

# Cross-Asset Class Momentum

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# Introduction

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- Concept of “price momentum” has been around for a long time
- Price momentum (factor) “exposure” familiar to anyone who has studied equity return factors. And, surely so, for quants
- Typically, price momentum has been studied and applied on an individual asset level or within an asset class
- Less addressed in the literature (and in practice) is how momentum in one asset class may be manifest in other asset classes

# Goals

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- Primary objective is to present results and theoretical description of cross-asset class momentum relationships
- Call attention to related work by others who have presented at prior Northfield conferences
- Highlight ongoing research by several colleagues within Northfield. Some of the work is preliminary, and provides a peek at where headed in this area
- Stimulate thinking and conversation

# Works Referenced/Shout Outs

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- Outside speakers at previous NIS conferences
  - Bektic
  - De Jong
  - Avino
  - Kritzman
- Northfield staff
  - Belev
  - diBartolomeo
  - Gold
  - MacQueen
  - Mostovoy

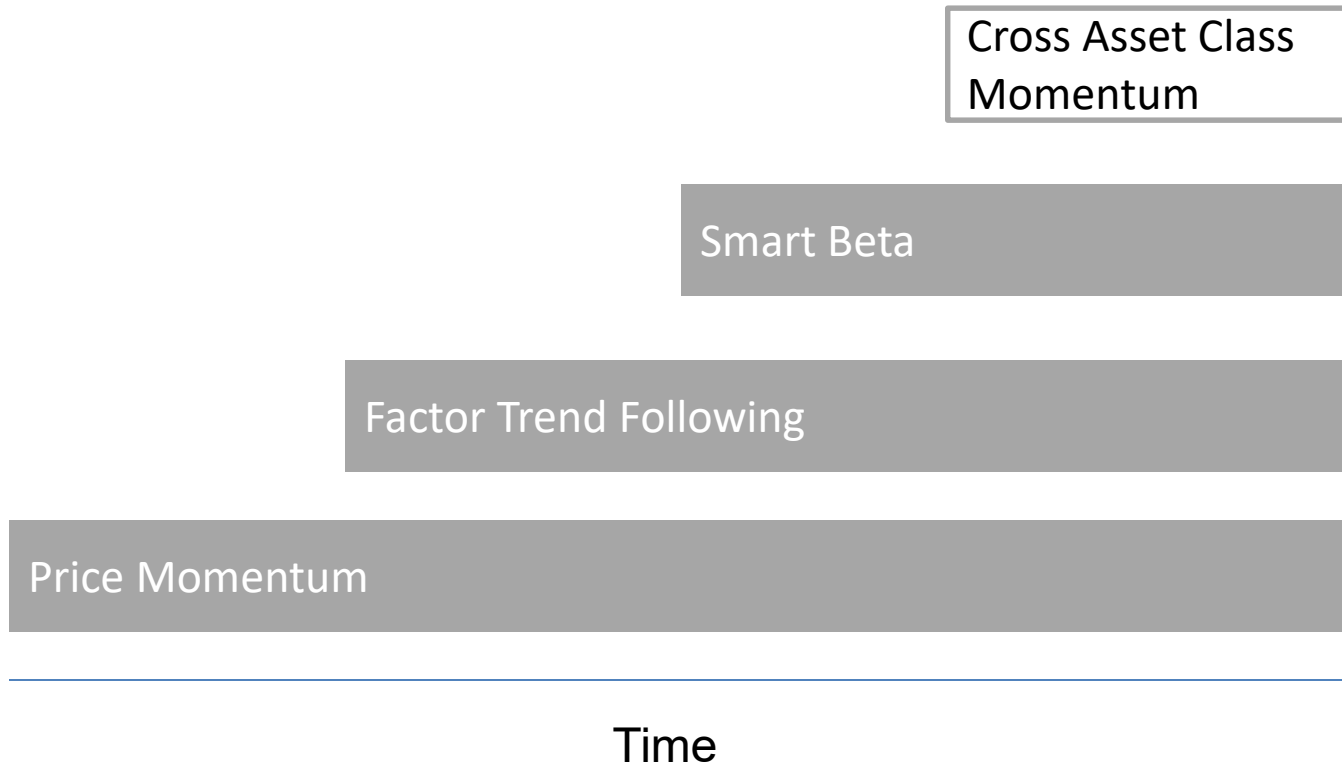
# Price Momentum in Equity Markets

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- Concept of “momentum” in financial markets around for a long time
  - Individual security – “a body in motion stays in motion”; absolute
  - Peer comparisons – securities that have outperformed peer securities likely to continue; relative
- In simplest terms, implies serial correlation
  - Positive first-order autocorrelation (last period impacts current)
  - History impacting current can also be more complicated
- In equity markets, hundreds of research papers with alternative formulations
  - Widely used is most recent year, Carhart (*Journal of Finance*, 1997)
  - Frequently combined in equity risk models with other “factors,” e.g. Fama and French (*Journal of Finance*, 1992)

# Evolution of “Momentum”

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# Explanations of Momentum

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- Purely Empirical
  - Not really an explanation
  - Technical Analysis – “cirque du soleil” of moving averages
  - ARIMA modeling
- Behavioral
  - Investor Behavior (e.g. biases)
  - Information Theory based (e.g. info dissemination and investor responses)
  - While plausible, often not provable
- Explicit Economic Linkages
  - Cross-Asset Class Momentum based upon fundamentals and economics

# Where We Are Going From Here

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- Equity—Fixed Income/Corporate Credit
- Equity—Real Estate
- Equity—Private Equity



# Equity Momentum and Corporate Credit Risk

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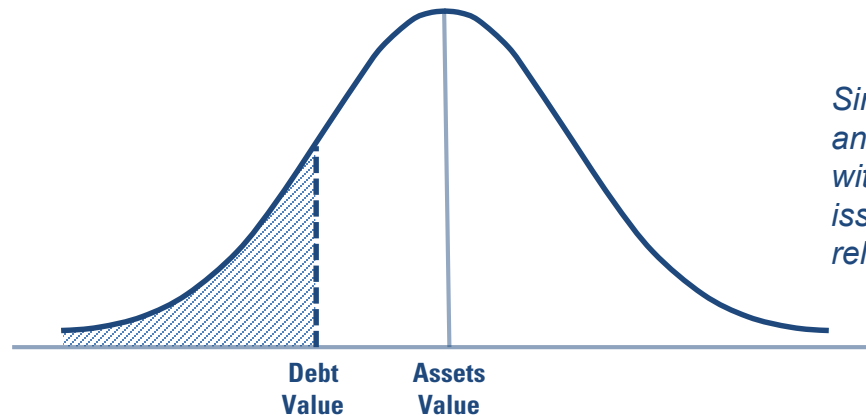
- Merton's pioneering work on contingent claims applied to corporate capital structure (*Journal of Finance*, 1974)
- Can be conceptualized in a simple and direct way
  - As value of a firm's stock increases, it becomes easier for a firm to sell new equity shares, raise cash and pay off any outstanding debt
  - Similarly, as total asset value of the firm increases, given level of debt outstanding, subsequent asset impairments less likely to lead to bond defaults
- Implies that both absolute and relative equity returns should have a perceptible impact on the perceived credit risk of corporate bonds and financial institutions (as counterparties).

# Basic Contingent Claims Literature

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- Merton (1974)
  - Poses equity of a firm as a European call option on the firm's assets, with a strike price equal to the face value of the firm's debt
  - Correspondingly, lenders are short a put on the firm assets
  - Default can occur only at debt maturity (European options)
- Black and Cox (1976)
  - Default can occur before debt maturity
  - Provide a "first passage" model - firm extinction if asset values hit a boundary value (i.e. specified by bond covenants)
- Leland (1994) and Leland and Toft (1996)
  - Accounting for tax deductibility of interest and costs of bankruptcy
  - Estimate boundary where equity value maximized subject to bankruptcy

# Merton – Developing Intuition



Since equity and debt are the claims on a company, and using Merton they each can be represented with options on assets, then the returns of the bonds issued and the return of the stocks issued can be related to one another

$$\text{Bond Return} = \text{"EquitynessScalar"} \cdot \text{Stock Return}$$

$$\text{Bond Return} = f(\text{MktValSecurities}, \text{OptionDeltas}) \cdot \text{Stock Return}$$

$$\text{Bond Return} = \left[ \left( \frac{\text{MktValEq}}{\text{MktValDebt}} \right) \cdot \left( \frac{-\delta_{\text{longPut}}}{\delta_{\text{longCall}}} \right) \right] \cdot \text{Stock Return}$$

# Applications: Sustainability and Credit Risk

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- Firm asset volatility determined from equity factor model. “What would the volatility of the stock be if the firm had no debt?”
- Corporate Sustainability
  - *Market implied expected life of the firm*  
(diBartolomeo, *Journal of Investing*, 2010)
  - Leave expiration date of option unknown, and solve numerically for “implied expiration date” that equates option value to the stock price
  - Utilize term structure of interest rates; or more complex option models that allow for stochastic interest rates
- Credit Risk
  - Credit risk/volatility constructed from volatility (and distribution) of assets which is the underlying of the Merton options
  - The “equity beta” for corporate bond derived from capital structure and delta’s of the Merton call and put options

# Empirical: Equity Momentum and Credit Risk

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- With the explosion in “smart beta” equity strategies, a newer body of work describing “smart beta corporate bond” strategies in relation to equities is being developed
- Following have been presented at Northfield events
  - Bektic (2018) focuses specifically on equity momentum effects. There is also a more general prior study (2017)
  - de Jong (2018) describes how a variety of equity attributes including momentum may impact credit risk
  - Avino and Salvador (2018) explore use of equity options to hedge credit risk in corporate bond portfolios.
  - Belev and diBartolomeo (2013, 2019) apply Merton approach to sovereign credits
  - MacQueen and Mostovoy (2018) develop “smart beta” bond strategies linked to equity price momentum

# Fama French Factors with Corp Bonds

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- Bektic (2017) presented at annual Northfield conference
  - Empirical results (2000 to 2016) suggest that the Fama French equity factors explain differences in corporate bonds returns
  - Reported effects are strongest in “high yield” bonds where both the likelihood of default and expected loss given default are highest
- Bektic (2018)
  - Focuses specifically on “spillover” of equity momentum effects into corporate bond credit risk
  - Momentum as defined by relative equity returns is shown to have significant explanatory power incremental to total equity returns
- Bektic (2019) presented at recent Northfield seminar in Abu Dhabi
  - Adds momentum to the 2017 study
  - Relies on Merton (1974) to provide the theoretical link to expectations of credit effects of equity factors

# Cross-Section of Corporate Bond Returns

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- de Jong (2018) presented at annual Northfield conference in Maine
  - Study examines both the cross-section of corporate bond returns and the estimation of risk in corporate bond markets.
  - Extensive empirical simulations of various equity related strategies that have been proposed in the “smart bond” literature.
  - Results suggest that equity related style factors do have significant explanatory power in bond returns
  - Impact of traditional credit rating changes (upgrades and downgrades) continues to have a profound effect on bond returns. May relate to regulatory injunctions on some large institutions (e.g. banks) holding “non-investment grade” bonds
- <https://www.northinfo.com/Documents/826.pdf>

# Hedging Credit with Equity Options

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- Avino and Salvador (2018) presented at recent Northfield seminar in London
  - If credit risk in bonds can be related to equity factors, such as momentum, then volatility risk in credit related yield spreads can be hedged with equity options
  - Demonstrates efficacy of hedging credit measured by credit default swaps hedged using equity options, with hedge ratios are defined by a “compound option” model
  - Hedging process put forward far less costly than previous proposals (e.g. a JPMorgan research paper from 2006) that focused on hedging actual dollar losses associated with potential defaults on corporate bonds
- <https://www.northinfo.com/documents/861.pdf>



# Merton Applied to Sovereign Credit Risk

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- Belev and diBartolomeo (2013) of Northfield apply a Merton based approach to assessment of sovereign credit risk
  - Each country is defined by its “national portfolio” which includes known local equity market plus nationalized resource and financial assets (e.g. oil production).
  - As the various sectors in the national portfolio show positive absolute returns or incremental momentum returns, this information is translated into expectations of government tax revenues and thereby the creditworthiness of the sovereign state
  - Winner of the 2013 PRMIA New Frontiers in Research award
  - A later version was published in 2019 as:  
Belev, Emilian and Dan diBartolomeo “Finance Meets Macroeconomics: A Structural Model of Sovereign Credit Risk”, M. Crouhy, D. Galai and Z. Weiner Editors, Contingent Claims Analysis in Corporate Finance, World Scientific, 2019

# Equity Momentum and Smart Beta Bonds

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- From Northfield, MacQueen and Mostovoy (2018) developed “smart beta” bond strategies based upon four equity style factors for the period from 2013-2017
  - Process first created optimized smart beta equity portfolios using only companies who had bonds outstanding
  - Two bond portfolio weighting schemes were then examined
    - Applying same weights as the optimized equity portfolios
    - Using the equity weights, with each adjusted for expectation of loss given default of the corresponding bond
  - Over this time period, the bond portfolios derived from equity momentum outperformed even though the equity momentum strategies themselves did not deliver significant positive alpha
  - Given the risk tolerance of typical bond investors (Northfield RAP = 10), the advantage of the momentum’s strategy over the Barclays Aggregate Bond Index was about 1% per year (large for bonds)

# Smart Beta Bonds – Updated

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- Since the 2018 MacQueen and Mostovoy study, we extended the sample period through Jan 2019 and further refined the experimental design.
  - Rather than compare versus a conventional bond benchmark, we created a custom benchmark for the momentum driven case
  - For each holding in smart beta bond portfolio, benchmark had a US Treasury bond holding of equal duration and equal position weight.
  - *The effect is that any difference between the portfolio returns and the custom benchmark entirely must arise from changes in credit risk*
- Relative return of the momentum factor smart bond portfolio was 11bp per year.
  - Relative bond portfolio performance positively related to absolute equity portfolio return to a *statistically significant degree*
  - Relative bond portfolio performance positively related to relative equity portfolio return (i.e. momentum alpha) but with borderline statistical significance

# Equity Momentum in Real Estate

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- Demand for commercial real estate in a given region is closely tied to the economic activity in that region. Momentum of equity market sector returns linked to effects on local real estate returns
  - Northfield Private Real Estate Risk Model uses linkage between equity sector momentum and employment profile of geographic areas to provide expectation for volatility of local commercial rents
  - See Gold (*Northfield News*, January 2018), <https://www.northinfo.com/Documents/794.pdf>
- Similarly several studies confirm the linkage between equity market returns and the relative performance of housing prices in given regions based on local economic profile
  - Bahmani-Oskooee and Ghodsi (*Real Estate Finance*, 2018) find significant explanatory power at the level of individual US states
  - Belev and Gold (*Real Estate Finance*, 2018) show that times series variation in housing prices by region can be replicated with portfolios constructed with liquid securities.

# Equity Momentum in Private/Public Equity

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- Kritzman, Kinlaw and Mao (MIT Working Paper 2014) assert that a material portion of the alpha associated with private equity investing is based on Private Equity managers' ability to make efficient allocations of capital across economic sectors
  - They argue the return momentum in private equity sector returns can be replicated in publicly traded securities such as sector ETFs, and are therefore distinct from any liquidity related effects.
- Czasonis, Kritzman, and Turkington (SSRN, 2017) argue that apparent return effects (e.g. momentum) may result from bias in the "mark to market" of private equity.
  - Unlike publicly traded assets, PE managers have wide discretion *to estimate the "fair market value"* of their private holdings
- Both studies are based on proprietary data provided by State Street.

# Northfield Research-Private Equity Momentum

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- As part of Internal research on private equity risk, Northfield used data provided by Prequin to study private equity markets from 2006 to 2018
- Number of PE deals done in each quarter exhibits positive serial correlation (i.e. momentum) to a statistically significant in total and also by sector
  - “Deal flow” dollars should be expected to be positively correlated as PE firms invest material effort and capital to operate their firms, raise capital and place investments. Some level of ongoing activity irrespective of the opportunity set at each moment in time
- Initial observations and analysis
  - Dollar amounts invested vary over time, but average deal size varies little
  - Deal flow variation over time related the number of deals
  - Highlights key difference between private and public markets. Research in public markets indicate time variation in trading volume appears related to *both* number of transactions and typical size of transactions. See Kyle and Obizheava (2013).

# Conclusions

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- Return momentum effects in equity markets are presumptively an observable manifestation of investor expectations of economic prosperity in a given company, equity sector or country.
- Through the Merton model (1974), there is a clear theoretical link between factor effects in equity markets and parallel effects in corporate bond markets.
  - Northfield’s multi-asset class risk model “Everything, Everywhere” has been based on Merton concepts for nearly two decades
  - Multiple recent empirical studies including internal Northfield research broadly support and validate application of the Merton process for formulating expectations of credit risk and the operation of “smart beta” bond portfolio strategies
- Similar relationships have been proposed and utilized in formulating expectations of return and risk in sovereign debt, real estate, real estate related securities, and private equity.