Finance Hub

https://financehub.bz/

Common factors in corporate bond returns

by Israel, Palhares, and Richardson (2017), forthcoming in the Journal of Investment Management

- Show evidence for carry, defensive, momentum and value factors in corporate bonds
- Talk about traditional long-and-short academic portfolios or a long-only, transactions-cost aware portfolio
- Investigate risk and mispricing explanations for factor portfolio positive performance

Background on the paper

- Paper written by AQR following a sequence of papers on credit risk premia
- This year AQR launched a its first quantitative bond fund and the paper is provides evidence for the "rationale" of the fund
- A few related papers:
  - This paper by guys from BNP
  - This paper on using equity factors to trade bonds

Basic idea

- Application of “Fama-French style” factor model ideas to the corporate bond market
  - carry
  - momentum
  - value
  - defensive
- Not exactly the first paper to apply factors to credit markets but probably the most comprehensive paper
- Credit markets are somewhat overlooked by the academic and applied literature on factor models

A few differences vs. equities

- Q5-Q1 portfolios in equities “tend” to be beta neutral, but typically this is not true in other asset classes
- Almost everything is correlated with credit spreads and it is not spread DV01 neutral
- Portfolio construction is an important aspect of the result
- Transaction costs per unit of risk is very high and it is crucial to take transaction costs into account and sometimes this means focusing on long-only portfolios
- Factors are designed with the combined z-score of several measures

Data

- ICE (former BAML) has all the data which originally comes from TRACE
- Return and characteristics data from 1997 to 2015 (easy to update)
- Universe selection:
  - Only senior debt
  - Most prevalent rating of the issuer
  - 5 to 15 year maturity
  - Largest amount outstanding for the issuer
- Note that selection goes against “size” and “liquidity” factors

Controlling for beta

beta = spread DV01 x spread

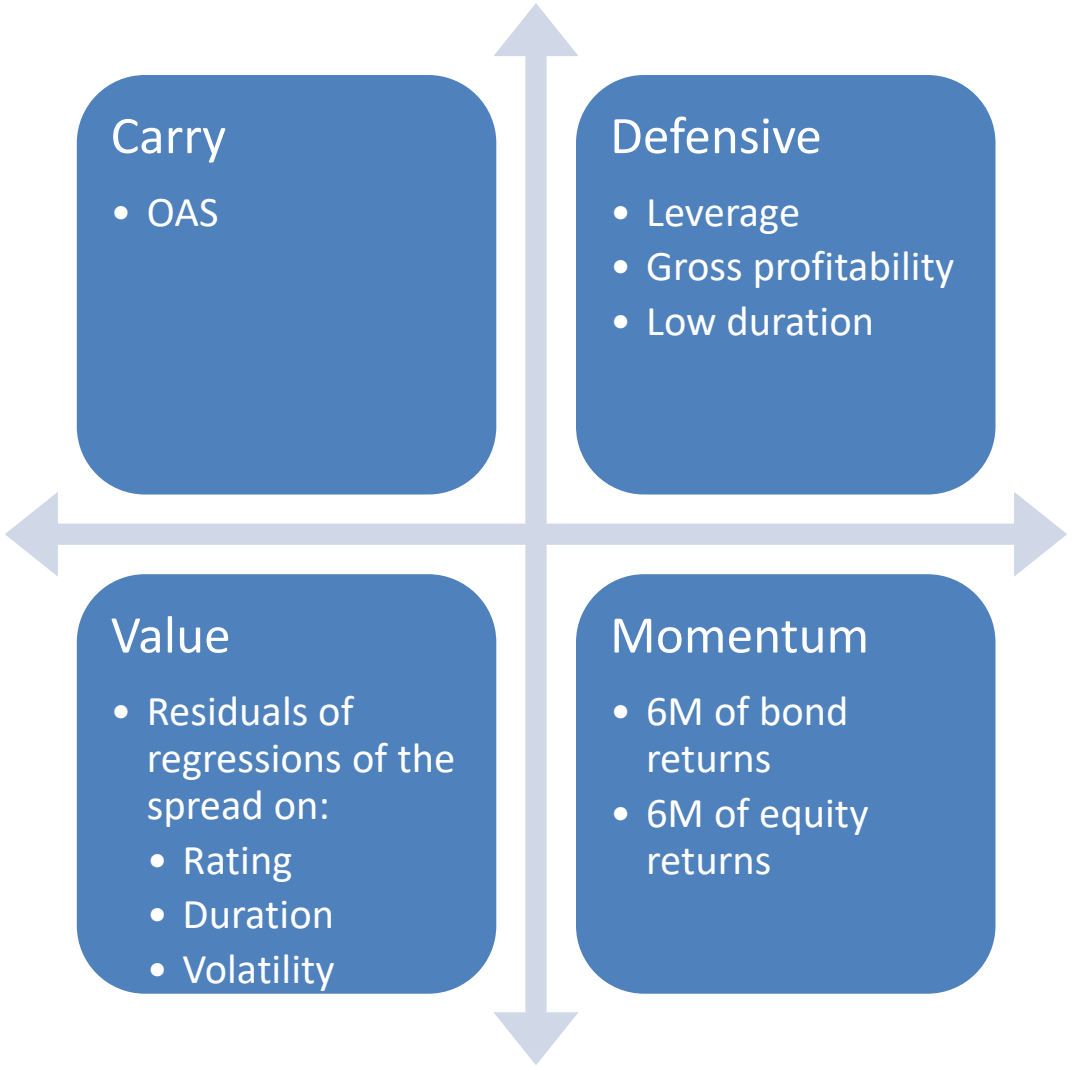
Characteristic	Large	…	Small	Large	…	Small
Large Beta	L_{11}	…	S_{1N}	L_{11}-avg(row 1)	…	S_{1N}-avg(row 1)
⋮	…	…	…	…	…	…
Small Beta	L_{K1}	…	S_{KN}	L_{K1}-avg(row K)	…	S_{KN}-avg(row K)

*demean characteristics within five ex-ante beta quintiles, except for duration and carry

Two types of long-short portfolios:

1. Standard Q1-Q5 zero-cost portfolio with bonds being value-weighted within quintiles (similar results for equal-weighted)
2. A portfolio that is linear in ranks for each characteristic and then volatility targeted to 5% using its 24-month realized volatility

Characteristics



Combine the z-score of the measure to create a "combined" measure of that particular characteristic

Also, normalize the characteristic itself

Note that the characteristics are not orthogonal and there is some "overlap"

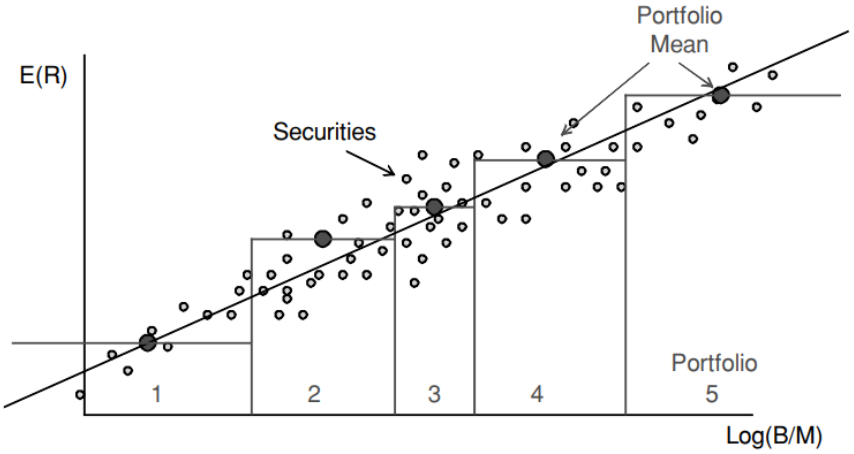
Combination factor

- The combined factor is an ***equal weighted average*** of the single-characteristic portfolios
- Each single characteristic informs us about properties of the SDF used to price corporate bonds. However, the single portfolio makes optimal use of the multiple characteristics and can be ***fully*** the SDF
- In order to deal with difficulties of shorting bonds and transaction costs, they also look at a ***long-only portfolio*** that takes into consideration realistic implementation by solving a linear optimization problem

Portfolios and regressions

- Long-short portfolios are the same as a regression on a step function

$$R^i_{t+1} = \alpha + b' C^i_t + \varepsilon^i_{t+1}$$



- Factor models are just the particular case where $m_{t+1} = a + b' f_t$ in a SDF framework: $p_t = E_t[m_{t+1} x_{t+1}]$
- So, the "combined" factor portfolio fully spans the movements of m_{t+1}

Fama-Macbeth regressions

Table 3: Fama-Macbeth Regressions (January 1997–April 2015)

The table below reports Fama-Macbeth regressions of monthly bond excess returns regressed onto normalized carry, defensive, momentum, and value style measures along with controls for market beta, rating, duration, and age percent variables (as defined in Table A.1).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	0.10	-0.02	0.04	-0.01	0.05	-0.10	-0.02
	[1.5]	-[0.2]	[0.5]	-[0.1]	[0.5]	-[1.2]	-[0.2]
Carry			0.00				0.14
			[1.0]				[2.3]
Defensive				0.15			0.03
				[5.0]			[0.9]
Momentum					0.15		0.22
					[3.3]		[7.1]
Value						0.26	0.30
						[5.8]	[10.7]
Mkt Beta	0.05	0.04	0.10	0.04	0.06	0.08	0.14
	[0.7]	[0.6]	[1.6]	[0.7]	[0.9]	[1.2]	[2.3]
Rating		0.02	-0.03	0.02	0.00	0.03	0.00
		[0.8]	-[1.0]	[0.6]	[0.1]	[1.0]	-[0.1]
Duration		-0.01	-0.01	0.01	0.00	0.01	0.01
		-[0.5]	-[0.5]	[0.8]	-[0.4]	[1.1]	[1.1]
Age Percent		0.25	0.23	0.22	0.23	0.14	0.09
		[2.2]	[2.0]	[1.9]	[2.0]	[1.2]	[0.9]
Avg. R-squared	0.07	0.10	0.14	0.10	0.11	0.11	0.15
Avg. Num. Obs.	723	671	671	671	671	671	671

- Both individually and combined, value and momentum are significant
- The carry is marginally significant and only when controlling for the remaining characteristics
- defensive loses significance when controlling for value and momentum
- In equities, R^2 are around half of the one found here

Long-Short Quintile Portfolios

Table 4: Quintile Portfolio Tests (January 1997–April 2015)

The table below reports performance annualized performance statistics for value-weighted quintile portfolios formed on carry, defensive, momentum, value, and combined style factors (as described in the text). "ConstVol" corresponds to quintile long-short portfolios targeting a constant volatility of 5% per annum (as described in the text).

		Q1	Q2	Q3	Q4	Q5	Q5 - Q1	ConstVol
Carry	Ret.	-0.4%	1.1%	1.5%	3.7%	3.7%	4.1%	1.1%
	Vol.	2.9%	4.4%	6.6%	8.7%	13.9%	11.7%	5.8%
	S.R.	-0.12	0.26	0.22	0.43	0.27	0.35	0.19
Defensive	Ret.	0.0%	1.4%	2.0%	1.9%	2.7%	2.7%	8.3%
	Vol.	6.0%	5.8%	6.4%	6.2%	5.6%	2.4%	6.9%
	S.R.	0.00	0.24	0.31	0.32	0.49	1.11	1.21
Momentum	Ret.	-0.2%	1.3%	1.5%	1.4%	2.7%	2.9%	7.5%
	Vol.	7.2%	6.1%	5.2%	5.3%	6.5%	3.4%	6.7%
	S.R.	-0.03	0.21	0.28	0.27	0.41	0.85	1.12
Value	Ret.	-0.4%	0.7%	1.6%	2.4%	3.5%	3.9%	10.7%
	Vol.	5.5%	5.8%	6.3%	6.8%	5.6%	2.2%	6.0%
	S.R.	-0.07	0.13	0.25	0.35	0.62	1.75	1.80
Combined	Ret.	-0.5%	1.0%	1.5%	2.3%	4.9%	5.4%	14.0%
	Vol.	5.6%	5.6%	6.3%	6.8%	6.0%	2.5%	6.0%
	S.R.	-0.09	0.18	0.24	0.34	0.81	2.19	2.32

- Consistent with the Fama-Macbeth results
- Strong positive results for defensive, momentum and value
- A portfolio that combines all of the factors at an equal-risk weight ("combined") performs better
- Sharpe ratios generally monotonically increases across quintiles for each of the characteristics

The backtests

Figure 1: Cumulative Style Factor Returns (January 1997–April 2015)

The figure below shows cumulative arithmetic returns for each of the carry, defensive, momentum, value and combined style factors (as defined in the text).

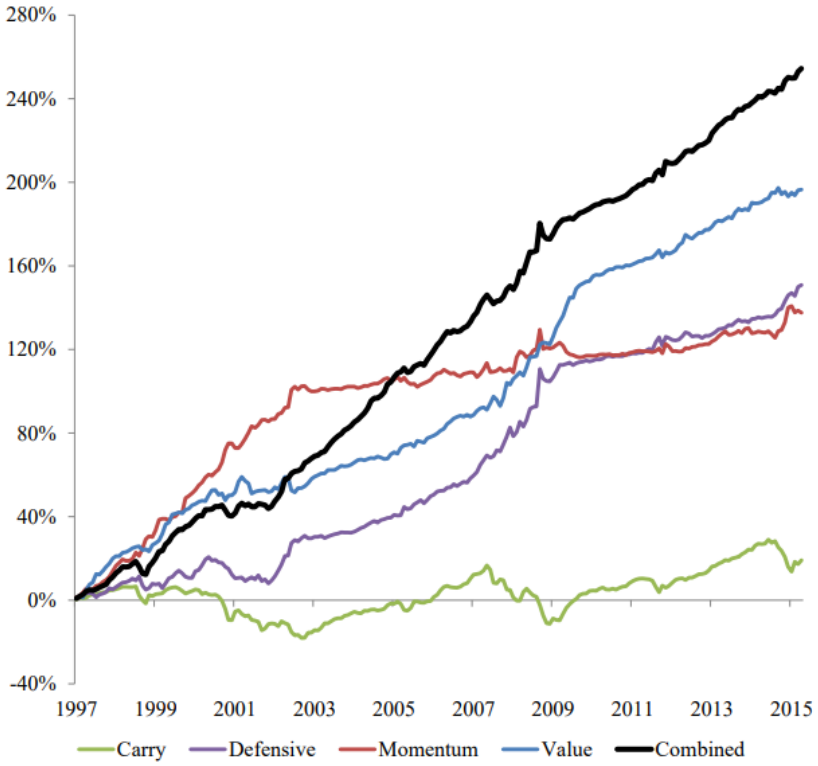
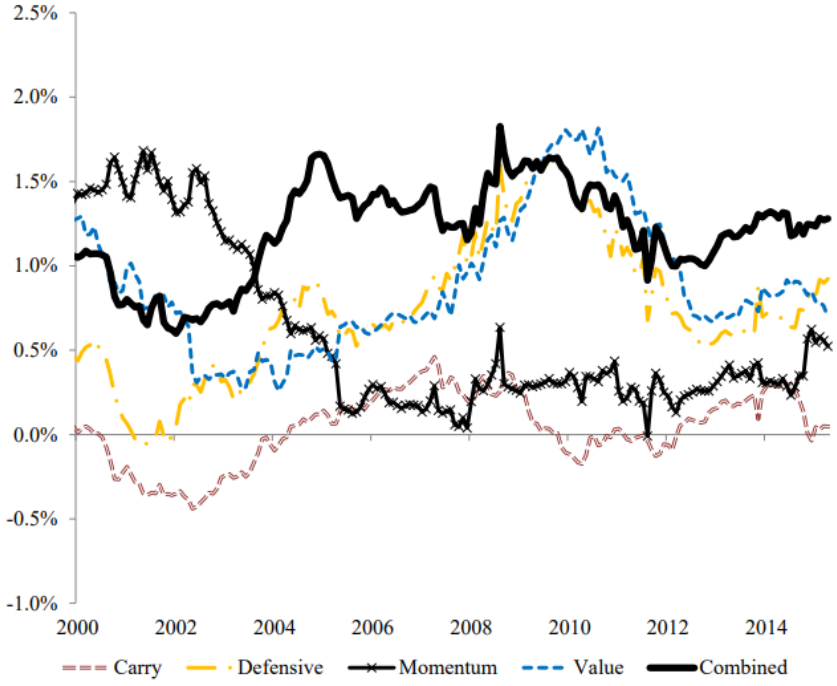


Figure 2: Rolling Regression Alphas

The figure below shows three-year rolling average regression alphas for each of the value, momentum, carry, defensive and combined style factors (as defined in the text). Regression alphas are computed monthly using the full-sample beta estimates (as reported in Table 6) and averaged over a trailing 36-month period.



The long-only portfolio

$$Maximize: \sum_{i=1}^{I} w_i . COMBO_i$$

subject to:

$$w_i \geq 0, \forall i \ (no\ shorting\ constraint)$$

$$|w_i - b_i| \leq 0.25\%, \forall i \ (deviation\ from\ benchmark\ constraint)$$

$$\sum_{i=1}^{I} w_i = 1 \ (fully\ invested\ constraint)$$

$$\sum_{i=1}^{I} |w_{i,t} - w_{i,t-1}| \leq 10\% \ (turnover\ constraint)$$

$$\sum_{i=1}^{I} |(w_{i,t} - w_{i,t-1}) . PRICE_{i,t}| \geq \$100{,}000, \forall i \ \ (minimum\ trade\ size\ constraint)$$

$$\sum_{i=1}^{I} |(w_i - b_i) . OAS_i| \leq 0.50\% \ (deviation\ from\ benchmark\ spread\ constraint)$$

$$\sum_{i=1}^{I} |(w_i - b_i) . Duration_i| \leq 0.50 \ (deviation\ from\ benchmark\ duration\ constraint)$$

	Optimized Portfolio	Benchmark	Active: Portfolio - Beta * Benchmark
Excess Return (gross)	5.72	4.14	2.45
Excess Return (net)	5.26	3.84	2.20
Volatility (net)	5.10	5.59	2.56
Sharpe Ratio (net)	1.03	0.69	0.86

- The optimized portfolio refers to the stream of returns generated by the optimized long-only portfolio that maximizes the score of the bonds held as explained in the text
- Benchmark is a cap-weighted portfolio of all the corporate bonds in our database
- The active returns reported below are the returns from the optimized portfolio less the benchmark using a 24-month rolling beta
- Gross returns are returns in excess of the risk free rate only. Net returns subtract estimated transaction costs from gross returns.

It’s always good to ask “why?”

- Alternative Risk Premia?
  - These portfolios generate tail-risks that are hard to bare at certain times and extra returns are just part of the risk sharing equilibrium between market participants with different levels of appetite for that risk
- Mispricing?
  - Some market structure or institutional constrain that prevents risk-sharing and creates an “opportunity”

No macro risk premia

Panel A: Monthly Volatility, growth and inflation

	Carry	Defensive	Momentum	Value	Combined
Intercept	0.00	0.01	0.01	0.01	0.01
	[1.1]	[4.4]	[3.2]	[5.6]	[7.9]
ΔLOGVIX	-0.01	0.03	0.02	0.02	0.02
	-[2.5]	[3.1]	[2.2]	[2.3]	[2.2]
ΔLOGINDPRO	0.09	-0.70	-0.41	-0.32	-0.68
	[1.0]	-[4.0]	-[2.2]	-[2.0]	-[4.2]
ΔLOGCPI	-0.02	0.91	0.23	1.08	1.12
	-[0.1]	[2.2]	[0.5]	[2.8]	[2.9]
Market Controls	Yes	Yes	Yes	Yes	Yes
Equity Factor Controls	Yes	Yes	Yes	Yes	Yes
R-squared	0.70	0.24	0.14	0.14	0.17

Panel B: Quarterly Broker-dealer change in log leverage

	Carry	Defensive	Momentum	Value	Combined
Intercept	0.00	0.03	0.02	0.03	0.04
	[1.4]	[5.0]	[4.1]	[6.0]	[8.4]
ΔLEV	-0.08	0.14	0.26	-0.18	0.07
	-[1.5]	[1.5]	[2.8]	-[2.2]	[0.8]
Market Controls	Yes	Yes	Yes	Yes	Yes
Equity Factor Controls	Yes	Yes	Yes	Yes	Yes
R-squared	0.77	0.17	0.33	0.26	0.20

- The single characteristic (except carry) and the combo portfolios seem to behave as a macroeconomic (volatility and inflation rise and when growth falls), making its positive expected returns puzzling
- Running time-series regressions on broker-dealers leverage, controlling for market and equity factor returns, they find that while dealer's balance sheet may play a role in explaining the value characteristic, it does not explain the other premia or the combo

No evidence for inefficiency I

Equity Analyst Coverage

	Carry	Defensive	Momentum	Value
Low	19.36	14.87	15.19	16.48
40	15.13	13.90	15.20	15.61
60	12.46	14.50	15.04	14.47
80	9.42	14.95	14.59	12.98
High	7.64	15.41	12.88	11.37
High-Low	-11.73	0.55	-2.31	-5.11
High-Low *t*-statistic	-18.66	2.03	-4.87	-13.38

Issue Market Value in Billions

	Carry	Defensive	Momentum	Value
Low	1.28	1.34	1.06	1.10
40	1.04	0.87	0.98	1.05
60	0.79	0.85	0.93	0.93
80	0.66	0.72	0.85	0.74
High	0.54	0.66	0.80	0.71
High-Low	-0.73	-0.69	-0.25	-0.39
High-Low *t*-statistic	-17.24	-9.93	-3.81	-5.27

Institutional Ownership of Bond

	Carry	Defensive	Momentum	Value
Low	0.50	0.48	0.49	0.51
40	0.54	0.52	0.50	0.49
60	0.50	0.50	0.50	0.48
80	0.46	0.47	0.49	0.49
High	0.40	0.47	0.46	0.49
High-Low	-0.10	-0.02	-0.03	-0.02
High-Low *t*-statistic	-5.18	-2.20	-3.50	-2.66

Average Shorting Cost Score of Bond

	Carry	Defensive	Momentum	Value
Low	0.05	0.10	0.14	0.10
40	0.05	0.09	0.10	0.10
60	0.08	0.12	0.10	0.14
80	0.17	0.20	0.12	0.19
High	0.52	0.18	0.21	0.17
High-Low	0.47	0.07	0.07	0.07
High-Low *t*-statistic	9.79	7.73	4.90	3.70

- If deviations from market efficiency and / or market frictions are empirically descriptive we would expect to see (i) lower analyst coverage, (ii) lower institutional ownership, and (iii) smaller bonds in the extreme portfolios for each characteristic. We would also expect to see greatest short selling costs in the lowest portfolio for each characteristic
- Across all four characteristics we do not see any consistent evidence supporting these explanations
- Bonds that score high in carry, momentum and value tend to be smaller, issued by more sparsely covered and owned by fewer institutions. Bonds, on the short side, however, display opposite rather than similar behavior. They are bigger, well covered and owned at a higher rate by institutional investors
- Finally, the short side of each characteristic portfolio is in fact cheaper to borrow than its long side
- Collectively, these patterns suggest that a simple mispricing hypothesis does not fit the data

No evidence for inefficiency II

Panel A: Characteristic Returns across Equity Analyst Coverage Terciles

	Low	Medium	High	High-Minus-Low
Carry	0.35%	0.25%	0.15%	-0.20%
	[1.9]	[1.6]	[1.1]	-[1.8]
Defensive	0.14%	0.08%	0.17%	0.02%
	[2.0]	[1.2]	[2.6]	[0.4]
Momentum	0.40%	0.18%	0.16%	-0.23%
	[4.4]	[2.6]	[2.1]	-[2.8]
Value	0.42%	0.39%	0.22%	-0.20%
	[6.7]	[7.0]	[2.9]	-[2.0]

Panel B: Characteristic Returns across Institutional Ownership Terciles

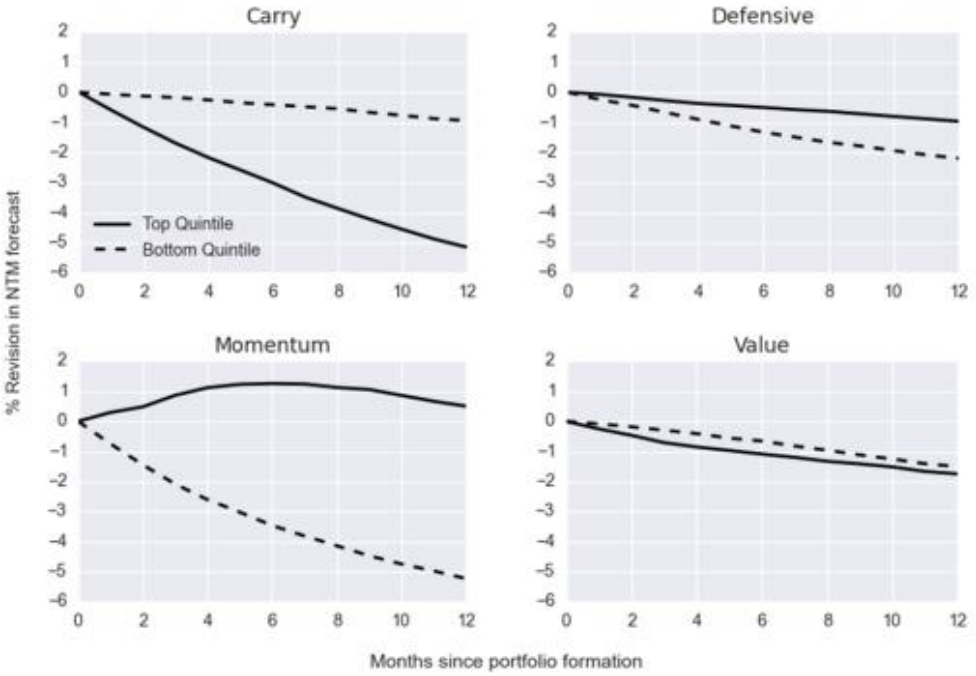
	Low	Medium	High	High-Minus-Low
Carry	0.32%	0.30%	0.28%	-0.03%
	[1.6]	[1.5]	[1.8]	-[0.3]
Defensive	0.11%	0.10%	0.17%	0.05%
	[1.7]	[2.5]	[4.5]	[0.9]
Momentum	0.26%	0.15%	0.06%	-0.20%
	[3.1]	[2.1]	[1.2]	-[2.3]
Value	0.21%	0.29%	0.31%	0.10%
	[3.6]	[4.6]	[6.7]	[1.7]

Panel C: Characteristic Returns across Bond Market Value Terciles

	Low	Medium	High	High-Minus-Low
Carry	0.28%	0.34%	0.23%	-0.06%
	[1.8]	[2.1]	[1.4]	-[0.6]
Defensive	0.14%	0.15%	0.11%	-0.02%
	[2.8]	[4.3]	[2.7]	-[0.4]
Momentum	0.37%	0.15%	0.12%	-0.25%
	[6.2]	[3.4]	[2.0]	-[3.4]
Value	0.28%	0.29%	0.19%	-0.08%
	[5.8]	[7.2]	[4.4]	-[1.4]

- A separate implication of the mispricing hypothesis is that the relation between characteristics and future returns will be stronger among bonds that are harder to arbitrage, less transparent or populated with a less sophisticated investor base
- Momentum long-and-short portfolios perform better in the less liquid, less transparent and less sophisticated segments of the corporate bond market
- However, the evidence is more mixed for the other characteristics, sometimes performing better in the more mispricing prone arbitrage segments of the market, sometimes performing better in the less vulnerable one, but rarely statistically significant

No evidence for inefficiency III



The dark lines are the cumulative revisions of the long portfolio and the dotted lines are the revisions for the short portfolio.

- If there are systematic predictable errors in sales forecasts, then we expect greater downward revisions for the short portfolio and greater upward revisions for the long portfolio
- The mispricing hypothesis is consistent with what we see for the momentum portfolio and to a lesser extent for the defensive portfolio
- For value and carry the result goes in the opposite direction of that predicted by the mispricing hypothesis but the difference is only statistically significant for carry