Risk, Valuation, and the Cost of Funding

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ETH
9 September 2011

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Risk, Valuation, and the Cost of Funding

Risk and the cost of funding are important factors in the valuation of derivative transactions.

Other considerations include

- credit risk of the counterparty
- the terms of a collateral agreement

What is the appropriate interest rate for discounting derivative cashflows?

What rates should we use for risk-free discounting in a “risk neutral” pricing model?

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Collateral Arrangements and Clearing Houses

Almost all derivative trades between banks are now collateralized. These include interest rate swaps, cross currency swaps, FX forwards, FX options, interest rate options, and OTC equity options. The collateral serves to eliminate most of the credit risk exposure between derivative counterparties.

The market values for these derivatives are calculated daily, and collateral must be posted to cover the net MV difference between two banks. If the net MV of Bank B's derivatives with Bank A is $20 MM, then Bank A will post $20 MM in cash collateral with Bank B. Bank B is obligated to pay an overnight interest rate on this cash collateral. The overnight rates are typically the effective Federal Funds rate for USD, TOIS for CHF, EONIA for Euro, SONIA for GBP, …

Many of the interest rate swaps between banks are now cleared through the London Clearing House. LCH requires collateral to cover the MV of the swap and they pay the overnight interest rate in that currency on the cash collateral.

Risk-Free Discounting

Up until a few years ago, most banks used the LIBOR-Swap curve for risk-free discounting. This was the consensus prior to the financial crisis.

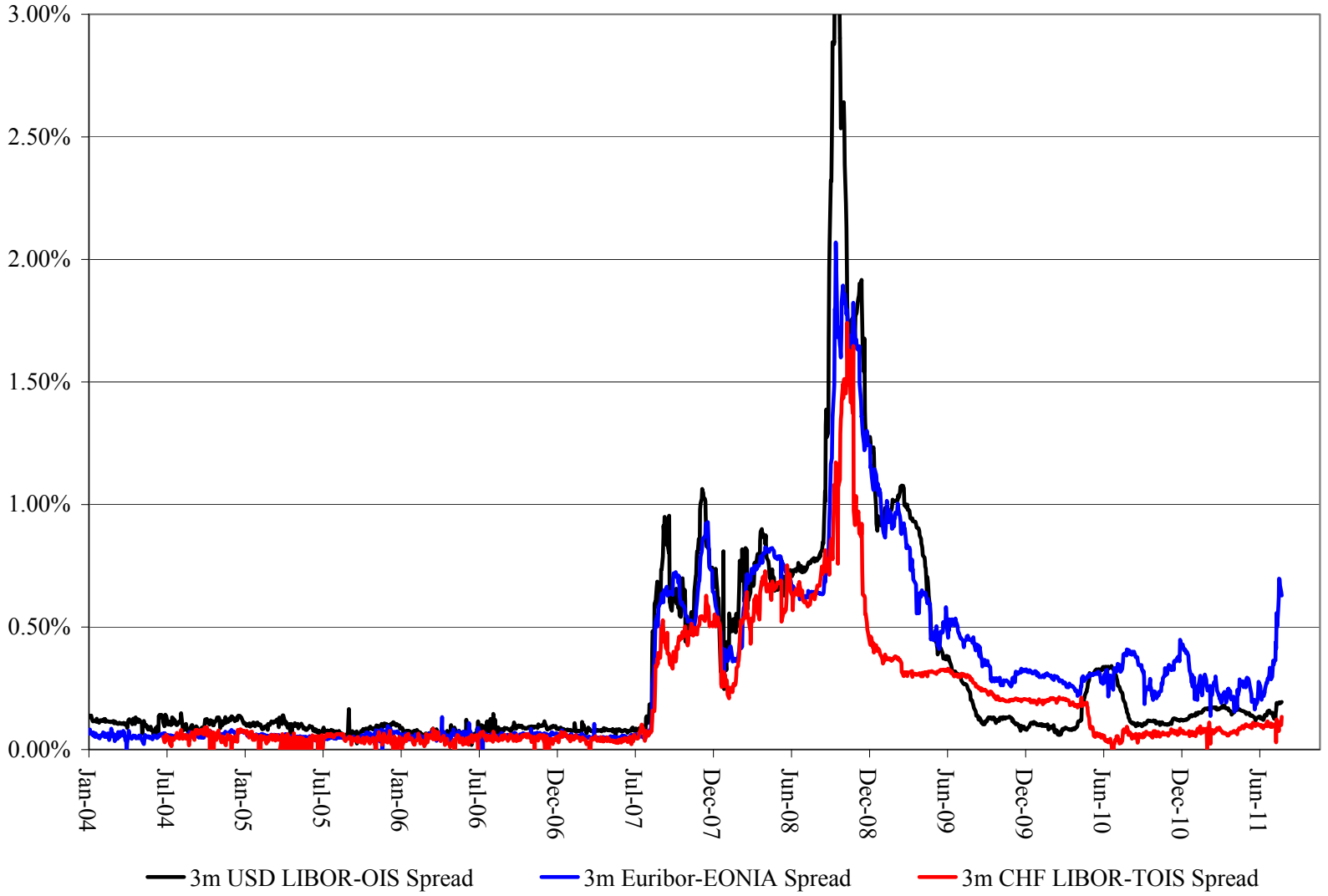
LIBOR represents the costs of borrowing and lending for AA banks, and these banks were viewed as being free of default risk. Interest rate swaps are derivatives on 3m LIBOR, or 6m LIBOR, and are used to extend the term structure of the LIBOR yield curve. The longer term cost of funding for a bank is typically greater than LIBOR/Swap.

A market has developed in swaps on the overnight interest rates (OIS). The market is now quoting and trading swaps on the US Fed funds rate out to 10 years, and swaps on EONIA out to 30 years. The alternative view is that discounting should be based on yield curves constructed from the overnight interest rates.

OIS rates can be viewed as risk-free rates.

If LIBOR and OIS rates are close, then the differences in discounting will not be significant. Since 2007, the differences have been large.

Historical Graph of LIBOR-OIS Spreads



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Derivatives Valuation

r - the risk-free rate at which a bank can borrow or lend

r_c - the interest rate paid on the collateral

$X(T)$ - the cashflow or payoff on a derivative at time T, then

$$V(0) = \hat{E}_0\left(e^{-\int_0^T r(u)du} \, g(X(T)) \right) + \hat{E}_0\left(\int_0^T e^{-\int_0^s r(u)du} \, V(s)\,[r(s) - r_c(s)]\,ds \right)$$

$$= \hat{E}_0\left(e^{-\int_0^T r_c(u)du} \, g(X(T)) \right)$$

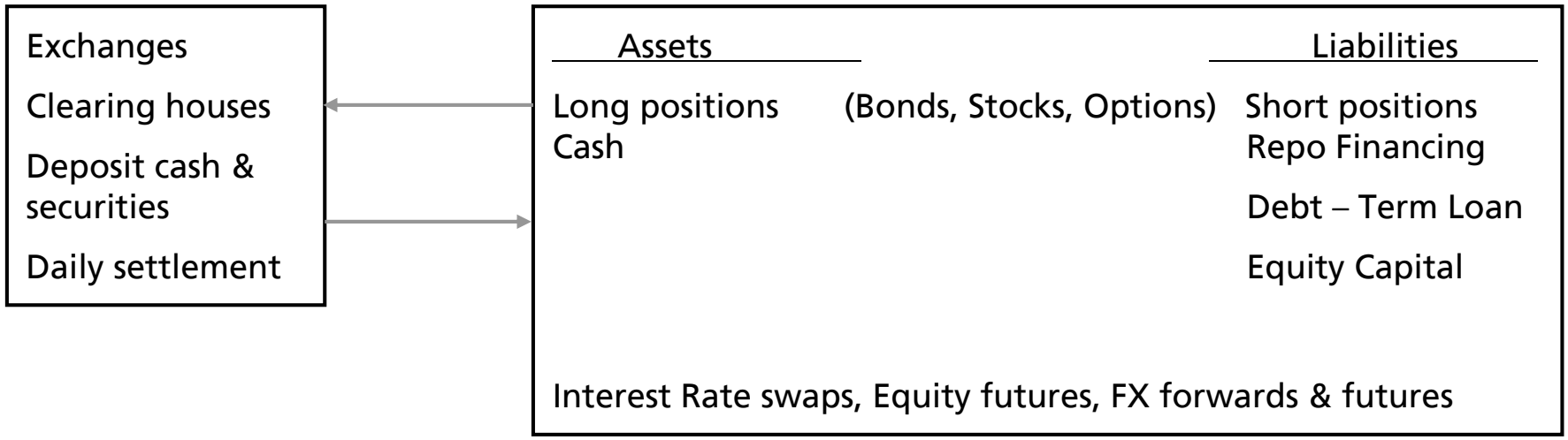
In words, if the collateral amount each day in the future is equal to the value of the trade and the overnight rate is paid on collateral every day, then discounting the trade cashflows with the collateral rate produces the correct valuation, even though the collateral rate may differ from the risk-free rate. [see Johannes & Sundaresan (2007)]

Funding Example – A Simple Trading Firm

Consider a small trading firm that raises equity capital from partners

The firm establishes trading relationships with a broker to execute trades that are cleared through exchanges and clearing houses.

There are initial margin requirements.



Funding Example – A Simple Trading Firm

The firm receives interest and dividends on long positions in bonds and stocks.

It pays interest on repo financing and debt financing. It has P&L on the trading positions, which are marked to the market every day. Trading positions can be funded directly (via repo and margin loans). The term loan represents another form of financing with an interest cost.

The partner's equity capital has a cost, also known as the required rate of return. The actual rate of return on equity capital can be measured for each accounting period (monthly, quarterly, or annually).

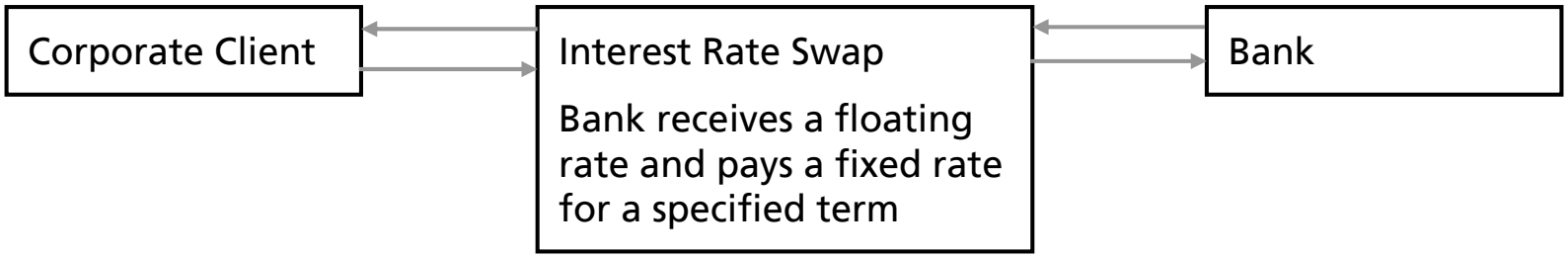
All of the trading positions for this Firm are marked by the exchanges and the clearing houses. Valuations for the bonds and stocks are based on market price quotes.

The valuation for interest rate swaps will be based on OIS discounting, calculated by the clearing house (LCH – London Clearing House).

Main point: The cost of funding has an impact on P&L for the trading firm, but not on the valuation of its positions.

2nd Example – A Banking Institution

A banking institution can engage in all of the trading activities of the small trading firm. In addition, it will accept deposits from customers, arrange loans, and structure derivatives for clients. Corporate clients typically enter into derivative transactions with banks on a uncollateralized basis. Hence, the bank must take the credit risk of its corporate clients.



The credit exposure in a derivative is two sided. To value the trade, one must consider the credit and default risk of both counterparties. See Duffie & Huang (1995).

Banks do account for the credit risk in the valuation of the trade. The adjustments for the credit risks of both counterparties are known as the credit valuation adjustment, or CVA.

The CVA is computed on a portfolio basis, using risk neutral default probabilities extracted from CDS spreads.

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2nd Example – A Banking Institution

Discount rate for valuation?

The bank must fund the cashflows of the uncollateralized derivative.

Consider the case of an uncollateralized interest rate swap when the bank hedges the market risk with an offsetting position in a collateralized interest rate swap.

Case 1: the swap goes in-the-money for the uncollateralized counterparty. The NPV is negative for the bank. This is offset by a positive NPV for the bank on the collateralized swap and the bank receives cash collateral. The bank pays the overnight rate on the cash collateral. Cashflows from the collateralized swap can be used to meet cash payments on the uncollateralized swap. The funding cost is the overnight interest rate.

Case 2: (the reverse) the swap goes out-of-the-money for the uncollateralized counter-party. The NPV is positive for the bank. This is offset by a negative NPV for the bank on the collateralized swap and the bank must pay cash to the clearing house. The bank receives the overnight rate on the cash collateral. Cashflows from the uncollateralized swap can be used to meet cash payments on the collateralized swap. The bank uses its funding sources to raise the cash required for the collateralized swap. What is the bank's cost of funding?

Funding Impact on a Banking Institution

What is the bank's cost of funding? Cost of debt and cost of equity capital?

Should we incorporate the bank's cost of debt in the discounting for the uncollateralized derivative?

The accounting concept of fair value dictates that we base the valuation on an estimate of the value that could be obtained by selling the claim in the market.

There is risk inherent in the management of counterparty exposure associated with uncollateralized derivative trades. (There is no static or dynamic hedge that will eliminate all of the risk. This is not the dynamic hedge of the Black-Scholes model.)

Counterparty credit risk impacts the bank's capital requirements.

References

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