

Swap Spreads: 2010¹

Among the many financial relationships that were thrown out of whack during the market turmoil of 2007-2009 was the so-called swap spread. A measure of the difference between risky and riskless interest rates, this quantity paradoxically got *smaller* during the crisis even as other such measures ballooned to historically unprecedented levels. (See Exhibit B.) Indeed, the situation turned from strange to stranger in the 4th quarter of 2008 when the 30-year swap spread turned *negative*. Taken at face value, this would seem to imply that somehow the U.S. government had become more risky than the large commercial banks, many of whom were seemingly tottering on the brink of default.

News reports remarked on the curiosity at the time. But with so many other market indicators pointing to widespread disruption, this particular anomaly was hardly the center of attention. Moreover, commentators seemingly felt that, in the general climate of market breakdowns, negative swap spreads could simply be explained by “selling pressure”, “hedging activity,” and a general “absence of liquidity”.²

Then another funny thing happened. As markets rebounded and panic subsided through 2009 and 2010, swap spreads *stayed negative*. Evidently the negative values were not merely some transient disequilibrium fluke made possible only because the underlying markets were not functioning.

At this point, with the underlying markets working as normal, the interpretation of the negative spreads moved from a matter of intellectual curiosity to one of serious investment opportunity. For, not only should swap spreads be positive intuitively, but, under text book conditions, negative swap spread should imply arbitrage.

In the Summer of 2010, **Malcolm Xi** was promoted to manager of U.S. fixed-income trading at GIC Asset Management, a Singapore sovereign wealth fund.³ Xi had been following the swap spread situation closely for the last several years, and had been paying close attention to the functioning of the associated markets that would be required to engage in an arbitrage-type transaction. With major resources available and the authority to execute, Xi carefully considered whether this was the right time to strike.

¹This case was prepared By Professor Tim Johnson with the assistance of Mo Liang for class discussion and analysis. The characters depicted are fictional. ©Tim Johnson 2011.

²Swap spreads in other OECD countries also became negative during this period.

³GIC, the Government of Singapore Investment Corporation manages portfolio assets of over USD 250 billion for the government of Singapore and the Monetary Authority of Singapore. It is estimated to be the third largest sovereign wealth fund in the world. See www.gic.com.sg.

Swap Spreads and Credit Spreads

The “swap spread” is simply defined as the difference between the LIBOR swap rate to a particular horizon and the yield-to-maturity of government bonds of the same horizon. The former component is defined as the fixed rate to be paid (typically semi-annually) in exchange for quarterly floating-rate payments equal to the LIBOR rate, reset every 90 days. The LIBOR rate, in turn, is the interbank interest rate available on dollar deposits between money center banks in London. As such, it is a risky interest rate, reflecting the credit spread of the quoting banks.

Mathematically, it is straightforward to show that the swap rate should also be equal to the yield-to-maturity (or coupon rate) on a hypothetical par bond of the same credit grade of a LIBOR-rated entity.⁴ So the swap spread can be viewed as the yield differential between comparable bank and government bonds. As such, a negative value implies that government debt is somehow being viewed as riskier than that of the banks.⁵

The absurdity of that proposition was strongly underscored during the financial crisis when the cost of insuring bank debt against default reached unprecedented highs. Indeed, much of the crisis management undertaken by U.S. authorities consisted – implicitly and explicitly – of steps to enhance bank credit with government guarantees. Of course, such steps would be meaningless (and ineffective) if somehow the banks were already safer than the government.⁶

At the short end of the yield curve swaps spreads remained positive. In effect, the shortest possible “swap spread” is simply the difference between the current LIBOR rate and 90-day Treasury bills (equivalent to the so-called “TED spread”). This had soared to an all-time high of over 450 basis points (bps) in October 2008, just as swap spreads were going the other direction. (Currently the TED spread was back to a more normal 25bp.) Implicitly, then, the swap spreads were impounding large negative *forward* credit spreads.

⁴The major banks do not typically have such long-term fixed-coupon debt outstanding.

⁵For an interesting discussion of the situation in early 2010 see <http://ftalphaville.ft.com/blog/2010/03/24/185226/the-negative-swap-time-warp/>.

⁶There was also talk in the market of a nefarious possibility: manipulation of LIBOR by the panel of banks whose quotes were used in the determination by the British Bankers Association. Banks could well have an incentive to underreport LIBOR if it raised their perceived safety. Indeed, recent academic studies support this view. See http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1569603. As a practical matter, it would seem hard to believe that this bias could ever be so extreme that LIBOR would be reported below Treasury rates.

Arbitrage Mechanics

To bet that LIBOR would never fall below equivalent government bond interest rates, the obvious trade to do would be to enter in to a 30-year LIBOR swap to pay fixed and receive floating interest payments, and then simply buy 30-year government bonds whose fixed coupons would offset the fixed obligation of the swap. The text-book arbitrage would then be to finance the long bond position by taking rolling short positions in 3-month T-bills. That way, every 90 days you could receive LIBOR and pay the T-bill rate on the same notional principle amount. In that case, the trade would be a winner on *both* legs. You'd get the difference in fixed rates *plus* the LIBOR/T-bill spread.

Now in practice, the financing wouldn't quite work like that. You could readily finance a long position in the 30-year bond via the repo market, which required, in effect, posting the bond as collateral for an overnight loan. Likewise shorting 3-month T-bills would require borrowing them via a reverse repo. The repo markets for Treasury debt were deep and liquid. But putting the long and short trades together like this would still require paying the bid/ask spread in the repo market every day. Ideally, you would like to be able to enter into a 3-month term-repo for your long bond position, i.e., lock-in a single rate each quarter. But such long-dated repo transactions were generally not available.

On the other hand, what's wrong with just rolling overnight financing? The overnight repo rate closely tracks the effective Fed funds rate, and hence was currently almost as low as the 3-month T-bill rate. So the floating rate side would continue to also offer positive carry.⁷ Moreover, another hedging instrument was available precisely to deal with the risk that the overnight financing rate would be volatile: an overnight index swap. An OIS was just a short term swap (e.g., 3-month) in which the floating rate was the *daily* Fed funds rate. Currently, for example, the 3-month OIS rate was 17bp. Hence, the owner of a bond position could finance it in the repo market, pay the repo rate, receive the floating side of an OIS, and lock in a 3-month carry cost of 17bp, very close to the 3-month T-bill rate.

A last feature of the repo market was so-called haircuts. Even on overnight loans collateralized by government bonds, there was some credit risk, which the market dealt with by requiring a certain amount of overcollateralization. In particular, the standard was a 2% haircut, meaning that only \$980,000 would be loaned against a bond whose market value was \$1 million. Of course, the loan amount would also change from one day to the next as the bond price moved. The haircut amount would have to be met by equity capital. While this is a costly commitment, Xi noted that the 2% standard haircut was not itself risky for overnight Treasury bond repos: it had not increased even at the height of the financial

⁷In fact, a new on-the-run 30-year bond would often be "on special", meaning the repo rate might even be lower than the regular rate for general collateral. Specialness typically lasted only a few weeks however.

crisis.⁸

So much for the financing. But what about the market risks of the positions? The 30-year interest rate swap would clearly become more or less valuable depending on the overall level of interest rates. In particular, the fixed payor would lose if the floating rate declined. However, under that scenario the value of a long position in Treasury bonds would increase. In theory, the two exposures were almost perfectly off-set. If B_{t,T_i} represents the present value at t of a dollar received at T_i , then the change in the value of the fixed payor's swap at fixed-rate s from one day to the next can be written

$$s \sum_{i=1}^N (B_{t,T_i} - B_{t+1,T_i}) + (B_{t,T_N} - B_{t+1,T_N}). \quad (1)$$

And this is also equal to the change in value of a coupon bond with coupon rate s . This suggests that the arbitrage position is hedged against interest rate risk.

But two important questions arise about this analysis.

First, do the economic gains and losses that each side of the position may experience actually correspond to *cash-flows* that may need to be funded? In other words, are the positions actually marked-to-market? If one side is and the other isn't, that could create a funding risk.

In fact, the repo financing of the long bond position would effectively mark that position to market. Every day the value of the loan would equal the value of the collateral. Hence any gains in the bond value would yield immediate cash inflows.

For the swap position, the cash flows depended on the details of how the trade was cleared. GIC could rely on any of several clearing banks to hold custody of its over-the-counter swap trades, and details of the marking-to-market could differ among them and would also depend on what arrangements were made with the swap counterparty.

The simplest option would be to exploit the interbank swap clearing facility **SwapClear**, a subsidiary of LCH.Clearnet.⁹ SwapClear would, in fact, mark the position to market daily using a version of the formula (1) above, thus very nearly off-setting the cash-flows from the repo refinancing. Also importantly, using SwapClear would eliminate the credit risk of the swap counterparty.¹⁰

The second crucial question about the market risk analysis is whether hedging the interest

⁸See "How debt markets have malfunctioned in the crisis", by Arvind Krishnamurthy, *Journal of Economic Perspectives*, (2010) v24, n1, pp 3-28.

⁹See http://www.lchclearnet.com/swaps/swapclear_for_clients/default.asp.

¹⁰There would remain some credit risk of LCH.Clearnet itself. But it had an extremely strong capital position, as well as options to draw further on its members' capital in a crisis. Moreover, with daily marking-to-market, the credit risk was limited to a single day's change in value of the swap.

rate risk was sufficient. After all, there were really *two* term structures of interest rates here, LIBOR rates and government rates, and the opportunity presented by the trade under consideration had arisen precisely because the two might move in very different ways.¹¹ Or, put another way, what if the swap spreads got *even more negative*? If markets can get out of line, then they can always get more out of line.

GIC was a long-term investor with plenty of capital. It was important to keep in mind that adverse changes in the swap spread would not affect the actual cash-flows from the original trade (the bond or the swap) which could be held to maturity. The trade would make money as long as, every quarter, the actual realized value of LIBOR was higher than the bond funding cost (the OIS rate). For example, suppose the 30-year yield was unchanged but the 30-year swap rate declined another 40bp after having put the trade on. Then the mark-to-market outflow would just add to the positive cash-flows in the future since the swap rate had to eventually converge to the LIBOR rate (albeit not completely for 29 3/4 years). But there seemed to be no way to do the trade without some exposure to short-term pain.

Were there other risks lurking in this potential transaction? What about a sovereign debt crisis? If the U.S. government could not pay its debts (and the Federal Reserve refused to finance its needs) then a re-scheduling of outstanding obligations was not out of the realm of possibility. This would not necessarily cause all other financial institutions to default. But it could certainly lead to much legal uncertainty for many contracts. Did this risk have anything to do with the negative swap spreads?

The Decision

It was Friday, August 13, 2010 and the New York markets were about to open. It was late evening in Singapore, and Malcolm Xi needed to issue instructions to his traders before his day would be over.

The U.S. Treasury had just issued a new 30-year bond, the 3 $\frac{7}{8}$ of 8/15/2040, and it was offered at par. The fixed-rate bid for 30-year LIBOR swaps was 3.445%. Both legs could be done for \$ 1 billion notional amount.

A look at the market monitors showed the other offered-side rates in Exhibit A. (All rates are annualized percentages.) Zero-coupon Treasury STRIPS could also be traded for every quarterly maturity out to 30 years, although bid-ask spreads were much more than

¹¹Mathematically, the discount factors B_{t,T_i} in (1) would be based on LIBOR rates for purposes of marking the swap to market, whereas treasury discount factors would implicitly determine the value of the bond position.

for on-the-run Treasury bonds and notes. Besides these instruments there were also traded futures on 3-month LIBOR (the Eurodollar futures on the CME) which were very liquid out to 10 years.¹²

What, if anything, was the best way to structure this trade?

¹²Less liquid, but also potentially available, were futures on the 30-year swap rate itself, as well as on the OIS rate.

Exhibits

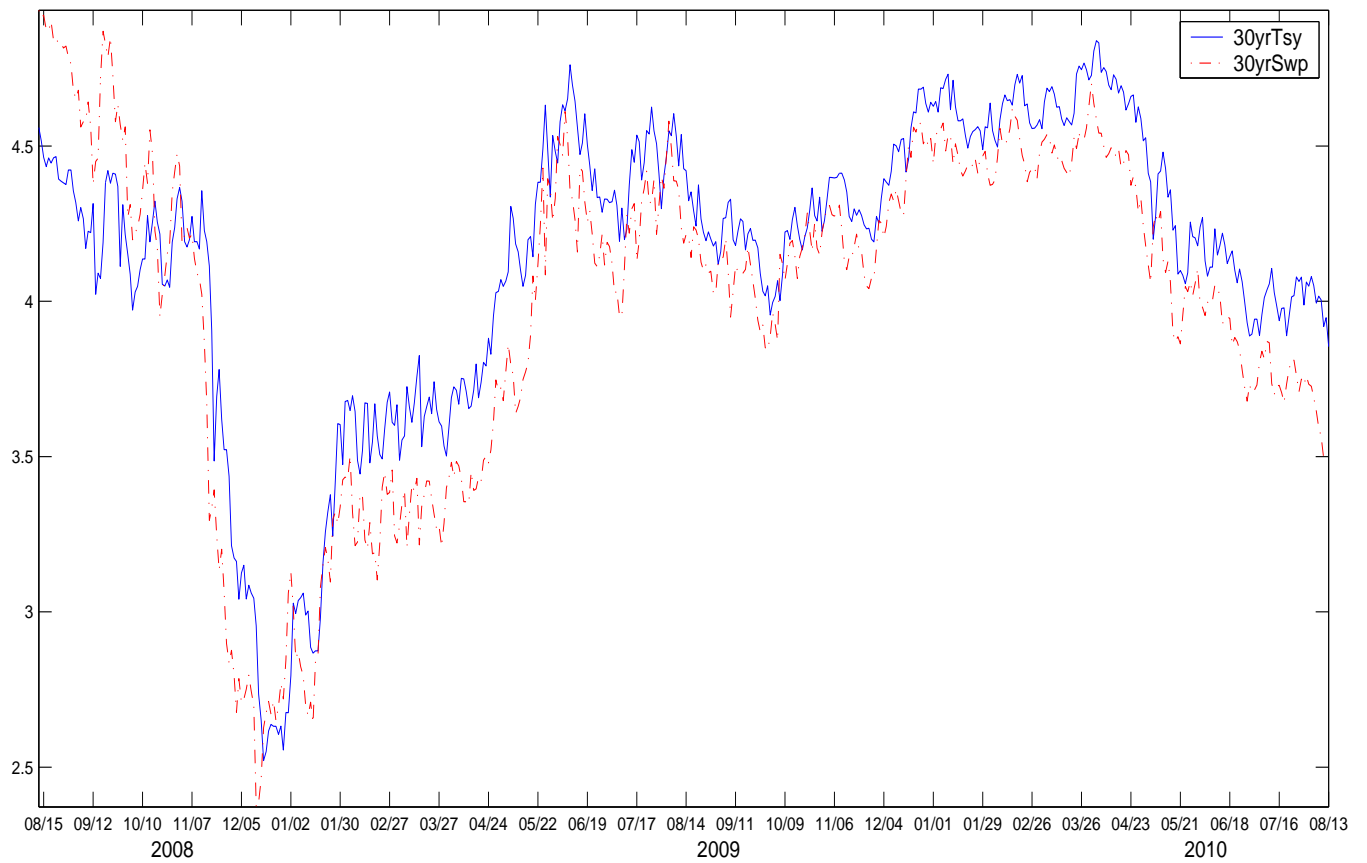
Exhibit A

MARKET RATES - 13 AUGUST, 2010, 8:00AM EST

3-month LIBOR	0.369 %
3-month T-bill	0.145 %
Fed funds (effective)	0.210 %
overnight repo (g/c)	0.225 %
overnight repo (special)	0.175 %
OIS	0.165 %
5-year CDS on JP Morgan Chase	0.990 %
5-year CDS on Goldman Sachs	1.610 %
5-year CDS on U.S.	0.425 %

Exhibit B

TREASURY AND SWAP RATES



Source: Bloomberg

Exhibit C

U.S. GOVERNMENT CREDIT RISK

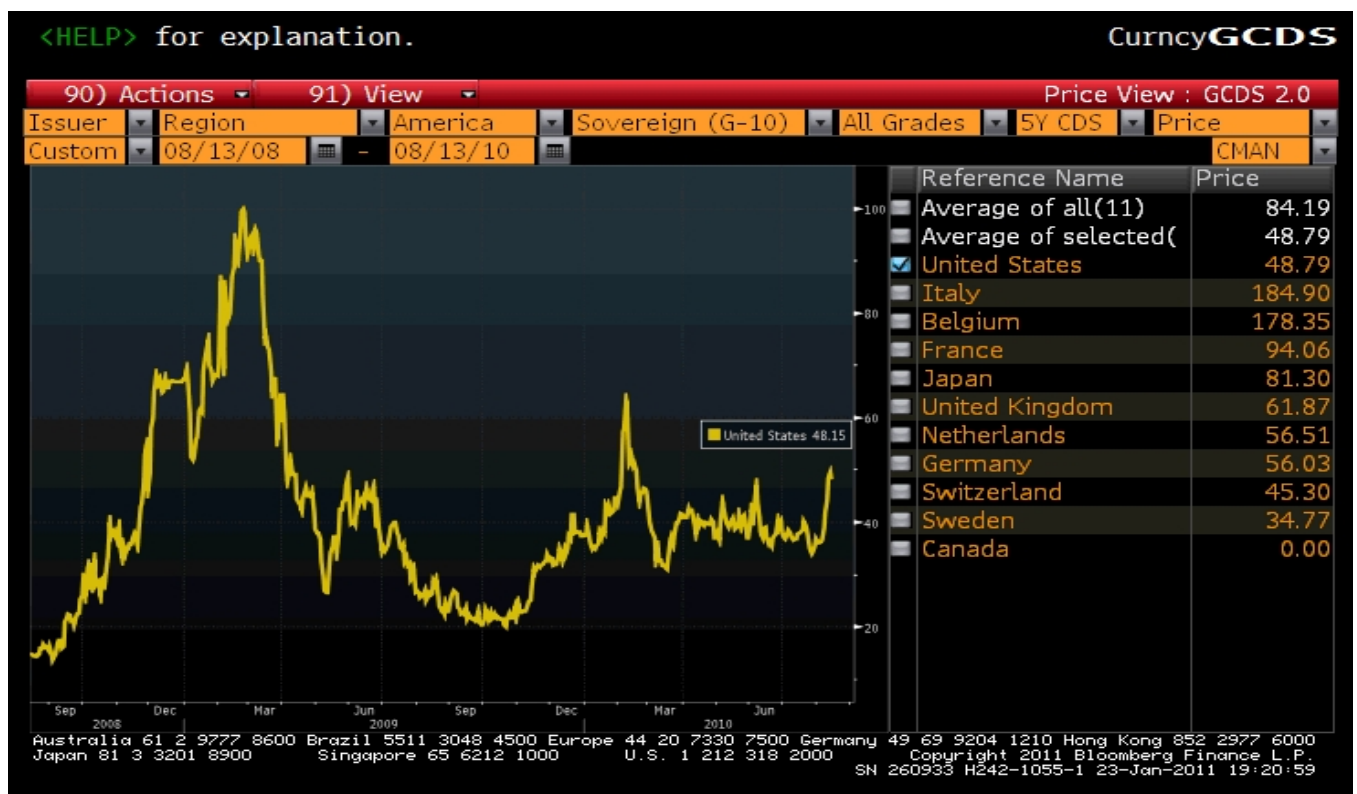


Exhibit D

Spread on 30-Year Interest-Rate Swap Edges Toward Zero Mark

By Liz Capo McCormick - August 6, 2009 13:43 EDT

Aug. 6 (Bloomberg) – The spread between the rate to swap floating for fixed-rate payments for 30 years and the yield on similar maturity Treasuries reached the smallest since June as trading normalizes after the worst credit seizure in decades.

The 30-year swap spread touched minus 7.47 basis points today, the closest to positive since it was negative 5 basis points on June 5. The 30-year swap rate broke a historical pattern in October and dipped below the 30-year Treasury yield for the first time, resulting in a negative swap spread. The move came amid a shortage of arbitrage capital as dealers cleaned up balance sheets and there was hedging related to losses on other derivatives contracts.

The spread has moved closer to zero partly as dealers now have more balance sheet available to hold cheap 30-year bonds, said Carl Lantz, an interest-rate strategist in New York at Credit Suisse Group AG, one of the 18 primary dealers that trade with the Federal Reserve. In addition, hedge funds have the appetite and ability to put on convergence trades while investors such as insurance companies that typically receive fixed in long-end swaps are using other alternatives.

The 30-year swap spread touched negative 61.75 basis points on Nov. 21. It averaged positive 44.16 for the five years prior to August 2007, when the collapse of the subprime mortgage market began. The subsequent seizure in credit markets triggered \$1.54 trillion of writedowns and credit losses at the worlds biggest banks and financial institutions and pushed the global economy into its first recession since World War II.

Normalization

Swap rates are usually higher than Treasury yields in part because the floating payments are based on interest rates that contain credit risk, such as the London interbank offered rate, or Libor. Swap rates serve as benchmarks for investors in many types of debt, including mortgage-backed and auto-loan securities. A basis point is 0.01 percentage point.

The 30-year swap spreads move toward positive territory signals a normalization after flows had distorted the level following the bankruptcy of Lehman Brothers Holdings Inc. on Sept. 15, said Charles Diebel, head of European fixed-income strategy at Nomura International Plc in London.

Given the amount of longer-term Treasuries the government is expected to issue and the natural tendency for investors to pay fixed in 30-year swaps, the 30-year swap spread isnt

likely to make much headway into positive territory, Credit Suisses Lantz said.

Treasury Auctions

The Treasury plans to sell a record \$75 billion in its quarterly auctions of debt next week. It will auction \$37 billion in three-year notes on Aug. 11, \$23 billion in 10-year notes Aug. 12 and \$15 billion in 30-year bonds Aug. 13.

Swap spreads were mixed today across maturities amid steady Treasury yields before a report tomorrow forecast to show employers cut jobs last month at a slower pace than in June and as the U.S. prepared for next weeks note and bond auctions.

The two-year swap spread narrowed 0.12 basis point to 44.25 basis points. The spread is based in part on expectations for changes in Libor and is used as a gauge of investor perceptions of credit risk. The five-year swap spread widened 0.5 basis point to 43.5 basis points today. The 10-year spread was 28.3 basis points, compared with 27 yesterday.

Three-month dollar Libor fell for a 10th day, to 0.464 percent from 0.468 percent yesterday, according to the British Bankers Association.

Libor-OIS

The Libor-OIS spread, a gauge of demand for cash and banks willingness to lend, was little changed at 27 basis points. The Libor-OIS figures quoted in contracts traded in the forward market were mixed. The so-called FRA/OIS spread priced to June 2010 was 31.42 basis points from 30.93 basis points yesterday, and the spread priced to June 2011 was at 25.5 basis points, unchanged, according to data compiled by Tullett Prebon Plc.

Implied yields on Eurodollar futures, the worlds most actively traded contract and a driver of movements in swap rates, were mixed. Traders also use Eurodollar futures to make bets on changes in the Feds target rate for overnight loans between banks. The Feds benchmark rate has remained in a range of zero to 0.25 percent since December.

The December 2009 contract yield was 0.75 percent, unchanged, while the implied yield on the December 2011 contract was down 3.5 basis points to 3.69 percent. Movements in implied yields, which are calculated by subtracting the quoted price from 100, give traders bets on where three-month dollar Libor will trade in the future.