Morgan Stanley

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Interest Rate Strategy

Duration Management / Return Strategies

MORGAN STANLEY RESEARCH
North America

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Changing Fixed-Income Landscape – Challenges Faced by Investors

Basics – Components of Returns

Relative Value – Strategies to Enhance Returns

Duration-Adjusted Returns

Where Are Recent Returns Coming From?

Main Takeaways

Changing Fixed-Income Investment Landscape

Not the Same Bond Market Anymore

Then…

- Interest rates have been on a steady decline for 30 years.
- Reduced inflation risks due to Fed's credibility to combat inflation.
- Economic growth supported by countercyclical measure from the Fed.
- Globalization – a disinflationary influence.

Now…

- Extraordinarily low interest rates in the US
  - Unconventional policy actions by the Fed and global central banks.
  - Global financial crisis and investor demand for safe haven assets.
- Fed pursuing monetary policy actions with the goal to raise inflation.
- Emerging Markets – source of inflation.
- Fundamental change in the risk perception of government debt.

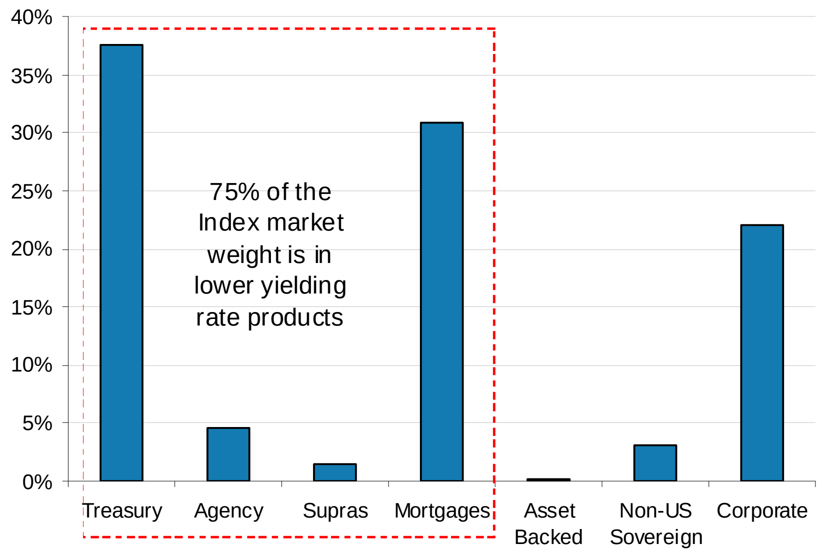
Challenges Faced by Investors

- Ultra low interest rates
  - Compensated very little for taking on duration risk.
  - Makes taking duration risk much less attractive than other forms of fixed-income risk.
  - Dearth of spread products makes diversification difficult.
  - How to limit exposure to sectors that do not offer attractive returns for risk.
  - Hedge asymmetric risk.
- Unconventional policy actions by the Fed and global central banks.
  - Central bank policy guessing game.
  - Is there room left for further stimulus?
  - Diminishing returns for incremental monetary action.
- Looming Deficits
  - Fiscal austerity at time of sluggish growth.
- Regulatory environment
  - Dodd Frank
  - Basel III
  - Deleveraging

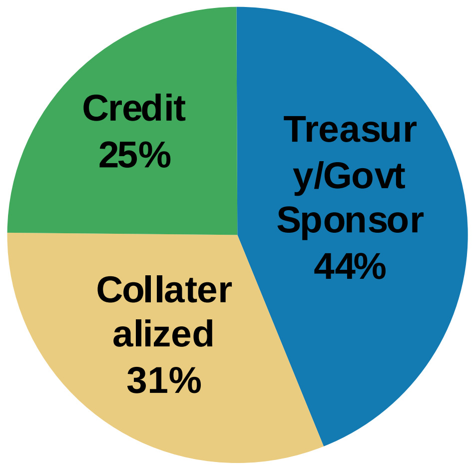
Large Concentration of Low Yielding Assets

- 75% of the Citi BIG Index is in government-related securities.
- Concentration of portfolio beta in low-yielding government debt.
- Significantly diminishes potential for alpha generation.

Rate Products Dominate Traditional Indices



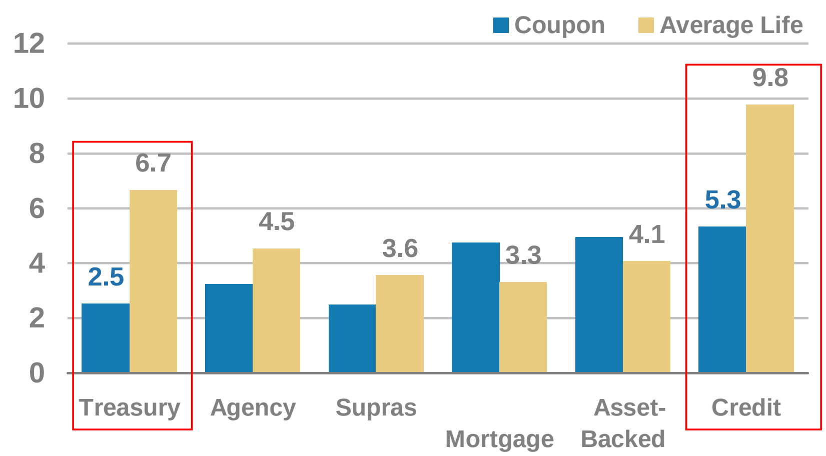
Higher-Yielding Credit Products Are a Smaller Piece of the Pie



Source: Yieldbook, Morgan Stanley Research

Income Cushion Is Shrinking

Longer Average Life but Smaller Coupons



Income Cushion Lowest since 1990

Note: Income cushion is akin to a 'break-even'. It is a measure of how much yields have to move before coupon returns offset losses from a move higher in yields

- In low rate environments, investors tend to extend out in duration to seek returns.
- But there is not enough income cushion to protect against a sell-off.
- Investors indexed to the BIG will start to incur capital loss if rates increase by 40bp.

Source: Yieldbook, Morgan Stanley Research

Basics – Understanding the Components of Return

Bond P&L

The P&L at the end of a trade is roughly

Bond P&L ≈ mark-to-market + Carry

Mark-to-market is the market price (PV) of the future cash flows.

Price Change is the biggest component of P&L

Carry and Rolldown can enhance returns.

To estimate the PNL of a long bond position in an **unchanged yield curve** we calculate:

- **Rolldown**
- **Carry**
- **Carry Quotient**

$$P\&L = \underbrace{[\ P(t) + AI(t)\ ]}_{\text{Horizon Price}} - \underbrace{[\ P(0) + AI(0) \times (1 + r * t/360)\ ]}_{\text{Purchase Price Growth}}$$

P(0) = today's price

P(t) = price at time (t)

AI = Accrued Interest

r = financing rate

t = horizon date

$$P\&L = \underbrace{[\ P(t) - P(0)]}_{\text{Price Change}} + \underbrace{\text{Coupon} * t/360}_{\text{Interest Income}} - \underbrace{[P(0) + AI(0)] \times r * t/360}_{\text{Financing cost}}$$

Source: Morgan Stanley Research

Rolldown

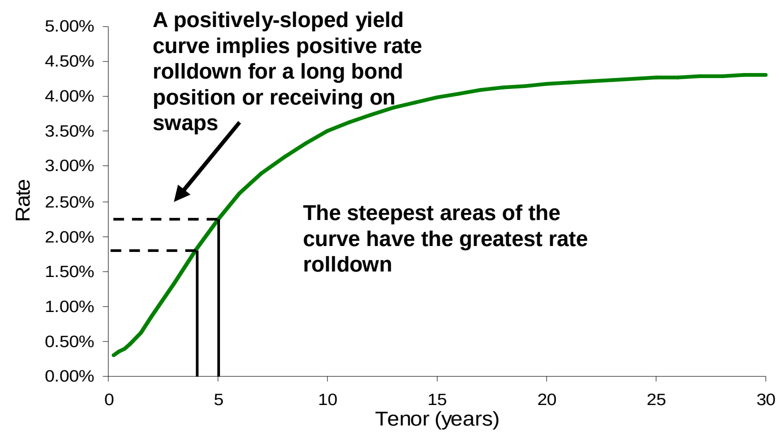
At horizon (e.g., in 3 months' time for a 10y bond), the remaining instrument is a 9y9m bond.

In an unchanged yield curve, the **mark-to-market will be represented by the rolled-down rate**. We expect to make:

$$\boxed{\text{rolldown} = r_{10} - r_{9.75}}$$

In a positively sloped yield curve, the rolled-down rate is lower than the spot rate.

If the Yield Curve Is Positively Sloped, Rolldown Is Positive



In Treasuries: 5y and 7y Sectors Have the Best Rolldown

Trade	Level	1d Change	Historical Z-Score	Yield: Rolldown
UST2Y	0.28	-1.97	0.88	2.44
UST3Y	0.39	-3.00	0.05	3.66
UST5Y	0.82	-5.01	-0.79	6.03
UST7Y	1.34	-6.36	-0.84	6.14
UST10Y	1.94	-6.08	-0.44	4.79
UST30Y	3.08	-6.19	0.05	0.37

Source: Morgan Stanley Research

Carry

The **carry for holding a bond** is the cost of holding the bond to horizon date (say 3 months). Intuitively, for a bond, it's

Carry = Coupon Received – cost of financing the bond

Coupon Received = Coupon * horizon days/actual days between coupon period

Financing Cost = (Price + Accrued Interest) * (repo rate/360)

Forward Price of Bond

$$F = P + rtP - ct$$

Borrowing rate

Carry rate

P = today's price

F = forward price

r = financing rate

t = time till the forward contract

c = cost of carry

In Treasuries: 10y Has Best Carry

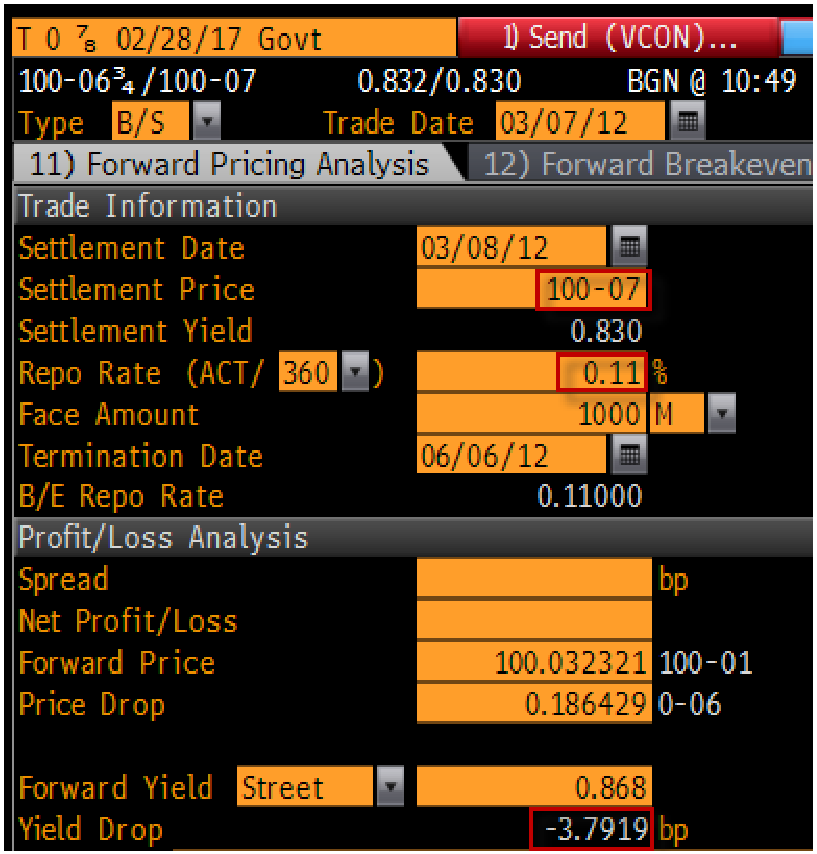
Trade	Level	1d Change	Historical Z-Score	Yield: Carry
UST2Y	0.30	2.38	1.59	2.97
UST3Y	0.41	2.16	0.46	3.56
UST5Y	0.85	2.60	-0.51	4.45
UST7Y	1.37	2.35	-0.62	5.12
UST10Y	1.97	2.77	-0.18	5.80
UST30Y	3.12	3.85	0.35	4.02

Source: Morgan Stanley Research

Carry: Two Representations

1. Carry as cash inflows minus outflows

The **carry for holding a 5y swap** is the cost of holding the bond to maturity. Intuitively, for a bond, it's = Coupon – Cost of Financing



Source: Bloomberg, Morgan Stanley Research

2. Carry as the hurdle rate (in bps running)

A long bond position should profit as long as the forward rate at the horizon is less than the forward rate.

Intuitively, spread between the spot rate and the forward rate tells us **how much the rate can rise before the trade loses money.**

This is the carry in bps running.

Basis Points Running

Given a dollar value $X, the value in bps running is the value divided by the DV01 of the instrument (in our case, the 2y forward 5y swap).

The DV01 is indicated above by $\wp_{2,5}$

This tells us the size of the forward rate move necessary to make or lose that much.

Rolldown & Carry: Graphical Summary

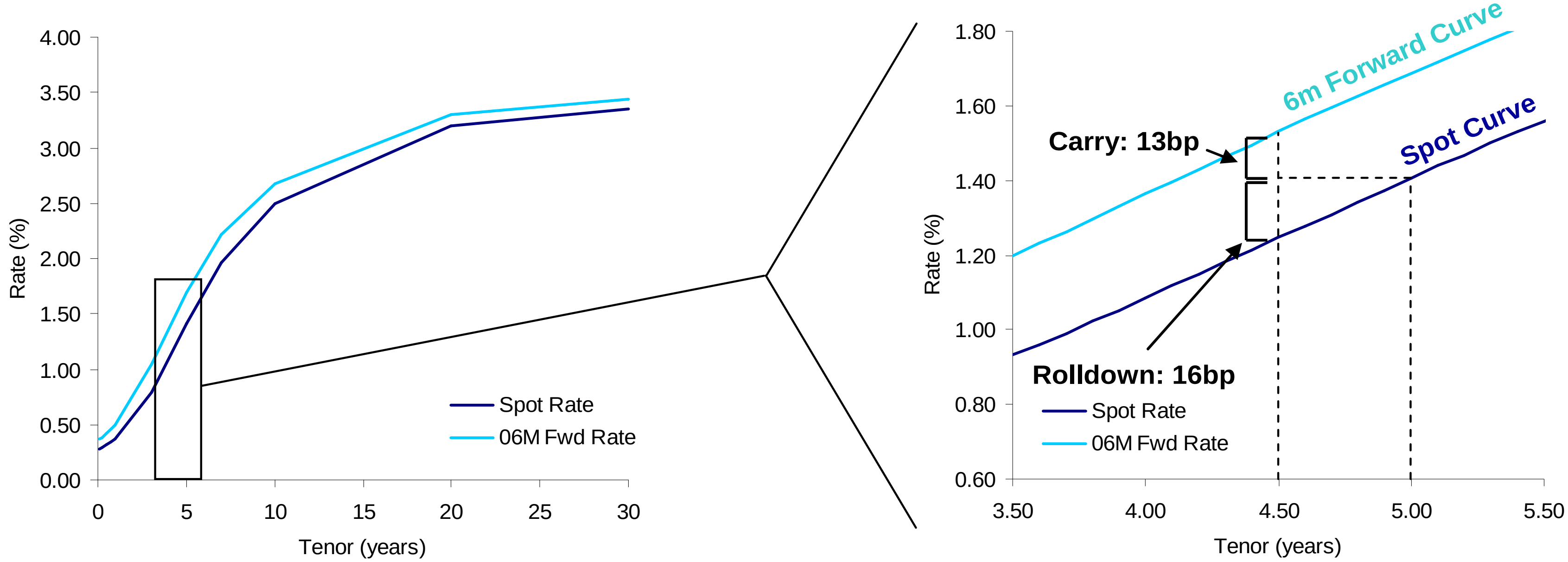
Quantifying rolldown and carry: Expected earnings in a static yield curve environment

In basis points running:

$$\text{carry} = r_{2,5} - r_7$$

$$\text{rolldown} = r_7 - r_5$$

$$\text{RD} + \text{C} = r_{2,5} - r_5$$



Source: Morgan Stanley Research

Carry Quotient: Adjusting for Volatility

Comparing Trades

A long-duration trade profits if the horizon is below the forward rate.

How big a move is needed for the trade to lose PNL?

The rolldown and carry is presented in absolute bps.

How do we judge how big that move is?

We divide by volatility to compare across tenors.

Realized Volatility

The daily realized volatility is calculated as

$$\sqrt{\frac{1}{N}\sum_{i=0}^{N-1}(r_{i+1}-r_i)^2}$$

To agree with the time to horizon, we multiply by the square root of the number of days to horizon. That is

$$\sqrt{\text{Days to Horizon}}\sqrt{\frac{1}{N}\sum_{i=0}^{N-1}(r_{i+1}-r_i)^2}$$

As long as the rolled-down rate is below the forward, a long-duration trade profits.

Spot 7y = 2.90

Spot 5y = 2.23

2y5y = 3.80

Rolldown and Carry (2y) = 67bp + 90bp = 157bp

Volatility (6m) = 114bp annualized

Carry Quotient = 157 / 228 = 0.69

Source: Morgan Stanley Research

Morgan Stanley Matrix – Screener

Source: Morgan Stanley Research

Relative Value Strategies to Enhance Returns

Risk-Adjusted Carry Still Highest in the 2-5y Sector

Government Bonds, Rolling Benchmarks - US

Select a Strategy: Default
Tenors: 2y, 3y, 5y, 7y, 1...

Trade	Level	1d Change	Historical Z-Score	Yield: Rolldown and Carry	Carry Quotient
UST2Y	0.31	1.18	1.97	4.88	0.60
UST3Y	0.43	1.11	0.92	7.63	0.52
UST5Y	0.89	1.48	-0.07	9.90	0.34
UST7Y	1.40	2.28	-0.37	10.39	0.28
UST10Y	1.98	-0.87	-0.25	10.47	0.25
UST30Y	3.10	-2.42	0.01	4.31	0.09

- 7-10y Treasuries offer the best rolldown and carry, but are also the point on the curve that will underperform the most in a sell-off.
- On a risk-adjusted basis (see Carry Quotient), the 2-5y sectors offer more attractive returns.
- Also we expect the UST 2s-10s curve to steepen in a sell-off, if data continue to surprise.

Source: Morgan Stanley Research

Identifying Rich / Cheap Sectors

- Spline Model
- Libor-OAS commonly referred to as 'Coupon-Adjusted Spread'

Sector Rich / Cheap Summary

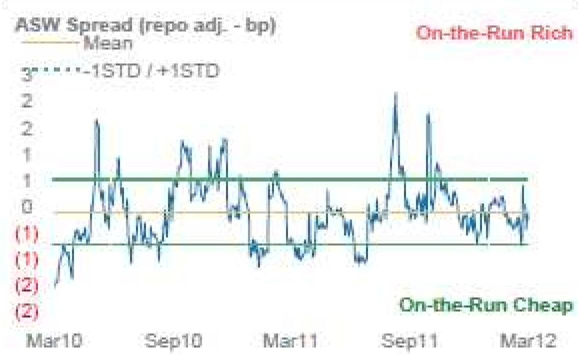
Sector Range (yrs)	Spline Model (average)			LIBOR-OAS (average)			Spline / LIBOR-OAS Signal	Yield: 3M Rolldown + Carry (average)				
	R/C[1] (bp)	3M Avg	3M Z-Score	Level (bp)	3M Avg	3M Z-Score		Carry	RD	RD&C	Real. Vol	RD&C/ Vol
0.5 - 1.0	(0.0)	(0.1)	0.1	34.9	45.3	(1.1)	-- / Cheap	3.4	0.5	3.8	4.2	0.9
1.0 - 1.5	0.1	0.1	(0.1)	32.4	41.1	(0.9)		2.8	1.7	4.5	7.1	0.7
1.5 - 2.0	(0.1)	(0.1)	0.0	29.7	37.7	(0.9)		2.8	2.2	5.1	8.2	0.6
2.0 - 2.5	(0.1)	(0.1)	(0.0)	27.8	35.5	(0.9)		3.0	2.4	5.3	10.6	0.5
2.5 - 3.0	0.2	(0.2)	0.6	26.9	34.7	(1.0)		3.4	2.9	6.3	13.7	0.5
3.0 - 3.5	0.2	0.2	0.0	27.1	35.2	(1.1)	-- / Cheap	4.4	2.9	7.4	18.1	0.4
3.5 - 4.0	(0.8)	(0.2)	(0.8)	28.3	35.5	(1.1)	-- / Cheap	5.2	3.3	8.5	21.7	0.4
4.0 - 4.5	0.5	0.1	0.3	26.8	34.2	(1.1)	-- / Cheap	5.8	3.6	9.4	24.5	0.4
4.5 - 5.0	0.1	(0.2)	0.5	26.7	32.8	(1.0)	-- / Cheap	6.1	4.0	10.1	27.0	0.4
5.0 - 5.5	(0.2)	(0.2)	0.0	26.8	31.8	(0.8)		6.2	4.2	10.4	29.0	0.4
5.5 - 6.0	0.2	0.3	(0.1)	26.4	31.0	(0.8)		6.3	4.4	10.7	31.8	0.3
6.0 - 6.5	(0.8)	(0.2)	(1.3)	26.7	29.9	(0.7)	Rich / --	6.2	4.7	10.9	33.6	0.3

Source: Morgan Stanley Research

On-the-Run vs. Off-the-Run Switches

- A common decision investors face is whether to roll USTs after the auction into the new OTR. This decision is typically driven by two factors:
  1. The general slope of the yield curve
  2. The liquidity premium associated with the OTR

5Y vs. 1-Old

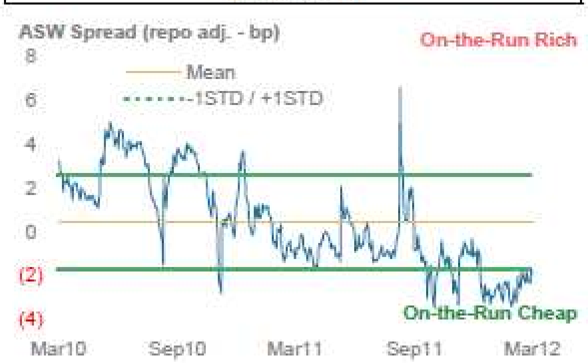


5Y vs. 2-Old

5Y vs. 3-Old

10Y vs. 1-Old

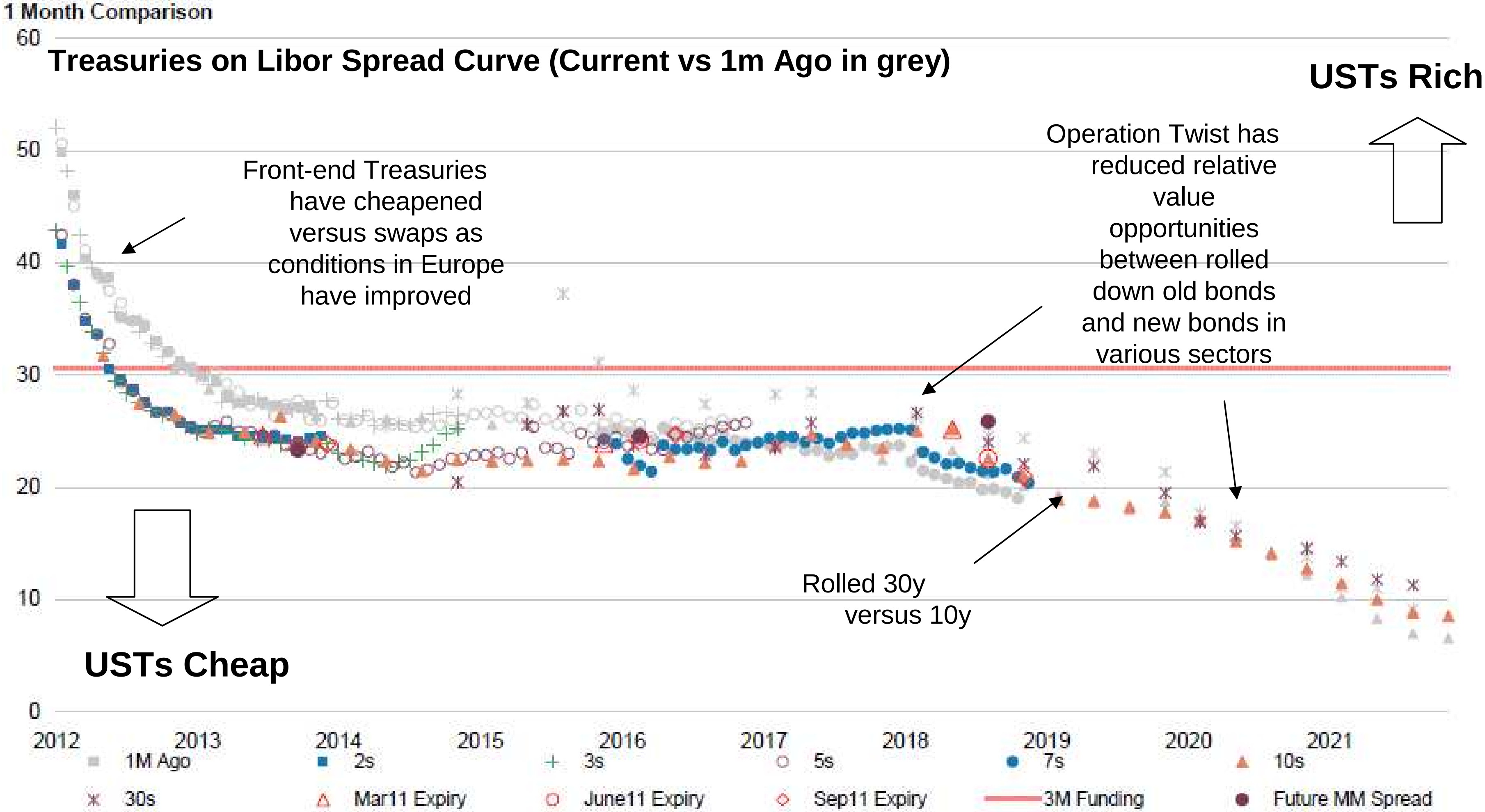
10Y vs. 2-Old



10Y vs. 3-Old

Source: Morgan Stanley Research

Change in the Libor OAS Term Structure

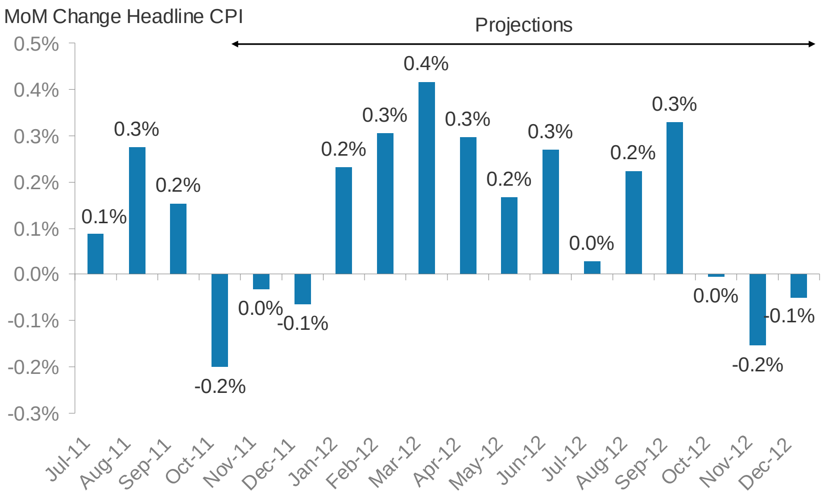


Rolldown and Carry is calculated for 3M as the UST RD&C minus the matched-maturity swap RD&C.
We define the Carry Quot. as (3M Rolldown and Carry) / 3M Realized Vol, for the purpose of determining the significance of the swap spread's rolldown and carry
Note: 3M Funding = 3M LIBOR - 3M Repo (GC)

Source: Morgan Stanley Research

Short-Dated TIPS Provide Yield Pick-Up

Short-Dated TIPS Pricing in Below Forecast Inflation



Disinflation Priced into Front-End TIPS

July12 TIPS		Dirty		Clean	Yield (Clean Price)
$PV (MS Inflation Forecast)	$	129.49	$	102.80	-3.40%
Cost Today	$	129.17	$	102.55	-2.85%
Expected Return	$	(0.31)	$	(0.25)	(55.25)
April 13 TIPS		**Dirty**		**Clean**	**Yield (Clean Price)**
$PV (MS Inflation Forecast)	$	110.44	$	103.06	-1.93%
Cost Today	$	109.98	$	102.63	-1.58%
Expected Return	$	(0.46)	$	(0.43)	(35.25)
July13 TIPS		**Dirty**		**Clean**	**Yield (Clean Price)**
$PV (MS Inflation Forecast)	$	130.92	$	106.24	-2.39%
Cost Today	$	129.93	$	105.45	-1.86%
Expected Return	$	(0.98)	$	(0.80)	(52.58)

- We opportunistically look to go long TIPS breakevens within the 1- to 4-year sector on a hold-to-maturity basis, as front-end valuations cheapen relative to our economic team’s inflation forecast.
- Protect against a geopolitical risk-event triggering a significant increase in oil prices.

Source: Morgan Stanley Research, Bloomberg

Duration-Adjusted Returns

Sharpe Ratio vs. Duration-Adjusted Returns

Carry Quotient ~ Sharp Ratio

Sharpe Ratio = Average Excess Return / Standard Deviation of Return

Problem:

- Standard deviation of returns is strongly related to duration of the security.
- Securities with higher duration will have higher returns if yields decline and lower returns when yields rise relative to shorter-duration securities.

Sharpe ratio is one good measure of risk versus return but not the only measure.

What are duration-adjusted returns?

- Return of an asset versus equivalent duration of Treasuries
- Typical analysis of callable returns involves looking at callables versus comparable duration agency bullets.
- A proxy for break-even.

Bond Returns Can Be Negative When You Adjust for Duration

Returns Summary to 2/16/2012

	5-day %	MTD %	YTD %	52-week %
BIG Index	0.18	1.67	8.45	9.18
Treasuries	0.13	0.44	9.09	10.48
Agencies	0.05	0.61	5.79	6.54
Supranationals	0.02	1.55	5.51	5.79
Corporates	0.33	4.58	10.79	10.97
Mortgages	0.16	1.22	6.93	7.40
ABS	0.12	0.99	7.68	8.32
Sov & Prov.	0.16	2.99	8.67	9.04
TIPS	0.49	1.84	15.85	17.87
Emerging Markets	0.34	4.30	11.39	12.29
High Yield	-0.11	6.57	9.45	5.97
Commodities	0.73	3.56	4.55	3.32
Equities (S&P 500)	0.45	8.91	7.98	1.63
USD	1.00	1.23	0.40	1.44

Duration Adjusted Returns to 2/16/2012*

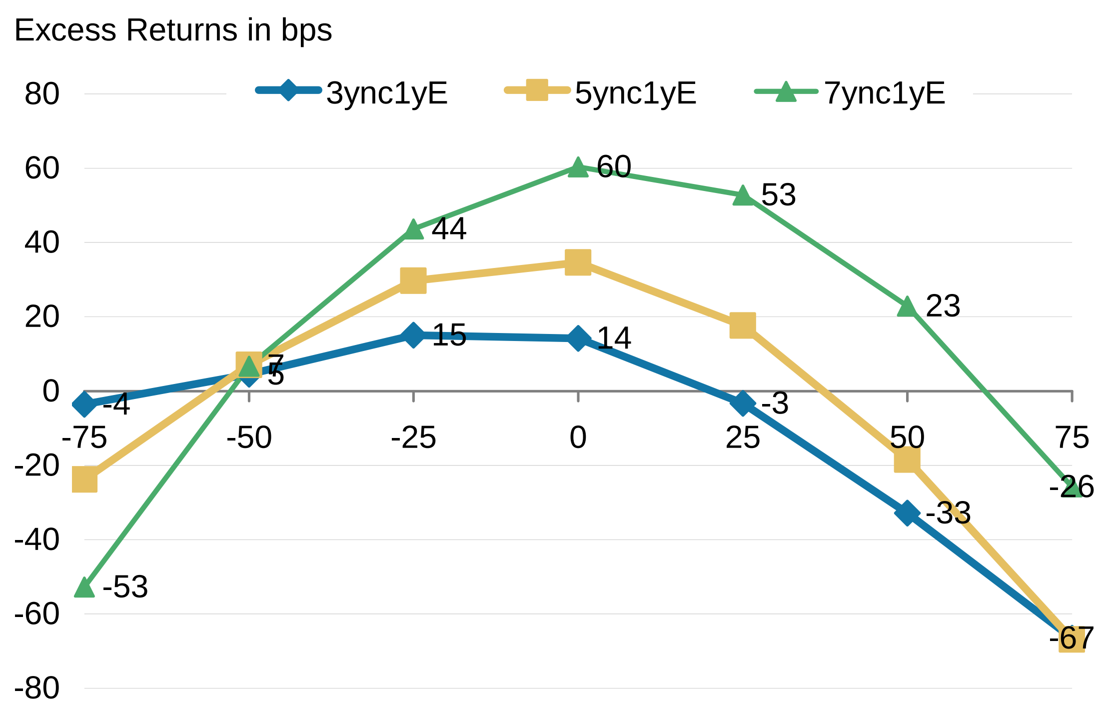
	5-day %	MTD %	YTD %	52 - week %
BIG Index	0.06	1.29	-0.06	-0.90
Treasuries	-	-	-	-
Agencies	-0.04	0.31	-0.90	-1.13
Supranationals	-0.06	1.29	-0.65	-1.37
Corporates	0.17	4.07	-0.63	-2.22
Mortgages	0.08	0.98	0.45	-0.87
ABS	0.03	0.71	1.28	1.08
Sov & Prov.	0.02	2.55	-0.82	-2.05
TIPS	0.29	1.18	2.25	2.03
Emerging Markets	0.17	3.75	-1.16	-2.39
High Yield	-0.22	6.21	1.09	-3.93
Commodities	-	-	-	-
Equities (S&P 500)	-	-	-	-
USD	-	-	-	-

** (Modified) Duration Adjusted Returns over Treasuries*

- TIPS best performing asset class in fixed-income last year.
- Spread products performed well on an outright basis, but had negative returns on a duration-adjusted basis.
- Lower-yielding risk-free products were the best performers.

Source: Yieldbook, Morgan Stanley Research

Callables vs. Comparable Duration Agency Bullets



- With the decline in implied vol, longer lock-outs look more attractive.
- Although Fed on hold makes such trades attractive, it takes less than a 25bp sell-off before 3nc1 callable underperforms a comparable duration bullet.

Source: Yieldbook, Morgan Stanley Research

Return Attribution

Components of Total Return

Returns → **Income**

Returns → **Capital Gains**

- Factors that affect returns – prices, curve, spreads, volatility, prepayments
- The main components of Returns:
  - Duration
  - Curve
  - Spread
  - Volatility
- Duration
  - Rolldown
  - Parallel shift
  - Curve reshaping
- Spread
  - Excess return (adjusted for duration)

January Returns for the Citi BIG Index

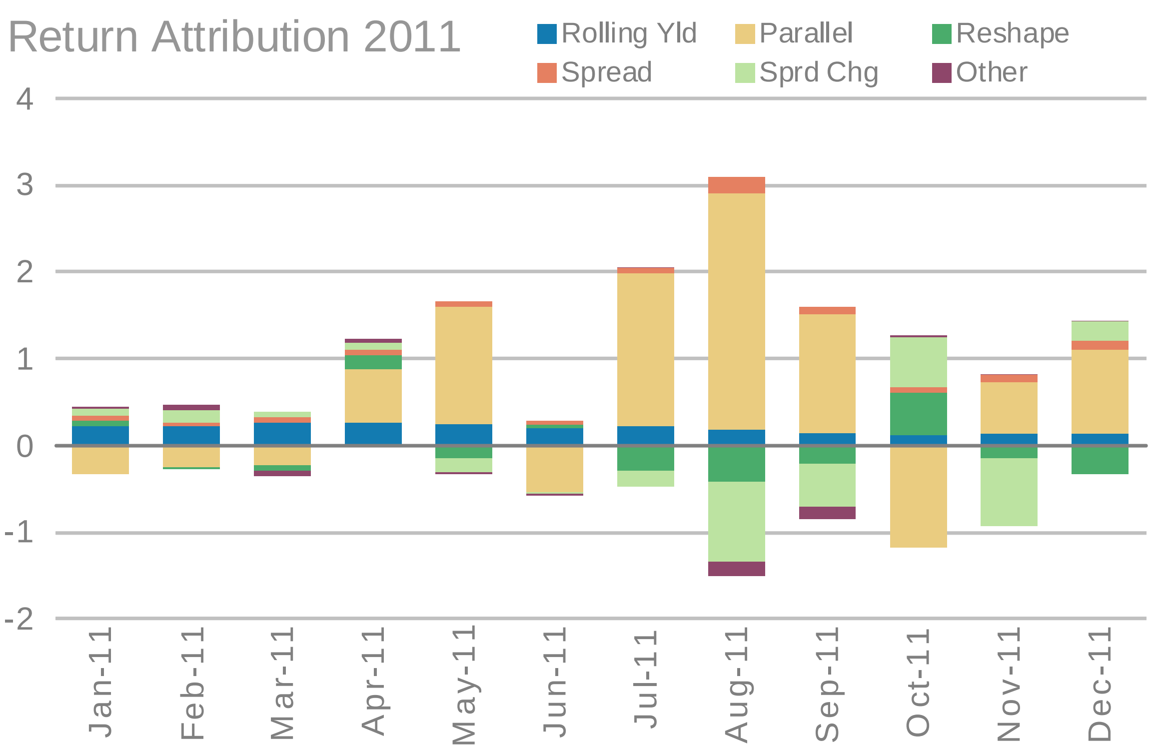
US Broad Investment-Grade (BIG) Bond Index - January 2012
Settlement Date : December 31, 2011, Horizon Date : Jan 31, 2012

Yield Book Return Attribution Report

				Matched Treasury Portfolio				Spread Advantage			
Description	Num of Issues	Market Value†	Total Return	Rolling Yield	Parallel	Reshape	Total	Spread	Spread Change	Other Mkt Effects	Total
Broad Investment-Grade Index	5072	14776.49	0.85	0.123	0.303	-0.066	0.360	0.094	0.429	-0.036	0.487
Treasury	197	5475.41	0.42	0.143	0.369	-0.100	0.412	-0.000	0.004	0.002	0.005
Govt Sponsored	303	900.02	0.71	0.099	0.238	0.010	0.348	0.034	0.327	0.004	0.365
Agency	211	689.59	0.55	0.100	0.247	-0.019	0.327	0.025	0.196	0.003	0.225
Supranational	92	210.42	1.24	0.099	0.209	0.106	0.414	0.064	0.755	0.005	0.825
Collateralized	281	4738.05	0.42	0.069	0.146	-0.001	0.214	0.144	0.180	-0.116	0.209
Mortgage	249	4715.25	0.42	0.069	0.146	-0.001	0.213	0.149	0.176	-0.118	0.207
Asset-Backed	32	22.81	0.85	0.102	0.231	0.061	0.394	-0.963	1.045	0.380	0.452
Credit	4291	3663.02	2.07	0.167	0.422	-0.116	0.473	0.185	1.407	-0.000	1.594
Corporate	4052	3225.51	2.21	0.169	0.430	-0.127	0.472	0.191	1.532	-0.001	1.725
Industrial	2241	1691.93	1.54	0.179	0.462	-0.162	0.478	0.145	0.916	-0.002	1.060
Utility	762	487.04	1.39	0.186	0.524	-0.306	0.402	0.166	0.820	-0.002	0.985
Finance	1049	1046.54	3.66	0.145	0.335	0.015	0.495	0.277	2.858	0.002	3.145
Non-US Sovereign & Provincial	239	437.51	1.11	0.152	0.363	-0.038	0.477	0.143	0.482	0.004	0.630

Source: Yieldbook, Morgan Stanley Research

Duration the Biggest Contributor of Returns



- Duration was the biggest contributor of returns. For 2012:
  - Fed
  - Economy
  - European debt turmoil
- Spread exposure can make or break returns.
- Rolldown and curve trades – small but not negligible.

Source: Yieldbook, Morgan Stanley Research

Main Takeaways

- Low rate environment - diminished returns and little income cushion.
- Getting the duration call right is key to maximizing total returns.
  - Nimble with your duration views
- Range-bound markets lead to complacency.
  - Tend to focus on just rolldown and carry strategies
  - Tend to chase returns:
    - By extending out the curve
    - Overweighting spread products
  - Buy cheap hedges to protect against a move higher in yields
    - Step-up callables
    - Low negative carry curve trades
- Alternative ways to enhance yields.
  - Right kind of spread exposure
  - Buy cheap inflation protection
- Focus on not just beta but also alpha.
  - Relative value strategies

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(as of February 29, 2012)

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	Coverage Universe		Investment Banking Clients (IBC)		
Stock Rating Category	Count	% of Total	Count	% of Total IBC	% of Rating Category
Overweight/Buy	**1120**	**38%**	**461**	**44%**	**41%**
Equal-weight/Hold	**1229**	**42%**	**449**	**42%**	**37%**
Not-Rated/Hold	**105**	**4%**	**24**	**2%**	**23%**
Underweight/Sell	**464**	**16%**	**124**	**12%**	**27%**
Total	**2,918**		**1058**		

Data include common stock and ADRs currently assigned ratings. An investor's decision to buy or sell a stock should depend on individual circumstances (such as the investor's existing holdings) and other considerations. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months.

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Disclosure Section (Cont.)

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