"Real Anomalies"

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Real Anomalies

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Based on work with Christian Opp (University of Rochester)

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Motivation Real Anomalies

The finance literature has spent enormous efforts studying alphas

- Hundreds of empirical papers documenting alphas (Harvey et al., 2015)
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- Our criterion: PV(real output losses) if α = mispricing
  - Method to provide mapping:
    Informationally inefficient market $\xrightarrow{?}$ Real inefficiency

The Research Question

What is an asset pricing anomaly?

- Informational inefficiency with respect to public information
- Empirically measured conditional on asset pricing model (Fama 70)
- The stance on what constitutes the efficient benchmark determines what is ultimately identified as a wedge [in any study of inefficiencies.]

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> If firms operate such that they maximize their going market values, what are the real implications of asset pricing anomalies [state price wedges]?

- Classic view: market prices aggregate information, yielding signals to decision makers Hayek (1945) & literature on feedback effects
  - Risk prices and risk exposures given current macro state
  - A firm's percentile of the BtM distribution ...

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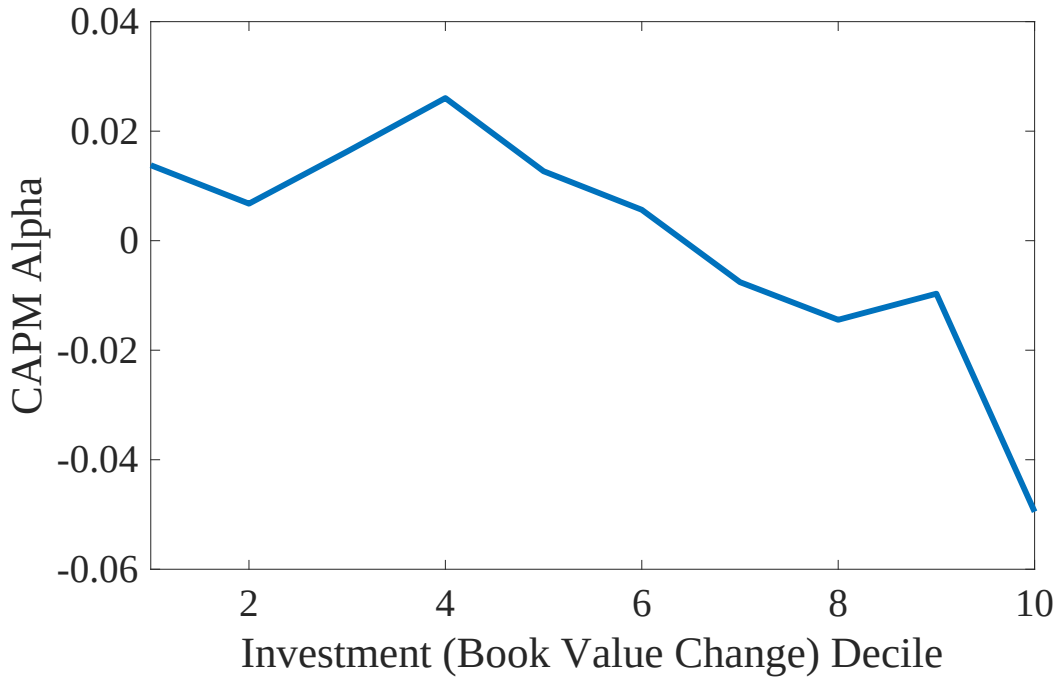
- How much is investment distorted and how much surplus is lost?

Initial Observation: Investment-α Relation in the Data



CAPM alphas of decile portfolios (both series are demeaned)

Empirical Observations:

- Investment is related to abnormal components of average returns
- Robust: true for CAPM, FF 3 factor, Carhart, Pastor-Stambaugh
- Holds with and without cash

But how large are the potential efficiency losses?

Outline

Framework ingredients:

- Investment model
- Distributions in closed-form

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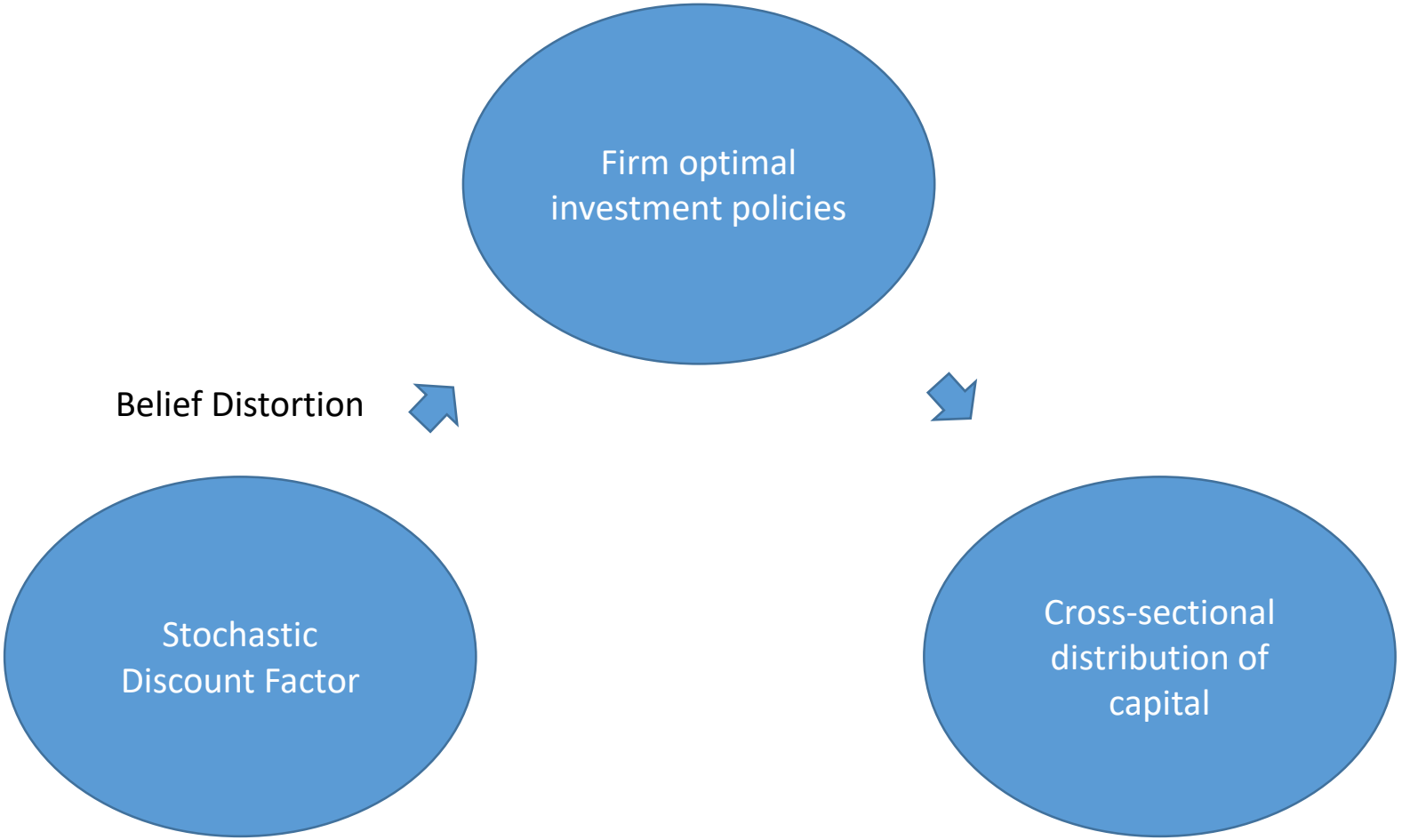
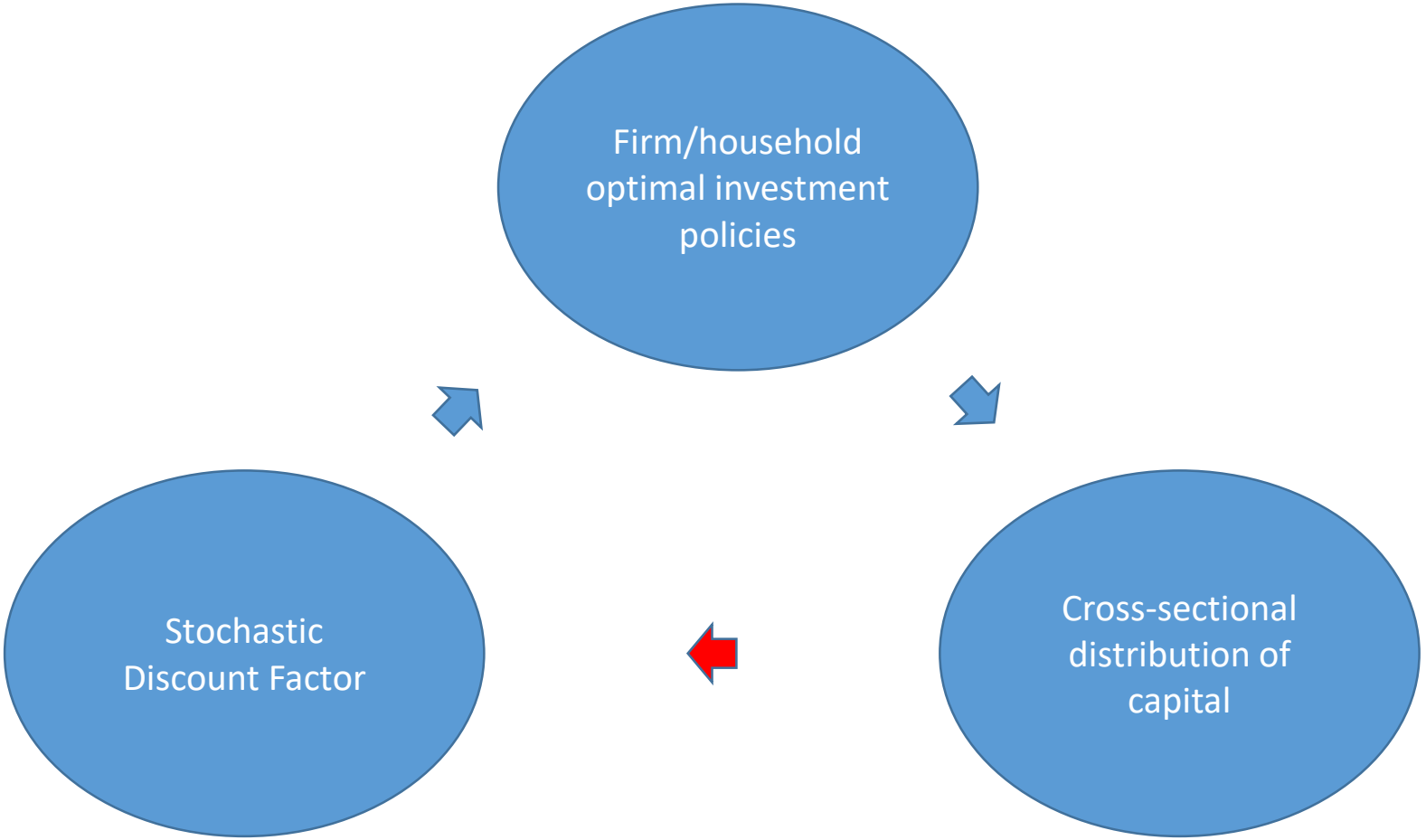
How much value is gained if anomaly is removed ($\alpha = 0$)?

Real Anomalies



Exactly Solved Economies with heterogeneity



Model Overview

Continuous time investment model

- Continuum of heterogenous firms with DRS technologies AK^{η}
- Asymmetric cost when searching for opportunities to (dis)invest
- Flexible stochastic structure: continuous time Markov chains

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Novel features:

1. Belief distortions: deviations from the efficient use of public information disciplined by empirical α-processes
2. Technology: search for lumpy capital adjustment opportunities
   - Firms search for opportunities for lumpy (dis)investment
   - Search expenditures control Poisson intensities of capital changes at fixed percentage increments $\Rightarrow$ discrete capital space

   Conditional on firm controls distributions available in closed-form
   Allows side-stepping time-consuming, imprecise simulations

Market Valuations

The market values a stream of firm after-tax net-payouts $\{d\Pi_\tau\}$ as follows:

$$\mathbb{E}_t^* \left[\int_t^\infty \frac{m_\tau}{m_t} d\Pi_\tau \right] = \mathbb{E}_t \left[\int_t^\infty \frac{m_\tau}{m_t} \underbrace{e^{-\int_t^\tau \alpha_u du}}_{\text{Mispricing Wedge}} d\Pi_\tau \right]$$

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Example:

- Information processing cost $\rightarrow$ not all public information processed. Empirical evidence consistent with trend in info. cost (Bai et al., 2016)

Efficient Prices & Model Misspecification

Joint hypothesis problem: may find cross-sectional alphas for two reasons:

1. Prices are not informationally efficient, and/or
2. The econometrician's model for prices is misspecified.

Suppose an economist believes that market prices are always efficient $\Rightarrow$ concludes that alphas due to model misspecification (e.g, omitted risk factors)

Do failures of asset pricing models matter for quantitative analyses of firms' real investment decisions, and if so, which types of failures?

Model Estimation

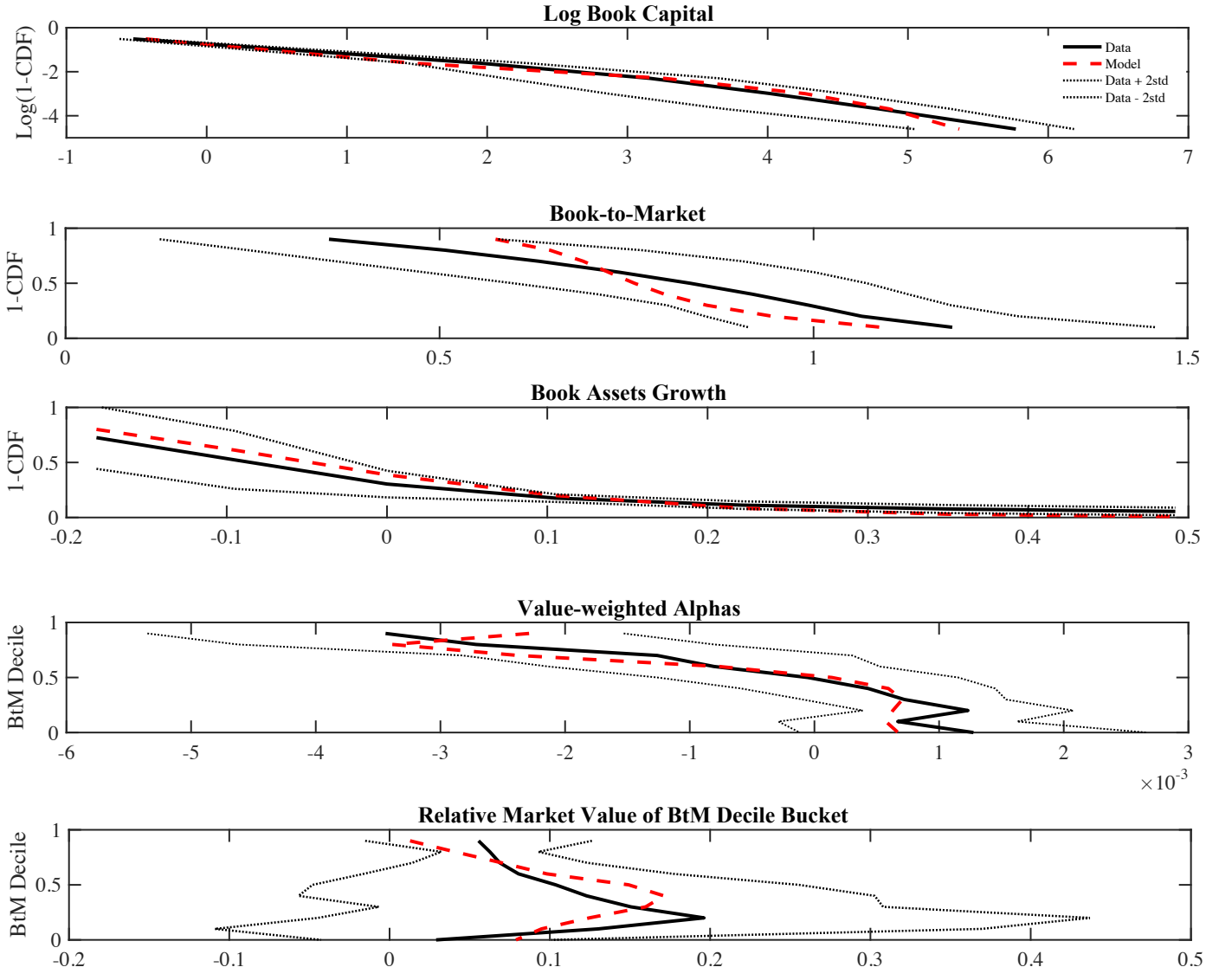
Estimation approach:

- Calibrate aggregate trend growth/vol, SDF
- Estimate 22 parameters minimizing distance between model & data
- 42 empirical moments targeted
  - Cross-sectional distribution of Market/Book
  - Cross-sectional distribution of Book size
  - Cross-sectional distribution of asset growth
  - Empirical alphas associated with Market/Book deciles
  - Market value weights of Market/Book deciles

Stochastic firm processes:

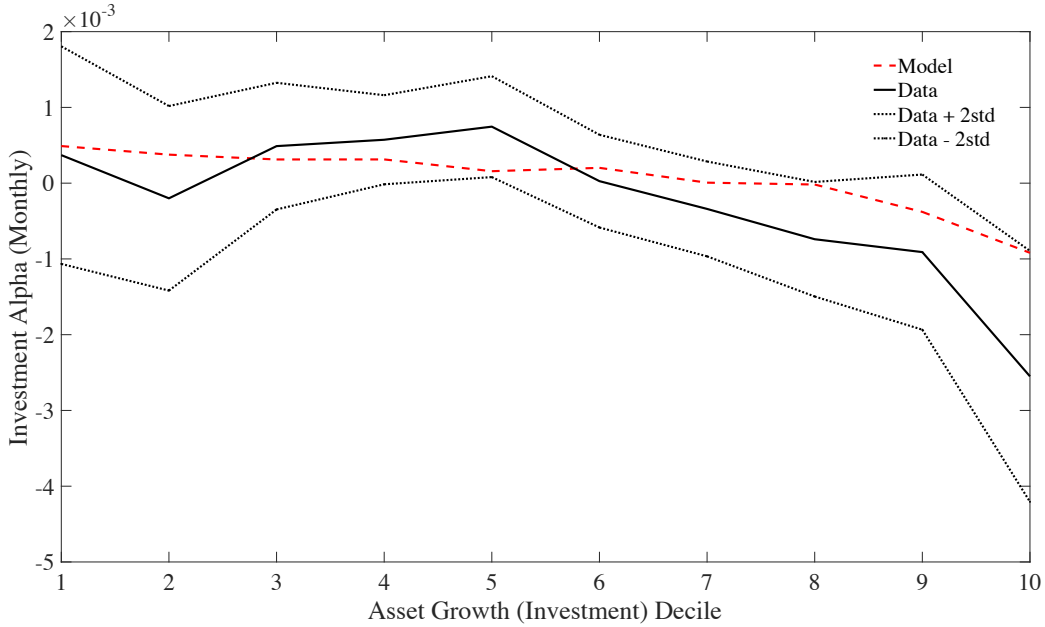
- Log-productivity process (11 states) and two sets of firms
- Firm-specific α-process (3 states)
- No dependence between technology shocks and α-process

Moments Fit



Book-to-Market ratios endogenously become a noisy measure of alphas

Investment-α Relation



CAPM alphas of decile portfolios

1. Empirical Observations:
   - Investment is related to abnormal components of discount rates
   - Robust across AP models and holds with and without cash
2. Estimated model under-represents relation (was not targeted)
3. Alpha process with strong mean-reversion.
   Conditional *one-year* alphas: -9.2%, -2.0%, and $+1.4\%$
   Uncond. probabilities of alpha states: 4%, 22%, and 74%

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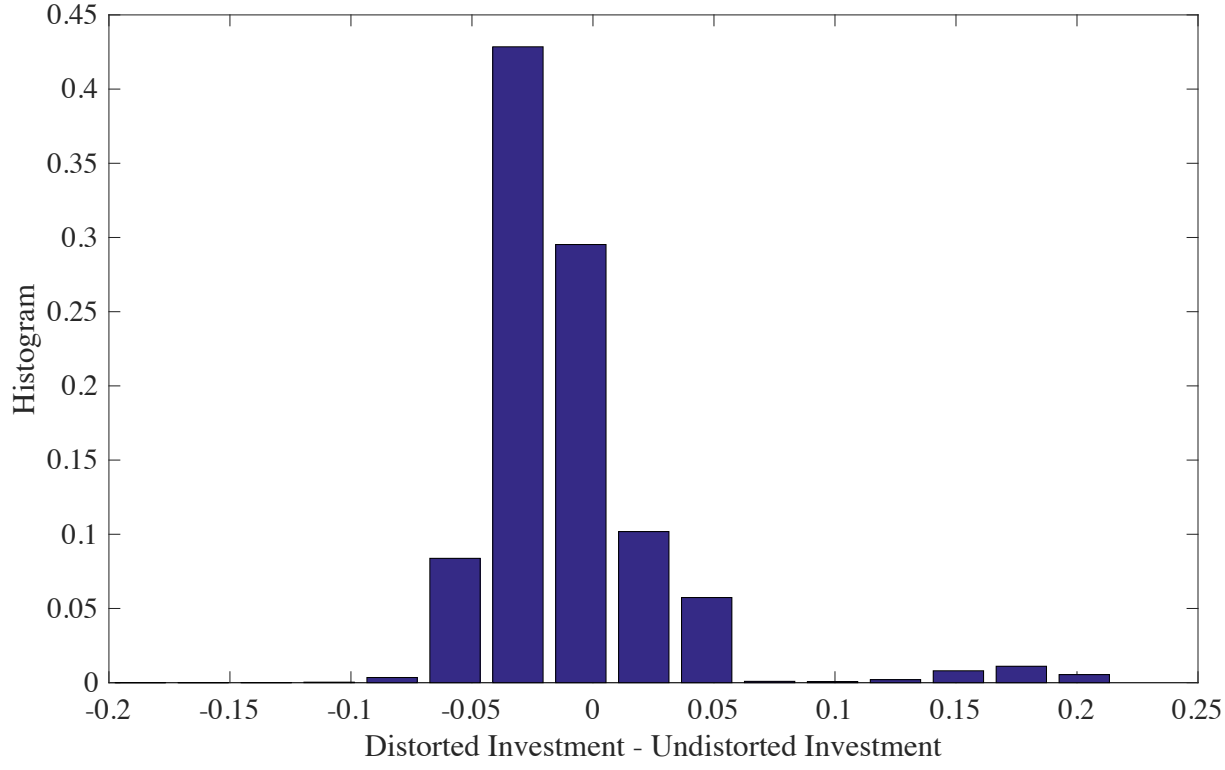
Distribution of Investment Distortions



- Distribution of the difference between the distorted and undistorted expected investment rate in each state (expected investment rate $= (i_+ - i_-)$)
- Note: investment-q relation is weak in the model, consistent with the data

Measuring Efficiency Gains

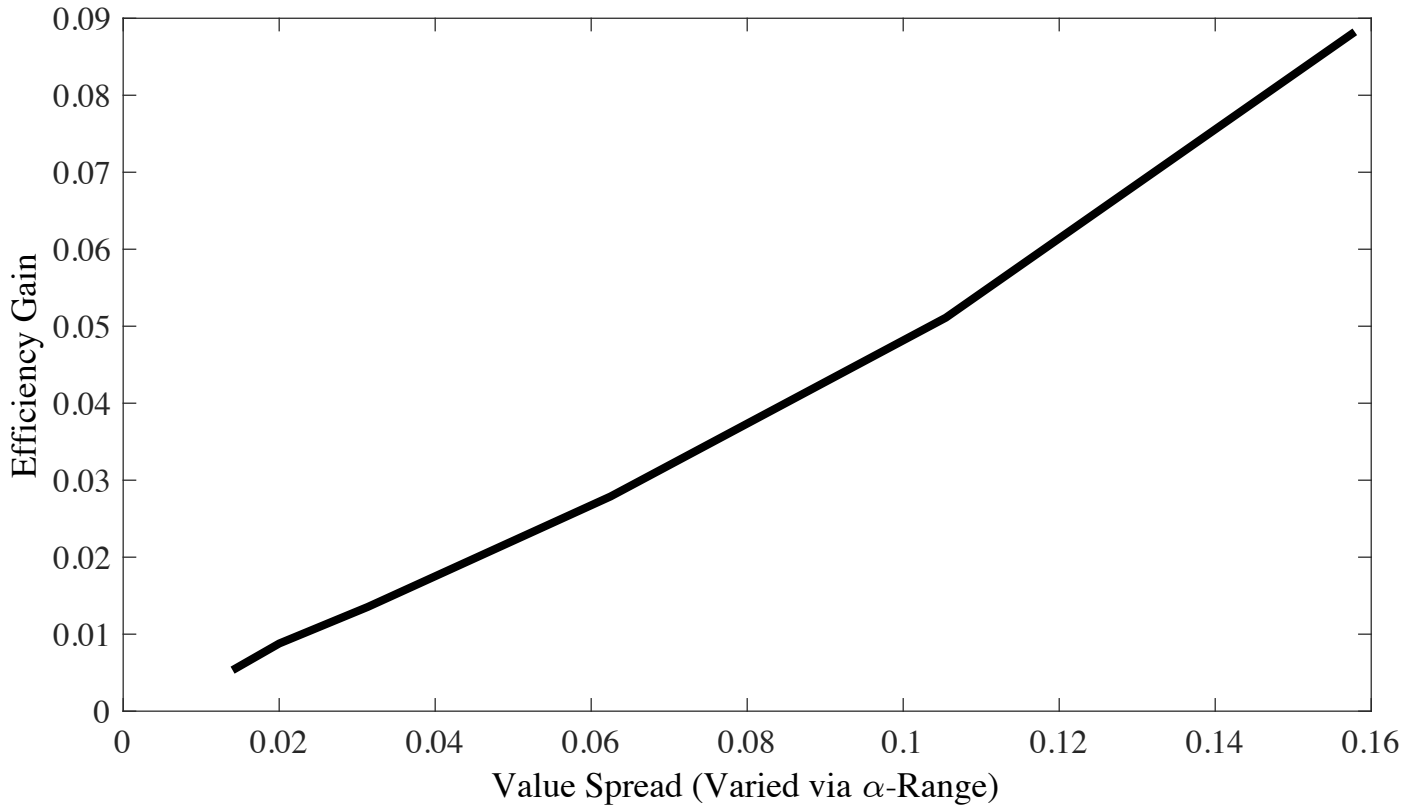
Efficiency gain from eliminating anomalies ($\alpha \to 0$):

$$gain = \frac{\mathbb{E}[\int_0^\infty \frac{m_\tau}{m_t} \text{Efficient CF}_\tau d\tau]}{\mathbb{E}[\int_0^\infty \frac{m_\tau}{m_t} \text{Actual CF}_\tau d\tau]} - 1$$

Interpretation as willingness to pay:

- Perpetual percentage fee of public firm net-payout ($\neq$ GDP) for fully eliminating alpha (finance industry/academia?) (McLean Pontiff 2016)
- Measure is closely related to a Lucas (1987) welfare calculation

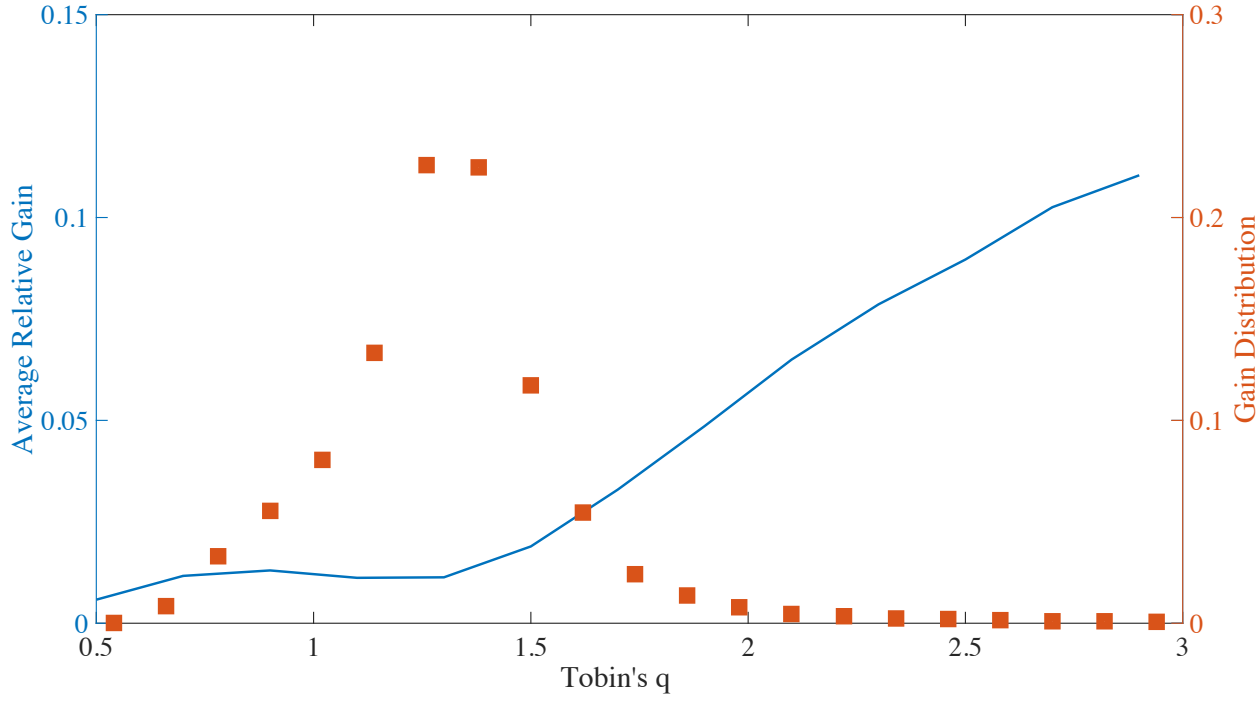
Gains and Value Spread



Gain as a function of the value spread

- Value spread for *equities* is about $6\% - 9\% \Rightarrow$ efficiency gain up to 4.3%.
- Even value spreads greater than 9% could be relevant in the context of other countries (Fama/French, 1998) and if one is interested in the potential value financial intermediaries in the U.S. are currently generating

Individual Firms' Value Gain & Tobin's q

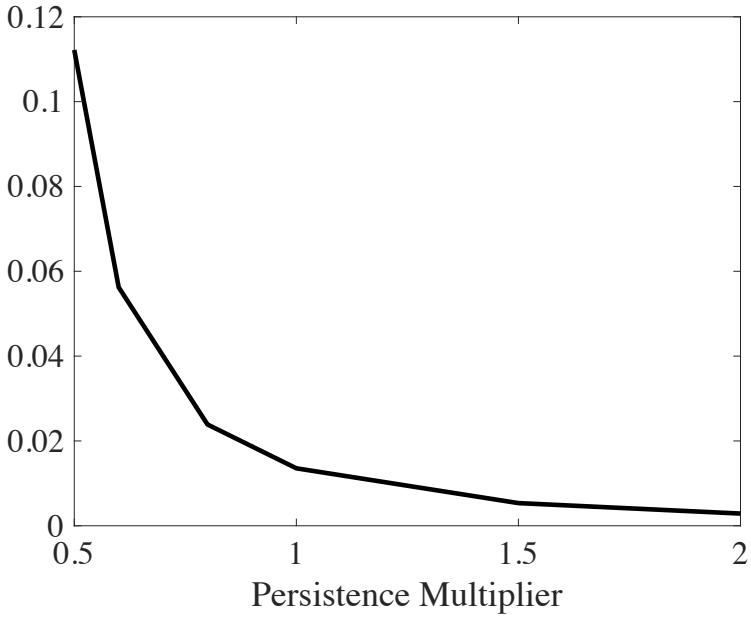


Asymmetric real impact of alphas due to asymmetric adjustment cost:

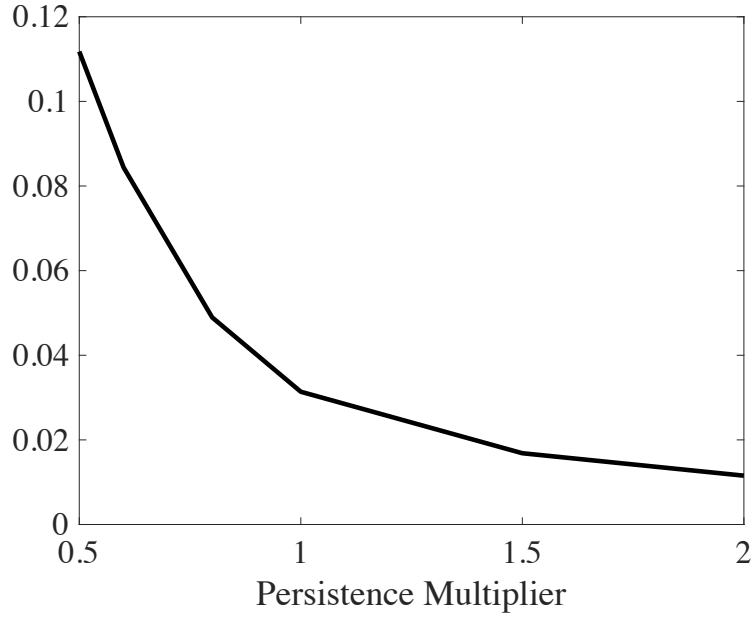
- Value firms (MV<BV) are in any case limited in their disinvestment due to greater frictions
- Growth firms both over- and underinvest!

Persistence of Alpha Process

(a) Efficiency *gain*



(b) Value spread



- The effects of changing the persistence of the α-process on the aggregate efficiency *gain* and on the value spread (multiply the transition rates (h_α^+, h_α^-) of the baseline parameterization by a factor $[0.5, 2]$)
- Persistence $\uparrow \rightarrow$ longer mispriced & price level is off by more

Summary & Conclusion

Which alphas matter for real activity?

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- Tobin's q, distortions emanate primarily from growth firms
- Persistence of alphas
- Small firms are affected more, but account for less market cap.

... a different approach to ranking candidate anomalies

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Key contributions relative to existing literature

- Evaluate aggregate real effects of cross-sectional AP anomalies
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Sheds light on value of activities improving informational efficiency

- financial industry (but just chasing highest alphas might be less effective!)
- academia [McLean/Pontiff, 2016]

Implications and Discussion

1. Focus so far has been on cross-sectional mispricings. What about market-wide (aggregate) mispricing?
2. Real implications of mispricing invalidates Sharpe's arithmetic in yet another way.

Main Takeaways

1. Tractable method with closed-form solutions for distributions
   $\Rightarrow$ makes assessing real effects of anomalies tractable/feasible
2. Sheds light on appropriate compensation of (financial) institutions eliminating informational inefficiencies
3. But chasing the highest alphas might be not most productive:
   High alpha $\neq$ most harmful mispricing (q, persistence, size, ...)

Empirical Persistence of Decile Sorts

- How persistent are anomalies? (staying in extreme deciles)
  1. Momentum — $\Pr[Stay] = 0.13$, $\alpha = 0.036$
  2. Investment — $\Pr[Stay] = 0.25$, $\alpha = 0.019$
  3. Value — $\Pr[Stay] = 0.55$, $\alpha = 0.023$
  4. Profitability — $\Pr[Stay] = 0.66$, $\alpha = 0.011$

  [average absolute alphas across deciles]

- Anomalies with small persistent alphas may be more relevant for real efficiency than large short-lived alphas!