Factor Models
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Agenda

- ➢ What is a factor model?
- ➢ Classic examples
- ➢ How can they be used in a fundamental process?
- ➢ Backtesting factor models
- ➢ Multi factor models

What is a factor model?
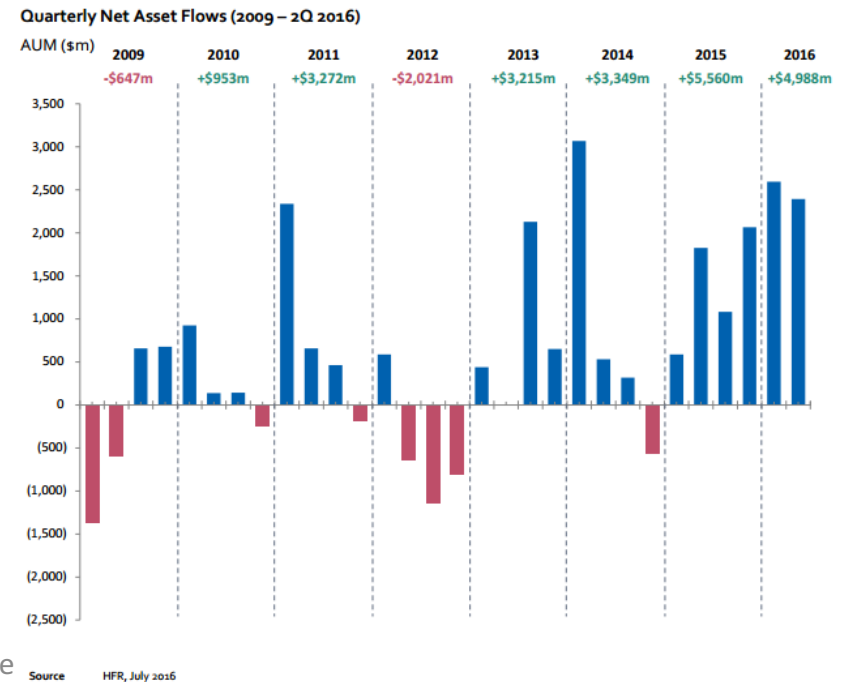
➤ Scores a <u>broad</u> set of stocks...

   The fundamental law of active management: $\propto = \boxed{IC} * \boxed{\sqrt{N}}$

                                                     skill   breadth

➤ Allows <u>cross-sectional</u> comparison (e.g., across market or industry)

➤ Has enough history to backtest

➤ Has economic or behavioral intuition

   ➤ e.g., high P/E stocks are trading above their economic value and will mean revert

Classic examples

➢ Value, Momentum, Quality (risk premia)

➢ Analyst revisions, insider trades, short-term mean reversion (faster)

➢ Some of these are crowded now -> need for more diversified and unique factor models

Quarterly Net Asset Flows (2009 – 2Q 2016)

AUM ($m)	2009	2010	2011	2012	2013	2014	2015	2016
	-$647m	+$953m	+$3,272m	-$2,021m	+$3,215m	+$3,349m	+$5,560m	+$4,988m

Source   HFR, July 2016

How can they be used by discretionary PMs?

➢ Idea generation

➢ Screening (positive or negative)

➢ Timing trades

➢ Position sizing

➢ Risk management: what are my factor exposures?

➢ Needs to roughly match time horizon & universe
  ➢ e.g., estimates/sentiment factors can be quicker,
  ➢ Some are specific to earnings season (e.g., cos which move earnings dates)
  ➢ Some work well for small caps but not large

➢ Some third party tools out there, but many quantamentals are building their own

Backtesting factors

➢ Typically cross sectional, independent from portfolio construction / rules

➢ Shows the overall behavior and characteristics of a factor

➢ Robustness: time, sectors, cap ranges, regimes

    ➢ and, especially: is it driven by illiquid stocks?

➢ Fractile analysis, ICs, long vs short

➢ Exposure to risk factors, and returns *residualized to* (controlled for) risk factors

➢ Turnover and realistic transaction cost assumptions

➢ Realistic universe

Backtesting factors (2)

- There are some third party tools for this (Clarifi, FactSet, Quantopian)
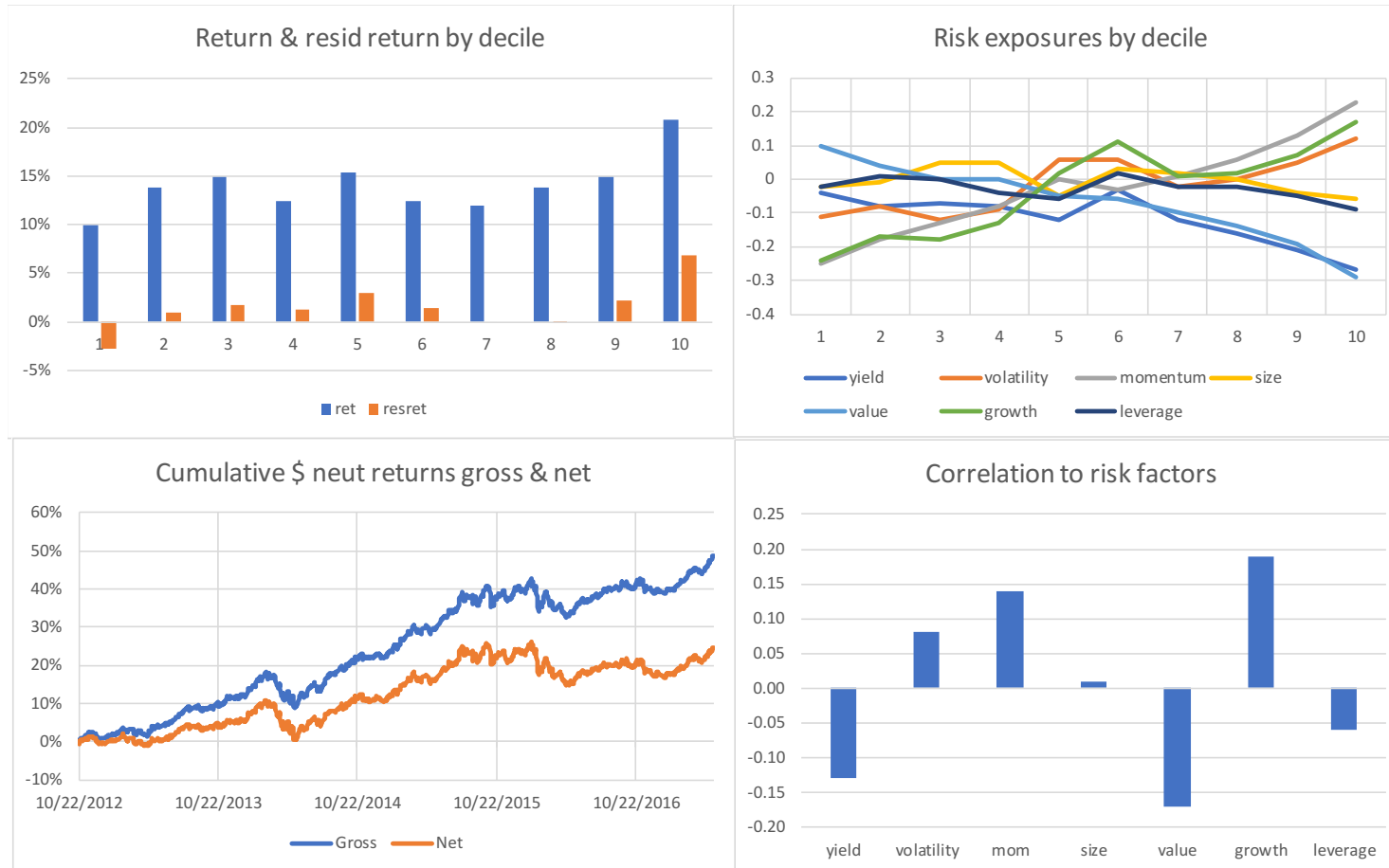- Most quants build their own, with custom features
- EA backtester:

Digital Revenue Signal

10 fractiles, full daily rebalance, 0 day lag, positions from open, TC 2/5/10

group	Names	Dates	AnnRet	Sharpe	%pos	ResRet	rSharpe	r%pos	NetRet	NetSharpe	Net%pos	turnover
all	**1756**	**1145**	**10.7%**	**1.60**	**58%**	**9.7%**	**2.28**	**57%**	**5.4%**	**0.80**	**55%**	**6.9%**
2012	1585	47	6.8%	1.65	49%	5.0%	1.45	49%	-0.5%	(0.12)	43%	9.9%
2013	1695	252	10.9%	2.53	56%	9.2%	2.55	57%	5.7%	1.33	52%	6.8%
2014	1775	252	10.2%	1.40	57%	8.6%	2.08	57%	5.3%	0.72	56%	6.4%
2015	1791	252	17.2%	2.27	63%	10.6%	2.75	59%	12.3%	1.62	60%	6.4%
2016	1783	252	-0.5%	(0.06)	56%	8.8%	1.63	53%	-6.0%	(0.76)	54%	7.2%
2017	1788	90	27.0%	5.40	67%	16.1%	4.06	61%	20.9%	4.21	60%	7.8%
Lg cap	306	1145	9.7%	1.18	55%	8.8%	1.26	53%	8.1%	0.99	55%	7.9%
Mid cap	342	1145	8.3%	0.92	56%	6.7%	0.91	52%	3.7%	0.41	55%	9.1%
Sm cap	1107	1145	11.7%	1.45	57%	10.7%	1.80	55%	4.1%	0.51	54%	7.5%
Growth	585	1142	4.5%	0.72	51%	5.6%	1.03	52%	-3.7%	(0.60)	48%	11.6%
Value	571	1142	6.1%	0.88	53%	7.6%	1.31	51%	-3.0%	(0.43)	50%	11.3%
LowVol	529	1142	0.3%	0.06	50%	0.4%	0.11	51%	-6.5%	(1.51)	46%	11.0%
HighVol	628	1142	9.5%	1.14	53%	10.4%	1.49	54%	-0.2%	(0.02)	51%	10.9%
DownMkt	1762	475	2.3%	0.33	55%	6.6%	1.53	54%	-43.5%	(6.04)	33%	59.5%
UpMkt	1752	670	16.7%	2.60	60%	11.8%	2.82	59%	-17.0%	(2.62)	46%	43.7%
Commercial Services	95	448	-2.5%	(0.21)	48%	-2.5%	(0.20)	48%	-13.5%	(1.12)	46%	13.5%
Consumer Discretionary	231	1141	8.3%	0.91	51%	7.2%	0.83	52%	0.0%	-	48%	11.0%
Consumer Non-Durables	79	383	23.8%	1.98	54%	25.5%	2.17	55%	16.4%	1.38	52%	11.8%
Energy	128	801	22.4%	1.48	55%	19.8%	1.43	54%	12.9%	0.85	53%	12.7%
Healthcare	123	743	12.4%	0.78	50%	6.6%	0.41	50%	2.3%	0.14	48%	13.2%
Industrials	139	1047	16.7%	1.53	53%	16.0%	1.55	52%	7.6%	0.70	50%	11.6%
Materials	123	735	1.3%	0.11	50%	0.3%	0.02	51%	-8.9%	(0.75)	47%	13.1%
Technology	183	1117	-2.0%	(0.17)	49%	5.3%	0.40	51%	-11.4%	(1.00)	46%	11.8%
Transportation	81	77	-35.9%	(2.39)	45%	-25.6%	(1.79)	45%	-45.9%	(3.06)	45%	12.1%
Utilities	98	55	6.5%	0.83	49%	-1.6%	(0.21)	47%	-6.7%	(0.85)	45%	23.6%

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Backtesting factors (3)

Return & resid return by decile

Risk exposures by decile

Cumulative $ neut returns gross & net

Correlation to risk factors

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Multi factor models

➢ Are the factors redundant? Correlation to other return and risk factors

➢ Combining categories (value + momentum, AQR)

➢ Combining within vs across time horizons - does it make sense to combine a quick factor with a slow factor?

➢ Weighting across factors
  ➢ Equally weighted?
  ➢ Regression-based weights (what performed best)?
  ➢ Machine learning?

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Summary

➢ Factor modeling can be a useful supplement to a discretionary process
  ➢ Enhancing returns
  ➢ Monitoring risk
  ➢ Trade timing

➢ Factors can be combined

➢ It's important to use systematic tools to understand the factors and how they behave and interact

➢ To be useful and robust, factors need to score a broad set of stocks and have plenty of history – and a good story!

➢ Classic factors can still have value, but crowding means that new factors, based on new data sets, are essential