US LIBOR Reaction To US Monetary Surprises

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Abstract

The Federal Open Market Committee announcement of the Federal Fund Target Rate is one of the most important policy news items in the world. Additionally, the role of the US London Interbank Offered Rate (LIBOR) and LIBOR-Federal Fund Effective Rate spreads are important for financial markets. This relationship is well-documented. Here, the relationship between varying maturities of the US LIBOR to unexpected changes in Federal Fund Target Rate is examined. The spread between the Federal Fund Effective Rate and the US LIBOR as it relates to these US monetary shocks is looked at. An event study analysis is used. The result is that the US LIBORs react negatively to US monetary shocks, as do LIBOR- Federal Fund Effective Rate spreads.

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1. Introduction

One of the most important monetary policy news items in the world is the announcement of the Federal Funds Target Rate by the Federal Open Market Committee (FOMC) at the Federal Reserve. Numerous studies have examined the empirical effects of these announcements. For example, Jensen and Johnson (1995), Jensen et al (1996), Thorbecke (1997), Patelis (1997), Ehrmann and Fratzscher (2004), Rigobon and Sack (2004), and Basistha and Kurov (2008) have looked at how these announcements affect U.S. equity markets; Husted and Kitchen (1985), Roley (1987), Tandon and Urich (1987), Arora and Cerisola (2001), Durham (2001), Ehrmann and Fratzscher (2002), Andersen et al (2003, 2005), Miniane and Rogers (2004), and Robitaille and Roush (2004) have examined how foreign exchange markets and foreign interest rates respond to US monetary surprise; finally, how these surprises affect foreign equity indices has been looked at by Johnson and Jensen (1993), Ehrmann and Fratzscher (2002, 2006), Ehrmann et al (2005), Wongswan (2005, 2006), and Heath and Kopchak (2015). Furthermore, two of the above mentioned studies[i] investigated whether the magnitude of this effect is different during expansions and recessions. In other words, do business cycles matter in determining the magnitude of the equity market reaction to monetary policy?

The focus of this study is on the reaction of varying maturities of the US London Interbank Offered Rate (LIBOR) to unexpected changes in the Federal Funds Target Rate. Additionally, the spread between the Federal Funds Effective Rate and the US LIBOR is explored. The importance of these classes of variables for financial markets is considerable. The US LIBOR is commonly used as a benchmark for banks in determining adjustable rate mortgages (ARM) and the spread between the LIBOR and the Federal Funds Effective Rate is seen as an indicator of the health of the credit markets.[ii] The important link between monetary

policy surprises and interest rates is well-documented. Sun and Sutcliffe (2003) look at monetary policy announcements in the UK and find that the UK LIBOR reacts strongly to these announcements. Xu et al (2012) find that surprise innovations to the Federal Funds Effective Rate have an impact on 1-year ARMs which is both statistically and economically significant. Here, a key result is that the US LIBORs react negatively to US monetary shocks, as do LIBOR-federal fund rate spreads.

Another caveat to this study is that the role of business cycles is explored. Do business cycles matter for this relationship and if so, what is the magnitude of this effect? Here, limited support is found for the importance of business cycles in determining the size of this effect.

The rest of the paper is organized as follows. Section 2 describes the theoretical underpinnings of this paper; specifically, the transmission channels and the testable hypotheses of this paper. In this paper an event-study approach is used as the estimation framework. In Section 3 a description of this methodology is given as well as a description of the data. Section 4 a discussion of the result is found. Both the benchmark case and the business cycle case are described. Section 5 explores some of the implications of the results from this paper. Finally, concluding comments are given in Section 6.

2. Transmission channels and testable hypotheses

2.1 Monetary Policy and Interest rates, specifically LIBOR

ARM rates are set by lenders with the US LIBOR being a prominent index.[iii] The US LIBOR is determined by taking an average of interbank rates from the world's most creditworthy financial institutions. While it is similar to the Federal Funds Effective Rate, it is different in that it is not targeted by the Federal Reserve. The Federal Funds Effective Rate represents the desired rate by

the Federal Reserve for overnight loans between important financial institutions. However, the LIBOR is not directly determined by any one agency; it is the resulting average rate based on the market for US dollars traded abroad. They are very similar in that they are both interest rates for overnight loans using the US dollar, but the former is determined for the domestic market for US dollars and the latter is for US dollars abroad, or Eurodollars. For this reason, they normally move together and their differences are merely semantic in nature, but sometimes they do not. These episodes usually represent times of dysfunction in the credit markets. [iv]

2.2 Credit Channel Theory

Bernanke and Gertler (1989) highlight the role that the state of the economy plays when investigating the effects of changes in monetary policy. During times of economic downturns, changes in credit conditions caused by monetary surprises have a larger impact than when the economy is witnessing positive real GDP growth. There are two channels through which this happens. When the supply of bank credit is decreased, borrowers who are dependent on external financing suffer. Secondly, firms become less credit worthy due to the diminishing quality of their balance sheets from the economic slowdown. Both channels in unison have a multiplier-type effect on real output. Furthermore, the economy becomes more sensitive to macroeconomic changes during economic downturns than during economic booms.

2.3 Hypotheses

In this paper two hypotheses are tested. The first is that both the US LIBOR and the LIBOR-Federal Fund Effective Rate spread react negatively to surprise U.S. monetary innovations. The second is that this effect is asymmetric; that is the response varies according to the state of the business cycle.

Sun and Sutcliffe (2003) looked at this effect for the UK using the UK LIBOR without accounting for business cycle effects. They found that there the effects were both significant statistically and economically. Here, this paper contributes to the literature by conducting a similar study for the US and the US LIBOR, but business cycle effects are incorporated.

3. Estimation Framework

3.1 Event-study Approach

In this paper an event-study approach is used. The events of interest are the surprise components from FOMC announcements concerning changes to the Federal Fund Target Rate. These include decisions to change and decisions not to change the Federal Fund Target Rate. Since these policy decisions are expected to be anticipated by the market, all or some of the effect would already be accounted for by the interest rate adjustments from the US LIBOR and the LIBOR-Federal Fund Effective Rate spread. The degree to which the market accurately anticipates these policy changes will decide the degree of the impact. Complete anticipation by markets would indicate that the US LIBOR and LIBOR-Federal Fund Effective Rate spread completely adjusted before the FOMC announcement. However, if the markets were surprised, or rather did not anticipate the event with complete accuracy, some reaction in the US LIBOR and LIBOR-Federal Fund Effective Rate spread would be expected.

After each event, the daily movement of the US LIBOR and the LIBOR-Federal Fund Effective Rate spread is examined. These events are considered exogenous since the event window is not long. As per Bernanke and Kuttner (2005) the FOMC announcement from September 17, 2001 which was in response to the events that took place on September 11, 2001 was not included in this study. All other FOMC announcements from November 1993 through

September 2008 are included.[v] The entire sample includes 175 observations. The study ends in 2008 since afterwards traditional monetary policy instruments were no longer the predominant tool of the Federal Reserve.

3.2 Target Rate Surprises

To capture the effect of the FOMC announcements, the unexpected component of the change in the Federal Fund Target Rate is inferred from changes in the current-month Federal Fund Futures Rate for the day of the announcement.[vi] This technique from Kuttner (2001) is prevalent in the literature. It is calculated by the following formula:

$$\Delta i_t^u = \frac{D}{D-d}\left(f_t^0 - f_{t-1}^0\right) \tag{1}$$

where Δi_t^u is the surprise component of the target rate change; f_t^0 is the Federal Fund Effective Rate inferred from the settlement price of the current-month fed funds futures contract; d represents the day on which the current FOMC meeting takes place and D is the number of days in the month. The subscript t represents the FOMC announcement. Also, the term $D/D-d$ is a scaling factor that adjusts for the number of days that remain in the month in which the rate change occurs.[vii] The average Federal Fund Effective Rate during the contract's month is employed to calculate the settlement price of the Federal Fund Effective Rate.

3.3 US LIBOR and US LIBOR-Federal Fund Effective Rate Spread Data

The US LIBOR rates were gathered from the St. Louis Federal Reserve Bank. Maturities range from overnight rates to one-year rates. For the LIBOR-Federal Fund Effective Rate spread, the Federal Fund Effective Rate also obtained from the St. Louis Federal Reserve Bank is used. The spread is created by subtracting the Federal Fund Effective Rate from the LIBOR. Two spreads are employed using different LIBOR maturities: the overnight rate and the one-month rate. The

former is more appropriate, but due to the limited data set of the former, the latter which covers the entire range of the data is used as well.

3.4 Business Cycle Data

To control for business cycles, the NBER recession dates are used. Over the sample three recession occur. One takes place from July 1990 through March 1991; the second happens between March 2001 through November 2001; the last begins in December 2007 and continues through the end of the sample of this study; specifically, ending in June 2009.

4. Empirical Results

4.1 Benchmark results

For the benchmark result, cyclical variations are ignored. Equation 2 is estimated:

$$R_t = \alpha + \beta \Delta i_t^u + \varepsilon_t \qquad (2)$$

Here, R_t is the daily rate of the US LIBOR or the LIBOR-Federal Fund Effective Rate spread on the day of the FOMC announcement (t). The surprise component of the FOMC announcements as described in equation 1 is represented by Δi_t^u. The residuals are represented by ε_t. This equation is estimated using OLS.

In table 1 the results from equation 2 are given. For the OLS estimation, due to the limited data set of the LIBOR rates with maturities less than one month, less observations are obtained. In all cases the effect of a surprise FOMC announcement is negative. This suggests that the market over-anticipates the change in the Federal Fund Effective Rate and adjusts accordingly after the announcement is made. The same is true of the spreads as well. However, in most of the cases the effect is not significantly different than zero. The exceptions are the two-week, three-month, four-month, five-month, and six-month US LIBORs, which are all

statistically significant at the 10% level and the one-month and two-month US LIBORs, which are all statistically significant at the 5% level, as well as the one-month LIBOR-federal funds rate spread which is statistically significant at the 1% level.

One issue with using OLS in this type of study is that it does not control for outliers. To correct for the effect of outliers, a robust regression is run as well. The estimation procedure that is used is the MM-estimation, which is a type of weighted least squares due to Yohai (1987) that allows for robustness when outliers are thought to be present. In table 2 these results are given. Again, the effect of a surprise FOMC announcement is negative on all variables. As before, only certain cases are statistically significant. At the 10% level they are the one-month, two-month, three-month and four-month US LIBORs and at the 1% level again only the one-month LIBOR-federal funds rate spread is statistically significant.

4.2 Allowing for Business Cycles

Next, business cycles as measured by the NBER are controlled for. Equation 3 as given below is estimated:

$$R_t = \alpha + \beta_1 \Delta i_t^u \left(1 - C_t\right) + \beta_2 \Delta i_t^u C_t + \mu_t \qquad (3)$$

The new term relative to equation 3 is the cyclical variation variable (C_t); it interacts with the U.S. monetary surprise variable and takes on a value of one when the US economy is in an economic downturn and zero, otherwise.

From table III, in the OLS estimation, U.S. monetary shocks have a negative economic effect in all cases, but not all cases are statistically significant. During an expansion at the 10% level, the overnight and two-week US LIBORs are statistically significant and at the 5% level the overnight LIBOR-Federal Fund Effective Rate spread is statistically significant. During a recession at the 10% level, the two-month, three-month, four-month, five-month and six-month

US LIBORs are statistically significant; at the 5% level, the one-month is and at the 1% level the one-month LIBOR-Federal Fund Effective Rate spread is statistically significant. Only the latter is statistically significant in both states and a Wald test confirms that state does matter. The coefficients are statistically different from each other with the one-month LIBOR-Federal Fund Effective Rate spread reaction being greater during a recession. This would support the credit channel theory.

From table IV, in M-M estimations, U.S. monetary shocks again have a negative economic effect on all dependent variables. However, at the 10% level during an expansion only the overnight and two-week are statistically significant. During a recession, the one-month, two-month, three-month and four-month US LIBORs are statistically significant at the 10% level. For both spreads, the effect is statistically significant no matter the state at the 1% level except during a recession for the one-month LIBOR-Federal Fund Effective Rate spread which is statistically significant at the 5% level. A Wald test confirms that the overnight LIBOR-Federal Fund Effective Rate spread coefficients are statistically different from each other with the economic effect being larger in magnitude during a recession. For the one-month LIBOR-Federal Fund Effective Rate spread the Wald test cannot support the coefficients being significantly different from each other.

5. Implications

The results from this study show that for certain maturities the LIBOR does not move perfectly with U.S. monetary shocks. The LIBOR seems to overshoot the surprise shock to the Federal Fund Effective Rate. Clearly, the intentions of the Federal Reserve do indeed surprise the LIBOR market. This is important since significant deviations of the LIBOR from the Federal Fund

Effective Rate can be indicators of monetary dysfunction. Generally, when the LIBOR does not move with the Federal Fund Effective Rate, conventional monetary policy tools are not as effective. These effects might pass through to the foreign exchange markets and equity markets, both domestic and foreign. This would be a possible extension of the results found here.

6. Concluding remarks

In this study the reaction of the US LIBORs of different maturities and two LIBOR-Federal Fund Effective Rate spreads to U.S. monetary shocks are documented. The result is that both variables react negatively to these shocks. This suggests that there is evidence of overshooting by the markets before the surprise is announced and then correcting after the surprise occurs.

Business cycles are also controlled for to test the credit channel theory. Support of the credit channel for the LIBOR-Federal Fund Effective Rate spreads is found. Also, support for some of the US LIBORs is found, although for the shorter maturity LIBORs a reverse result appears. However, due to the limited number of observations in these shorter series this result may not be robust.

Endnotes

[i] Basistha and Kurov (2008), and Heath and Kopchak (2015).

[ii] For a general summary of the importance of the LIBOR and the LIBOR spreads, see Kiff (2012).

[iii] See Consumer Handbook on Adjustable-rate Mortgages published by the Board of Governors of the Federal Reserve System.

[iv] This is widely known in financial literature, but for a more elaboration explanation of the importance of this spread see James Hamilton's post at: http://econbrowser.com/archives/2008/09/understanding_t-2.

[v] The beginning date of the sample is determined by the earliest available data for the surprise series.

[vi] Alex Kurov generously provided this data.

[vii] See Kuttner (2001) for more details on the scaling factor as well as the calculations of this component.

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Table I

	Intercept	Surprise
overnight	3.216	-0.029
	(0.000)	(0.165)
one-week	3.852	-0.022
	(0.000)	(0.295)
two-week	3.167	-0.033
	(0.000)	(0.092)
one-month	4.519	-0.032
	(0.000)	(0.029)
two-month	4.568	-0.030
	(0.000)	(0.039)
three-month	4.600	-0.029
	(0.000)	(0.051)
four-month	4.622	-0.028
	(0.000)	(0.054)
five-month	4.653	-0.027
	(0.000)	(0.070)
six-month	4.678	-0.026
	(0.000)	(0.080)
nine-month	4.757	-0.023
	(0.000)	(0.109)
ten-month	4.788	-0.023
	(0.000)	(0.117)
eleven-month	4.821	-0.022
	(0.000)	(0.126)
twelve-month	4.850	-0.022
	(0.000)	(0.132)
spread w/overnight	0.268	-0.003
	(0.001)	(0.710)
spread w/one-month	0.183	-0.013
	(0.000)	(0.000)

In this table the coefficients for the OLS regression [$R_t = \alpha + \beta \Delta i_t + \varepsilon_t$] are given. The dependent variable is the close-to-close daily return of the US LIBOR or the spread between the LIBOR and the federal funds rate in levels.

Table II

	Intercept	Surprise
overnight	3.200	-0.030
	(0.000)	(0.177)
one-week	3.884	-0.023
	(0.000)	(0.323)
two-week	3.150	-0.034
	(0.000)	(0.108)
one-month	4.570	-0.030
	(0.000)	(0.055)
two-month	4.620	-0.029
	(0.000)	(0.073)
three-month	4.650	-0.027
	(0.000)	(0.088)
four-month	4.676	-0.026
	(0.000)	(0.097)
five-month	4.706	-0.025
	(0.000)	(0.118)
six-month	4.732	-0.023
	(0.000)	(0.133)
nine-month	4.807	-0.021
	(0.000)	(0.171)
ten-month	4.838	-0.021
	(0.000)	(0.181)
eleven-month	4.873	-0.020
	(0.000)	(0.198)
twelve-month	4.894	-0.020
	(0.000)	(0.195)
spread w/overnight	0.268	-0.003
	(0.001)	(0.710)
spread w/one-month	0.136	-0.007
	(0.000)	(0.000)

In this table the coefficients for the MM-estimation [$R_t = \alpha + \beta \Delta i_t + \varepsilon_t$] are given. The dependent variable is the close-to-close daily return of the US LIBOR or the spread between the LIBOR and the federal funds rate in levels.

Table III

	Intercept	Expansion	Recession
overnight	3.225	-0.060	-0.012
	(0.000)	(0.084)	(0.638)
one-week	3.854	-0.049	-0.003
	(0.000)	(0.130)	(0.904)
two-week	3.175	-0.059	-0.018
	(0.000)	(0.069)	(0.435)
one-month	4.516	-0.023	-0.044
	(0.000)	(0.230)	(0.045)
two-month	4.565	-0.021	-0.042
	(0.000)	(0.273)	(0.053)
three-month	4.597	-0.020	-0.040
	(0.000)	(0.311)	(0.063)
four-month	4.619	-0.020	-0.039
	(0.000)	(0.308)	(0.070)
five-month	4.650	-0.018	-0.037
	(0.000)	(0.343)	(0.086)
six-month	4.676	-0.018	-0.036
	(0.000)	(0.361)	(0.098)
nine-month	4.754	-0.016	-0.033
	(0.000)	(0.406)	(0.128)
ten-month	4.786	-0.016	-0.032
	(0.000)	(0.414)	(0.139)
eleven-month	4.819	-0.015	-0.031
	(0.000)	(0.426)	(0.148)
twelve-month	4.848	-0.015	-0.031
	(0.000)	(0.433)	(0.154)
spread w/overnight	0.268	-0.003	-0.003
	(0.001)	(0.847)	(0.749)
spread w/one-month	0.181	-0.008	-0.018
	(0.000)	(0.038)	(0.000)

In this table the coefficients for the OLS regression [$R_t = \alpha + \beta_1 \Delta i_t(1\text{-}C_t) + \beta_2 \Delta i_t C_t + \mu_t$] are given. The dependent variable is the close-to-close daily return of the US LIBOR or the spread between the LIBOR and the federal funds rate in levels.

Table IV

	Intercept	Expansion	Recession
overnight	3.209	-0.066	-0.014
	(0.000)	(0.081)	(0.611)
one-week	3.885	-0.054	-0.005
	(0.000)	(0.135)	(0.869)
two-week	3.150	-0.067	-0.020
	(0.000)	(0.058)	(0.448)
one-month	4.578	-0.022	-0.044
	(0.000)	(0.291)	(0.066)
two-month	4.627	-0.020	-0.042
	(0.000)	(0.343)	(0.076)
three-month	4.663	-0.018	-0.041
	(0.000)	(0.394)	(0.088)
four-month	4.685	-0.018	-0.039
	(0.000)	(0.394)	(0.097)
five-month	4.709	-0.016	-0.037
	(0.000)	(0.427)	(0.110)
six-month	4.736	-0.016	-0.036
	(0.000)	(0.450)	(0.122)
nine-month	4.815	-0.013	-0.034
	(0.000)	(0.517)	(0.141)
ten-month	4.835	-0.014	-0.034
	(0.000)	(0.510)	(0.146)
eleven-month	4.868	-0.013	-0.033
	(0.000)	(0.529)	(0.152)
twelve-month	4.897	-0.013	-0.033
	(0.000)	(0.543)	(0.152)
spread w/overnight	0.082	-0.006	-0.009
	(0.000)	(0.000)	(0.000)
spread w/one-month	0.136	-0.008	-0.004
	(0.000)	(0.000)	(0.040)

In this table the coefficients for the M-M estimation [$R_t = \alpha + \beta_1 \Delta i_t(1-C_t) + \beta_2 \Delta i_t C_t + \mu_t$] are given. The dependent variable is the close-to-close daily return of the US LIBOR or the spread between the LIBOR and the federal funds rate in levels.