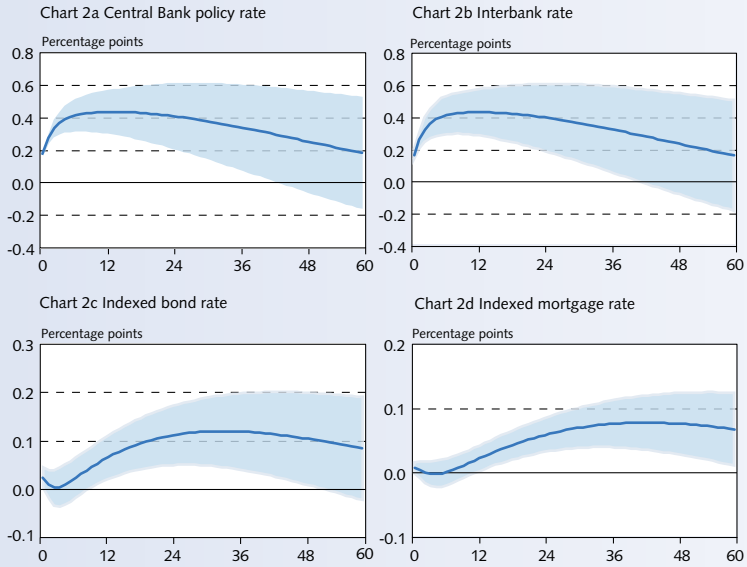
2. The definition of the Central Bank's key rate can change from one period of time to another, depending on conditions in the financial markets. From January 2001 through March 2009, the Bank's key rate was defined as the rate on seven-day collateralised Central Bank loans, and from April through September 2009 it was defined as the rate on financial institutions' current accounts with the Bank. From October 2009 through May 2014, the key rate was defined as the average of the current account rate and the rate on 28-day certificates of deposit, and since May 2014 it has been defined as the rate on seven-day term deposits with the Bank.

3. The zero-coupon yield curve is estimated using the Nelson-Siegel method, using rates on indexed Government bonds, indexed HFF bonds, and indexed Housing Bonds falling under market making agreements. The short end of the yield curve is estimated using short-term real rates based on measured twelve-month inflation.

4. Pétursson (2001b) uses the average rate on indexed banking system loans; i.e., a weighted average of base rates on indexed loans issued by the banks and savings banks. Virtually the same results are obtained when this rate is used instead of the indexed mortgage rate, as is done here; however, if the general bank rate is used, the impact of monetary policy on lending rates is somewhat stronger than is reported here.

Chart 2

The impact of an unforeseen one-standard-deviation shock to the Central Bank's policy rate[1]



1. The chart shows impulse response functions for an unforeseen one-standard-deviation shock to the Central Bank policy rate on short- and long-term interest rates over a five-year (60-month) period. The structural VAR estimated uses monthly data for the period 2001-2018. The structural shocks are identified using a Cholesky ordering based on Pétursson (2001b). The shaded area shows the 95% confidence interval.

Source: Central Bank of Iceland.

transmitted virtually intact in a rise in three-month interbank rates. Although the contemporaneous effect on the indexed bond rate is relatively small, it is statistically significant based on the 95% confidence interval. It gradually increases and peaks at 0.12 percentage points just over two years after the original shock. The impact on indexed mortgage lending rates becomes statistically significant one year after the original shock, and the peak impact is similar to the impact on the bond rate. The contemporaneous impact of the shock is of a magnitude similar to that described in Pétursson (2001b), but it is more persistent and somewhat stronger at its peak.

Finally, Chart 3 shows how much of the variability in individual interest rate series can be explained by underlying shocks to the four interest rates over the same five-year period as is shown in Chart 2. It shows, for example, that fluctuations in interbank rates can be traced largely to unforeseen shocks to the policy rate; i.e., interbank rates are determined largely by developments in the Central Bank's policy rate. As time passes from the original shock to the policy rate, its share in the variability of bond and mortgage lending rates also increases. For instance, monetary policy shocks explain nearly half of the variability of mortgage lending rates after three years, and about two-thirds after five years.[5]

Summary

Changes to the Central Bank's policy rate appear to be transmitted normally along the yield curve. By the same token, changes in the policy rate have a statistically significant impact on indexed mortgage lending rates, and the transmission of monetary policy to lending rates seems to have strengthened since the 1990s. The impact of changes in the policy rate lasts longer and appears to be transmitted directly to mortgage rates instead of being transmitted through

5. If the statistical estimate is repeated using a short-term real rate (the short-term interest rate net of inflation), it can be seen that the above-described estimate mainly reflects the impact of a shock to short-term real rates on indexed rates.

Chart 3

Variance decomposition of interest rate fluctuations[1]

1.The chart shows the share of different interest rate shocks in the variability of interest rates over a five-year (60-month) period. The structural VAR estimated uses monthly data for the period 2001-2018. The structural shocks are identified using a Cholesky ordering based on Pétursson (2001b).

Source: Central Bank of Iceland.

bond rates, as previous studies had indicated. This can also be seen in the fact that the Bank's policy rate now explains a larger share of the variability in mortgage rates than before.[6]

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6. These findings are somewhat at odds with those published in the appendix to a recent report to the Government on proposed changes to the monetary policy framework (Jónsson *et al.*, 2018), in which the authors conclude that the impact of monetary policy on indexed lending rates is statistically insignificant. Their study uses a structural VAR similar to that estimated by Pétursson (2001b) and used in this Box, but without bond interest rates. Furthermore, the model is estimated using only data from 2011, which makes the findings less reliable.