

Eurodollar futures and LIBOR

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Abstract. The Chicago Mercantile Exchange is a global derivatives market place. The CME group is an order driven exchange that facilitates the trading of forward, futures and options contract on numerous products within key asset classes such as agriculture/energy/metals, equities, interest rates, and exchange rates. Hence a very popular US interest rate futures contract is the three-month Eurodollar futures traded on the CME.

Keywords. Eurodollar; LIBOR; Interest rates; Financial crises.

JEL. N10; N20; E40; E50; G21.

1. Introduction

The Eurodollar interest rate is the rate of interest earned on Eurodollars deposited by one bank with another bank. It is in many ways the same as the London Interbank Offer Rate (LIBOR). The 3-month Eurodollar futures contracts are futures contracts on the three-month Eurodollar interest rate. The contracts have maturities in March, June, September and December for up to 10 years in the future.

Calculation:

If X is the quoted price for a Eurodollar futures contract, the exchange defines the value of one contract as:

$$10,000 [100 - 0.25(100 - X)] \quad (1)$$

Thus, the Settlement price of 95.53 for the June 2011 contract as shown in the tables below, corresponds to the contract price of:

$$10,000[100 - 0.25(100 - 95.53)] = \$988,825$$

It can be seen from equation [1] that a change of one basis point or 0.01 in a Eurodollar futures quote corresponds to a contract price change of \$25.

When the third Wednesday of the delivery month is reached the contract is settle in cash. The final marketing to market sets Q equal to $100 - R$ where R is the actual three-month Eurodollar interest rate on that day, expressed with quarterly compounding and an actual/360-day count convention. Thus, if the three-month Eurodollar interest rate on the third Wednesday of the delivery month is 8% the final marking to market is 92 and the final contract price from equation [1] is:

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10,000[100-0.25(100-92)] = \$980,000

If Q is a Eurodollar futures quote, (100-Q) % is the Eurodollar futures interest rate for a three-month period beginning on the third Wednesday of the delivery month. If Q is a Eurodollar futures quote, (100-Q) % is the Eurodollar futures interest rate for a three-month period beginning on the third Wednesday of the delivery month. Thus, the below table indicates that on March 15, 2011 the futures interest rate for the three-month period beginning Wednesday June 20, 2001, was 100-95.53 = 4.47%. This is expressed with quarterly compounding and an actual/360-day count convention.

Other contract similar to the CME Eurodollar future contract trade on interest rates in other countries. As shown in the table below CME and SGX trade Eur- yen contracts, LIFFE and MATIF trade Euribor contracts (i.e. contracts on the three-month Libor rate for the euro) and LIFFE trades three-month Euro Swiss futures

Interest rate futures quotes from the WSJ March 16 2001.
(Columns show month, open, high, low, settle change, lifetime high, lifetime low, and open interest, respectively)

INTEREST RATE									
Treasury Bonds (CBT)-\$100,000; pts 32nds of 100%									
Mar	106-11	106-26	106-02	106-14	+	3	106-35	95-02	47,402
June	106-26	106-17	106-24	106-04	+	3	106-17	96-21	47,587
Sept	106-15	106-09	106-17	106-02	+	3	106-04	96-22	2,814
Est vol	225,000	vs	Net	338,300	open	at	524,394	+1,141	
Treasury Notes (CBT)-\$100,000; pts 32nds of 100%									
Mar	95-25	107-04	106-19	95-50	+	85	107-04	98-59	22,810
June	106-11	106-22	106-03	106-15	+	83	106-22	99-11	49,988
Sept	106-02	106-20	106-04	106-04	+	85	106-20	100-18	4,839
Est vol	225,000	vs	Net	270,100	open	at	621,650	+1,772	
10 Yr Agency Notes (CBT)-\$100,000; pts 32nds of 100%									
Mar	100-26	100-02	99-25	100-07	+	122	107-27	95-25	12,194
June	100-17	100-02	100-01	100-27	+	112	101-16	99-01	43,325
Est vol	4,000	vs	Net	9,200	open	at	52,800		
5 Yr Treasury Notes (CBT)-\$100,000; pts 32nds of 100%									
Mar	100-05	100-10	100-03	100-10	+	82	100-10	100-01	25,713
June	100-15	100-24	100-08	100-23	+	82	100-23	100-09	57,113
Sept	100-02	100-02	100-02	100-02	+	82	100-02	100-02	1,504
Est vol	107,000	vs	Net	117,300	open	at	346,200	+1,604	
2 Yr Treasury Notes (CBT)-\$100,000; pts 32nds of 100%									
Mar	100-24	100-31	100-21	100-21	+	82	100-21	100-01	4,362
June	100-28	100-02	100-02	100-00	+	82	100-02	100-01	79,842
Est vol	10,000	vs	Net	5,000	open	at	95,000	-40	
30 Day Federal Funds (CBT)-\$5 million; pts of 100%									
Mar	94.740	94.790	94.730	94.740	+	001	95.910	94.000	21,708
Apr	95.10	95.21	95.16	95.20	+	04	95.21	94.21	17,131
May	95.31	95.35	95.29	95.35	+	04	95.35	94.21	5,723
June	95.44	95.51	95.45	95.52	+	07	95.51	94.20	3,403
July	95.62	95.62	95.53	95.62	+	08	95.62	94.20	2,040
Est vol	14,000	vs	Net	18.100	open	at	82,700	-70	
Muni Bond Index (CBT)-\$1,000; times Bond Buyer MBI									
Mar	105-15	105-20	105-14	105-17	+	10	105-17	99-03	3,332
June	104-21	104-30	104-16	104-27	+	10	105-20	101-21	11,620
Est vol	800	vs	Net	1,200	open	at	18,100	-100	
Index Clear 104-30; Yield 5.30									
Treasury Bills (CME)-\$1 mil.; pts of 100%									
	OPEN	HIGH	LOW	SETTLE	CHANGE	YIELD	CHANGE	OPEN	
Mar	95.59	95.64	95.52	95.52	+	03	95.59	95.59	1,219
June	96.08	96.13	96.06	96.11	+	03	96.08	96.11	1,491
Est vol	485	vs	Net	780	open	at	4,530	-80	
Libor 1 Mo. (CME)-\$3,000,000; pts of 100%									
Mar	94.65	94.69	94.65	94.69	+	04	95.01	94.20	20,570
Apr	95.15	95.19	95.13	95.18	+	05	95.02	94.20	18,819
May	95.20	95.40	95.21	95.38	+	07	95.07	94.21	8,811
June	95.43	95.54	95.43	95.53	+	09	94.47	94.20	1,590
July	95.50	95.59	95.49	95.58	+	08	94.42	94.20	494
Aug	95.50	95.59	95.49	95.58	+	08	94.42	94.20	204
Sept	95.50	95.59	95.49	95.58	+	08	94.42	94.20	204
Est vol	5,710	vs	Net	7,000	open	at	60,540	-267	
Eurodollar (CME)-\$1 Million; pts of 100%									
Mar	95.06	95.10	95.03	95.09	+	02	94.81	94.20	516,791
Apr	95.24	95.29	95.24	95.28	+	04	94.72	94.20	25,625
May	95.41	95.44	95.39	95.43	+	06	94.57	94.20	1,598
June	95.43	95.55	95.43	95.53	+	08	94.07	94.20	693,688
July	95.59	95.59	95.58	95.58	+	12	94.41	94.20	1,012
Aug	95.50	95.54	95.50	95.52	+	10	94.38	94.20	708,199
Sept	95.54	95.47	95.50	95.45	+	10	94.25	94.20	291,820
Oct	95.56	95.40	95.25	95.27	+	09	94.03	94.20	129,506
Nov	95.03	95.17	95.03	95.14	+	09	94.86	94.20	316,329
Dec	94.84	94.96	94.83	94.93	+	09	94.57	94.20	292,738
Jan	94.61	94.72	94.60	94.71	+	09	94.29	94.20	163,020
Feb	94.57	94.68	94.57	94.66	+	08	94.34	94.20	129,515
Mar	94.48	94.59	94.48	94.56	+	08	94.44	94.20	99,406
Apr	94.40	94.51	94.40	94.48	+	08	94.32	94.20	95,176
May	94.27	94.37	94.26	94.34	+	08	94.06	94.20	79,956
June	94.27	94.38	94.26	94.34	+	08	93.88	94.20	76,267
July	94.21	94.30	94.18	94.27	+	08	93.72	94.20	61,145
Aug	94.12	94.24	94.12	94.20	+	08	93.60	94.20	62,968
Sept	94.02	94.12	94.03	94.08	+	08	93.52	94.20	51,648
Oct	94.01	94.12	94.01	94.09	+	08	93.41	94.20	36,722
Nov	93.87	94.06	93.87	94.03	+	08	93.27	94.20	22,302
Dec	93.81	94.01	93.81	94.01	+	07	93.23	94.20	13,913
Jan	93.81	93.90	93.81	93.86	+	07	93.14	94.20	9,415
Feb	93.82	93.92	93.82	93.88	+	06	93.12	94.20	19,942
Mar	93.78	93.87	93.78	93.83	+	06	93.17	94.20	18,294
Apr	93.75	93.82	93.74	93.79	+	06	93.21	94.20	17,857
May	93.65	93.73	93.64	93.69	+	05	93.31	94.20	13,136
June	93.64	93.71	93.63	93.72	+	05	93.28	94.20	11,626
July	93.54	93.61	93.53	93.67	+	04	93.33	94.20	8,488
Aug	93.51	93.58	93.51	93.62	+	04	93.37	94.20	7,120
Sept	93.45	93.51	93.45	93.54	+	04	93.46	94.20	7,782
Oct	93.35	93.41	93.35	93.47	+	04	93.53	94.20	6,488
Nov	93.30	93.37	93.30	93.43	+	03	93.67	94.20	5,064
Dec	93.21	93.24	93.25	93.49	+	03	93.51	94.20	3,976

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10 Yr. Canadian Govt. Bonds (IME)-C\$100,000									
Mar	105.10	105.33	104.91	105.81	+ 0.10	105.25	101.80	5.505	
June	105.10	105.33	104.91	105.81	+ 0.10	105.40	103.30	61.851	
Est vol 2,838; vol Wed 3,501; open int 67,356, -723									
10 Yr. Euro Notional Bond (MATIF)-Euro 100,000									
Mar	90.32	90.40	90.13	90.30	+ 0.05	90.35	88.33	175,093	
June	90.42	90.70	90.25	90.45	+ 0.08	90.70	89.09	28,708	
Est vol 221,548; vol Wed 218,992; open int 187,296, +6,100									
3 Month Euribor (MATIF)-Euro 1,000,000									
Mar	---	---	---	95.24	- 0.02	96.95	94.63	6,053	
June	---	---	---	95.58	+ 0.02	98.45	94.55	3,357	
Sept	---	---	---	95.82	+ 0.03	96.75	94.47	2,021	
Dec	---	---	---	95.75	+ 0.03	96.58	94.37	2,835	
Mar02	---	---	---	95.79	+ 0.03	96.48	94.45	2,617	
June	---	---	---	95.69	+ 0.03	96.29	94.35	328	
Sept	---	---	---	95.60	+ 0.04	96.21	94.27	475	
Dec	---	---	---	95.45	+ 0.03	95.97	94.10	330	
Est vol 0; vol Wed 0; open int 18,059, unch.									
3 Yr. Commonwealth T-Bonds (SFE)-A\$100,000									
Mar	95.44	95.57	95.43	95.54	+ 0.09	95.57	94.25	0	
June	95.50	95.62	95.48	95.55	+ 0.05	95.62	94.94	231,145	
Est vol 289,602; vol Wed 358,007; open int 231,145, -295,318									
Euro-Yen (SGX)-Yen 100,000,000 pts Of 100%									
Mar	99.78	99.79	99.77	99.77	- 0.01	99.79	98.08	98,662	
June	99.88	99.88	99.87	99.87	- 0.01	99.88	98.17	111,846	
Sept	99.88	99.88	99.87	99.87	- 0.01	99.88	98.17	111,846	
Dec	99.85	99.85	99.84	99.84	- 0.01	99.85	98.17	37,560	
Mar02	99.86	99.86	99.84	99.84	- 0.01	99.86	98.17	37,560	
June	99.85	99.85	99.83	99.83	- 0.02	99.85	98.11	32,807	
Sept	99.79	99.79	99.77	99.75	- 0.01	99.79	98.35	14,507	
Dec	99.70	99.70	99.68	99.67	- 0.01	99.70	98.28	2,702	
Mar03	---	---	---	99.60	- 0.01	99.54	98.45	2,702	
June	---	---	---	99.51	- 0.01	99.54	98.40	2,702	
Sept	---	---	---	99.37	- 0.01	99.42	98.34	2,702	
Est vol 25,077; vol Wed 34,483; open int 439,071, +62									
5 Yr. German Euro-Govt. Bond (EURO-BOBL) (EUREX)-Euro 100,000; pts of 100%									
June	106.60	106.75	106.53	106.74	+ 0.08	106.75	103.50	48,288	
Sept	---	---	---	107.02	+ 0.08	108.65	105.51	5,638	
vol Thu 456,995; open int 473,927, +46,697									
10 Yr. German Euro-Govt. Bond (EURO-BUND) (EUREX)-Euro 100,000; pts of 100%									
June	109.45	109.67	109.40	109.64	+ 0.08	109.70	106.00	68,778	
Sept	109.64	109.70	109.49	109.70	+ 0.01	109.70	107.96	5,747	
vol Thu 706,063; open int 693,543, +92,384									
2 Yr. German Euro-Govt. Bond (EURO-SCHATZ) (EUREX)-Euro 100,000; pts of 100%									
June	103.03	103.09	102.97	103.07	+ 0.03	103.22	102.27	57,008	
Sept	---	---	---	102.98	+ 0.03	---	---	4,304	
vol Thu 379,199; open int 511,372, +57,585									

2. Forward vs future rates

For short maturities (upto one year) the Eurodollar interest rate can be assumed to be the same as the corresponding forward interest rate.

A convexity adjustment is made to convert Eurodollar future rates to forward interest rates.

$$\text{Forward Rate} = \text{Futures Rate} - \frac{1}{2} \sigma^2 t_1 t_2$$

Where t_1 is the time to maturity of the futures contract, t_2 is the time to maturity of the rate underlying the futures contract and σ is the standard deviation of change in the short-term interest rate in one year. Both rate are expressed with continuous compounding. A typical value for σ is 1.2% or 0.012.

Hence,

Considering the situation where $\sigma=0.012$ and we wish to calculate the forward rate when the eight-year Eurodollar futures price quote is 94. In this case In this case $t_1 = 8$, $t_2=8.25$, and the convexity adjusted,

$$\frac{1}{2} \times 0.012^2 \times 8 \times 0.00475$$

Or 0.475%. The futures rate is 6% per annum on an actual/360 basis with quarterly compounding. This is $6 \times 365/360 = 6.083\%$ per annum on an actual/365 basis with quarterly compounding or 6.038% with continuous compounding. The forward rate is, therefore $6.038-0.475=5.563\%$ per annum with continuous compounding.

The forward rate is less than the futures rate. The size of the adjustment is roughly proportional to the square of the time to maturity of the futures contract. Thus, the convexity adjustment for the eight-year contract is approximately 64 times for a one-year contract.

3. The LIBOR zero curve

The LIBOR zero curve which is also sometimes referred to as the swap zero curve is frequently used as a risk-free-zero curve when derivatives are valued. Spot LIBOR rates are used to determine very short-term LIBOR zero rates. After that Euro futures (i.e Eurodollar futures, Euroyen futures, Euribor futures, etc.) are frequently used. Once a convexity adjustment such as that just described is made, the Euro futures contract define forward rates for future three-month time periods.

In the US, March, June, September and December Eurodollar futures are often used to determine the LIBOR zero curve out to five years. Suppose that the i th Eurodollar futures contract matures at time T_i ($i=1,2,\dots$). We usually assume that the forward interest rate calculated from this futures contract applies to the Period T_i to T_{i+1} . (There is at most a small approximation here). This enables a bootstrap procedure to be used to determine zero rates. Suppose that F_i is the forward rate calculated from the i th Eurodollar futures contract and R_i is the zero rate for a maturity T_i :

Then we have

$$F_1 = \frac{R_{i+1}T_{i+1} - R_iT_i}{T_{i+1} - T_i}$$

So that,

$$R_{i+1} = \frac{F_i(T_{i+1} - T_i) + R_iT_i}{T_{i+1}}$$

Hence,

The 400-day LIBOR zero rate has been calculated as 4.80% with continuous compounding and from a Eurodollar future quote it has been calculated that the forward rate for a 91 day period beginning in 400 days is 5.30% with continuous compounding We can use the above equations to obtain the 491-day rate as

$$\frac{0.053 \times 91 + 0.048 \times 400}{491} = 004893$$

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Overnight euro LIBOR Interest Rates

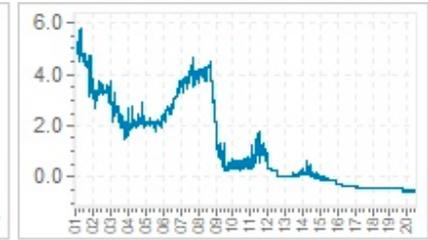
Last Month-June 2020



Last Year-2019



Full Term- 2001-2020



1-month US Dollar LIBOR Interest rate.

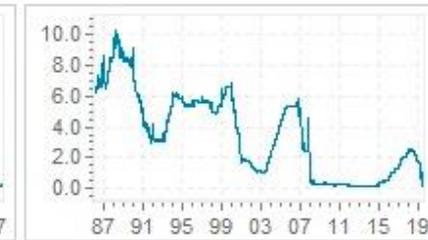
Last Month-June 2020



Last Year-2019



Full Term- 2001-2020



6-month British pound sterling LIBOR interest rate

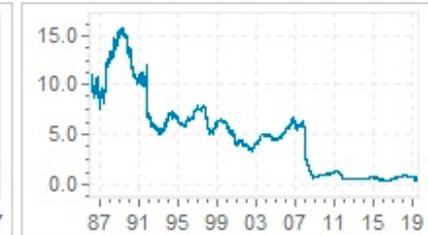
Last Month-June 2020



Last Year-2019



Full Term- 2001-2020

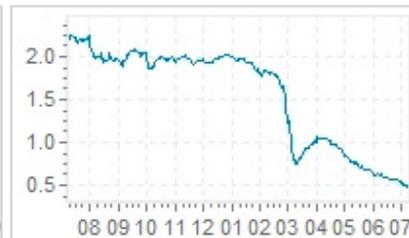


12-Month US Dollar LIBOR interest rate

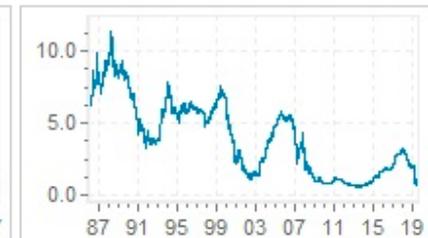
Last Month-June 2020



Last Year-2019



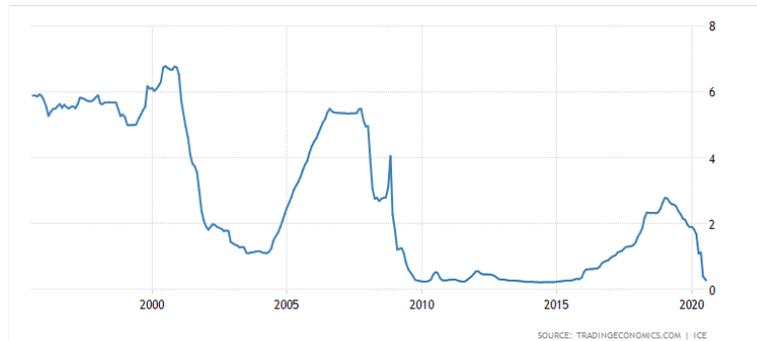
Full Term- 2001-2020



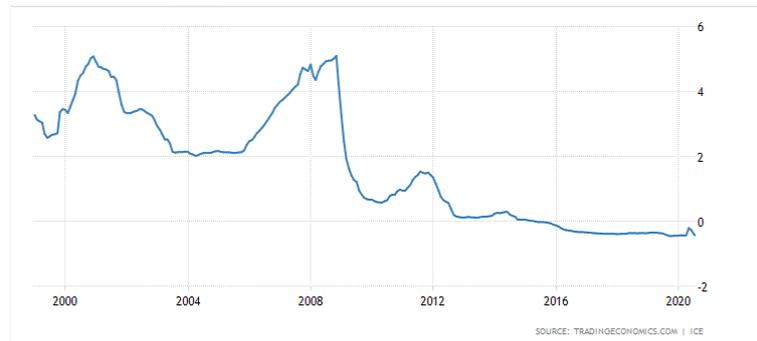
Source: [Retrieved from].

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US Dollar LIBOR Three Month Rate



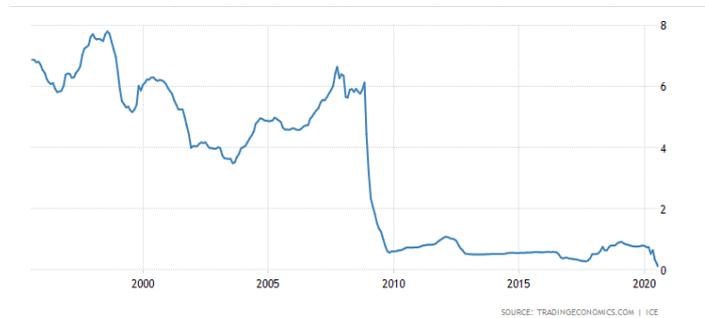
Euro LIBOR Three Month Rate



US – Three Month LIBOR, based on US Dollar



British Pound Libor Three Month Rate



Source: [Retrieved from](#).

Eurodollar futures provide an effective means for companies for companies and banks to secure interest rate for money they plan to borrow or lend in the future. The Eurodollar is used to hedge against yield curve

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changes over multiple years in the future. A Eurodollar future is a cash settled futures contract whose price moves in response to the LIBOR interest rate. Eurodollar futures are a way for companies and banks to lock in an interest rate today, for money they intend to borrow or lend in the future. LIBOR is the average interbank interest rate at which a selection of banks on the London money market are prepared to lend to one another. The LIBOR comes in 7 maturities (from over to 12 months) and in 5 different currencies. The LIBOR is important because lenders, including banks and other financial institutions use LIBOR as the benchmark reference for determining interest rate for various debt instruments. It is also used as benchmark for mortgages, corporate loans, government bonds, credit cards, student loans in various countries. Hence, the importance of both the Eurodollar future and LIBOR rates cannot be stressed enough especially in the case of international financial management and financial crises.

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