

No. 2 | 2009

# Economic commentaries

## Relationship between key rates and money market rates

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# Relationship between key rates and money market rates

*In this note we argue that the pass-through from key policy rates to money market rates has been high in Norway and other countries and remained high during the financial crisis.*

Over the past few months the financial system in Norway and other countries has been exposed to unusually large shocks. One aspect of the financial crisis has been a significant widening of the spread between money market rates and expected key policy rates. In particular, interest rate premiums on interbank loans showed a marked increase after the financial crisis entered a more serious phase in mid-September last year, when the US investment bank Lehman Brothers filed for bankruptcy (see Charts 1 and 2). Trust and confidence between financial market participants had been eroded, and banks and other financial institutions were unable to provide sufficient credit to borrowers and distribute risk efficiently.

Effective monetary policy requires a high degree of pass-through of key policy rate changes to money market rates. By controlling the key policy rate, the central bank influences short-term money market rates and thereby longer-term money market rates, the interest rate on government and corporate bonds as well as banks' lending rates. It is these interest rates that matter to economic agents. When the pass-through from the key policy rate to money market rates is perfect, the central bank can control the level of

money market rates, as higher money market premiums can be offset by a lowering of the key policy rate.

A key issue is whether the pass-through from the key policy rate to money market rates has changed as a result of the financial crisis. Charts 3 to 7 show three-month money market rates, expected key rates over the next three months and the difference between them for Norway, Sweden, the euro area, the UK and the US.<sup>1</sup> Charts 8 to 12 show the corresponding twelve-month rates. As is evident from the charts, there is a close relationship between the expected key rate and money market rates, also after the onset of the financial crisis. Focusing on Norway, we see that money market rates have fallen in line with the reductions in the key rate since October last year.

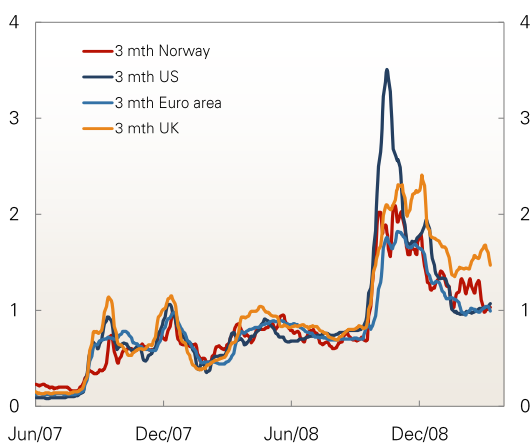
We estimate the pass-through from the key policy rate to money market rates by running the following regression:

$$(i - ekey) = a + b ekey + cX,$$

where  $i$  is the money market rate and  $ekey$  is the expected

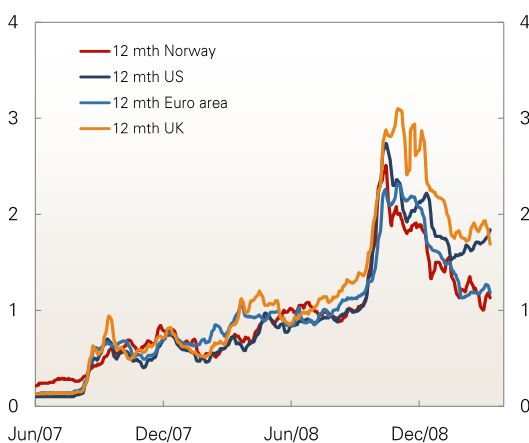
<sup>1</sup> For Sweden, the euro area, the UK and the US the expected key rate is measured by the so-called OIS (Overnight Indexed Swap) rate. The OIS rate expresses the expected future overnight interest rate and is closely related to the expected future key rate. The three- and twelve-month OIS are used as proxies for the expected key rate three and twelve months ahead, respectively. In Norway, there is no OIS, but Norges Bank constructs a measure of the expected key rate based on other market interest rates and judgment.

Chart 1. Difference between three-month money market rates and expected key rates over the next three months. Percentage points. 5-days moving average. 1 June 2007 – 12 March 2009



Source: Thomson Reuters, Bloomberg, Norges Bank

Chart 2. Difference between twelve-month money market rates and expected key rates over the next twelve months. Percentage points. 5-days moving average. 1 June 2007 – 12 March 2009



Source: Thomson Reuters, Bloomberg, Norges Bank

key rate over the same horizon as the money market rate.<sup>2</sup> The variable X includes different proxies for risk that may have had an effect on money market premiums. The coefficient b is of particular interest. If b=0, the pass-through from the key policy rate to money market rates is complete and we can rewrite the equation as

$$i = a + e_{key} + cX.$$

When the estimate of b is close to zero, an increase in the expected key rate by one percentage point will lead to an increase in the money market rate of one percentage point. In this case, money market premiums are independent of the level of the key rate and the central bank cannot use the key rate to influence money market premiums.

Money market premiums may be influenced by market participants' perception of risk. To control for this effect, we include two different indicators of risk in the regressions:

- The risk premium on three-month money market rates in the USD LIBOR<sup>3</sup> market (the difference between the three-month money market rate in the USD market and the expected key policy rate in the US over the next three months). This variable is meant to capture any spillover from premiums in the US money market to money markets in other countries.
- The VIX index, reflecting expected volatility in the S&P500 index.

The model is estimated using least squares methods on daily data for Norway, Sweden, the euro area, the UK and the US. We estimate models both for three- and twelve-month interest rates for two time periods, before and after the Lehman Brothers bankruptcy.<sup>4</sup>

The estimation results are presented in Table 1. In general the estimated coefficients of the expected key policy rate are numerically small, indicating a high pass-through from key policy rates to money market rates. With the exception of the US three-month rate, this holds for all countries, for both maturities and for both estimation periods.<sup>5, 6</sup>

The estimation results indicate that the two risk indicators have had an effect on money market premiums. For Norway, USD money market premiums seem to be particularly important. This may reflect that banks active in the Norwegian money market (NIBOR<sup>7</sup>) raise loans in US dollars and exchange them for NOK. Hence, higher USD money market premiums tend to spill over to premiums in the NIBOR market.<sup>8</sup>

Swedish money market premiums are also influenced by the VIX index, in particular in the period after the collapse of Lehman Brothers when volatility in money market premiums was exceptionally high. For the euro area and the UK, the results indicate that money market premiums depend on both USD money market premiums and the VIX index. This may reflect the spillover of stock market risk and money market premiums in the US to other money market rates in the rest of the world. Finally, for the US we find a significant effect of the VIX index on money market premiums.<sup>9</sup>

2 In the analysis we wish to include a measure of the expected key rate over a specific horizon (we focus on the three- and twelve-month horizons). If, instead of the expected key rate, we had used the actual level of the key rate, our measure of the spread between the key rate and money market rates would also reflect expected changes in the key rate over the same horizon. See Taylor, J.B. and J.C. Williams (2009) "A Black Swan in the Money Market," *American Economic Journal: Macroeconomics* vol. 1, pp. 58-83 for a discussion of the importance of controlling for expected changes in the key policy rates.

3 London InterBank Offered Rate.

4 Specifically, the two time periods are 2 January 2007 - 29 August 2008 and 18 September 2008 - 17 March 2009. The reason why we split the sample this way is that we want to investigate whether the large widening of the spreads in the money market after the collapse of Lehman Brothers affected the pass-through of key policy rate changes to money market rates.

5 Although the pass-through from the key rate to money market rates was also high in the period after Lehman Brothers went bankrupt, money market rate volatility increased and spreads widened markedly.

6 It can be argued that the OIS rates (and the proxy we construct for Norway) are imperfect measures of expected future key rates. The OIS rate reflects the expected overnight interest rate in the money market. During normal times this is a good proxy for the expected key rate, but in periods of financial turmoil, the overnight rate might differ from the key rate. E.g., in the euro area, large injections of liquidity in the money market have on occasion pushed the overnight interest rate below the key rate. As a robustness check we estimated the equation using the actual key rate instead of the expected future key rate. The interest rate spread then reflects expected changes in the key rate over the time horizon, but we avoid some of the measurement problems associated with the OIS. The results confirm our previous finding of a high degree of pass-through from the key rate to money market rates. For Norway, although the estimate of b is significantly different from zero in the period before the Lehman Brothers collapse for the three-month interest rate, the estimated coefficient is numerically small. For the period after the Lehman Brothers collapse, the estimate of b is not significantly different from zero for the three- or the twelve-month rates.

7 Norwegian InterBank Offered Rate.

8 See *Monetary Policy Report 3/08* for details on the functioning of the NIBOR market.

9 For the US, only the VIX index was included.

Table 1. Estimated effect of key policy rate and risk indicators on money market premiums

			<i>constant</i>	<i>i(-1)-ekey(-1)</i>	<i>ekey</i>	<i>VIX</i>	<i>US 3m.- premium</i>	<i>s</i>
Norway	3m	Before LB	0,04	0,89**	-0,004		0,08**	0,04
		After LB	0,22**	0,66**	0,05**		0,04*	0,16
	12m	Before LB	-0,07**	0,93**	0,017**		0,04**	0,04
		After LB	0,18**	0,73**	0,04**		0,07**	0,12
Sweden	3m	Before LB	0,01	0,93**	-0,002		0,04**	0,02
		After LB	-0,06	0,85**	0,01	0,003**		0,09
	12m	Before LB	-0,02	0,94**	0,003	0,0008*	0,04**	0,04
		After LB	-0,06	0,89**	0,02	0,003*		0,13
Euro area	3m	Before LB	0,04**	0,92**	-0,01**	0,0006**	0,08**	0,02
		After LB	-0,01	0,83**	0,01*	0,003**	0,03**	0,05
	12m	Before LB	0,25**	0,85**	-0,06**		0,15**	0,07
		After LB	-0,02	0,87**	0,03**	0,003**	0,02*	0,06
UK	3m	Before LB	-0,04	0,91**	0,005	0,001**	0,07**	0,03
		After LB	0,06*	0,84**	0,02**	0,004**		0,08
	12m	Before LB	0,03	0,95**	-0,01	0,001**	0,04**	0,04
		After LB	0,32**	0,56**	-0,03	0,007**	0,22**	0,21
US	3m	Before LB	-0,02	0,96**	-0,001	0,002**		0,04
		After LB	-0,04	0,93**	0,11**	0,002*		0,1
	12m	Before LB	0,01	0,97**	-0,004*	0,0009**		0,03
		Etter LB	0,1**	0,88**	0,06**	0,002**		0,08

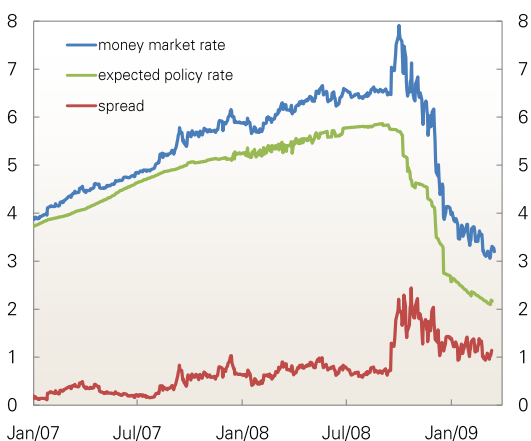
The regressions include the lagged value of the dependent variable. To find the "long-run solution" of the model, one has to solve the equation for this variable. We use asterisks \* and \*\* to indicate that the coefficient is statistically significant at the five and ten per cent significance levels, respectively. s is the residual standard error.

## Conclusion

Our estimation results indicate a high degree of pass-through from key policy rates to money market rates. Importantly, there is no clear evidence that the pass-through has been reduced as a result of the financial crisis. This implies that central banks to a large extent can control the level of money market rates, though not premiums. In order to influence premiums in the money market, central banks have to rely on other measures, such as extra liquidity provision.

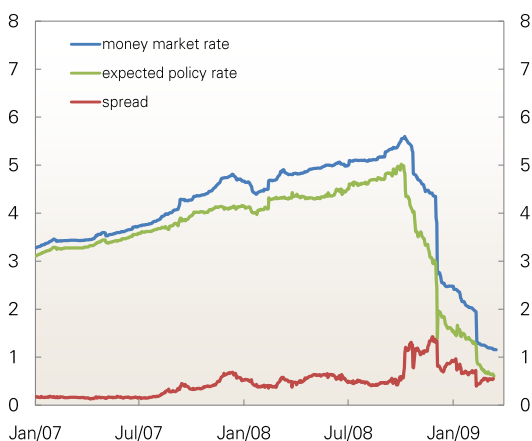
The estimation results should be interpreted with care. The finding that the pass-through from the key rate to money market rates is high appears to be robust. Regarding the effect of the different risk indicators, the results are likely to be more dependent on the specification of the model and on the exact choice of indicators to include in the regression.

Chart 3. Norway  
 Three-month money market rate, expected policy rate over the next three months (both in per cent) and the spread between them (in percentage points). 1 January 2007 – 17 March 2009



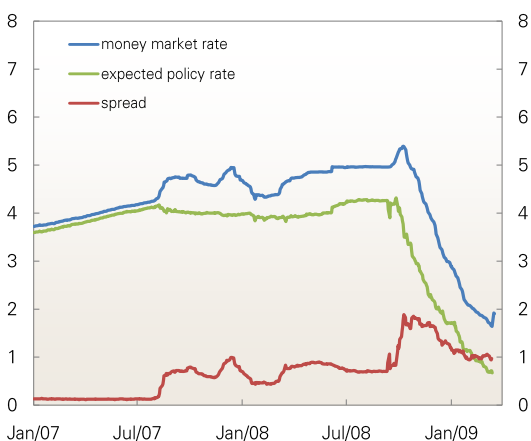
Source: Thomson Reuters, Bloomberg, Norges Bank

Chart 4. Sweden  
 Three-month money market rate, expected policy rate over the next three months (both in per cent) and the spread between them (in percentage points). 1 January 2007 – 17 March 2009



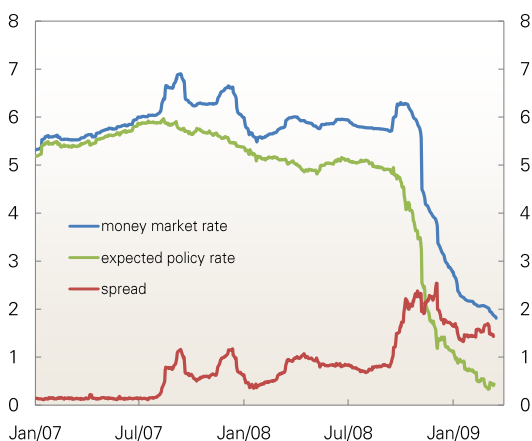
Source: Thomson Reuters, Bloomberg

Chart 5. Euro area  
 Three-month money market rate, expected policy rate over the next three months (both in per cent) and the spread between them (in percentage points). 1 January 2007 – 17 March 2009



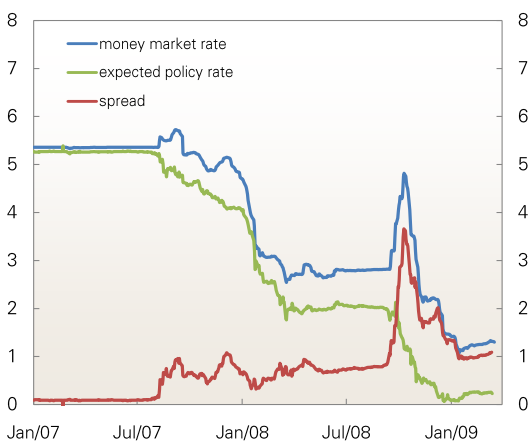
Source: Thomson Reuters, Bloomberg

Chart 6. UK  
 Three-month money market rate, expected policy rate over the next three months (both in per cent) and the spread between them (in percentage points). 1 January 2007 – 17 March 2009



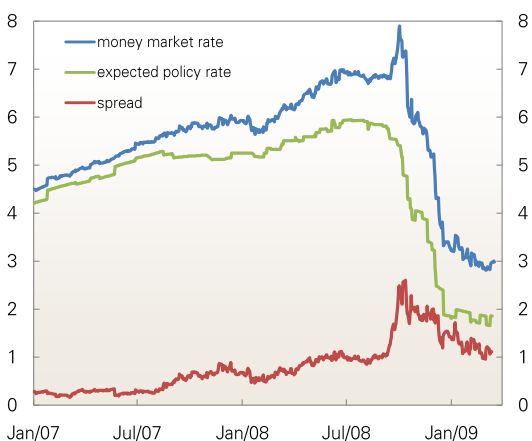
Source: Thomson Reuters, Bloomberg

Chart 7. US  
 Three-month money market rate, expected policy rate over the next three months (both in per cent) and the spread between them (in percentage points). 1 January 2007 – 17 March 2009



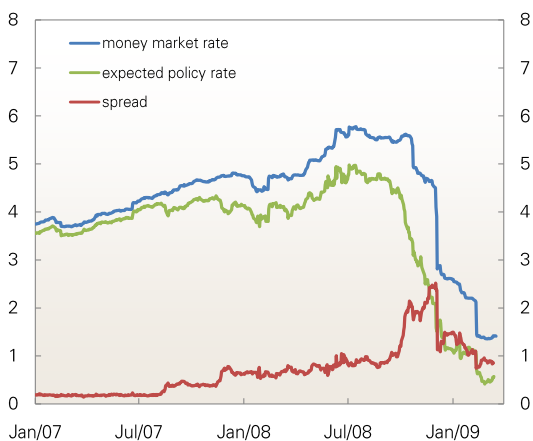
Source: Thomson Reuters, Bloomberg

Chart 8. Norway  
 Twelve-month money market rate, expected policy rate over the next twelve months (both in per cent) and the spread between them (in percentage points). 1 January 2007 – 17 March 2009



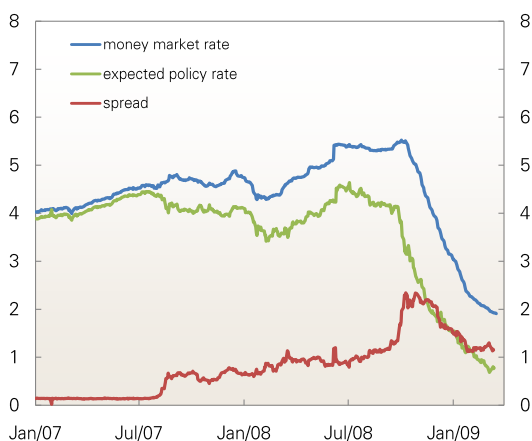
Source: Thomson Reuters, Bloomberg, Norges Bank

Chart 9. Sweden  
 Twelve-month money market rate, expected policy rate over the next twelve months (both in per cent) and the spread between them (in percentage points). 1 January 2007 – 17 March 2009



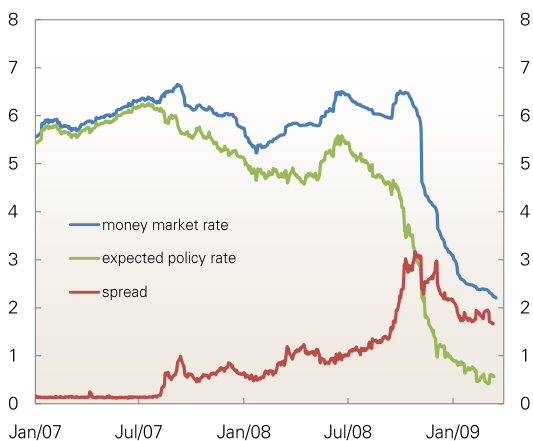
Source: Thomson Reuters, Bloomberg

Chart 10. Euro area  
 Twelve-month money market rate, expected policy rate over the next twelve months (both in per cent) and the spread between them (in percentage points). 1 January 2007 – 17 March 2009



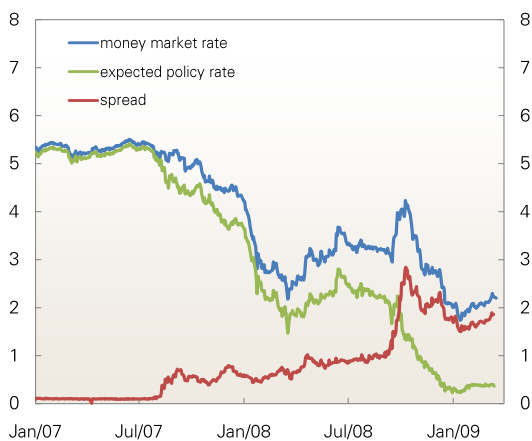
Source: Thomson Reuters, Bloomberg

Chart 11. UK  
 Twelve-month money market rate, expected policy rate over the next twelve months (both in per cent) and the spread between them (in percentage points). 1 January 2007 – 17 March 2009



Source: Thomson Reuters, Bloomberg

Chart 12. US  
 Twelve-month money market rate, expected policy rate over the next twelve months (both in per cent) and the spread between them (in percentage points). 1 January 2007 – 17 March 2009



Source: Thomson Reuters, Bloomberg