Interest Rate Swaps

Financial Markets, Day 3, Class 4

Jun Pan

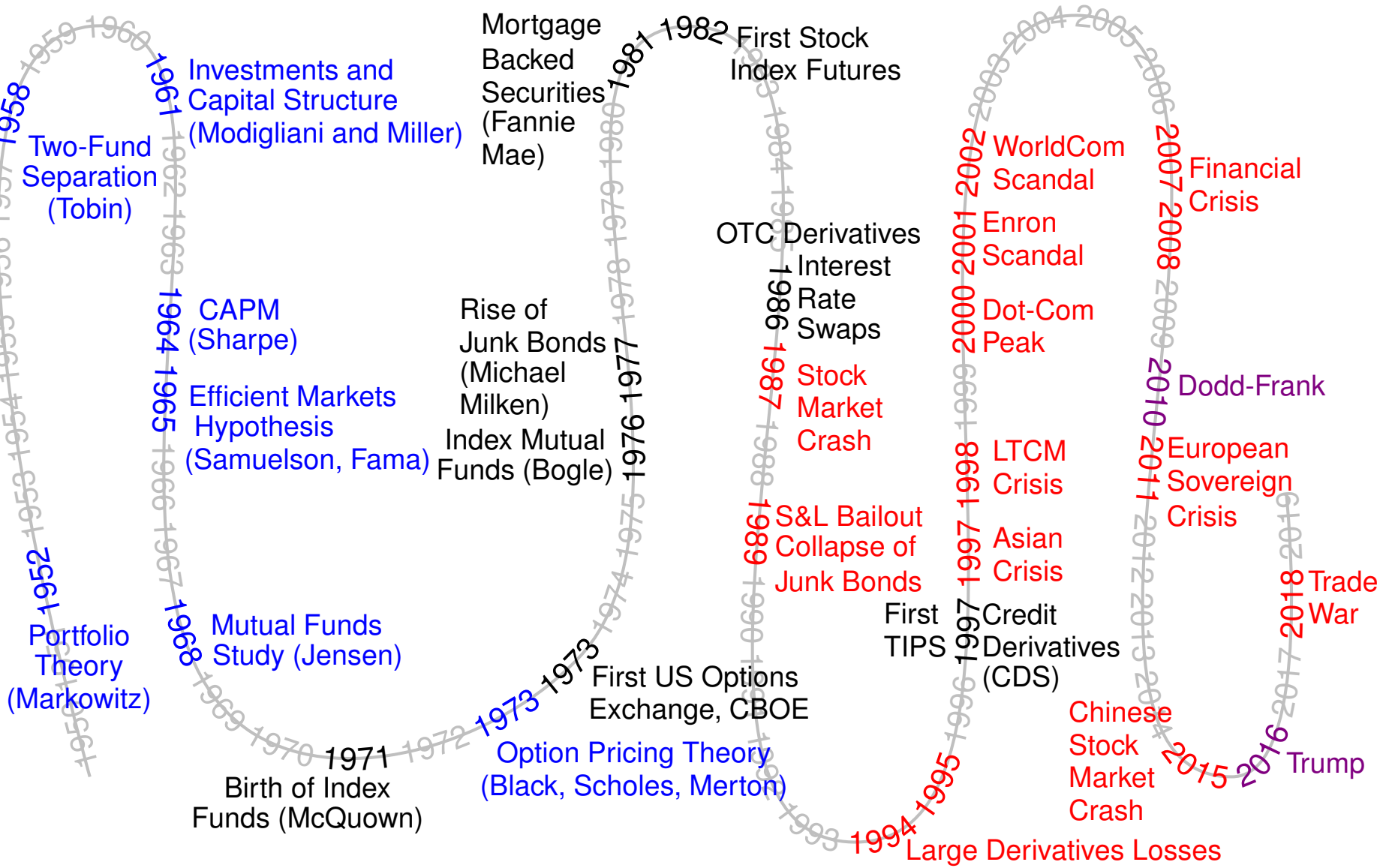
Shanghai Advanced Institute of Finance (SAIF)
Shanghai Jiao Tong University

April 20, 2019

Outline

- Pricing of Interest-Rate Swaps.
- Using Interest-Rate Swaps.
- OTC Derivatives.

Modern Finance



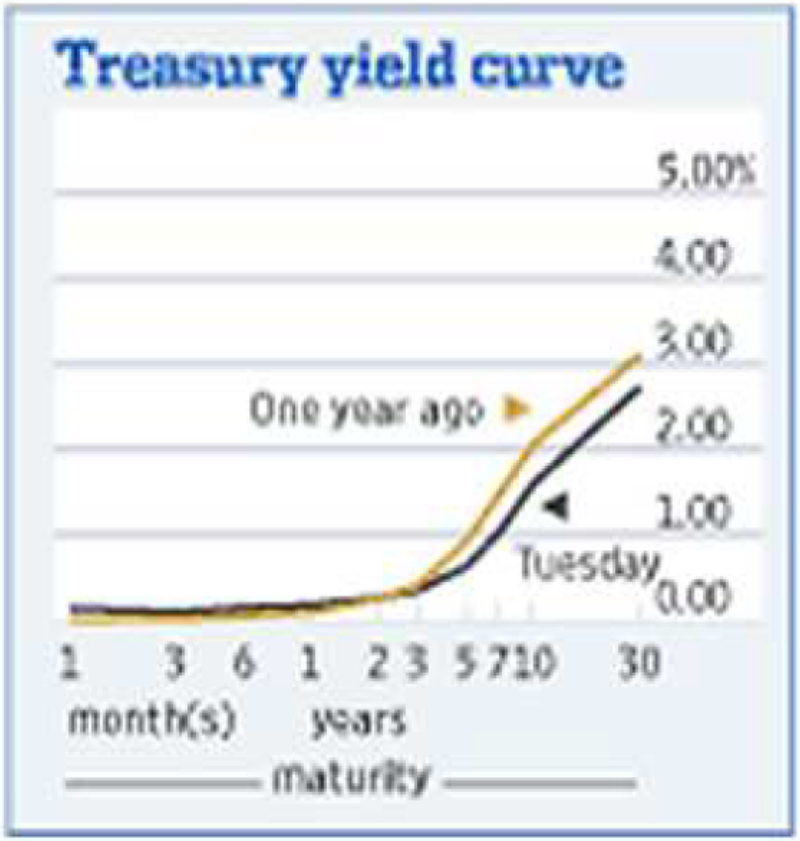
Interest Rate Swap

Ticker: DES

Benchmarked against USD 3m Libor
- Quarterly
- ACT / 360

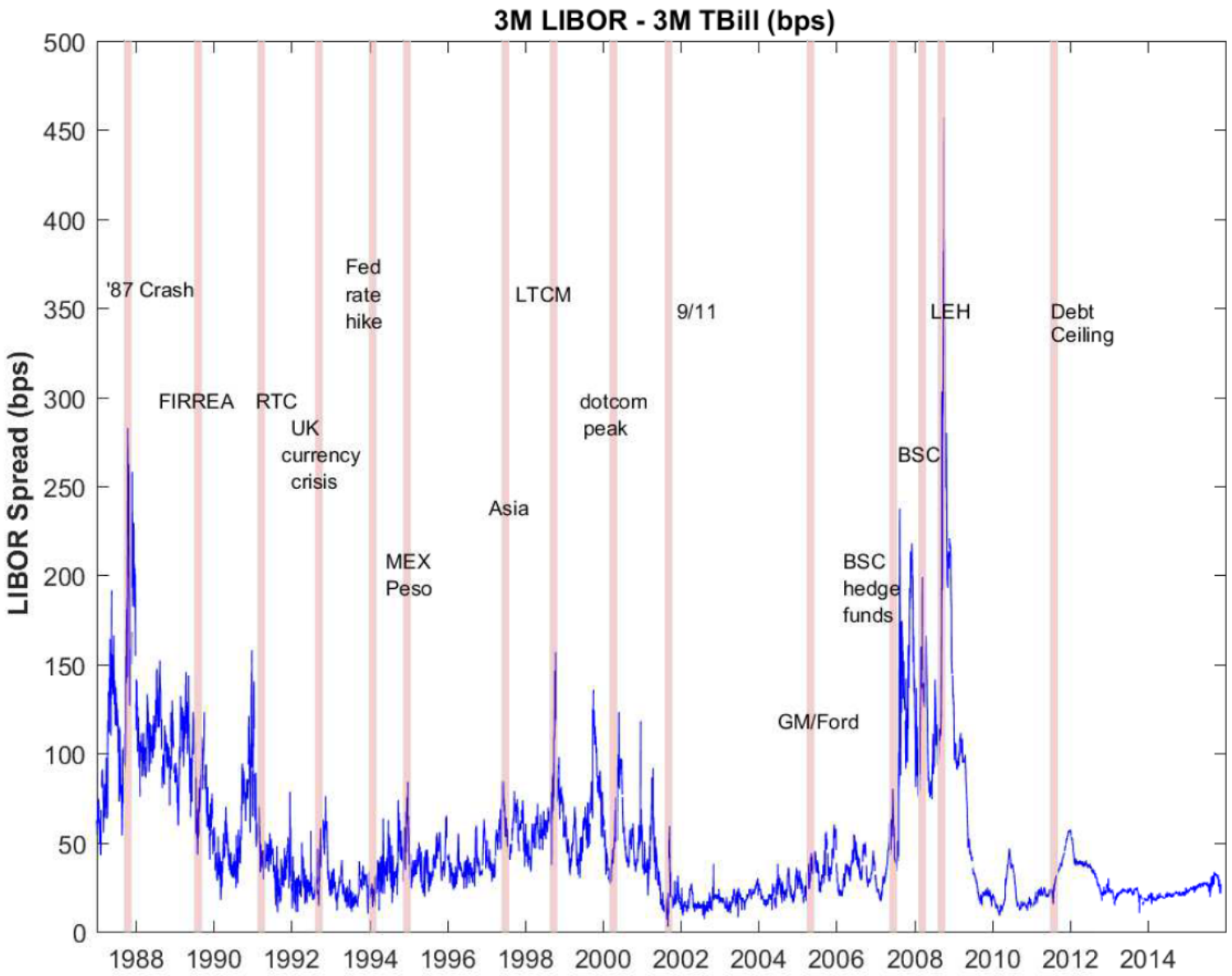
5Y Swap Rate: 2.417% (p.a.)
- Semi-Annual
- 30/360

Treasury and Swap Curves, November 13, 2012

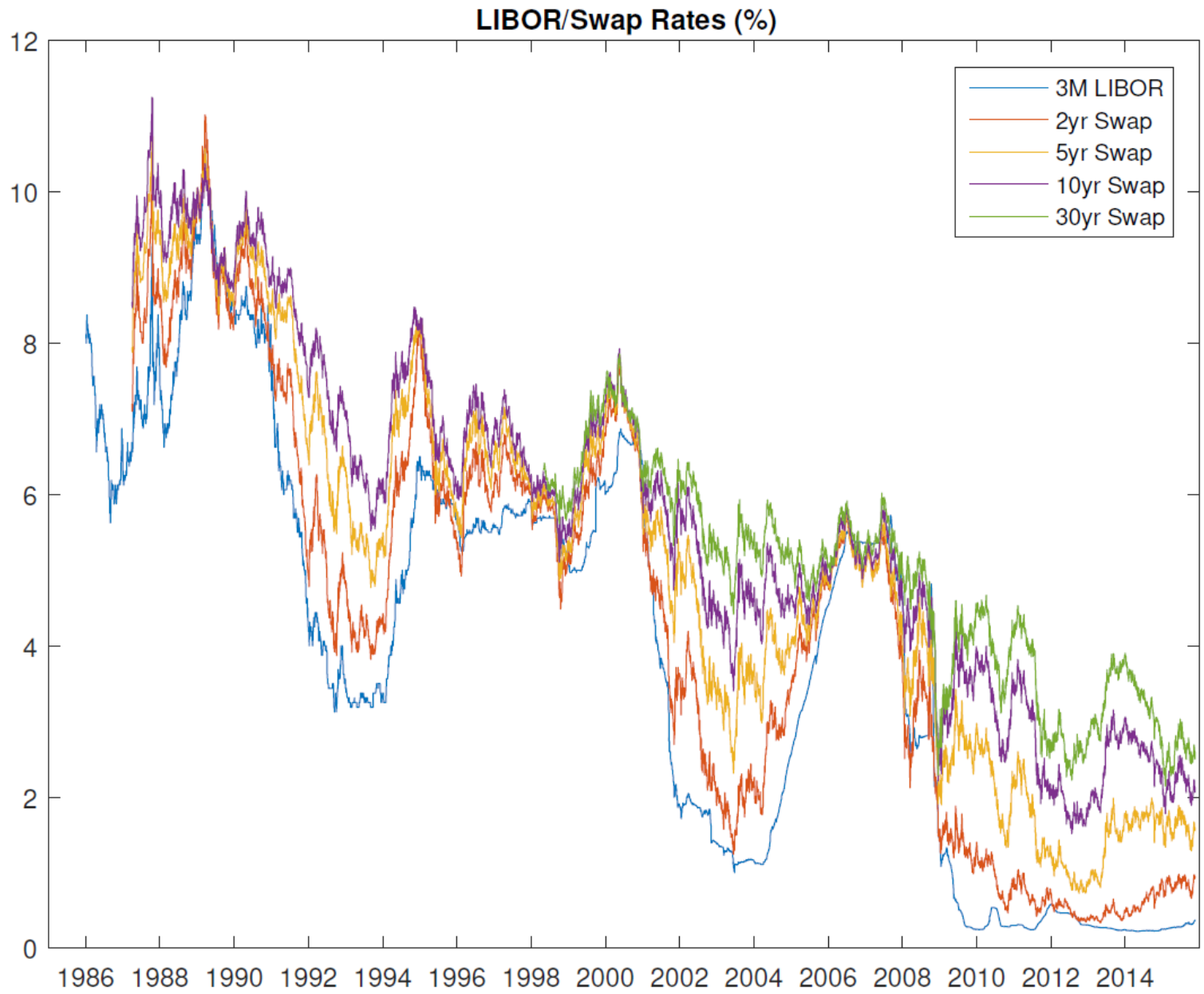


Treasury and Swap Curves, April 2007

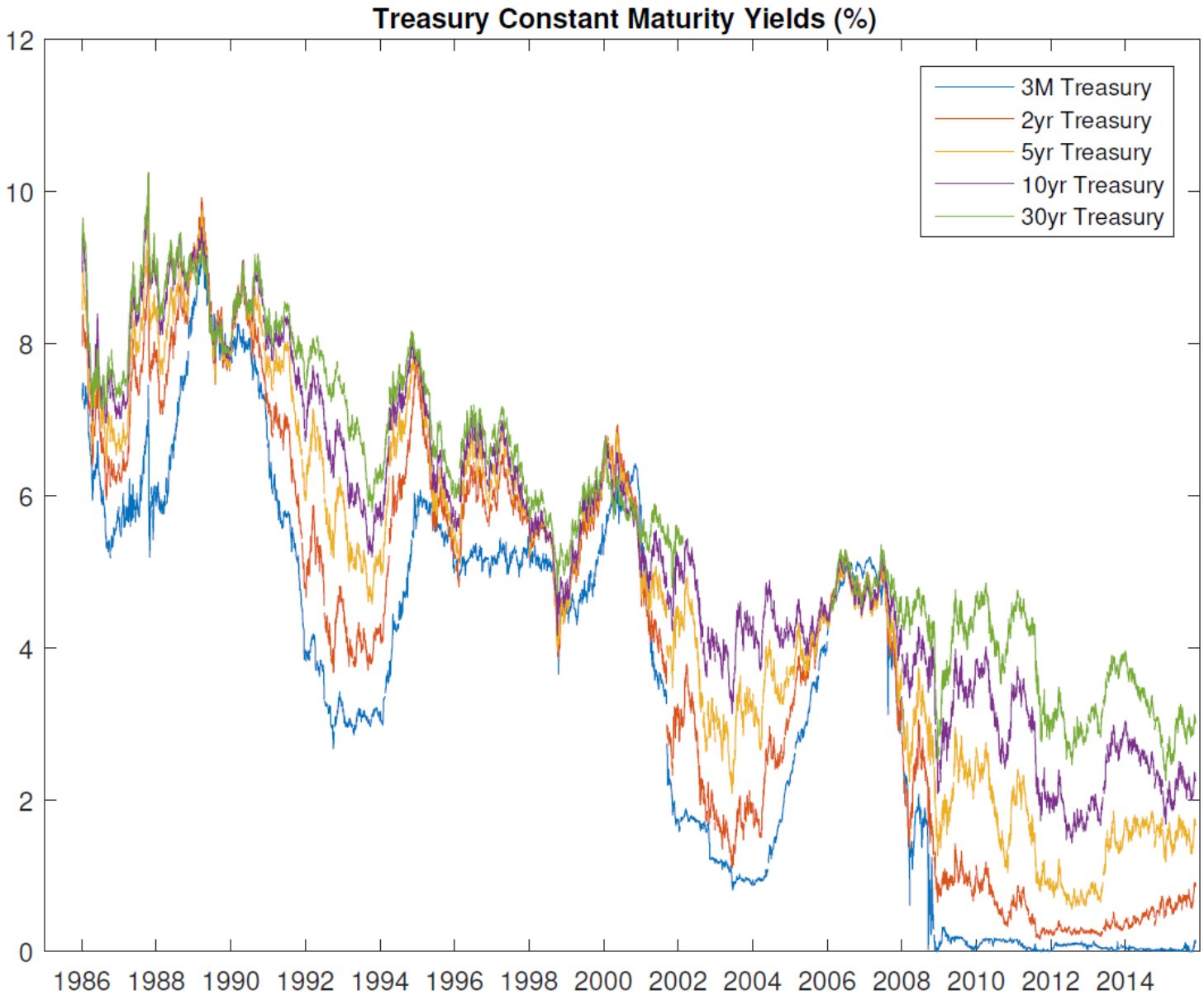
LIBOR Spread



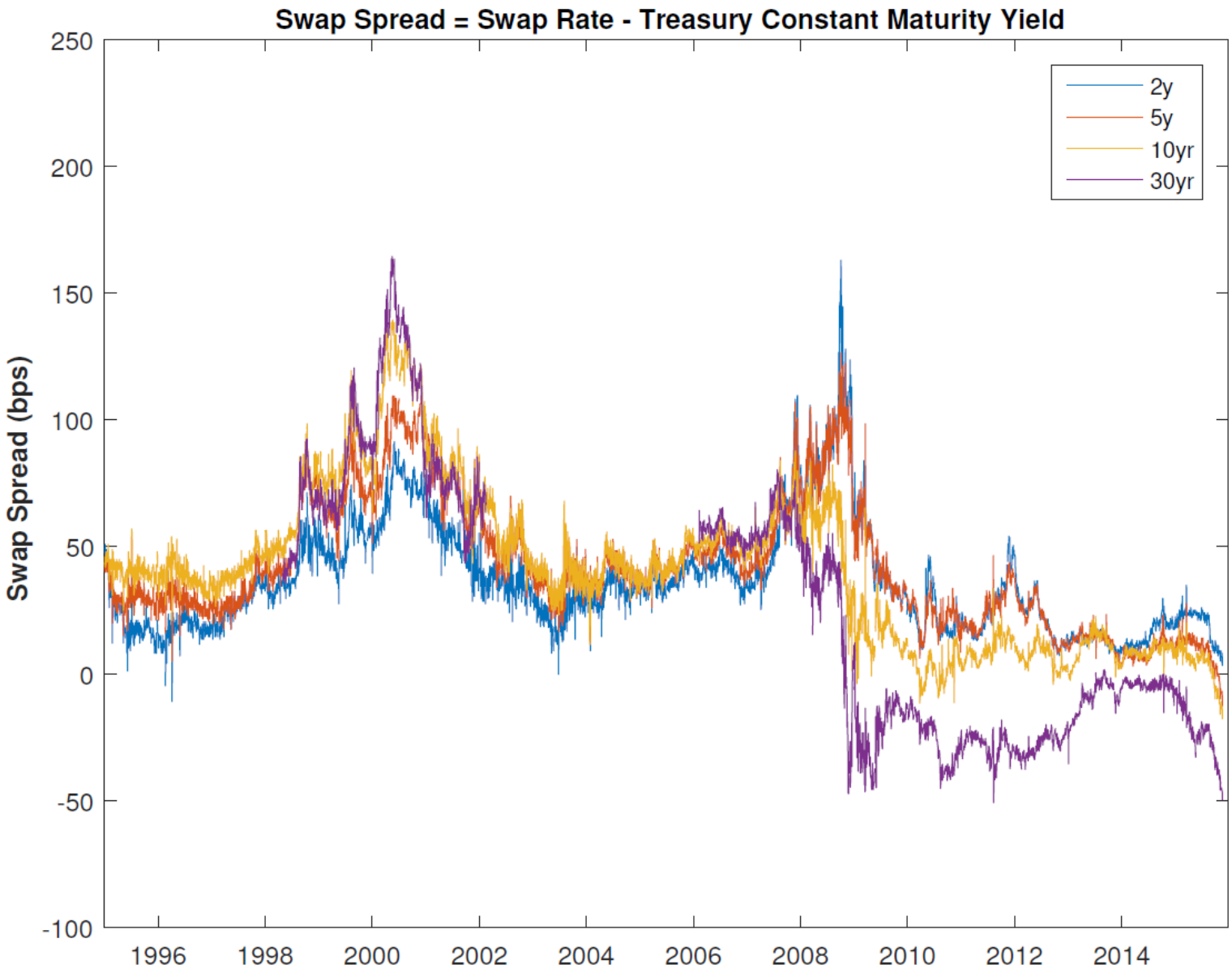
Swap Curve


LIBOR/Swap Rates (%)
3M LIBOR
2yr Swap
5yr Swap
10yr Swap
30yr Swap
12
10
8
6
4
2
0
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

Treasury Curve



Swap Spread


Swap Spread = Swap Rate - Treasury Constant Maturity Yield
Swap Spread (bps)
250
200
150
100
50
0
-50
-100
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2y
5y
10yr
30yr

Exposure to counterparty risk

- At inception swaps have no value. The counterparty for which the swap value becomes positive has a credit exposure on the other counterparty equal to the value of the swap.
- The practice of posting collateral are used to limit the potential counterparty credit risk. Marked to the market on a regular basis (monthly or even daily between swap dealers), the counterparty with a negative value has to deliver an amount in collateral (most usually cash or Treasury bonds) proportional to the value of the swap.
- Most participants in the market and dealer banks have minimum rating requirements for their counterparties. Weaker counterparties would be denied access to the swap market or experience very tight collateral requirements. The collateral requirements are normally tightened in the event of a downgrading.

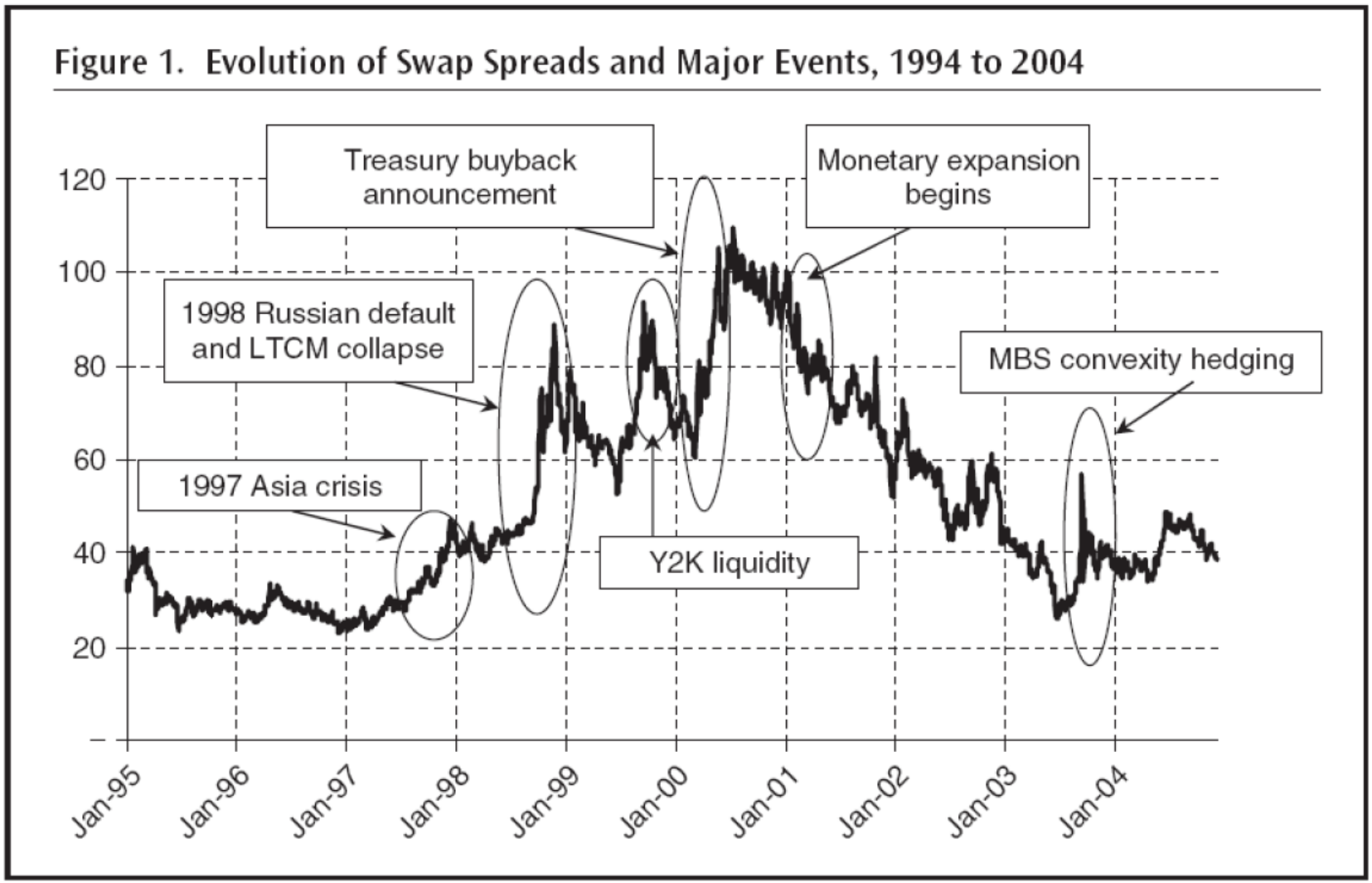
Swap spreads: Swap Rate - Treasury Rate

What are the possible determinants of the Swap Spreads?

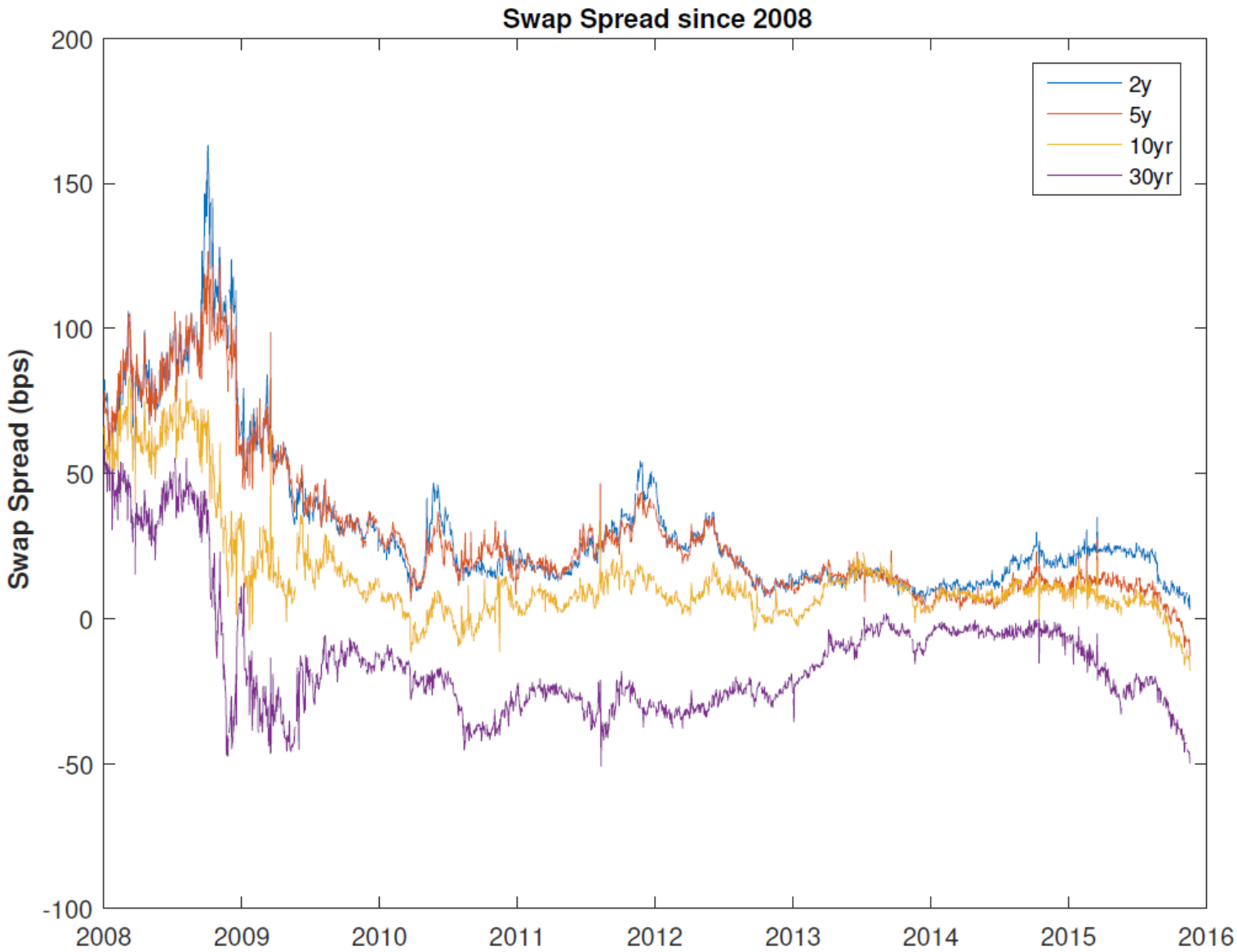
- Treasury supply
- Counterparty risk
- Credit risk
  - The spread of three-month LIBOR (unsecured borrowing) over three-month general collateral term repo (secured borrowing).
  - The AA credit spreads
- Liquidity convenience yield of treasury bonds
  - On-off-the-run treasury bond yield differential
- Mortgage backed securities (MBS) and hedging activities

Swap spread = swap rate - yield of on-the-run treasury:

Swap spread = swap rate - yield of on-the-run treasury:



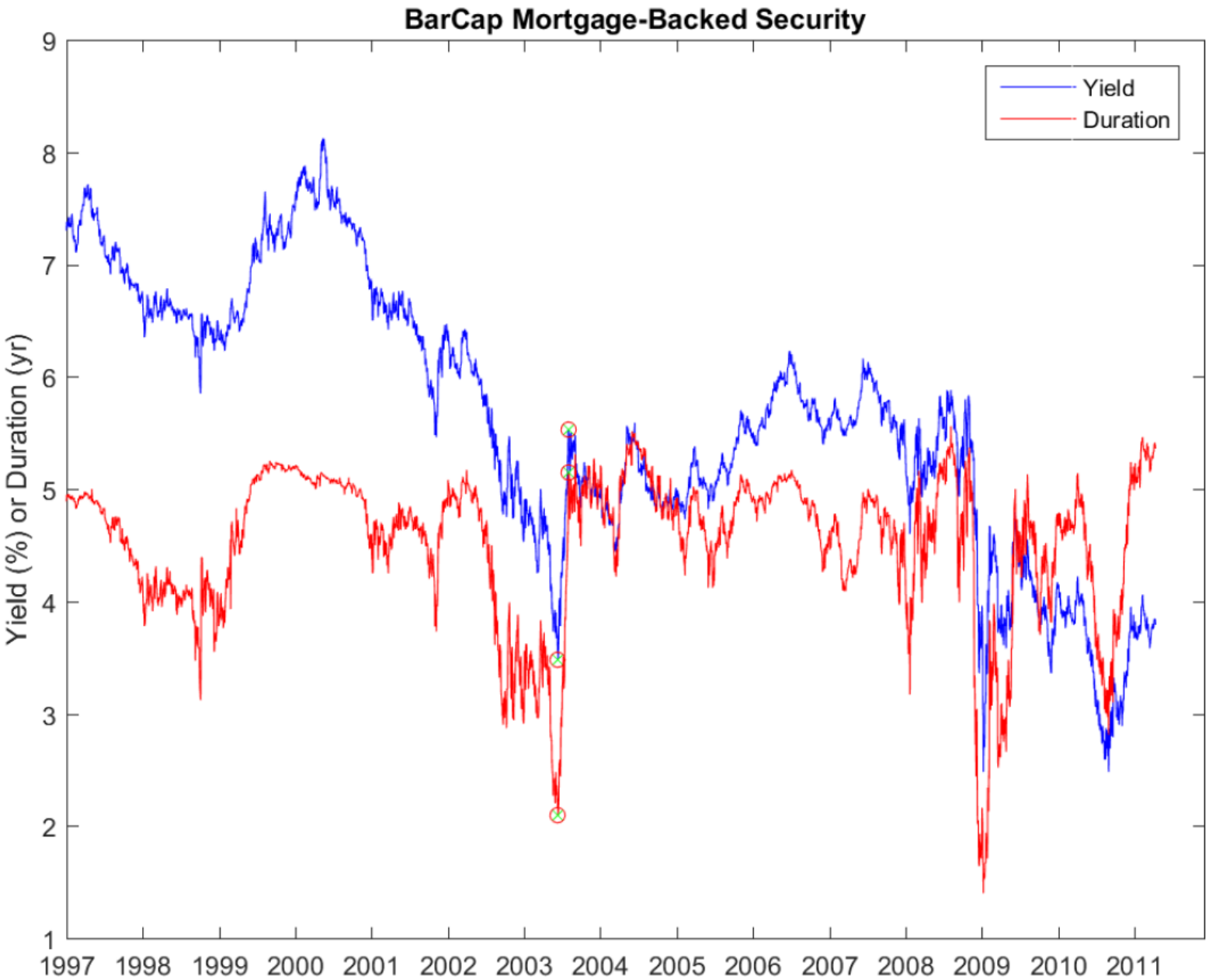
Negative Swap Spreads after Lehman



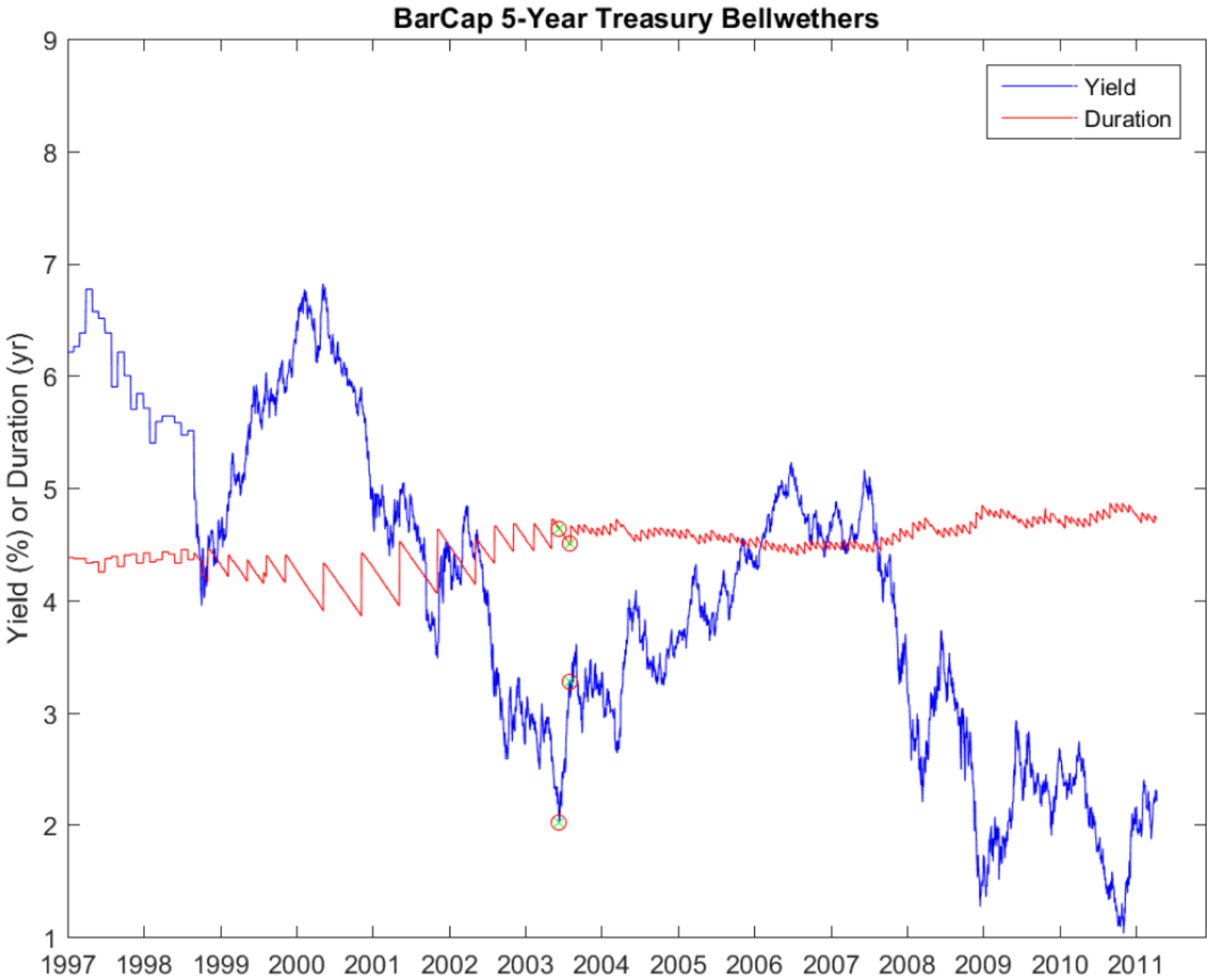
MBS Negative Convexity Hedging

- Because of the prepayment options given to homeowners/mortgage borrowers, mortgage-backed securities (MBS) have negative convexity.
- Interest rates fall: MBS duration shortens; need to buy back duration.
- Hedging with IR swaps: add receive-fixed or terminate pay-fixed.
- Interest rates increase: MBS duration increases; need to sell duration.
- Hedging with IR swaps: add pay-fixed.

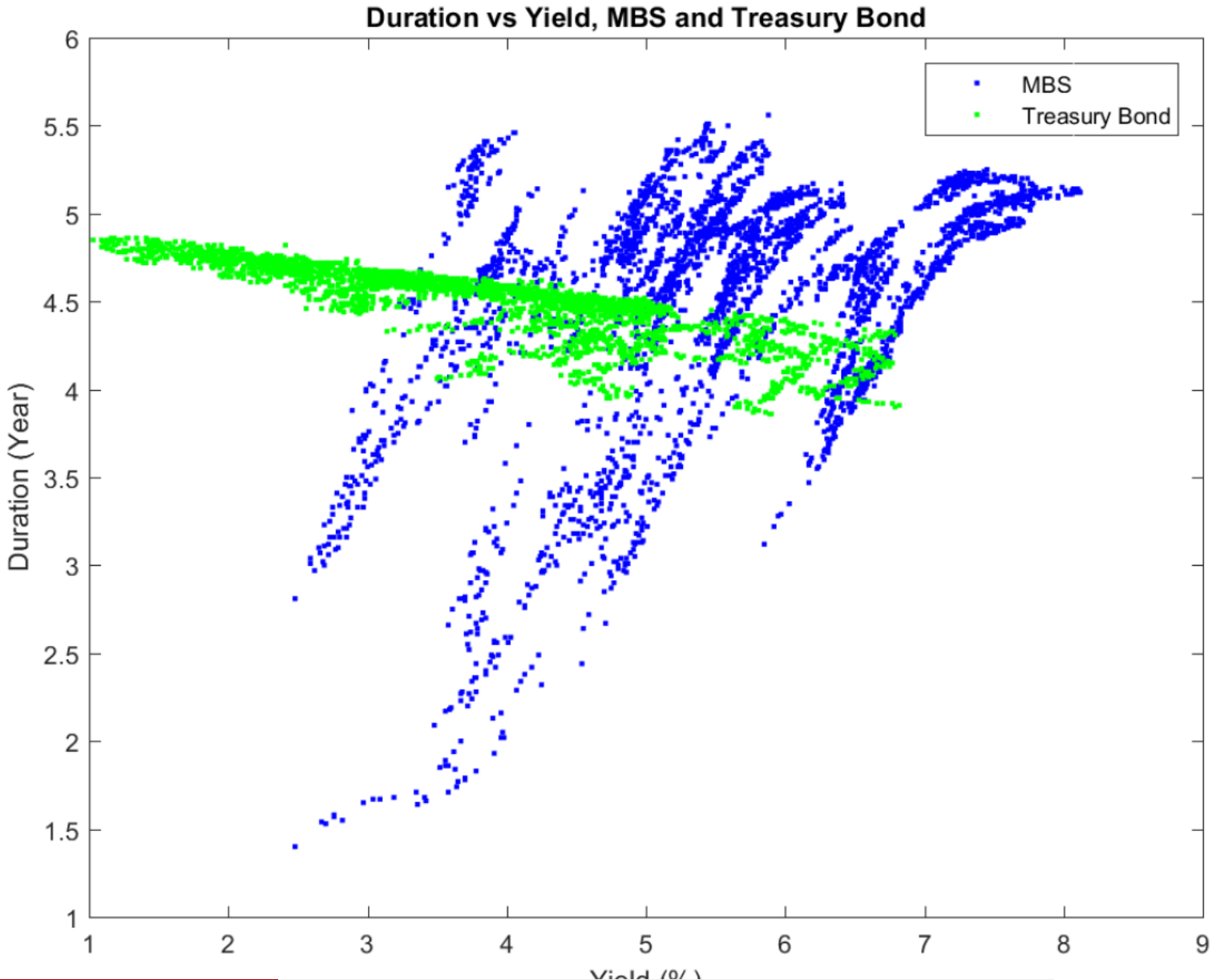
Mortgage-Backed Security, Yield and Duration



Treasury, Yield and Duration



Relation between Duration and Yield



Risk Management Derivatives, Fannie Mae 2010 10K

	Interest Rate Swaps				Interest Rate Swaptions					
	Pay-Fixed	Receive-Fixed[2]	Basis[3]	Foreign Currency[4]	Pay-Fixed	Receive-Fixed	Interest Rate Caps	Futures	Other[5]	Total
	(Dollars in millions)									
Notional balance as of December 31, 2008	$ 546,916	$ 451,081	$ 24,560	$1,652	$ 79,500	$ 93,560	$ 500	$ —	$827	$1,198,596
Additions	297,379	279,854	2,765	577	32,825	19,175	6,500	—	13	639,088
Terminations[6]	(461,695)	(455,518)	(24,100)	(692)	(13,025)	(37,355)	—	—	(92)	(992,477)
Notional balance as of December 31, 2009	$ 382,600	$ 275,417	$ 3,225	$1,537	$ 99,300	$ 75,380	$7,000	$ —	$748	$ 845,207
Additions	212,214	250,417	55	636	51,700	51,025	—	598	—	566,645
Terminations[6]	(317,587)	(301,657)	(2,795)	(613)	(53,850)	(47,790)	—	(353)	(59)	(724,704)
Notional balance as of December 31, 2010	$ 277,227	$ 224,177	$ 485	$1,560	$ 97,150	$ 78,615	$7,000	$ 245	$689	$ 687,148
Future maturities of notional amounts:[7]										
Less than 1 year	$ 70,656	$ 14,200	$ 50	$ 386	$ 20,750	$ —	$ —	$ 125	$ 75	$ 106,242
1 to less than 5 years	90,788	168,000	35	—	35,300	4,500	7,000	120	593	306,336
5 to less than 10 years	96,400	29,632	100	511	10,200	20,970	—	—	21	157,834
10 years and over	19,383	12,345	300	663	30,900	53,145	—	—	—	116,736
Total	$ 277,227	$ 224,177	$ 485	$1,560	$ 97,150	$ 78,615	$7,000	$ 245	$689	$ 687,148

Interest Rate Sensitivity of Net Portfolio, Fannie Mae 2014

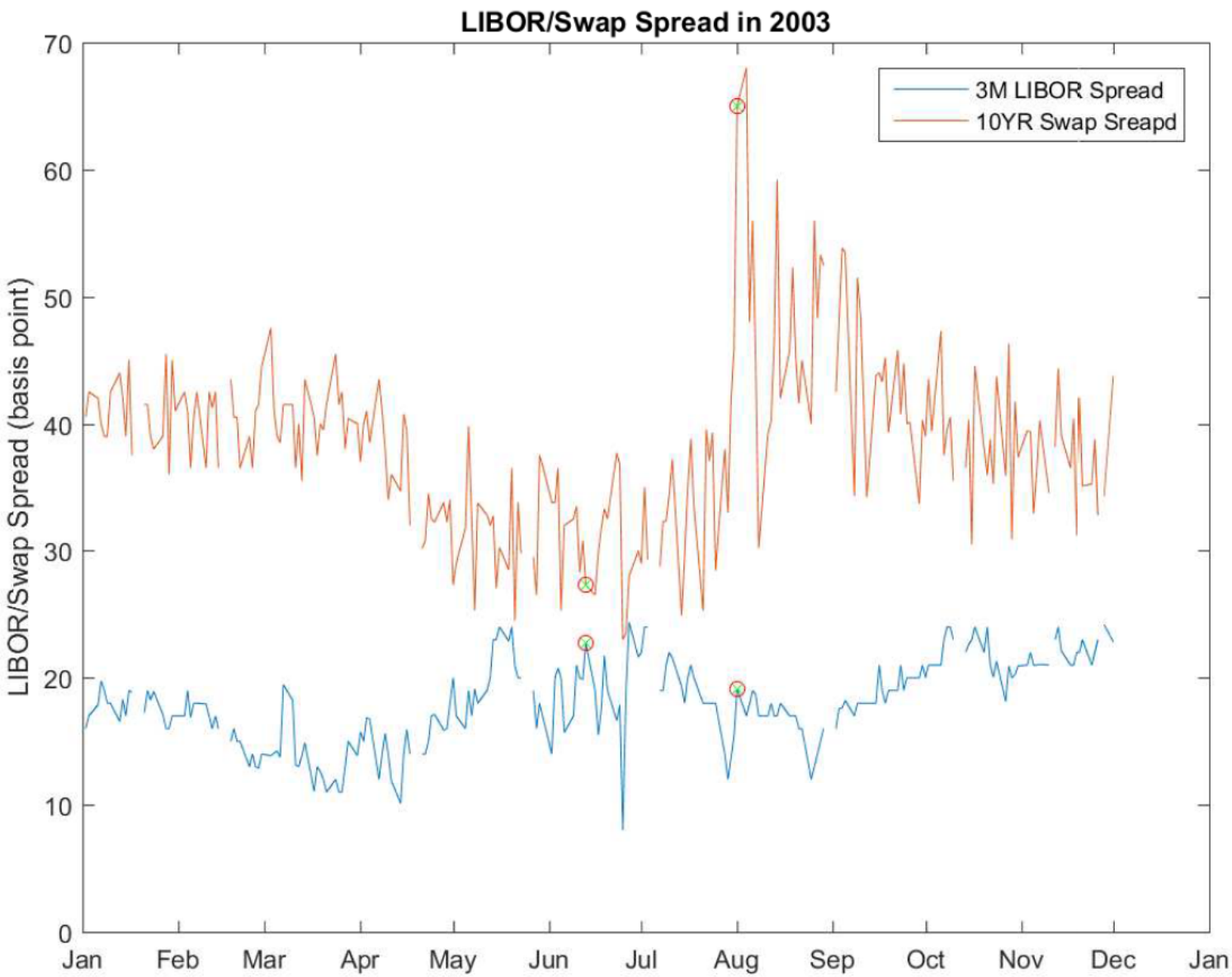
	As of December 31,[2]	
	2014	2013
	(Dollars in billions)	
Rate level shock:		
-100 basis points	$ 0.4	$ 0.1
-50 basis points	0.1	0.0
+50 basis points	(0.1)	(0.1)
+100 basis points	(0.1)	(0.5)
Rate slope shock:		
-25 basis points (flattening)	0.0	0.0
+25 basis points (steepening)	(0.0)	0.0

	For the Three Months Ended December 31, 2014[3]		
	Duration Gap	Rate Slope Shock 25 bps	Rate Level Shock 50 bps
		Exposure	
	(In months)	(Dollars in billions)	
Average	0.1	$ 0.1	$ 0.0
Minimum	(0.3)	0.0	—
Maximum	0.5	0.1	0.1
Standard deviation	0.2	0.0	0.0

MBS Footprint on Swaps

- The developments in the markets are such that swaps have behaved far more efficiently than Treasurys as a hedging instrument for MBS.
- Most of these hedging activities center around 5-10yr IR Swaps.
- The sharp increase of 10yr rates in summer 2003 resulted in a sudden increase in MBS duration. As a result, there were increasing amount of fixed-payers, effectively putting a selling pressure on the "swap bond." This resulted in a temporary spike in the 10yr swap spread (a footprint of MBS hedging on the swap market).

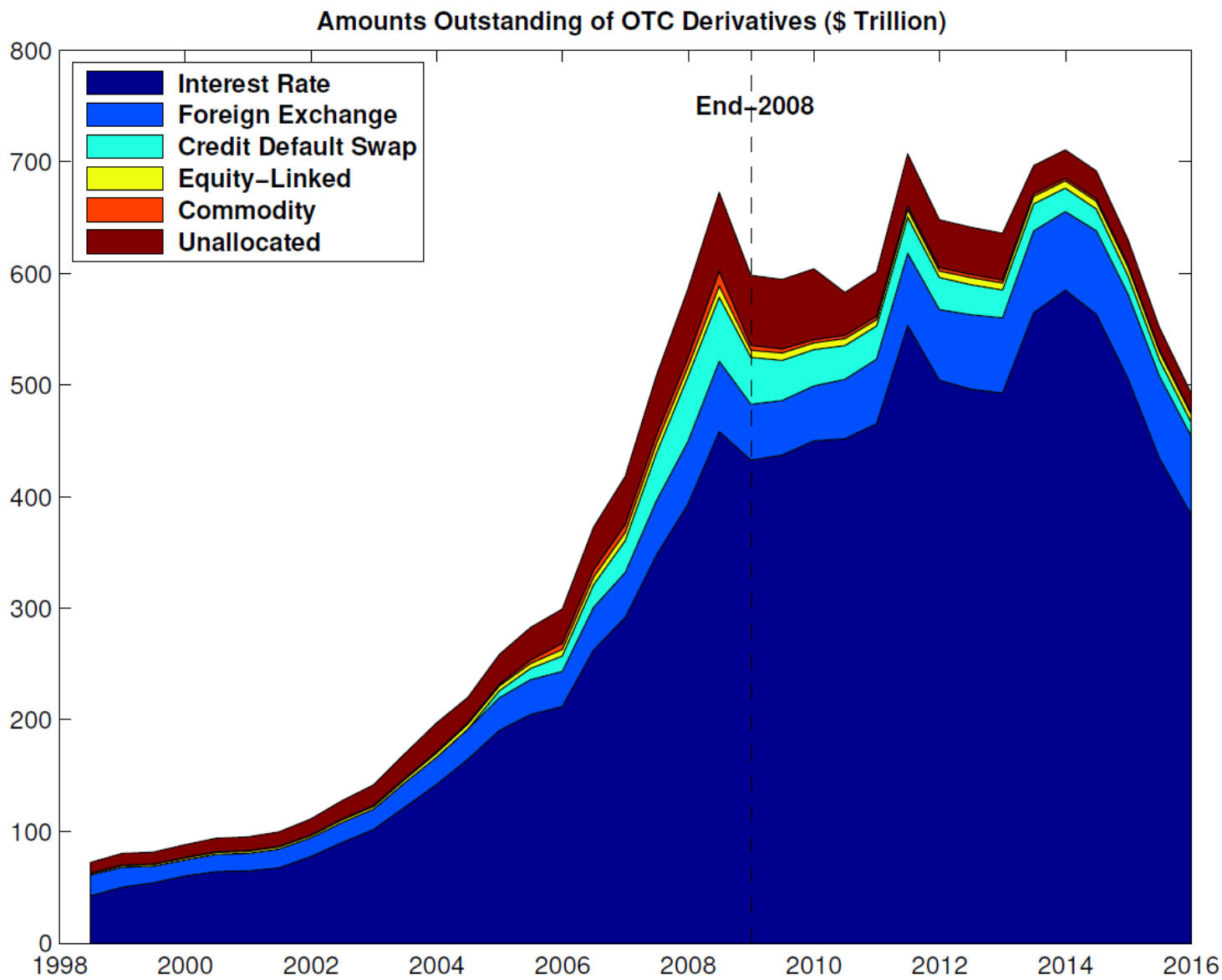
LIBOR/Swap Spread in 2003



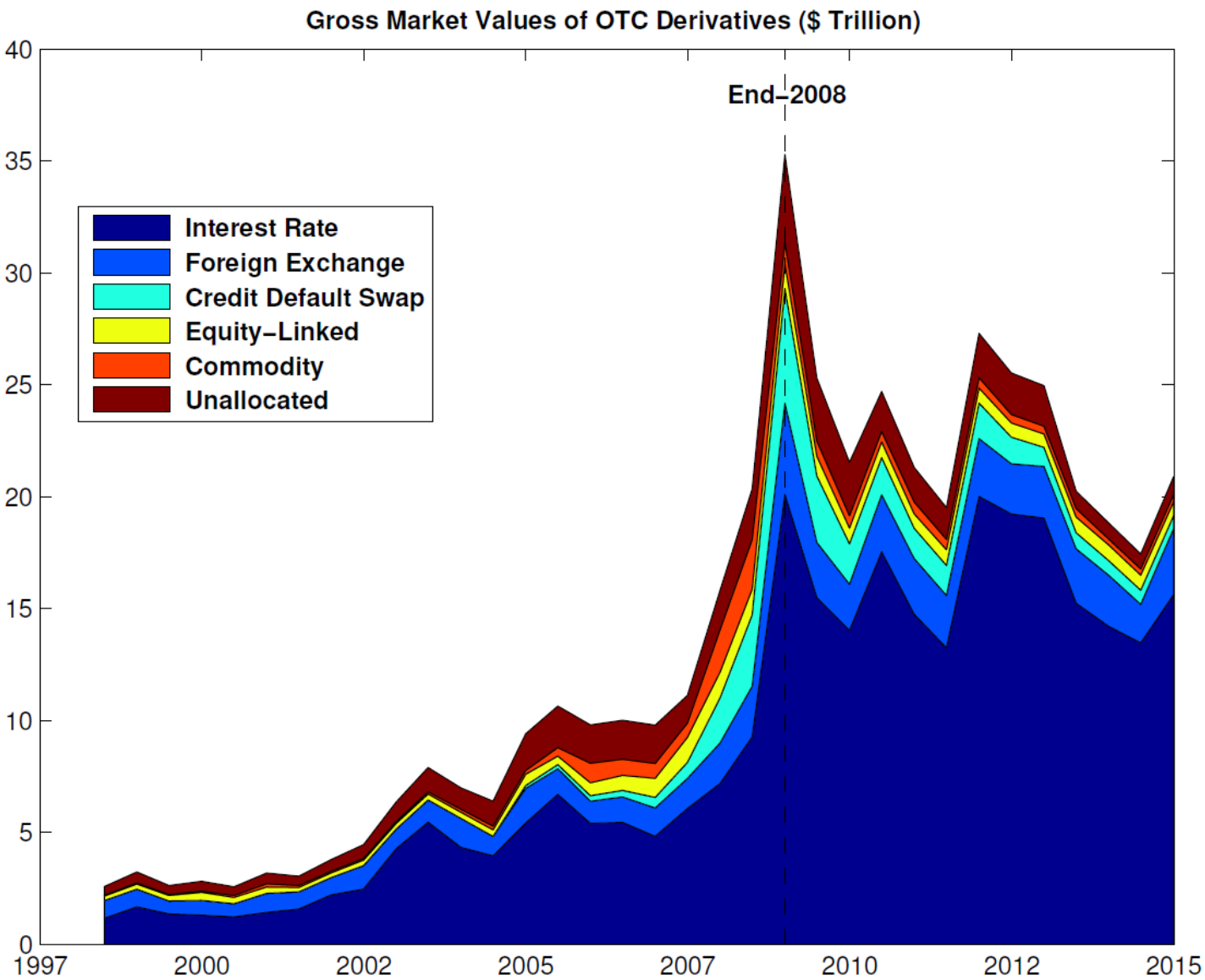
The Global OTC Derivatives Market

- The global OTC derivatives market had its beginning in the mid-1980s. Over the past 30 years, it has grown into an important part of the global financial markets, allowing business to manage and hedge financial risk.
- By far, the most important segment of this market is interest-rate product. As such, most of the hedging activities on interest rate risk have migrated from Treasury bonds to interest rate swaps.
- In addition, it also provides derivatives on currency, credit, equity, and commodities.

OTC Derivatives, Amounts Outstanding



OTC Derivatives, Market Value



Derivatives Usage