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The Low Vol. Phenomenon across the Capital Structure: Stocks vs. Bonds

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The Low-Vol. Phenomenon

- The ‘Low Vol.” phenomenon – the tendency of **lower-risk stocks to outperform high-risk stocks** on a risk-adjusted basis – is widely documented (Ang, Hodrick, Xing, and Zhang 2006; Frazzini and Pedersen 2014)

- A similar pattern was also detected within credit: **short-maturity bonds had better risk-adjusted performance than long-maturity bonds** (Ambastha, Ben Dor, Dynkin, and Hyman 2008)

- Underlying theory: Investors with leverage constraints chase risky assets as a form of taking on leverage and, thus, bid up the prices and drive down the expected returns of risky assets (Frazzini and Pedersen 2014)

Does the Low-Vol. Phenomenon Hold *across* Asset Classes?

- Bonds and stocks represent the two extremes of a company's capital structure

Bonds	Stocks
Low vol. asset	**High vol. asset**

Low Vol. Hypothesis

Bonds have better risk adj. performance than stocks → **Is this the case empirically?**

Answering the question, "Are bonds delivering better risk-adjusted performance than stocks?"

- **Approach 1 (easier but incorrect):**
  comparing aggregate bond vs. equity index returns

  Inappropriate due to the following 3 issues

  I. *Constituent difference*

  II. *Weights mismatch (issuer and sector)*

  III. *Risk mismatch*

- **Approach 2**
  Using a carefully matched sample of bonds-to-stocks at company level

Outline

Methodology

Portfolio-Level Performance

Cross-Sectional Differences

Is Liquidity the Driver?

Methodology

Bond – Equity Sample Construction

- All issuers in the US credit (Jan 1990 – Dec 2017) and Pan Euro credit indices (May 2002 – Dec 2017) were linked to accounting and equity data from COMPUSTAT
- **Key challenges: Lack of common firm identifiers and corporate events**
- Mapping is based on methodology used in BEAM (Bonds in Equity Asset Momentum)*

Results

- Mapping success (IG and HY) increased consistently over time
- In recent years, mapped sample covered 90% in market cap, almost 100% for US IG
- Most unmapped HY issuers had no identifiers (private firms)

Matching of Corporate and High Yield Index Constituents to COMPUSTAT

Year End Market Value	US ($ Bln)						Pan Euro (Euro Bln)				
	1994	1999	2004	2009	2013	2017	2003	2007	2011	2014	2017
Corporate Index	560	914	1,697	2,555	3,727	5,192	1,003	1,205	1,607	1,930	2,330
Mapped	85%	87%	94%	98%	97%	98%	77%	90%	86%	87%	88%
HY Index	144	351	610	747	1,270	1,339	63	77	154	348	330
Mapped	68%	65%	83%	82%	80%	85%	56%	67%	66%	74%	73%
Agg. Universe (IG+HY)	704	1,265	2,307	3,302	4,996	6,531	1,065	1,282	1,761	2,279	2,660
Mapped	82%	81%	91%	94%	93%	96%	76%	89%	84%	85%	86%

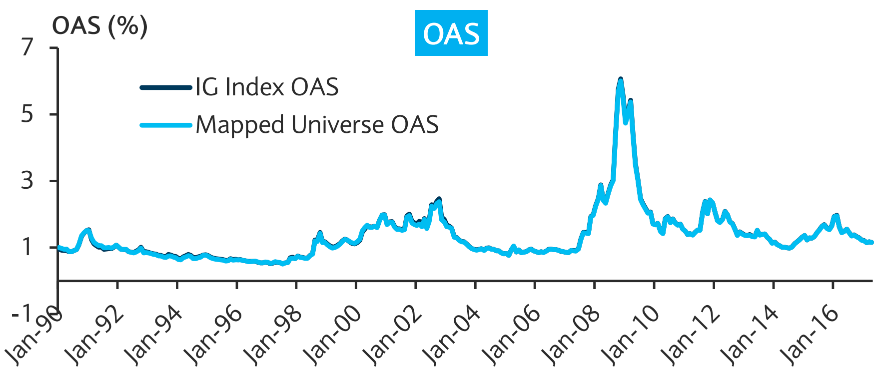
Source: Bloomberg, Compustat, Barclays Research

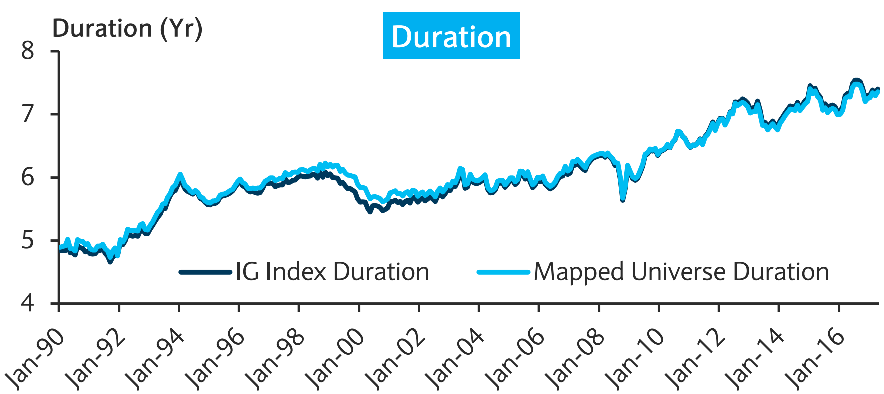
*Ben Dor, A., and Xu, J., BEAM (Bonds in Equity Asset Momentum) Value of Bond Market Information in Equity Momentum Strategies, Barclays Capital, 5 June 2014

Mapped Samples Are Similar to IG and HY Indices

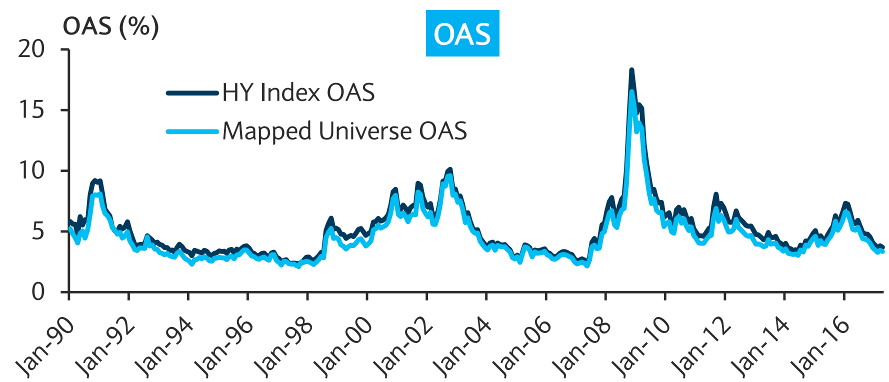
- Our mapped bond universe was similar to the IG and HY indices in terms of spread and duration

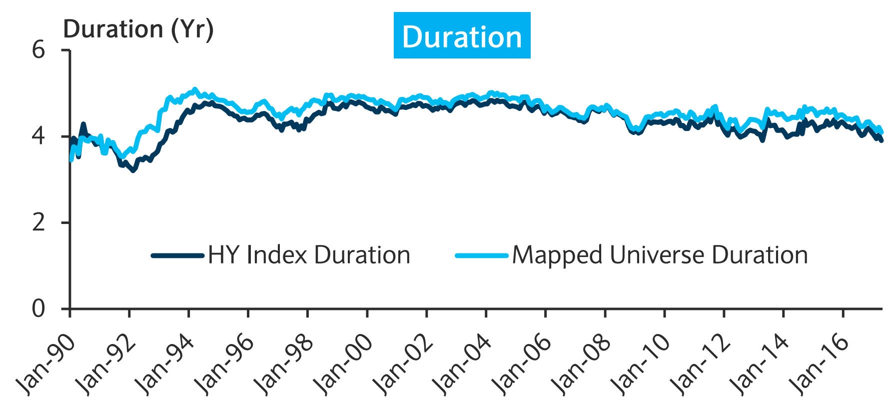
Mapped Univ. vs. Index – US IG





Mapped Univ. vs. Index – US HY





Source: Bloomberg, Compustat, Barclays Research

Mapped Equity Universe vs. Russell Indices

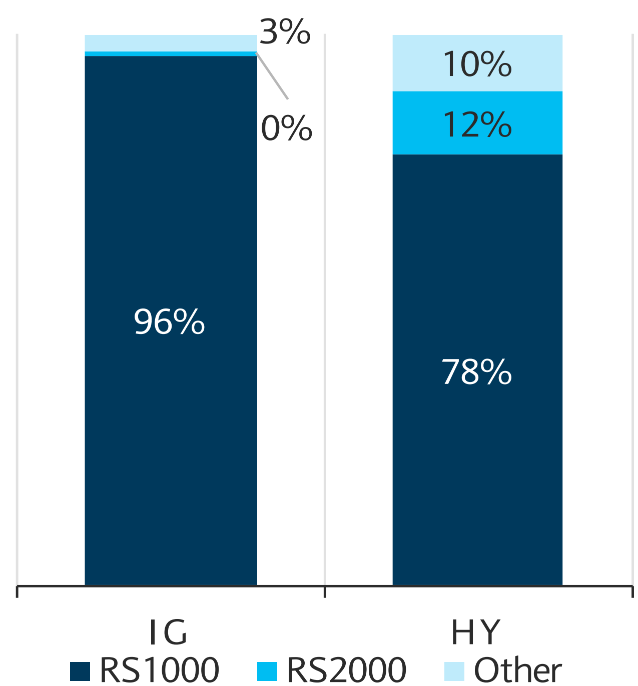
- The mapped IG (HY) equity sample had similar characteristics as the Russell 1000 (2000), but the median individual stock performance (ret and Sharpe ratio (S.R.)) was better than either index
- On average, 96% (IG) and 78% (HY) of the mapped equity sample (in terms of MV) was in the RS1000 and 0.1% (IG) and 5% (HY) was in the RS 2000

Characteristics (Jan. 1990 – Jan. 2018)

	Characteristics					Performance		
Universe	Avg. Mkt Cap ($Ml)	B/M Ratio	β_S&P 500	Dividend Yield (%/y)	% Paying Dividend	Median Ret. (%/Yr)	Median Stock-level Vol. (%/Yr)	Median S.R. (ann.r)
Mapped IG Equities	18,144	0.45	0.95	2.32	91%	12.92	27.77	0.39
Mapped HY Equities	3,139	0.61	1.26	1.61	39%	15.21	43.43	0.31
Russell 1000	11,759	0.43	1.03	2.04	69%	12.01	35.07	0.28
Russell 2000	581	0.55	1.26	1.38	40%	12.21	50.13	0.21

Note: B/M, beta, dividend yield, and ret. were calculated as value-weighted average for each month. Avg. Mkt cap and % paying dividend were calculated as an equally weighted average each month. The time-series averages were reported in the table. Avg. vol. and S.R. were calculated for each individual security for their entire duration in the sample and the cross-section equally weighted averages are reported in the table. Source: Bloomberg, Compustat, Barclays Research

% of Mapped Equities that are in Russell Indices (in terms of MV)



Step 1: Construct Mapped Bond and Equity Portfolios

Each month, we construct two portfolios (*Bond* and *Equity*) with

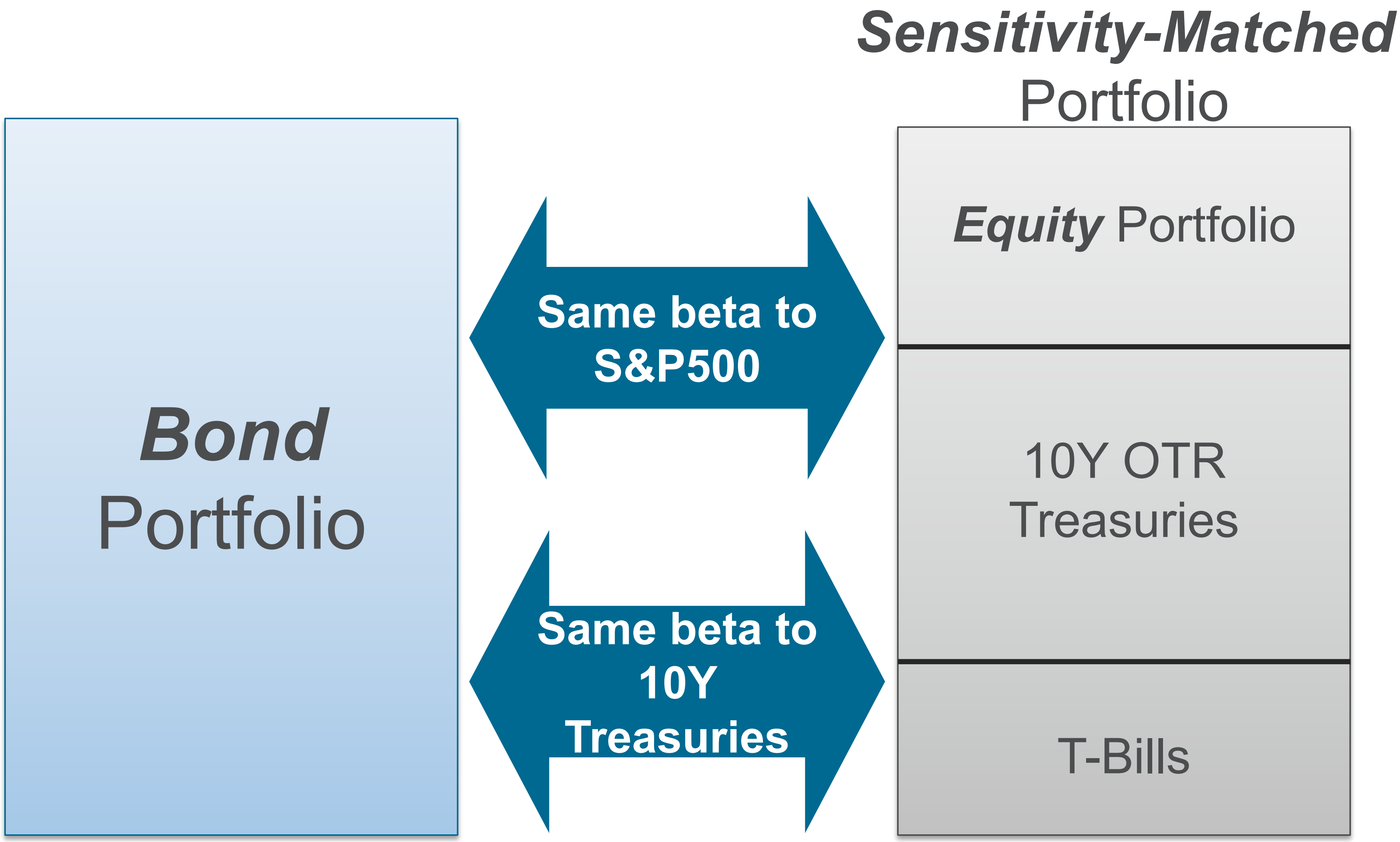
Bond Portfolio		***Equity*** Portfolio
Bond of Issuer 1	Identical set of Issuers	Equity of Issuer 1
Bond of Issuer 2		Equity of Issuer 2
Bond of Issuer 3	Identical Weights	Equity of Issuer 3
…		…
…		…
Bond of Issuer N		Equity of Issuer N

4 Weighting Schemes:
equal weights,
bond MV,
equity MV, and
total MV (bond+equity))

Source: Barclays Research

Step 2: Multi-Dimension Risk Matching

Each month, we construct a replicating portfolio comprised of the *Equity* port., Treasuries, and T-bills that matches the 2 factor sensitivities of the *Bond* port.



Source: Barclays Research

Matching Portfolios by Factor Sensitivities

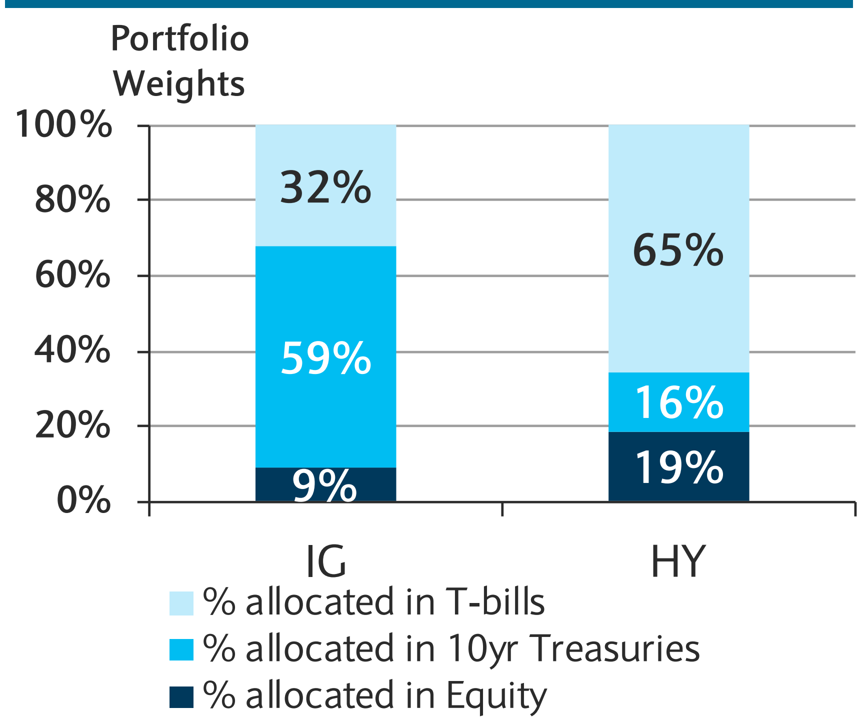
- Factor sensitivities were calculated using trailing 36m data
- Ex-ante sensitivities were similar across all the weighting schemes

Pre-Formation Avg. Sensitivities
(Trailing 36m Regression, Avg. across time series from Jan. 1993 - Jan. 2018, EW, total returns used)

	Portfolio	β_S&P 500	% of month with 5%-significance	β_10y Treasury ret.	% of month with 5%-significance	Adj. R2
IG	Bond	0.09	66%	0.59	99%	75%
	Equity	0.95	100%	0.00	6%	85%
HY	Bond	0.25	87%	0.08	43%	41%
	Equity	1.29	100%	-0.39	24%	67%

Source: Bloomberg, Compustat, Barclays Research

Average Portfolio Weights
(Jan. 1993 – Jan. 2018, EW)



Post-Formation, Bond and Sensitivity-Matched Port. Had Same Exposure

- Post-formation, the *bond* and *sensitivity-matched* portfolios had no difference in their factor exposures
- Similar results across weighting schemes and in both IG and HY

Post-Formation Portfolio Return Sensitivities
(Jan. 1993 - Jan. 2018, EW, total returns used)

	Portfolio	Intercept	T-Stat	β_S&P500	T-Stat	β_10y Treasury ret.	T-Stat	adj. R2
IG	**Bond over Sensitivity Matched Portfolio**	**0.46**	**2.08**	**-0.06**	**-1.13**	**-0.09**	**-1.07**	**5.6%**
	Bond	0.38	1.75	0.17	2.90	0.43	5.79	50%
	Sensitivity-Matched Portfolio	-0.08	-1.01	0.23	14.68	0.51	11.12	85%
HY	**Bond over Sensitivity Matched Portfolio**	**0.36**	**2.40**	**-0.04**	**-0.80**	**-0.04**	**-0.48**	**0.6%**
	Bond	0.48	2.99	0.28	4.26	0.01	0.10	31%
	Sensitivity-Matched Portfolio	0.12	1.54	0.32	11.93	0.05	1.02	59%

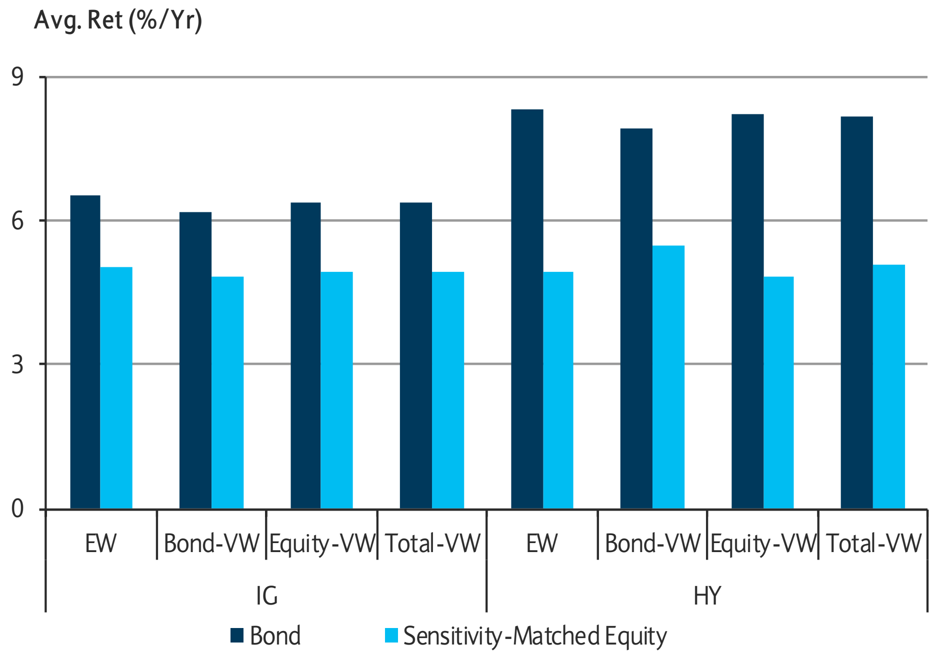
Source: Bloomberg, Compustat, Barclays Research

Portfolio-Level Performance

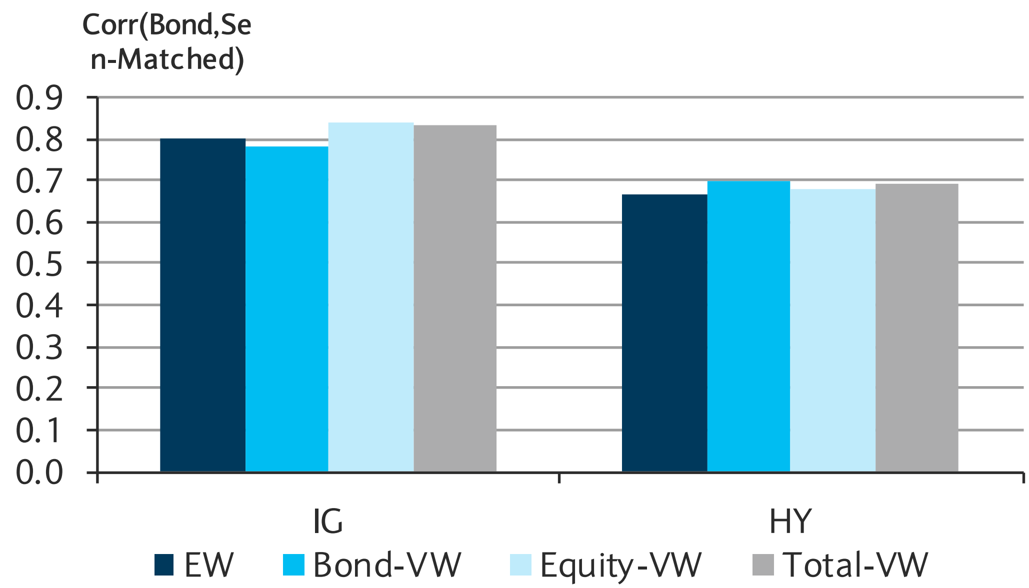
Bonds Had Higher Avg. Returns than Sensitivity-Matched Portfolio

- Sensitivity-matched equity portfolio had almost identical factor exposures as the bond portfolios post formulation but produced much lower avg. returns, regardless of the weighting scheme in both IG and HY
- Regardless of the difference in avg. returns, the correlations were high for both IG and HY among all weighting schemes

Avg. Ret. of Bonds vs. Sensitivity-matched Equity (Jan. 1993 – Jan. 2018, total returns)



Post-Formation Correlation b/w Bond and Sensitivity-Matched-Equity Portfolios (Jan. 1993 - Jan. 2018)

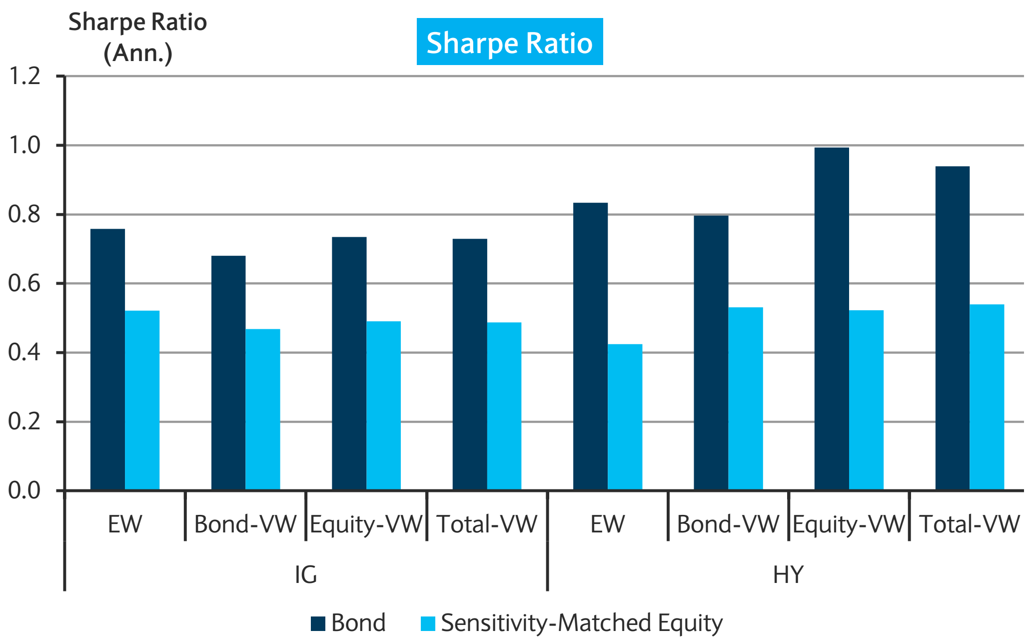


Note: the mapped bond universe has a price filter of $40 to exclude bonds traded on recovery. Results were similar using no price filter
Source: Bloomberg, Compustat, Barclays Research

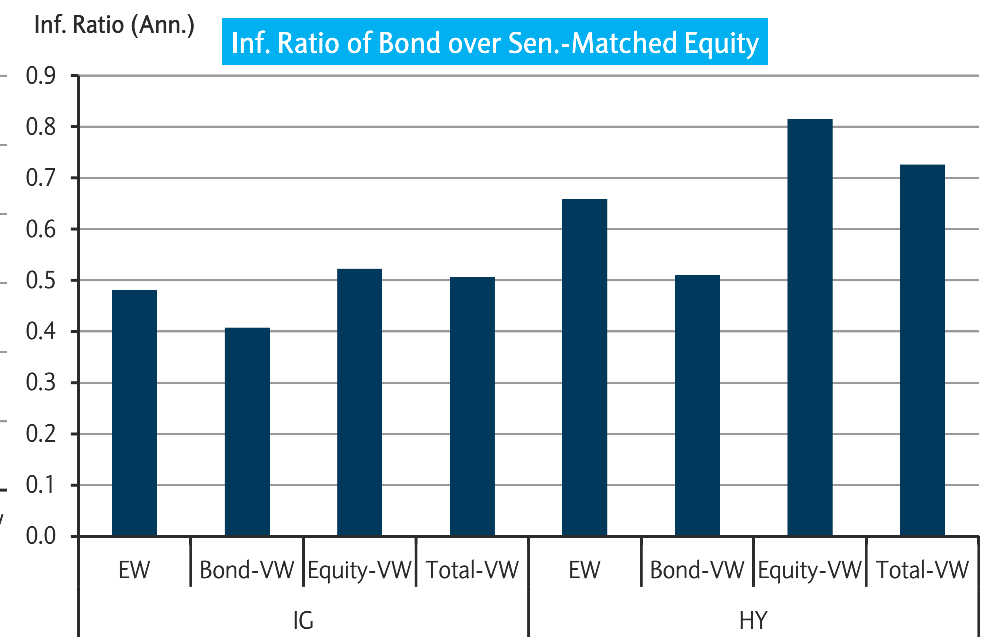
Bond Portfolios Had Higher S.R. than Sensitivity-Matched Equity

- Regardless of the weighting scheme, bond portfolios had higher S.R. on average than equity portfolios of the same company in both IG and HY
- The I.R. of bonds over sensitivity-matched equity ranged from 0.41 to 0.82 with different weighting schemes

Sharpe Ratios of Bonds vs. Matched-Equity (Jan. 1993 – Jan. 2018)



Inf. Ratios of Bonds over Matched Equity (Jan. 1993 – Jan. 2018)



Source: Bloomberg, Compustat, Barclays Research

Bond Outperformed Sensitivity-Matched Equities

- The bond portfolios outperformed sensitivity-matched equity portfolios with
  - ✓ Higher avg. ret.
  - ✓ Inf. ratio ranges from 0.41 to 0.82
  - ✓ Regardless of weighting schemes in both IG and HY

Performance of Bond over Sensitivity-Matched Portfolios (Jan. 1993 – Jan. 2018)

	Weighting Scheme	Avg. Ret (%/Yr)	Vol. (%/Yr)	Inf. Ratio (Ann.)	Worst Monthly Ret (%)	Max. DD (%)	Corr (Bond, Matched Equity)
IG	EW	1.51	3.13	0.48	-3.06	-15.29	0.80
	Bond-VW	1.37	3.36	0.41	-5.45	-10.31	0.78
	Equity-VW	1.47	2.82	0.52	-3.59	-9.99	0.84
	Total-VW	1.47	2.90	0.51	-3.88	-9.97	0.83
	Avg. across weighting	1.45	3.05	0.48	-4.00	-11.39	0.81
HY	EW	3.39	5.15	0.66	-6.91	-15.02	0.67
	Bond-VW	2.45	4.79	0.51	-4.46	-11.81	0.70
	Equity-VW	3.37	4.13	0.82	-5.94	-9.61	0.68
	Total-VW	3.10	4.26	0.73	-5.55	-10.22	0.69
	Avg. across weighting	3.08	4.58	0.68	-5.71	-11.66	0.68

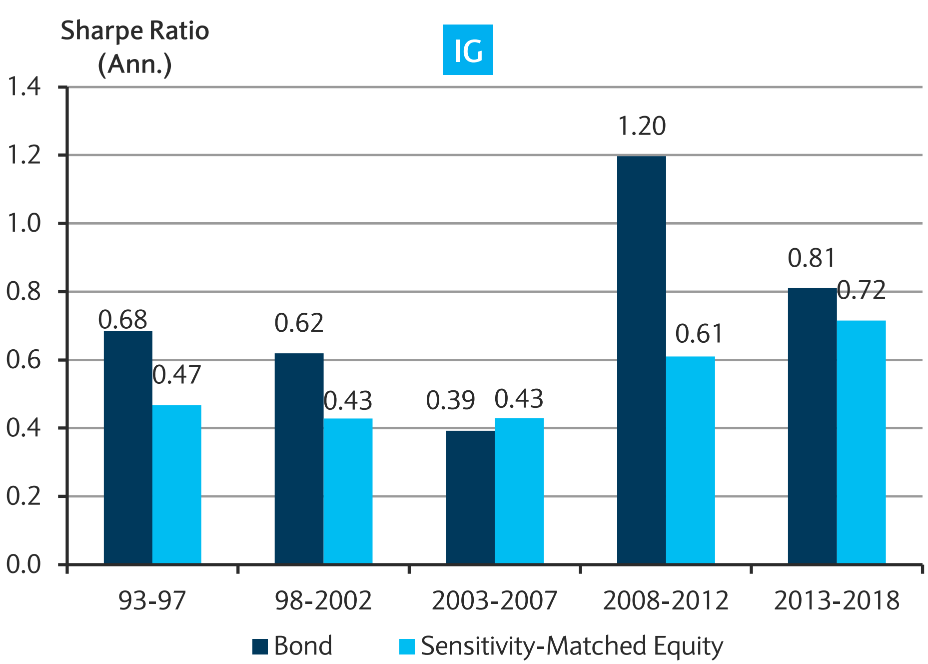
Source: Bloomberg, Compustat, Barclays Research

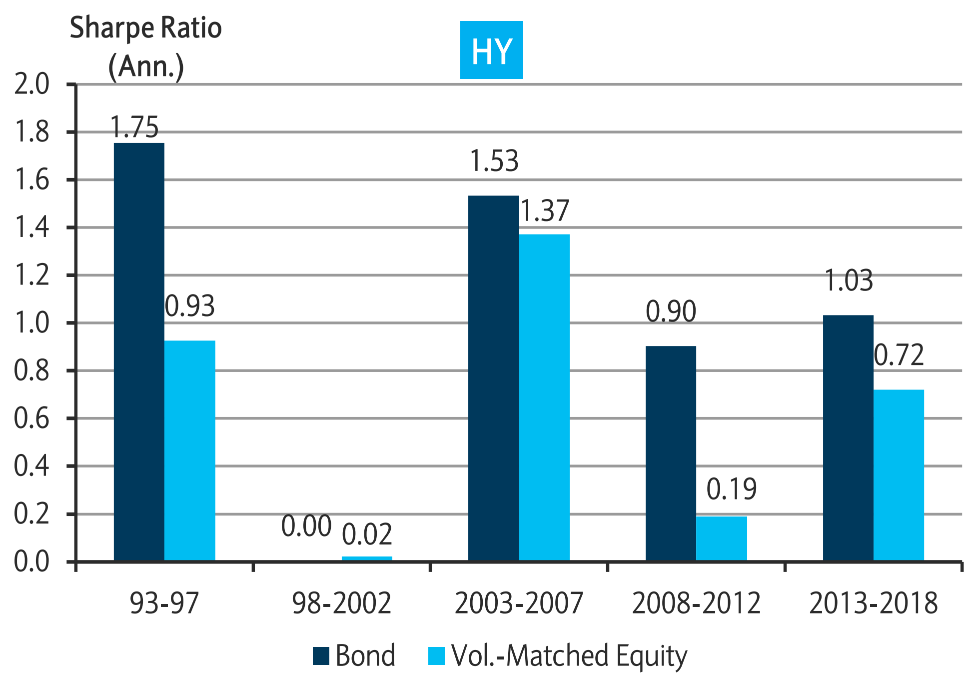
Bond Outperformance Was Not Limited to a Single Period

- Bond portfolios had higher S.R. than sensitivity-matched equity portfolios in most sub-periods except 2003-2007 for IG and 1998-2002 for HY

- Sub-period performance comparison were similar in all weighting schemes

Sharpe Ratios of Bond vs. Sensitivity-Matched Equity in Sub-Periods (EW)



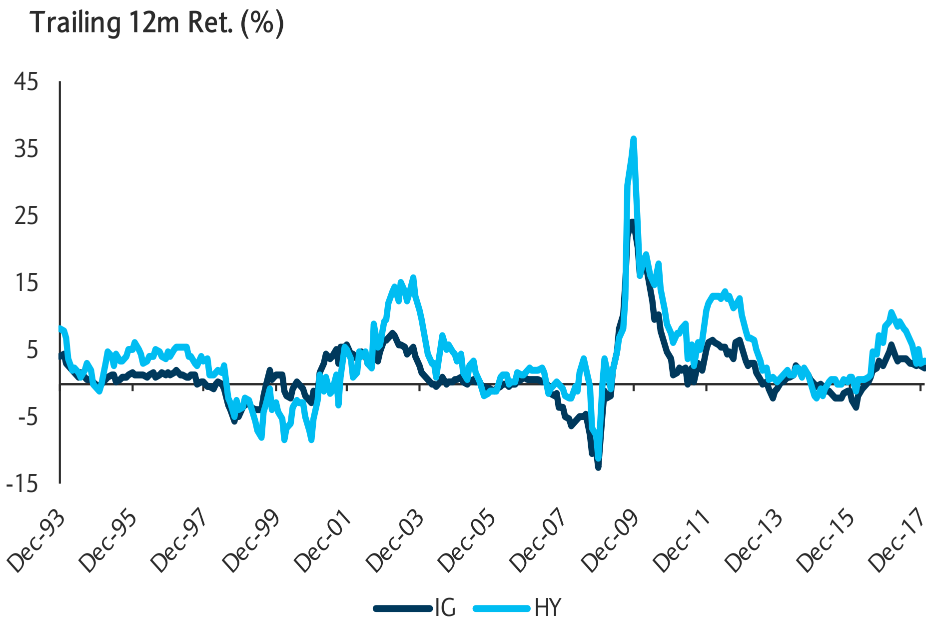


Source: Bloomberg, Compustat, Barclays Research

But in Some Periods, Stocks Did Outperform Bonds

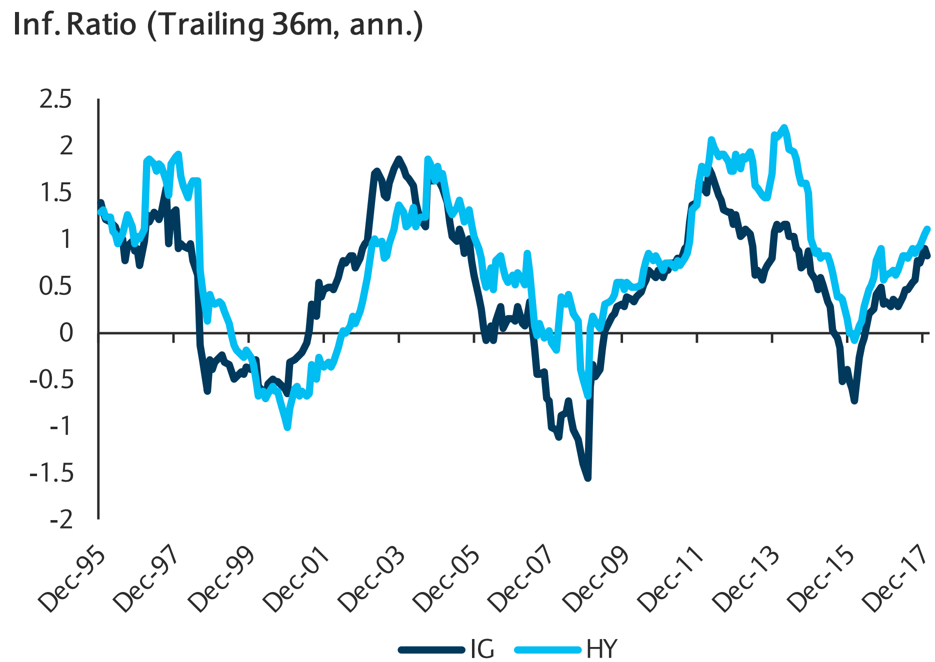
- Similar dynamics with all weighting schemes

Trailing 12m Ret. Diff of Bond over Sensitivity-Matched Equity (EW)



Corr(IG,HY) = 0.86

Trailing 36m Inf. Ratio of Bond over Sensitivity-Matched Equity (EW)



Corr(IG,HY) = 0.79

Source: Bloomberg, Compustat, Barclays Research

Bond Outperformance Intact after Controlling for Macro Factors

- The intercept term is significantly positive in both IG and HY
- Inflation and term premium are significantly related to the contemporaneous bond-over-matched equity returns for both IG and HY

Regression Coefficients of Bond-over-Sensitivity-Matched Equity on Standardized Macroeconomic Variables (EW, monthly ret., Jan. 1993 – Jan. 2018)

Coefficients	IG	HY
Intercept (%/yr)	1.56**	3.36***
SP500 - 10Y Treasury Ret	-0.15	-0.27*
VIX monthly Chg	-0.12	-0.24
Inflation (%chg in monthly CPI)	0.16**	0.31***
CFNAI Diffusion Index	0	0.02
Monthly Yield Chg (10Y Treasury)	0.07	0.08
Term Premium (10Y - 2Y Treasury Yield)	0.15***	0.25***
Default Premium (Baa - 10Y Treasury Yield)	0.02	0.03
Adj. R2	4%	5%

Note: Macroeconomic variables were standardized using time series mean and std. for easier interpretation.
Source: Compustat, Bloomberg, Chicago Fed, Bureau of Labor Statistics, Barclays Research

Bond Outperformed Equities after Controlling for Risk Factors

- The bond portfolios significantly outperformed sensitivity-matched equity portfolios even after controlling for common risk factors (Fama-French 5 factors and Momentum)

Regression of Bond over Sensitivity-Matched Equities on FF and Momentum Factors (Jan. 1993 – Jan. 2018)

		EW	Bond-VW	Equity-VW	Total-VW
IG	alpha (%/yr)	2.185**	1.903**	1.978**	1.972**
	Mkt Beta	-0.032	-0.026	-0.025	-0.025
	SMB Beta	0.017	0.029	0.035**	0.034*
	HML Beta	-0.051	-0.096	-0.059	-0.065
	RMW Beta	-0.03	0	-0.004	-0.003
	CMA Beta	-0.011	0.024	0.012	0.016
	MMT Beta	-0.026	-0.032	-0.04**	-0.039**
	Adj. R2	4.78%	6.83%	7.20%	6.97%
HY	alpha (%/yr)	4.399***	3.113***	4.13***	3.823***
	Mkt Beta	-0.043	-0.026	-0.031	-0.029
	SMB Beta	-0.026	0.03	0.02	0.023
	HML Beta	-0.079	-0.085	-0.078	-0.08
	RMW Beta	-0.026	0.007	-0.004	0
	CMA Beta	-0.048	-0.054	-0.014	-0.025
	MMT Beta	-0.023	-0.022	-0.047***	-0.041**
	Adj. R2	3.18%	4.08%	4.78%	4.37%

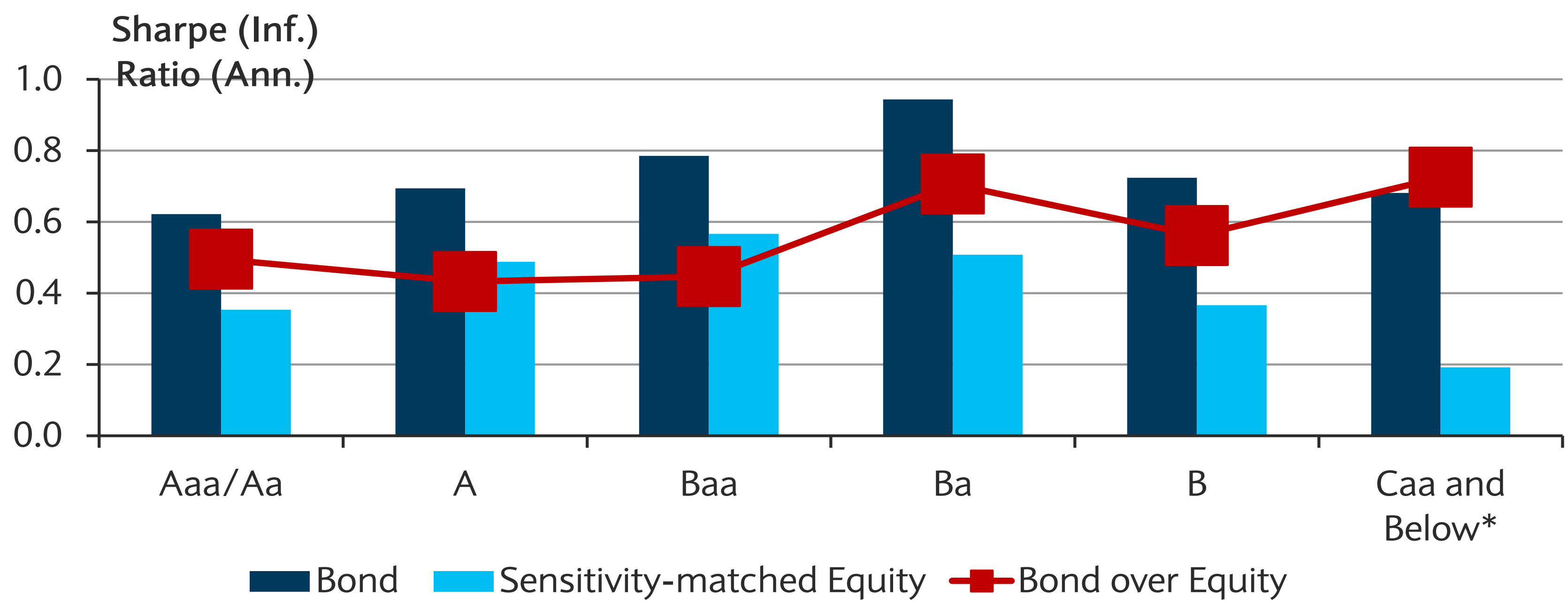
Note: */**/*** indicates 10%-/5%-/1%-level of significance. Newey-West Standard Errors with 12lags were used.

Source: Bloomberg, Compustat, Ken French Data Library, Barclays Research

Bonds had Higher S.R. than Equities across all Ratings

- In all rating categories
  - ✓ Bonds had higher S.R. than their equity counterparts
  - ✓ The bond over equity return diff. also had positive I.R ranging from 0.43 to 0.73
- Results hold regardless of weighting schemes

Sharpe (Inf.) Ratios (Ann.) of Bond vs. Sensitivity-Matched Equity in Each Rating (Jan. 1993 – Jan. 2018, EW)

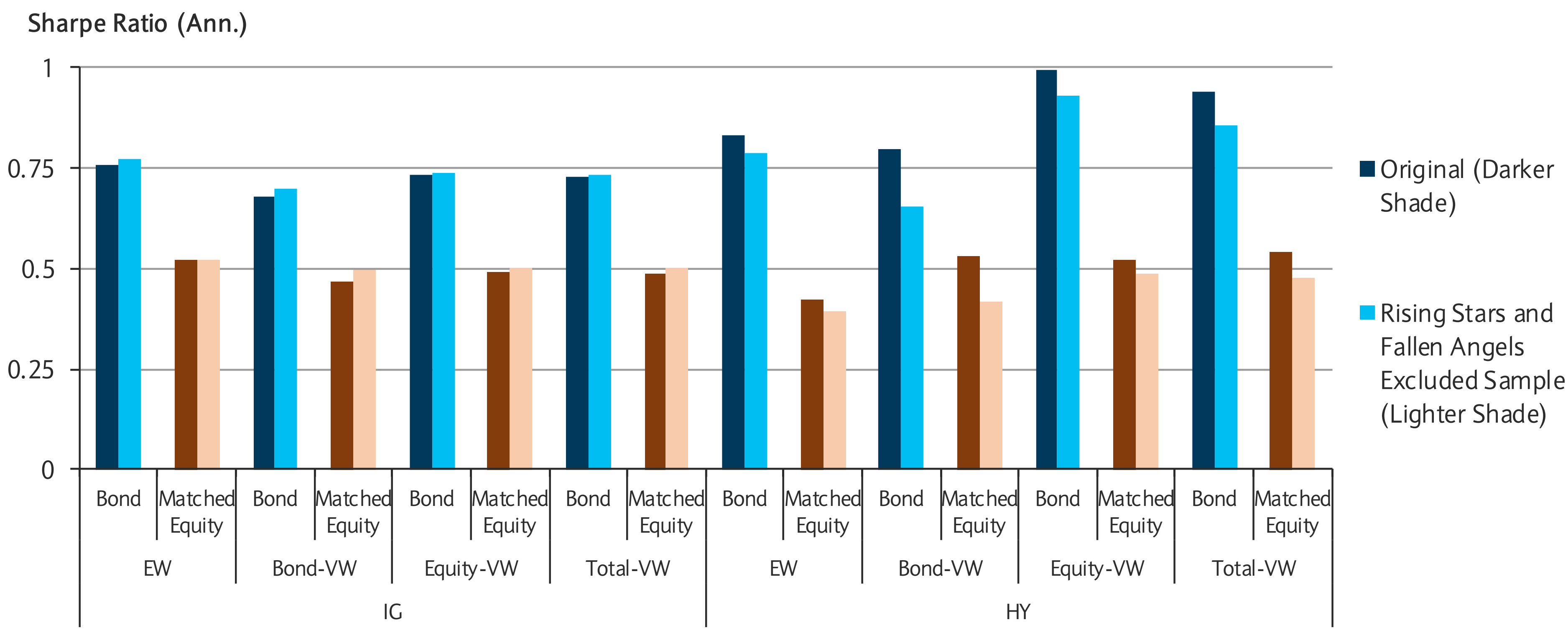


Note: The statistics shown for Caa and below are from Jan. 2002 – Jan. 2018 due to lack of observation in this rating bucket from 1993-2001.
Source: Bloomberg, Compustat, Barclays Research

Were Higher Bond returns Driven by Rising Stars or Fallen Angels?

- No. Excluding Rising Stars (IG bonds that were in HY in any month during previous 24m) and Fallen Angels (HY bonds that were in IG in any month during previous 24m-period) had **no material effect** on the outperformance of bonds over sensitivity-matched equities

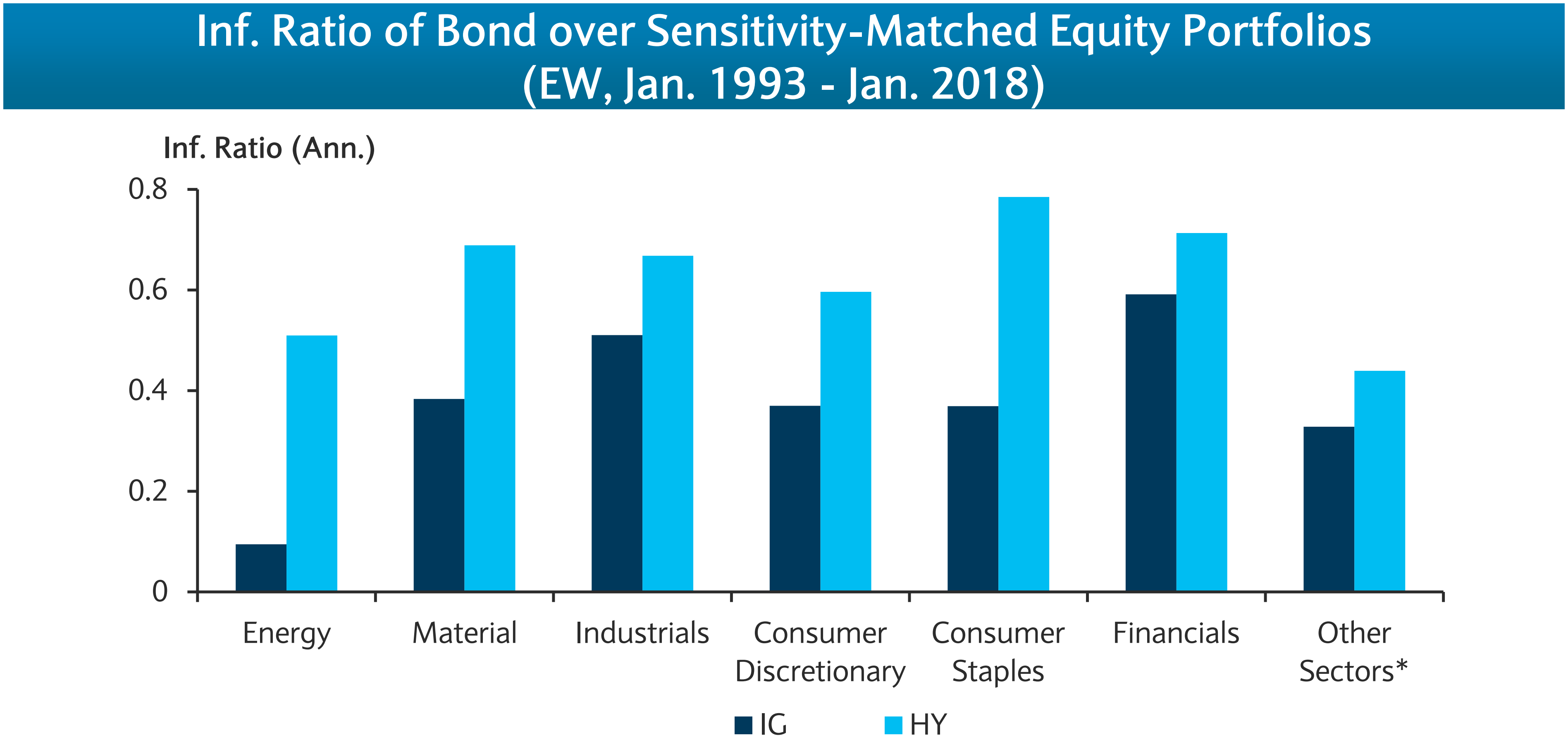
Sharpe Ratios of Original Sample vs. Sample excluding Fallen Angels and Rising Stars (Jan. 1993 – Jan. 2018)



Source: Bloomberg, Compustat, Barclays Research

Bonds Outperformed Sensitivity-Matched Equities in all Sectors

- In all GICS sectors, the bond portfolios outperformed corresponding sensitivity-matched equity portfolios in both IG and HY
- The results are similar regardless of weighting scheme

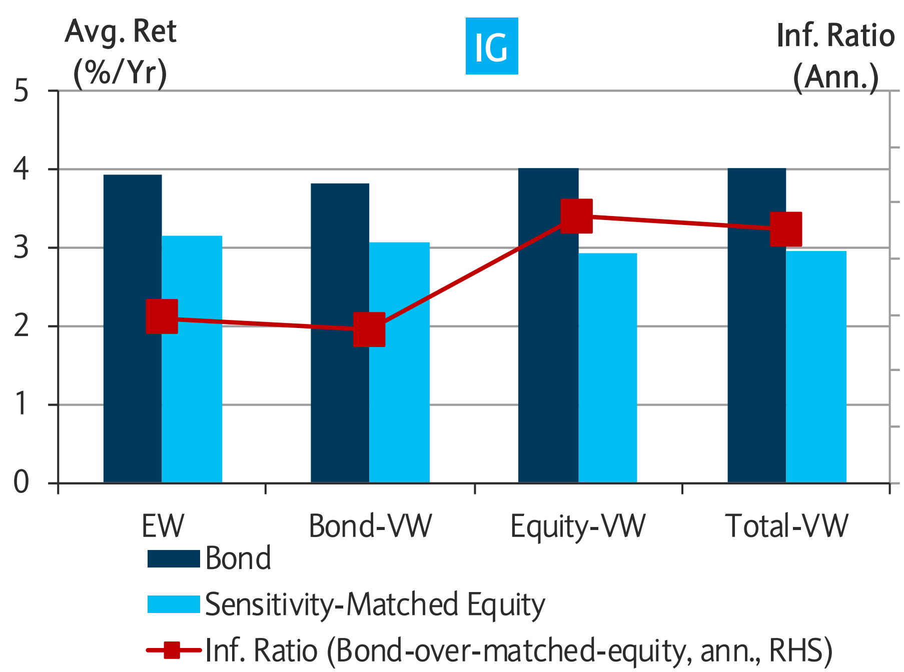


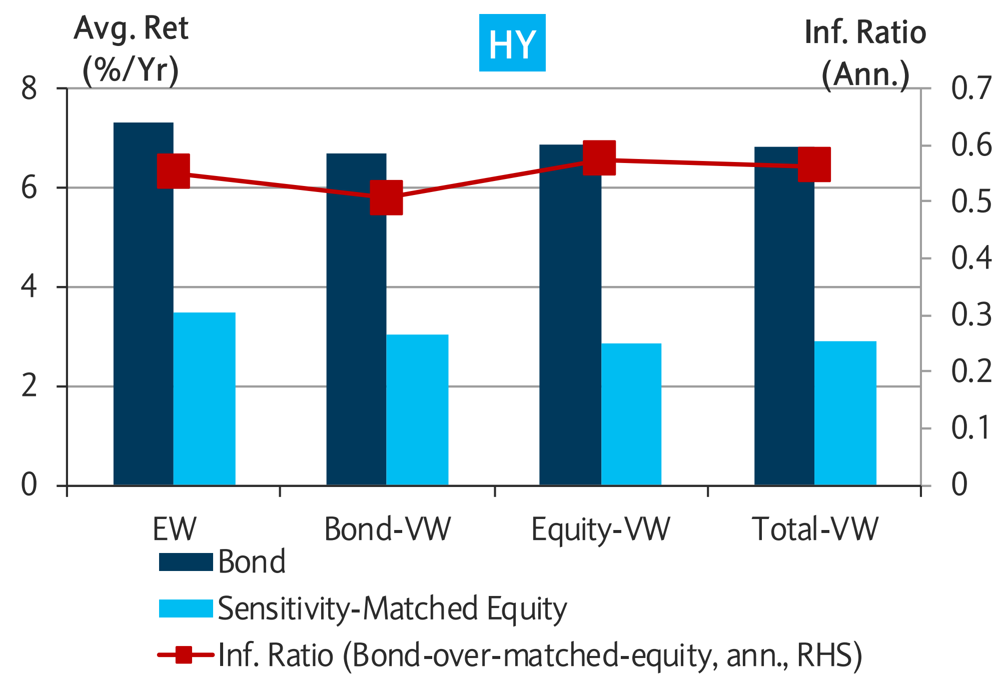
Note Other sectors include utilities, health care, information technology, and telecommunications. These sectors did not have enough observations on their own, so they were grouped together. Source: Bloomberg, Compustat, Barclays Research

Similar Bond Outperformance in European Markets

- Similarly, in European markets, bond portfolios had higher avg. ret. and Sharpe ratios than the sensitivity-matched equity portfolios
- The Inf. ratios of bond over matched equity are about 0.4 for IG and 0.5 for HY
- The results are consistent across different weighting schemes

Bond vs. Sensitivity-Matched Equity Portfolio Performance in European Markets
(May. 2005 – Jan. 2018)





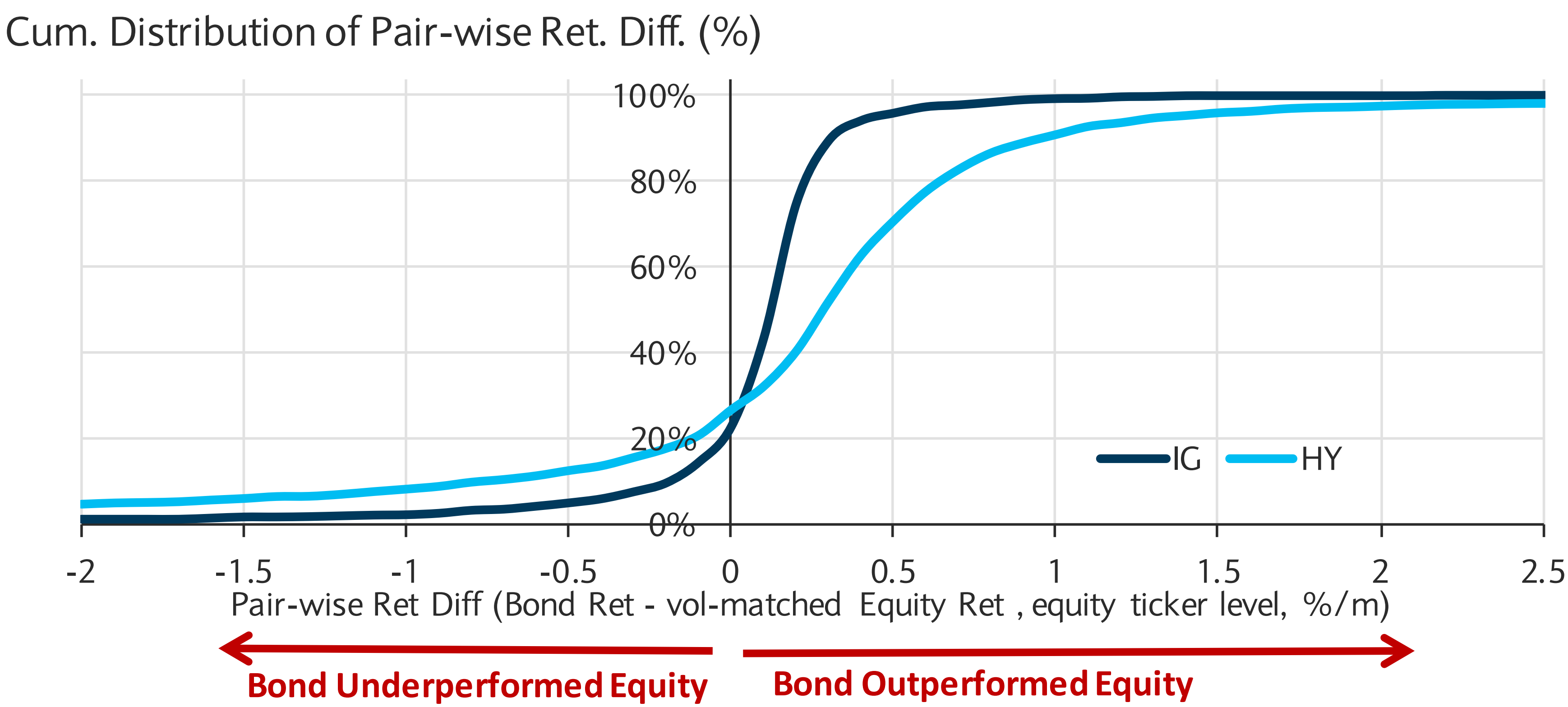
Source: Bloomberg, Compustat, Barclays Research

Cross-Sectional Differences

More than 70% of Companies Had Higher Avg. Bond Ret.

- For each company, we looked at the diff. in avg. ret. between its bond and sensitivity-matched return (applying the **same weights across the board for IG/HY**)*
- 77% of IG and 73% of HY companies had higher avg. returns with their bonds than with their sensitivity-matched equities during 1993-2018

Cum. Distribution of Pair-wise Ret. Diff. (EW, Jan. 1993 – Jan. 2018)



Note: weights on equity, 10y treasury, and T-bills calculated monthly from EW bond and equity portfolios using sensitivity matching of two factors (S&P 500 and 10y Treasury Ret).
Source: Bloomberg, Compustat, Barclays Research

How Did the Hedging Work in the Cross-Section?

- Even when we apply the **same weights across the board** for the hedging portfolio of each individual company, the majority of the difference portfolio (bond over matched equity) has non-significant post-formation exposures to the two factors (S&P500 and 10y Treasuries)
- For the difference port., the magnitude of the ex-post sensitivities were small and could only explain a small % of total variation

Post-Formation Company-Level Exposures to Factors (EW, Jan. 1993 – Jan. 2018, Company-level regressions of bond – sensitivity matched equity monthly ret on S&P 500 and 10y OTR Treasury ret)

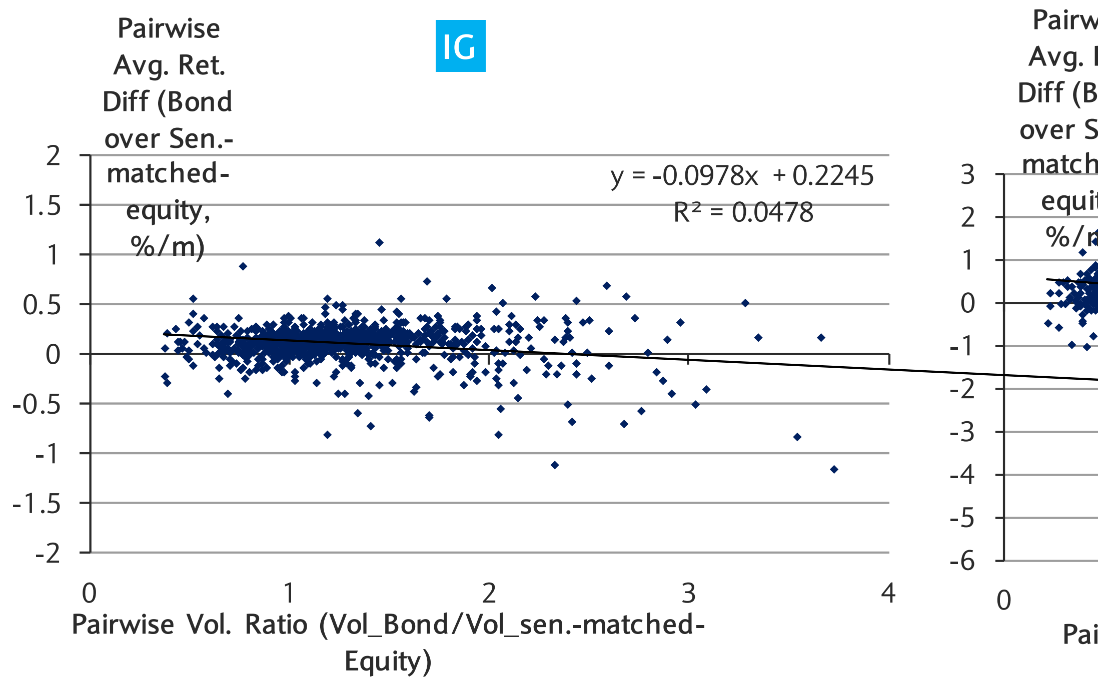
						Under-hedged		Over-hedged		
						Positive Coef.		Negative Coef.		
		Avg. Coef.	25%-tile	Median	75%-tile	% in the cross-section	% Significant (10%-level, over all)	% in the cross-section	% Significant (10%-level, over all)	% non-significant coef.
IG	beta_SP500	-0.007	-0.064	-0.017	0.040	42%	8%	58%	18%	74%
	beta_10yTreasury	-0.033	-0.157	-0.017	0.111	46%	19%	54%	22%	59%
	adj. R2	9%	0%	5%	13%					
HY	beta_SP500	0.004	-0.129	-0.019	0.113	46%	9%	54%	13%	79%
	beta_10yTreasury	-0.010	-0.231	0.008	0.244	48%	15%	52%	10%	75%
	adj. R2	6%	-1%	2%	9%					

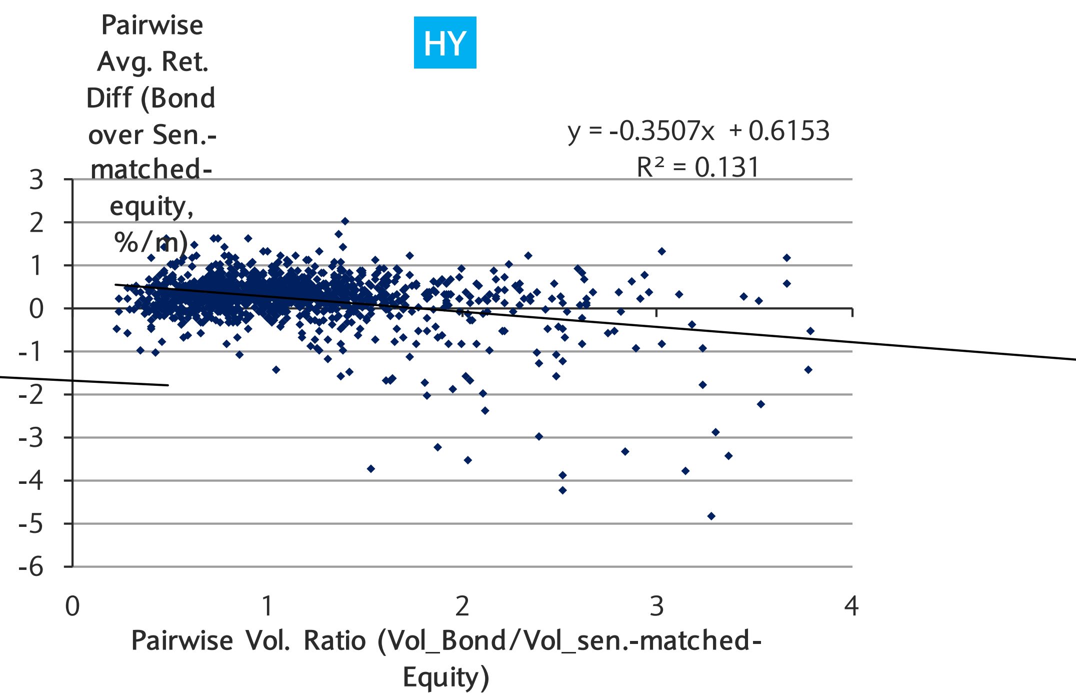
Note: weights on equity, 10y treasury, and T-bills calculated monthly from EW bond and equity portfolios using sensitivity matching of two factors (S&P 500 and 10y Treasury Ret).
Source: Bloomberg, Compustat, Barclays Research

Scatter-Plot of Pair-Wise Vol. Ratio vs. Ret. Diff

- We applied the same weights to all individual equities (in IG/HY) every month
- In reality, different companies might need different weights for their equities to have the same factor sensitivities as the bond
- The positive diff in return could be driven by bonds having higher risk (proxied by vol)
- Scatter-plot shows that bonds with higher vol than equity did not have higher ret.

Pair-wise Vol. Ratio vs. Ret Diff (Bond over Matched-Equity, Jan. 1993 – Jan. 2018, EW)



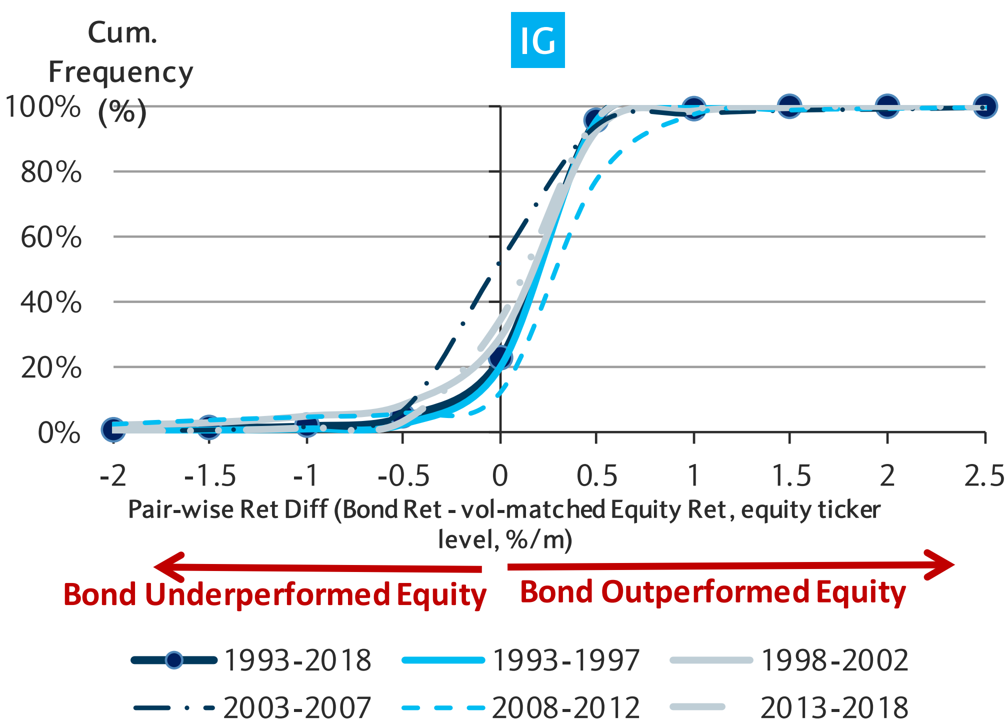


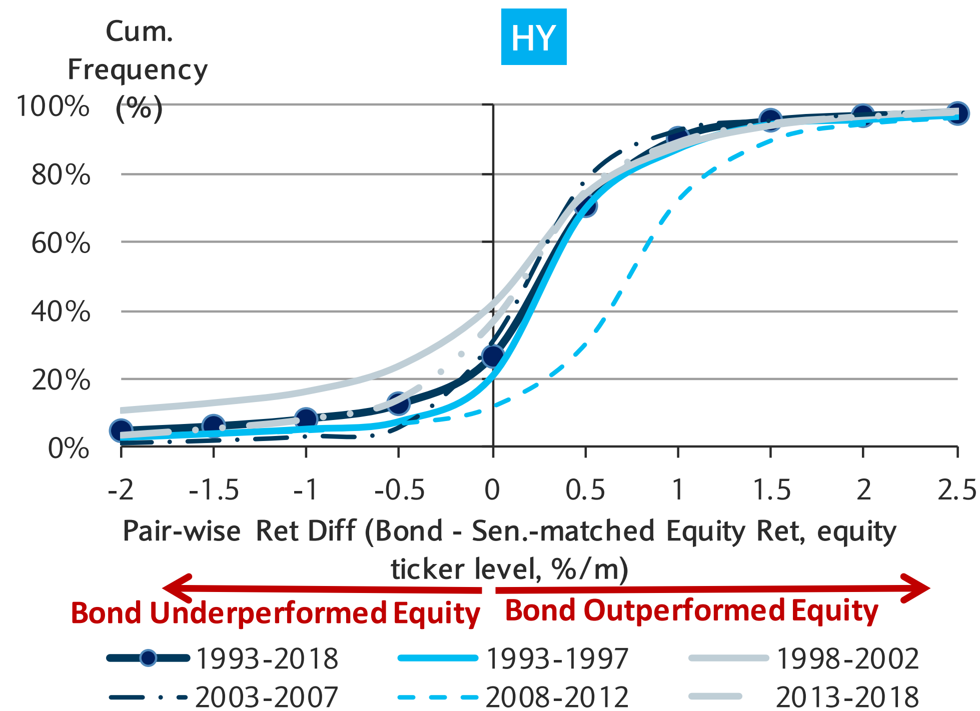
Note: weights on equity, 10y treasury, and T-bills calculated monthly from EW bond and equity portfolios using sensitivity matching of two factors (S&P 500 and 10y Treasury Ret).
Source: Bloomberg, Compustat, Barclays Research

% of Companies with Outperforming Bonds Varied over Time

- The fraction of companies with higher bond returns ranged from 47% (IG 2003-07) to 88% (HY 2008-12) in the sub-periods

Sub-periods Cum. Distribution of Pair-wise Ret. Diff. (EW)



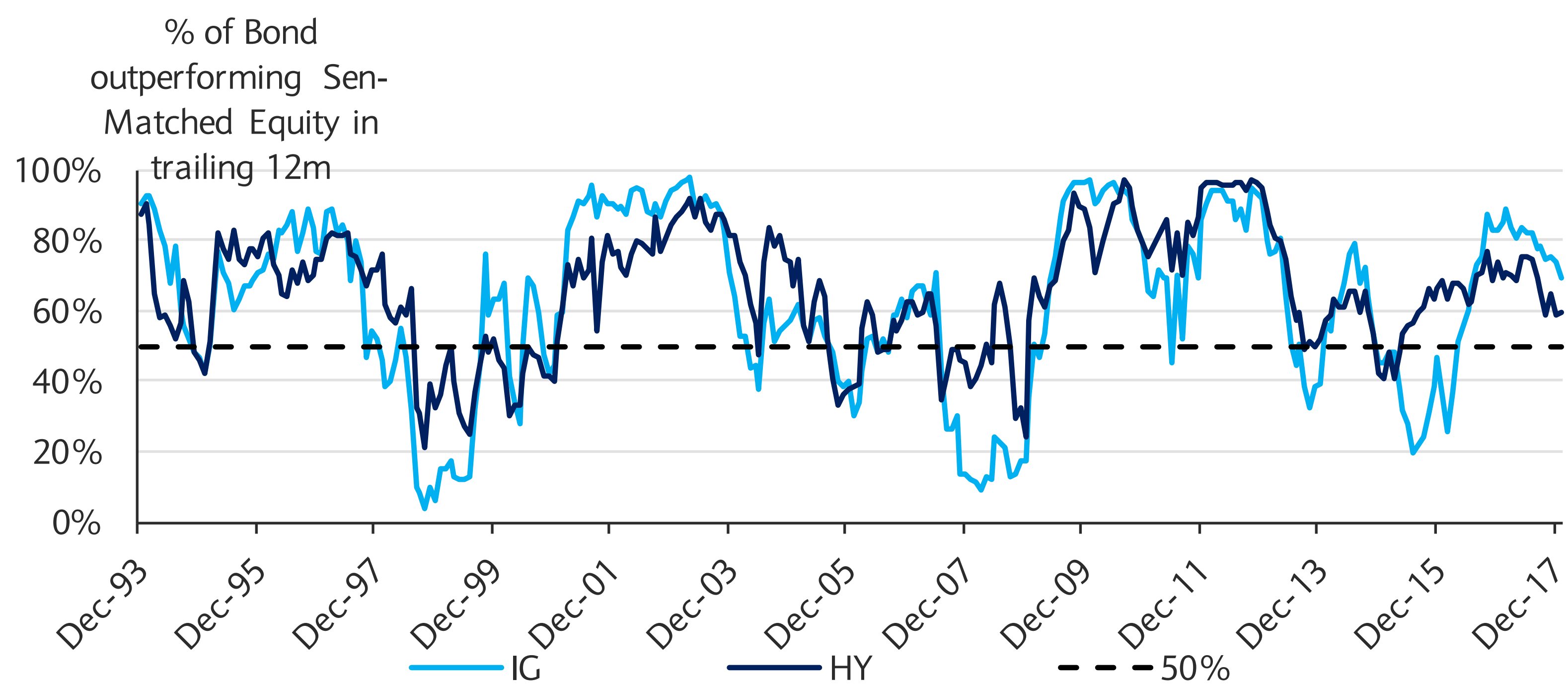


Note: weights on equity, 10y treasury, and T-bills calculated monthly from EW bond and equity portfolios using sensitivity matching of two factors (S&P 500 and 10y Treasury Ret).
Source: Bloomberg, Compustat, Barclays Research

% of Bond outperforming Sen.-Matched Equity Varied over Time

- Similar as the magnitude of outperformance, there is time-series variation in the cross-section of the % of companies whose bonds outperformed stocks on a risk-adjusted basis
- In each period, some stocks did better than bonds from the same company in the trailing 12m-period

% of Companies whose Bond Outperformed Sensitivity-Matched Equity in the trailing 12m (EW)



Note: weights on equity, 10y treasury, and T-bills calculated monthly from EW bond and equity portfolios using sensitivity matching of two factors (S&P 500 and 10y Treasury Ret).
Source: Bloomberg, Compustat, Barclays Research

Is Liquidity the Driver?

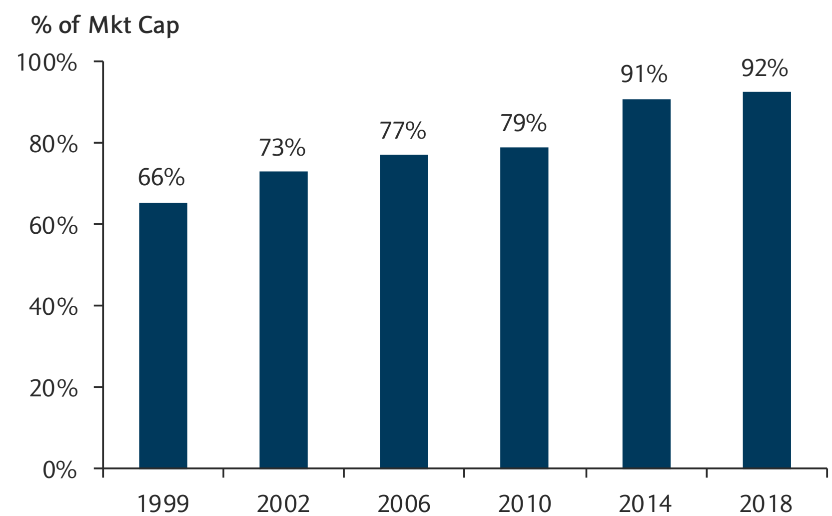
Is Liquidity Driving the Bond-over-Equity Outperformance?

- We focus on a sub-sample with liquid bonds and equities: S&P 500 companies with publicly traded bonds included in the Bloomberg Barclays Corporate and HY index
- Bonds outperformed matched equities in a similar pattern as in IG
  - ✓ Sensitivity-matched equity had high corr. with bond portfolio
  - ✓ EW *Bond* port. outperformed sensitivity-matched equities by 1.84%/year with an I.R. of 0.52
  - ✓ Results were similar across weighting schemes

S&P 500 Sample: Performance of Bond over Sensitivity-Matched Equity Portfolios
(EW, Dec. 1997 – Jan. 2018 due to availability on S&P500 constituent data)

Weighting Scheme	Avg. Ret (%/Yr)	Vol. (%/Yr)	Inf. Ratio (Ann.)	Worst Monthly Ret (%)	Max. DD (%)	Corr(Bond, Matched Port.)
EW	1.84	3.57	0.52	-3.30	-11.99	0.71
Bond-VW	1.76	3.86	0.45	-5.37	-8.50	0.70
Equity-VW	1.66	3.12	0.53	-3.47	-9.23	0.79
Total-VW	1.70	3.24	0.52	-3.79	-9.10	0.78

%Mkt Cap of S&P 500 stocks having mapped index bonds



Source: Bloomberg, Compustat, Barclays Research

Note: the coverage data are of January for each year listed.

Another Approach: Quantifying Bonds' Liquidity using *LCS*

Liquidity as Cost of Trading:

- Liquidity Cost Score (LCS) measures the cost of an *immediate, institutional-size, round-trip* transaction, expressed as a percent of the bond's price:
  - OASD × (Bid spread – Ask spread) *if quoted on spread*
  - (Ask price – Bid price) / Bid price *if quoted on price*

- Launched in October 2009 for USD IG and HY corporate bonds, with history available from January 2007. Currently, LCS is computed for ~20,000 bonds
- Based on bond-level information, and published by Barclays QPS Research (see Konstantinovsky, Ng, and Phelps, 2015; Konstantinovsky, 2018; for more details)

LCS Ranking Had Little Effect on Bond Outperformance

- Each month, we divided all issuers into low and high LCS categories and tracked their performance in a similar way
- In low and high LCS buckets, bond-over-sensitivity-matched portfolios had similar I.R. in both IG and HY and across weighting schemes
- Similar bond outperformance across LCS rankings indicates that liquidity is not a reason for bonds' outperformance over equities

Performance of Bonds over Matched Equity Portfolios **by LCS Ranking**
(EW, Jan. 2010* – Jan. 2018)

	LCS Ranking	Avg. Ret (%/yr)	Vol. (%/Y)	Inf. Ratio (Ann.)	Worst Monthly Ret (%/m)	MaxDD (%)
IG	Low LCS (High Liquidity)	1.45	1.83	**0.80**	-1.00	-2.49
	High LCS (Low Liquidity)	2.82	3.47	**0.81**	-2.45	-7.11
HY	Low LCS (High Liquidity)	3.88	3.09	**1.26**	-1.79	-3.79
	High LCS (Low Liquidity)	5.96	5.40	**1.10**	-3.45	-7.95

Note: Analysis starts in 2007 due to availability of LCS data. Source: Bloomberg, Compustat, Barclays Research

Bond Outperformance Remained Strong after Transaction Costs

- Transaction costs account for only a small part of bonds' returns, due to their long holding periods

	Annualized Bond Transaction Cost (%)	Average LCS (%)	Average Bond Holding Period (Yr)
IG	0.16	1.07	5.5
HY	0.64	1.65	3.3

- As a result, incorporating transaction costs in bonds made only a very small difference on the bond outperformance over equities
  - ✓ The I.R. of **net** bond over sensitivity-matched equity portfolios remained strong at 0.46 for IG and 0.66 for HY
  - ✓ Results were similar across weighting schemes and (for HY) risk-matching methods

Gross and Net Performance of Bonds over Sensitivity-Matched Equity Portfolios
(EW, Jan. 2007* – Jan. 2018, transaction costs approximated by LCS, incorporated at sales)

	IG						HY					
	Bond			Bond over Sensitivity-Matched Equities			Bond			Bond over Sensitivity-Matched Equities		
	Avg. Ret (%/Yr)	Vol. (%/Yr)	Sharpe Ratio (Ann.)	Avg. Ret (%/Yr)	Vol. (%/Yr)	Inf. Ratio (Ann.)	Avg. Ret (%/Yr)	Vol. (%/Yr)	Sharpe Ratio (Ann.)	Avg. Ret (%/Yr)	Vol. (%/Yr)	Inf. Ratio (Ann.)
Gross	5.86	5.24	**0.94**	2.05	4.13	**0.50**	7.88	8.49	**0.82**	4.74	6.22	**0.76**
Net of Transaction Costs	5.70	5.26	**0.91**	1.88	4.12	**0.46**	7.24	8.62	**0.74**	4.10	6.25	**0.66**

Note: Analysis starts in 2007 due to availability of LCS data. Source: Bloomberg, Compustat, Barclays Research

Summary

Key Results

I. On average, bonds achieved higher S.R. than equities of the same company, in both IG and HY regardless of the weighting scheme used

II. The outperformance was evident across sub-periods, ratings, sectors, in European markets and after controlling for equity and macro risk factors

III. Bond outperformance was not driven by their lower liquidity or higher transaction costs

IV. The bond-over-equity performance exhibits significant variation over time and in the cross-section

Implications:
Separating View Formation from Instrument of Execution

- Most mandates today are asset class specific: bonds and equities are separate
- Different parts of an issuer's capital structure may be more attractive at times

A 'Unified' mandate would allow a PM to:

1. Form a view on a company
2. Find out which part of the capital structure should be used to express that view

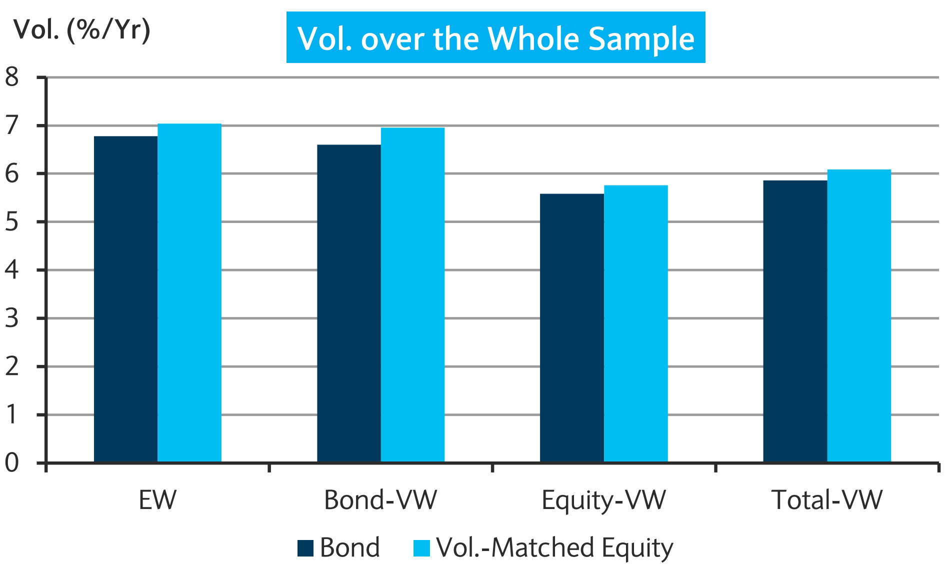
Such a unified mandate would add another source of alpha on which PMs can capitalize, in addition to identifying mispricing across companies

Appendix
Risk Matching Using Total Volatility

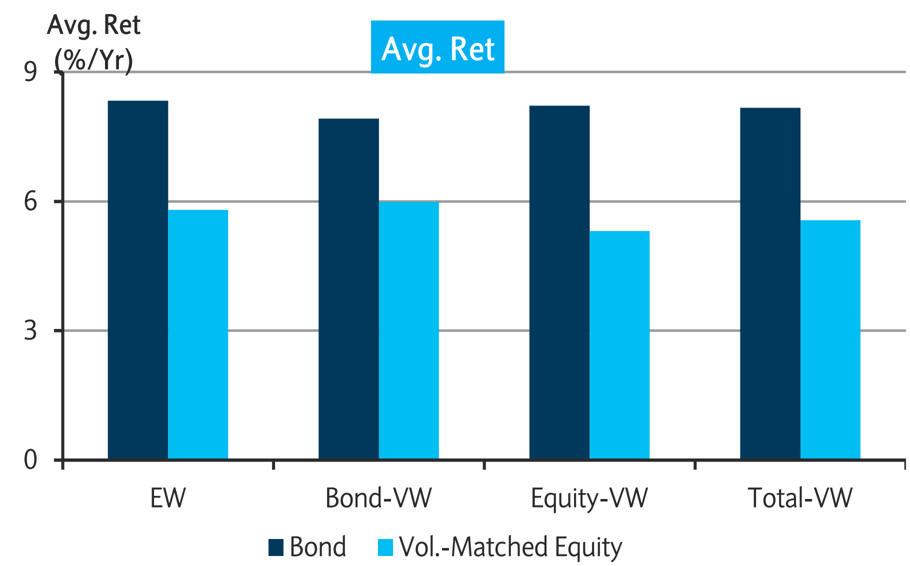
HY Bonds Had Higher Avg. Returns than Equities Matched by Vol.

- Scaling equity returns using the ratios of trailing 36m vol. generated equity portfolios with almost identical vol. as the HY bond portfolio post-formation
  - ❖ Any excess weight is allocated to T-bills
- With similar vol., HY bond portfolios had higher average returns than the vol-matched equity portfolios, regardless of the weighting scheme

Vol. of Bonds vs. Vol.-matched Equity (Jan. 1993 – Jan. 2018)



Avg. Ret. of Bonds vs. Vol.-matched Equity (Jan. 1993 – Jan. 2018)

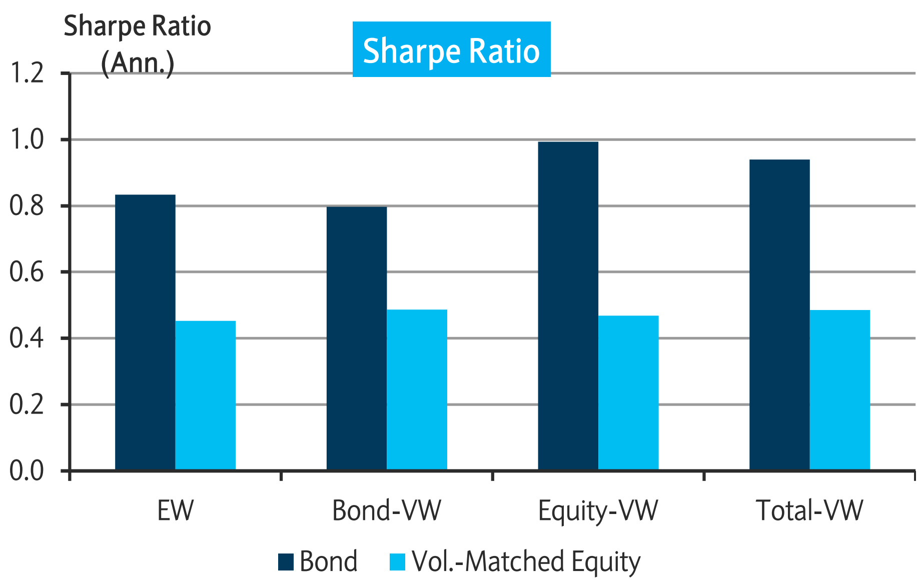


Note: the mapped HY bond universe has a price filter of $40 to exclude bonds traded on recovery. Results were similar using no price filter
Source: Bloomberg, Compustat, Barclays Research

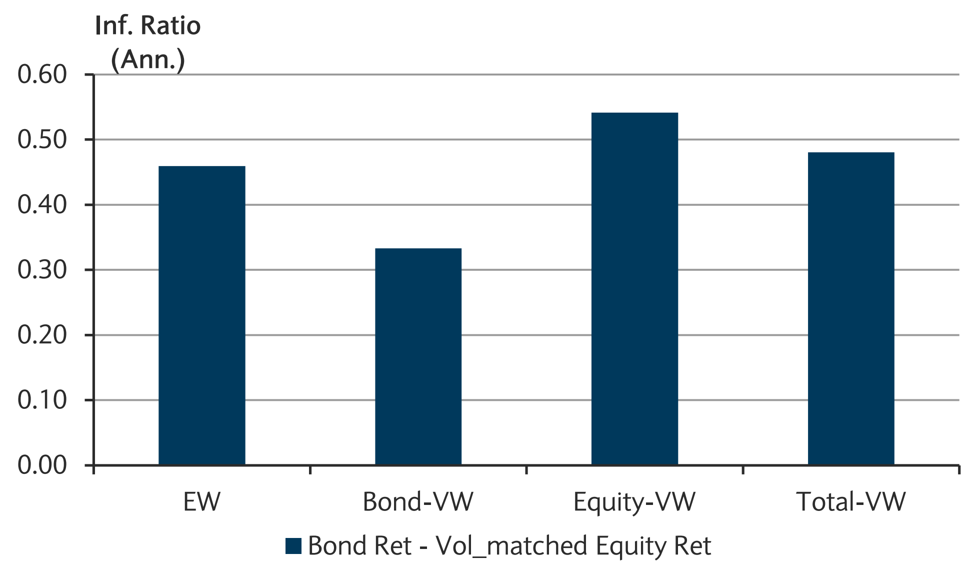
HY Bonds Portfolios Had Higher S.R. than Vol.-Matched Equity

- Regardless of the weighting scheme, high yield bonds had higher S.R. on average than equities of the same company
- The I.R. of bonds over vol-matched equity ranged from 0.33 to 0.54 with different weighting schemes

Sharpe Ratios of Bonds vs. Equity (Jan. 1993 – Jan. 2018)



Inf. Ratios of Bonds over Vol-matched Equity (Jan. 1993 – Jan. 2018)



Source: Bloomberg, Compustat, Barclays Research

Performance Statistics of HY Bonds vs. Vol.-Matched Equities

Performance Statistics of Bonds vs. Equity (Jan. 1993 – Jan. 2018)							
Weighting Scheme	Return Series	Avg. Ret (%/Yr)	Vol. (%/Yr)	Sharpe (Inf.) Ratio (Ann.)	Worst Monthly Ret (%)	Max. DD (%)	Corr. with HY bond tot ret
EW	Bond	8.34	6.78	0.83	-15.55	-25.09	
	Vol-matched Equity	5.81	7.04	0.45	-8.23	-26.78	0.68
Bond-VW	Bond	7.93	6.60	0.80	-13.48	-24.74	
	Vol-matched Equity	5.99	6.96	0.49	-8.64	-26.32	0.64
Equity-VW	Bond	8.22	5.58	0.99	-13.36	-19.98	
	Vol-matched Equity	5.31	5.76	0.47	-7.00	-23.72	0.55
Total-VW	Bond	8.17	5.86	0.94	-13.39	-21.26	
	Vol-matched Equity	5.56	6.08	0.49	-7.48	-24.31	0.59
EW	Bond over Vol.-Matched Equity	2.53	5.51	0.46	-7.33	-13.49	
Bond-VW		1.93	5.79	0.33	-6.24	-20.77	
Equity-VW		2.91	5.37	0.54	-6.36	-15.51	
Total-VW		2.61	5.43	0.48	-5.91	-16.75	

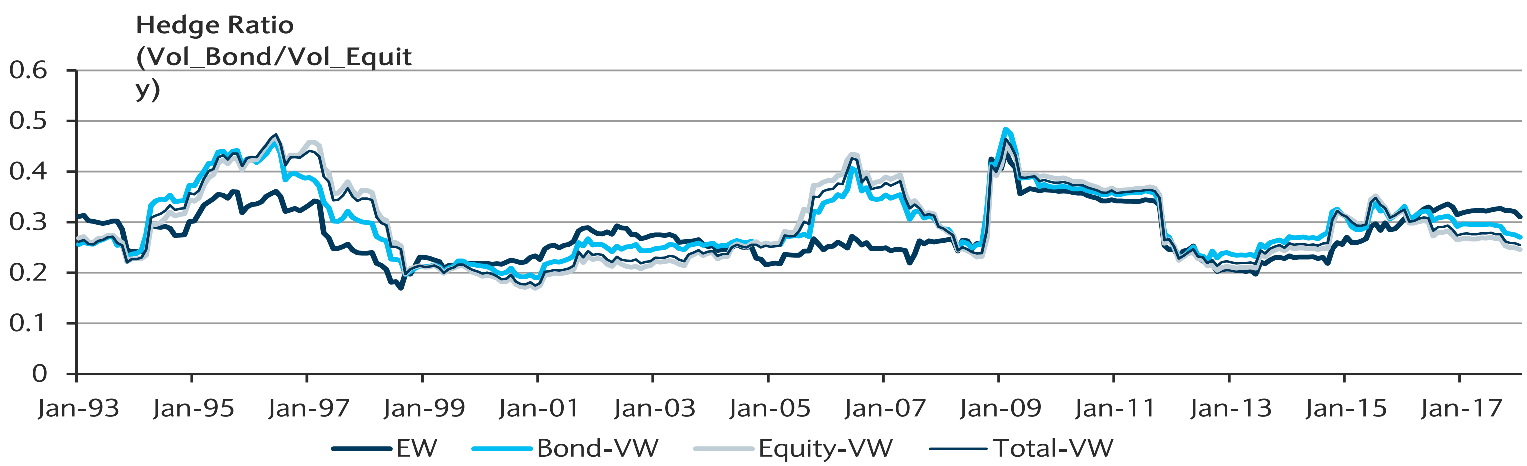
Source: Bloomberg, Compustat, Barclays Research

Hedge Ratio Insensitive to Weighting Schemes

- The equity portfolio HR varied between 0.2 to 0.5 over time, with an average of 0.3
- The avg. HR is very similar across different weighting schemes
- In most months, the difference in HR using different weighting schemes was small

Hedge Ratio (Jan. 1993 – Jan. 2018)				
	EW	Bond-VW	Equity-VW	Total-VW
Avg. HR (Vol_Bond/Vol_Equity)	0.28	0.30	0.30	0.30
Stdev. (HR)	0.05	0.07	0.08	0.07

Hedge Ratio over time (vol_bond/vol_equity, Jan. 1993 – Jan. 2018)



Source: Bloomberg, Compustat, Barclays Research

Bond Had Higher S.R. than Equities

- Bond portfolios had higher S.R. than the equity portfolios without risk matching, regardless of the weighting scheme

HY bonds and equity indices and portfolio returns using different weighting schemes (Jan. 1990 – Jan. 2018)

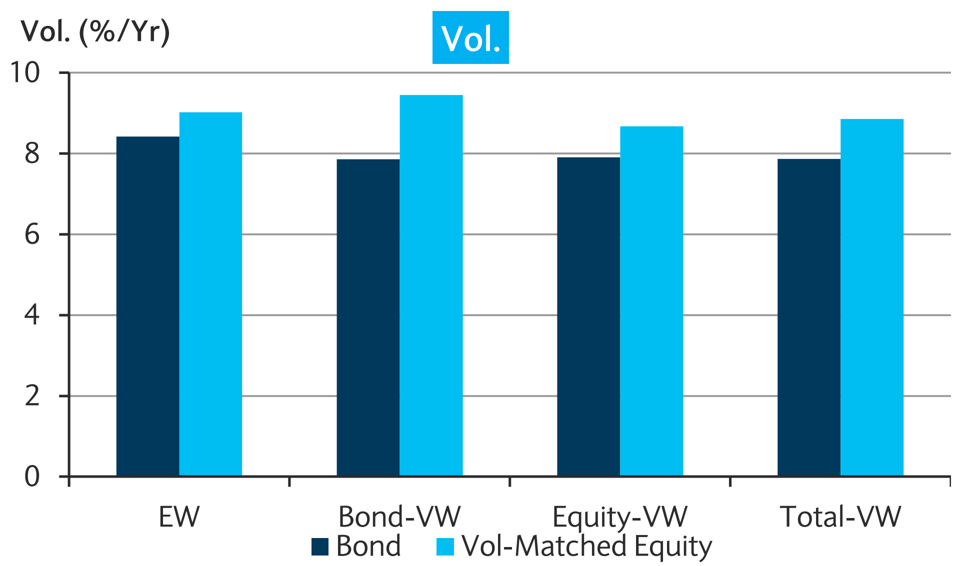
		Avg. Ret (%/Yr)	Vol. (%/Yr)	Sharpe Ratio (Ann.)	Worst Monthly Ret (%)	Max. DD (%)
Bond	Bloomberg Barclays U.S. HY Index*	8.70	7.62	0.75	-15.81	-31.86
	EW	9.01	6.82	0.88	-15.55	-25.09
	Bond-VW	8.53	6.47	0.86	-13.48	-24.74
	Equity-VW	8.92	5.55	1.07	-13.36	-19.98
	Total-VW	8.83	5.79	1.01	-13.39	-21.26
Equity	Russell 2000 Index	11.19	18.68	0.44	-20.80	-52.89
	EW	12.87	22.82	0.43	-29.80	-68.20
	Bond-VW	13.04	21.53	0.47	-27.30	-66.32
	Equity-VW	10.54	18.61	0.41	-26.61	-63.77
	Total-VW	11.43	19.41	0.44	-26.80	-64.23

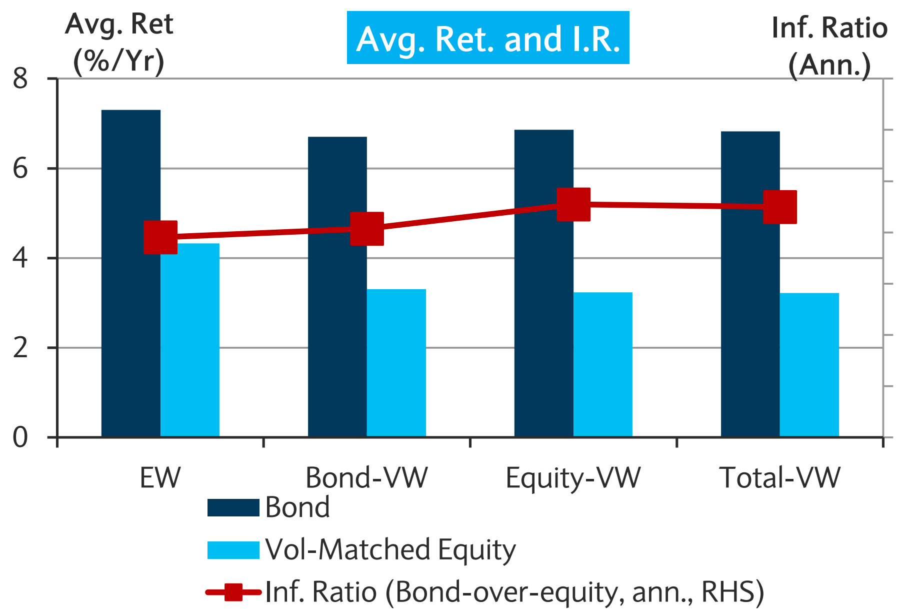
Note: the HY bond index and mapped bond universe have a price filter of $40 to exclude bonds traded on recovery.
Source: Compustat, Bloomberg, Barclays Research

Similar HY Bond Outperformance in European Markets

- HY Bonds had higher S.R. than vol-matched equities
  - Across all HY Ratings
  - In all sectors
- Similarly in European Markets, bond portfolios had similar vol as vol-matched equity portfolios, but higher avg. ret for May 2005 – Jan. 2018

Bond vs. Vol-Matched Equity Portfolio Performance in European Markets
(May. 2005 – Jan. 2018)





Source: Bloomberg, Compustat, Barclays Research

Sensitivity-Matching Worked Best for IG

- In IG, sensitivity-matching works the best at matching risk, since IG bonds have a substantial Treasury component
  - ✓ Sensitivity-matched equity had the highest corr. with IG bond portfolio
- Bond outperformed sensitivity-matched equities by 1.51%/year with an I.R. of 0.48
- Results were similar across weighting schemes

Performance of IG Bond over Matched Equity Portfolios
(EW, Jan. 1993 – Jan. 2018)

Matching Method	Avg. Ret (%/Yr)	Vol. (%/Yr)	Sharpe (Inf.) Ratio	Worst Monthly Ret	Max. DD (%)	Corr(Bond, Matched Equity)
Vol-matched	-0.02	6.45	0.00	-5.19	-34.74	0.26
Sensitivity-Matched	1.51	3.13	0.48	-3.06	-15.29	0.80
Income-Matched	-1.07	5.33	-0.20	-5.12	-38.99	0.49

Source: Bloomberg, Compustat, Barclays Research

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