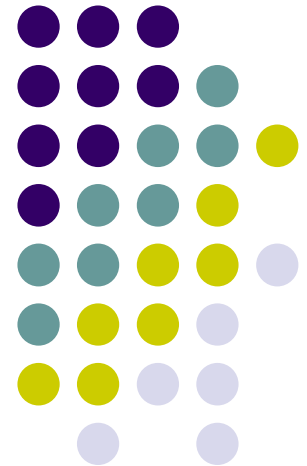
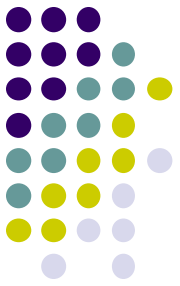


Stock Return Predictability

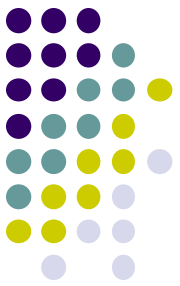
Sheridan Titman
University of Texas





Outline

1. The Market Efficiency Debate
2. Macro-finance example
 - Uncertainty about recession duration
3. Cross-sectional return anomalies
 - Value, profitability and asset growth
 - A parsimonious model of creative destruction



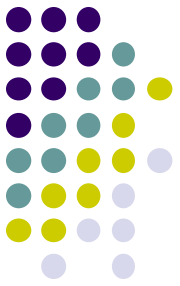
The 2013 Nobel Prize Debate

- Return differences reflect risk differences (Fama)
 - Risk varies over the time series and cross-sectionally
 - Risk preferences change over time
- Behavioral biases distort prices (Shiller)
 - People are overconfident about their information
 - People sometimes panic or get overly enthusiastic



Examples

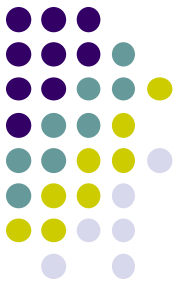
- Time Series Evidence: Market returns are higher following recessions
 - Fama: The market is riskier coming out of recessions
 - Shiller: The market overreacts to macro news
- Cross-sectional Evidence: Value Stocks outperform Growth Stocks
 - Fama: Value/distressed stocks are riskier
 - Shiller: Growth/glamour stocks are subject to “irrational exuberance”



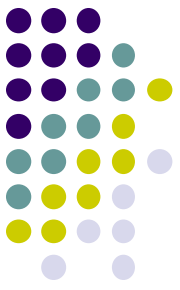
Third Possibility

- The economic environment generating returns is complicated
 - Requires investors to have beliefs
 - Historical data challenges
- Even rational people make mistakes
 - Price patterns may reflect beliefs that turned out to be wrong
 - What are the sources of those mistakes?

Interpreting Semi-strong Form Efficiency



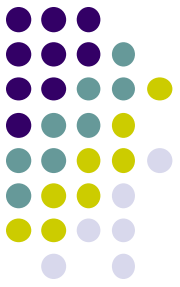
- Definition: Prices *fully* reflect all public information
- Interpretation
 - Send my coauthors (e.g. Kent and Jegadeesh) back to 1965 with modern computers and detailed databases (up to 1965)
 - If markets were semi strong efficient, Kent and Jegadeesh would not outperform investors with primitive computers and incomplete data (and no training in modern finance)
- Of course market prices were “wrong,” but not necessarily “irrational”



Macro Time-Series Example

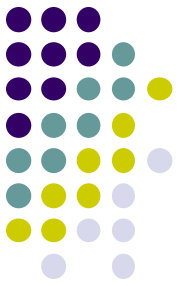
- Why are returns higher following recessions?
 - The market is riskier coming out of recessions (Fama)
 - The market overreacts to macro news (Shiller)
 - The economy recovered from past recessions faster than anticipated (i.e., investors happened to be wrong)

Business Cycle Expectations



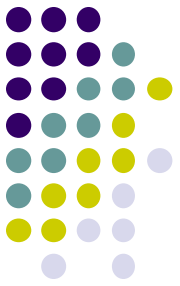
- Minor recession or prolonged downturn?
 - Did the great depression influence post-war investors' beliefs?
 - Did the 90s Japanese financial crisis influence investors in the 2008 financial crisis?
- Are US post war return patterns consistent with “wrong” prior beliefs arising rationally?

Cross-sectional Example



- Corporate opportunities tend to be mean-reverting
 - (e.g., Apple cannot mint money forever)
- The amount by which opportunities mean-revert determines how much prices react to information
 - e.g., how much should Apple stock increase with a 30% increase in iPad sales
- If the market is systematically “wrong” about mean-reversion, market prices will either over or under-react
 - creating momentum and/or value effects, etc.

US Cross-Sectional Patterns

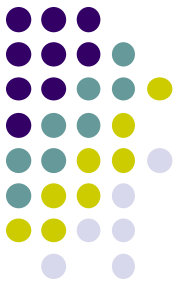


Fundamentals

- Size
- Value
- Profitability
- Asset Growth

Investment Flows

- Post-earnings announcement drift
- Short-run return reversals
- Momentum



Fundamental versus flow signals

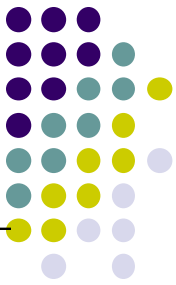
Fundamental signals

- High Sharpe ratios
- Relatively low turnover
- High potential mispricing (>30%)

Investor flow signals

- High Sharpe ratios
- High turnover
- Low potential mispricing (<10%)

Sharpe Ratios of Characteristic-Sorted Portfolios



Market-Neutral Portfolios				
Weight *				
Value minus Growth (Market-to-Book)	High minus Low Profitability	Low minus High Asset Growth	Standard Deviation (Annualized %)	Sharpe Ratio (Annualized) ^a
1.000	0.000	0.000	13.423	0.385
0.000	1.000	0.000	12.428	0.435
0.000	0.000	1.000	10.693	0.515
0.458	0.542	0.000	8.450	0.627
0.000	0.421	0.579	8.079	0.676
0.176	0.420	0.404	7.768	0.696

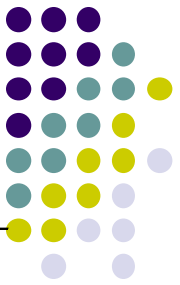
* Weights are calculated according to mean-variance efficiency

^a Under the null of zero expected return, $p < 0.001$ when Sharpe ratio is larger than 0.440

Monthly return correlation between strategies:

value and profitability: -0.142; value and asset growth: 0.621; profitability and asset growth: -0.007

Sharpe Ratios of Characteristic-Sorted Portfolios



Market-Neutral Portfolios				
Weight				
Value minus Growth (Market-to-Book)	High minus Low Profitability	Low minus High Asset Growth	Standard Deviation (Annualized %)	Sharpe Ratio (Annualized)
0.333	0.333	0.333	8.013	0.669 ^a
0.208	0.424	0.368	7.760	0.695 ^b
0.300	0.324	0.376	7.992	0.673 ^c

^a Equally-weighted portfolio; p-value: 1.40×10^{-6}

^b Minimum-variance portfolio; p-value: 5.75×10^{-7}

^c Risk-parity portfolio; p-value: 1.22×10^{-6}

Sharpe Ratios of Characteristic-Sorted Portfolios

(Half-samples)



Market-Neutral Portfolios				
Weight				
Value minus Growth (Market-to-Book)	High minus Low Profitability	Low minus High Asset Growth	Standard Deviation (Annualized %)	Sharpe Ratio (Annualized)
<i>July 1964 – June 1989</i>				
0.333	0.333	0.333	5.184	0.972^a
0.228	0.516	0.256	4.106	1.009^b
<i>July 1989 – June 2014</i>				
0.333	0.333	0.333	9.789	0.627^c
0.220	0.383	0.397	9.683	0.683^d

^a Equally-weighted portfolio; p-value: 7.92×10^{-12}

^b Minimum-variance portfolio; p-value: 1.41×10^{-12}

^c Equally-weighted portfolio; p-value: 5.52×10^{-6}

^d Minimum-variance portfolio; p-value: 8.70×10^{-7}

Sharpe Ratios of Characteristic-Sorted Portfolios

(excluding the largest 10% of firms each year)



Market-Neutral Portfolios				
Weight *				
Value minus Growth (Market-to-Book)	High minus Low Profitability	Low minus High Asset Growth	Standard Deviation (Annualized %)	Sharpe Ratio (Annualized) ^a
1.000	0.000	0.000	15.392	0.520
0.000	1.000	0.000	13.399	0.554
0.000	0.000	1.000	9.231	0.734
0.433	0.567	0.000	11.744	0.654
0.000	0.343	0.657	7.574	0.924
-0.146	0.380	0.766	7.230	0.946

* Weights are calculated according to mean-variance efficiency

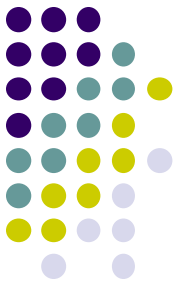
^a Under the null of zero expected return, $p < 0.001$ when Sharpe ratio is larger than 0.440

Monthly return correlation between strategies:

value and profitability: 0.353; value and asset growth: 0.626; profitability and asset growth: -0.010

Sharpe Ratios of Characteristic-Sorted Portfolios

(excluding the largest 10% of firms each year)



Market-Neutral Portfolios

Weight

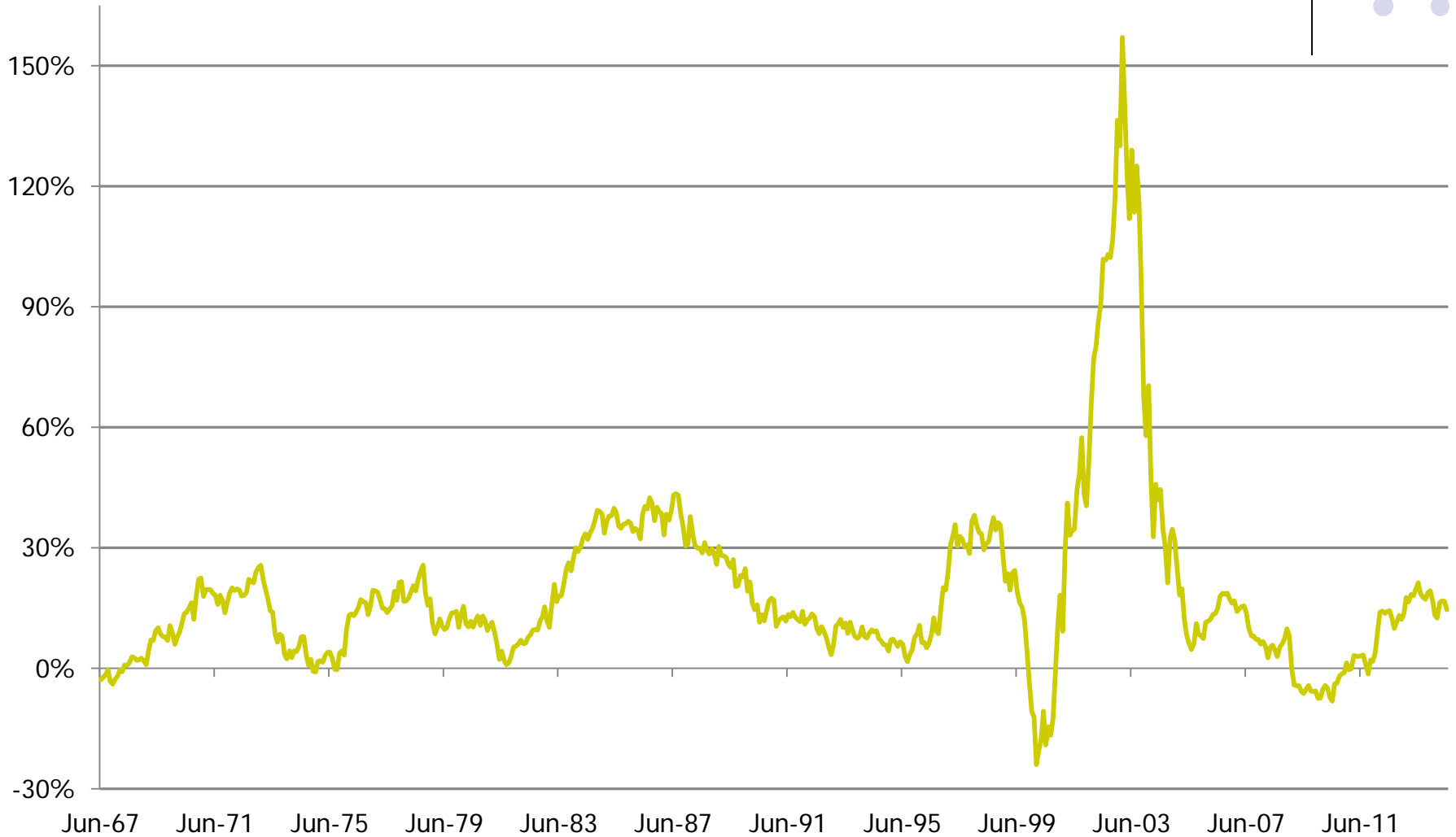
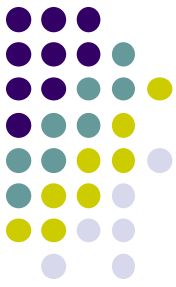
Value minus Growth (Market-to-Book)	High minus Low Profitability	Low minus High Asset Growth	Standard Deviation (Annualized %)	Sharpe Ratio (Annualized)
0.333	0.333	0.333	9.563	0.774 ^a
-0.211	0.379	0.832	7.188	0.941 ^b

^a Equally-weighted portfolio; p-value: 3.25×10^{-8}

^b Minimum-variance portfolio; p-value: 3.23×10^{-11}

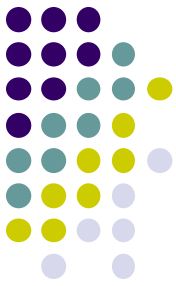
Rolling 3-year CAR of the Mean-variance Efficient Portfolio

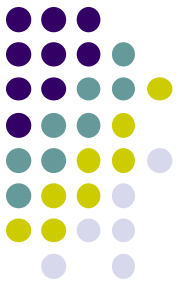
(three strategies; market-neutral; Sharpe ratio 0.696)



Rolling 3-year CAR of the Mean-variance Efficient Portfolio

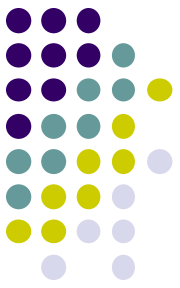
(excluding the largest 10% of firms; three strategies; market neutral; Sharpe ratio 0.924)





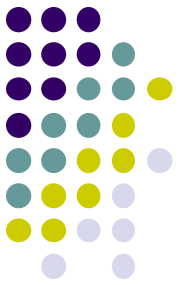
Observations

- Historical cross-sectional return patterns are inconsistent with “rational expectations”
 - Extreme Sharpe ratios for market neutral portfolios
 - Probability of observing by chance $< .1\%$
 - Not a return for risk
 - Investors would have acted differently if they had anticipated these return patterns
 - The “strategy” lost significant amounts only during the internet bubble period
 - Extremely volatile in the late 1990s and early 2000s
 - Looks like an innovation factor?



Research Agenda

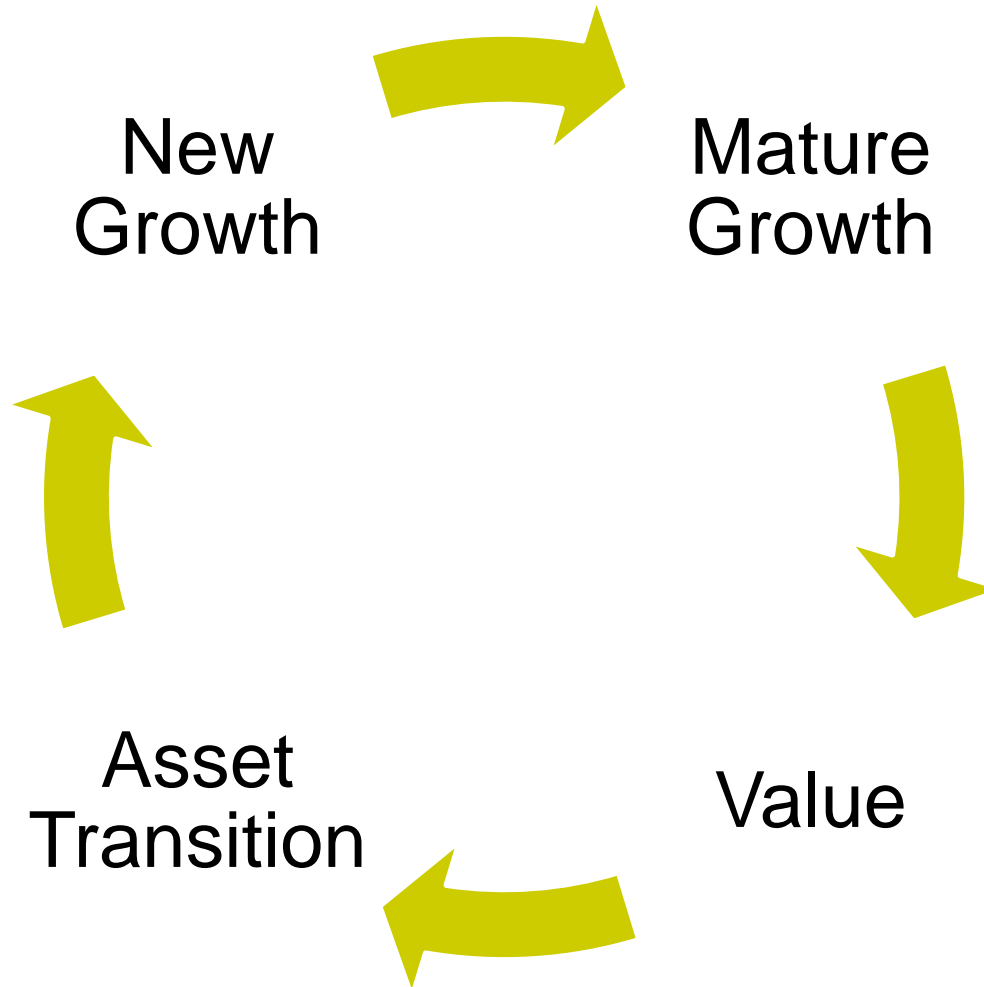
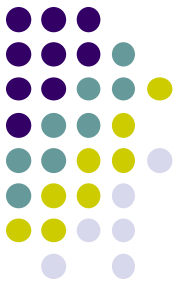
- Develop a plausible model with simulated sample paths that exhibit asset growth, value and profitability effects
- Consider conditions under which these sample paths arise “too often”
 - That is, are there plausible mistakes that can generate these return patterns?
 - What is the cause of these mistakes?
 - Computational limitations, overconfidence, optimism

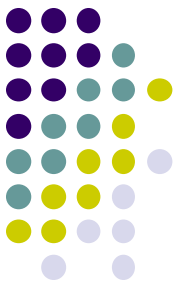


The Model

- Firms can inhabit three states that capture the arrival of new opportunities
 - New Growth: very profitable opportunities
 - Mature Growth: moderately profitable opportunities
 - Value: harvesting existing businesses

Firm Migration

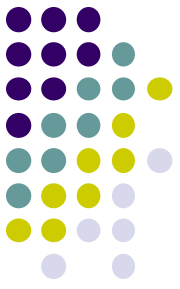




Systematic Shock

- The macro environment can be characterized by the arrival rate of new growth opportunities
- Creative Destruction: A higher arrival rate implies a higher destruction rate
 - High arrival rate is especially good for unprofitable growth ...
 - but especially bad for profitable value

Creative Destruction



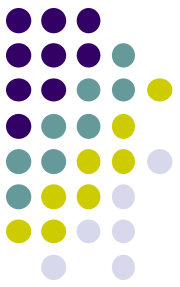
- New projects supplant existing projects





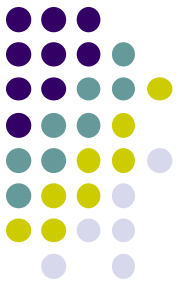
More details

- Investors observe the recent arrival rate of new investment opportunities
- Soft information that requires judgment
 - The state of technical and regulatory environment
 - May be overconfident about their judgment
- These sources of information are combined to form expectations about future arrival rates
- Investors believe the soft signal is more precise than it really is



What is our explanation for the historical return pattern?

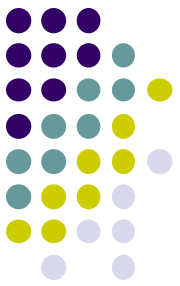
- Investors overreact to the soft innovation signals
 - They think the signal is more precise than it is
- Favorable signals lead to
 - Unprofitable growth firms being overvalued
 - Profitable value firms being undervalued



Relevant Assumptions

- Level of overconfidence
 - Biased investors' 90% confidence intervals are accurate 34% of the time (compared to 50% in survey evidence)
- Persistence of the innovation process
 - Half life of 10 years

Under these assumptions, we see extreme Sharpe ratios in more than 10% of the sample paths



Conclusion

- Characteristic-sorted portfolios exhibited extreme Sharpe ratios during the past 50 years
 - Inconsistent with rational pricing models
 - Indicates that investors made mistakes
- What was the mistake?
 - Investors over-reacted to soft information about the innovation climate
 - Our calibrated model suggests that these high Sharpe ratios can occur a bit more than 10% of the time