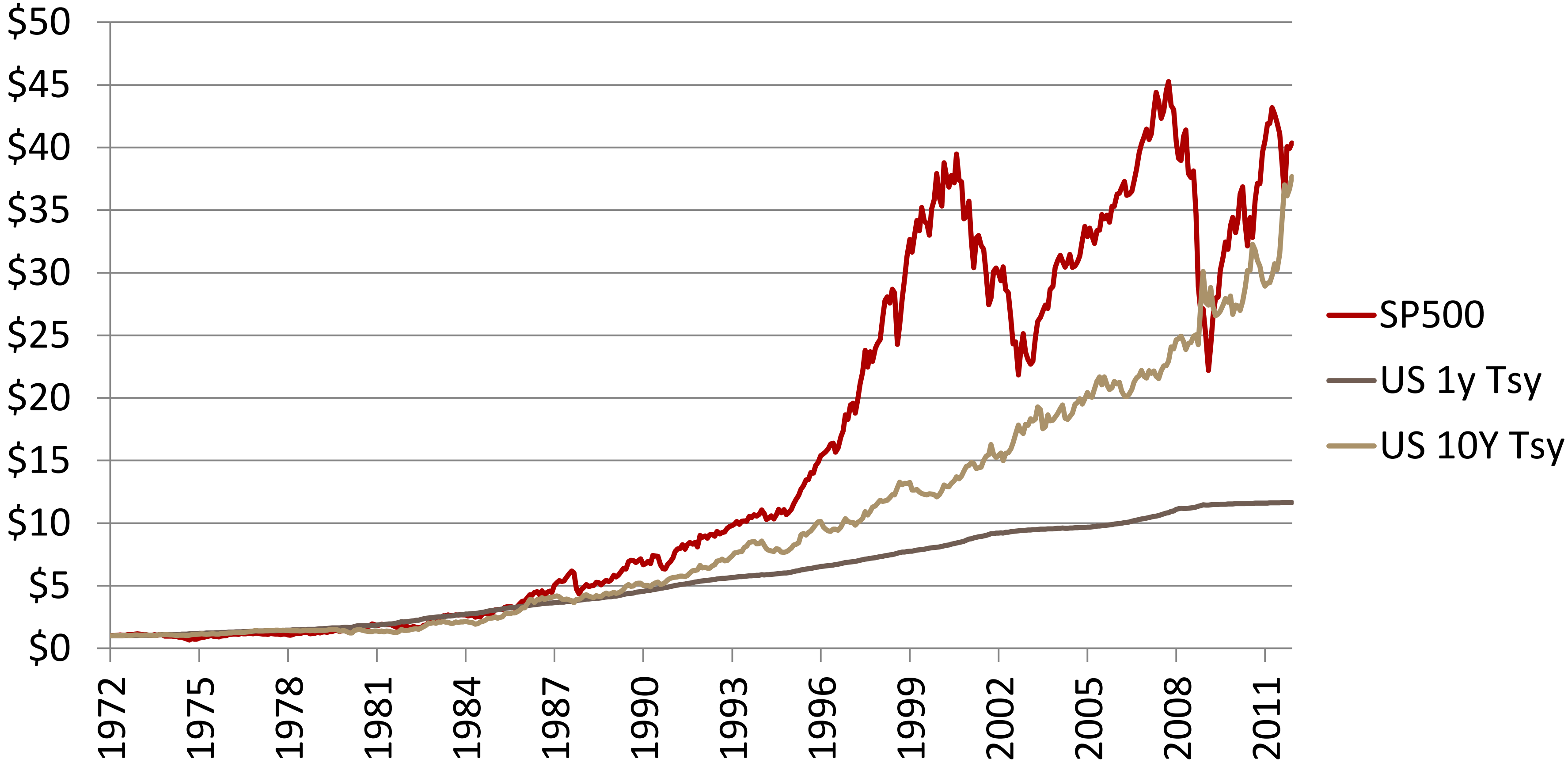
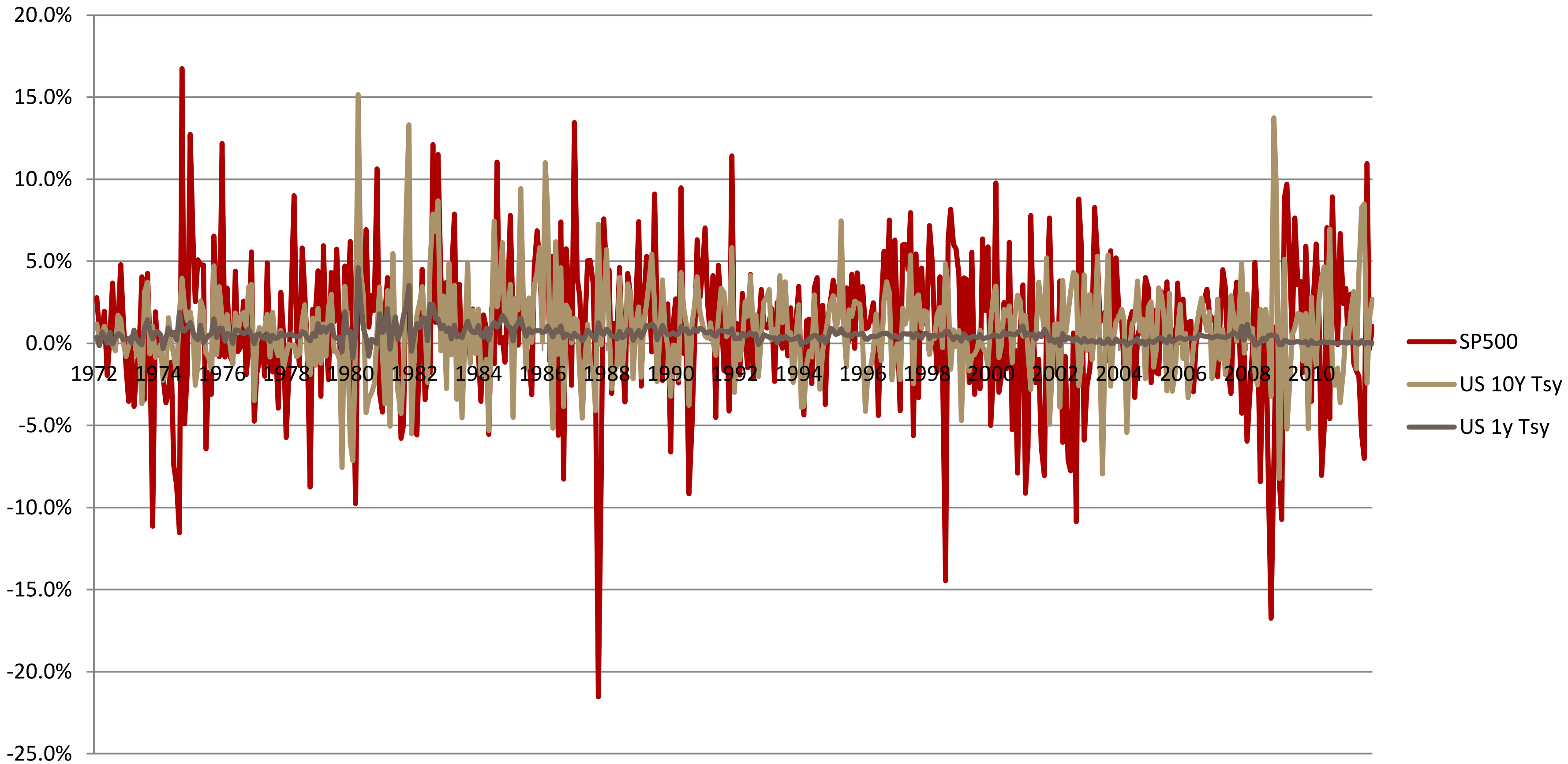
Markus K. Brunnermeier

LECTURE 1: INTRODUCTION EMPIRICAL REGULARITIES

Money, Bonds vs. Stocks

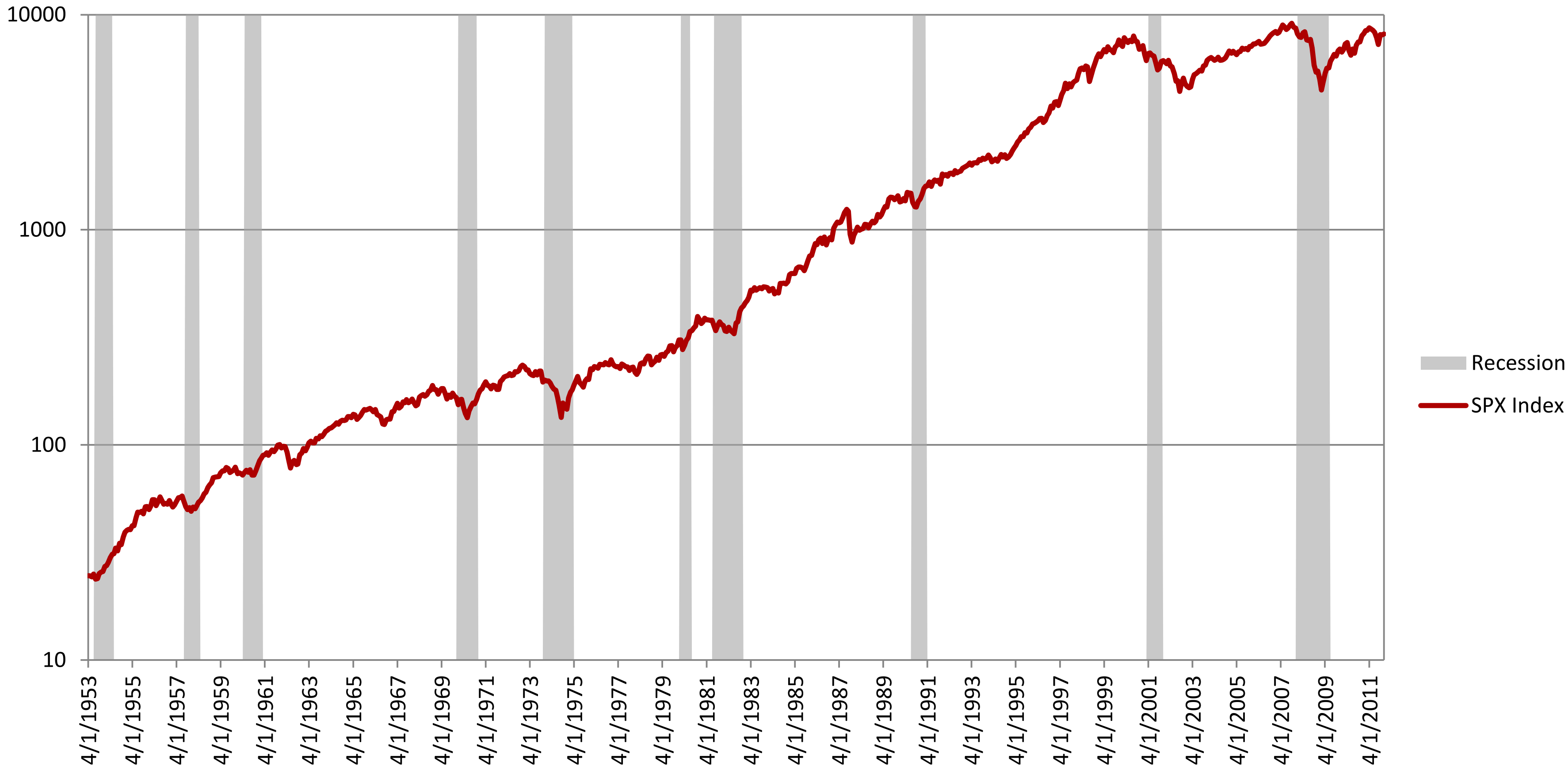


Monthly Returns



But what is the right horizon?

Compared to Recessions



Stock Market Predictability

- Random walk hypothesis:
  - Stock market prices evolve according to a random walk, and therefore cannot be predicted.
- Changes in stock prices can only be attributed to:
  - News on future cash flows
  - Change in “Risk premia” – the “dark matter” of finance
  - Shifts in Behavioral Bias

Testing Market Predictability

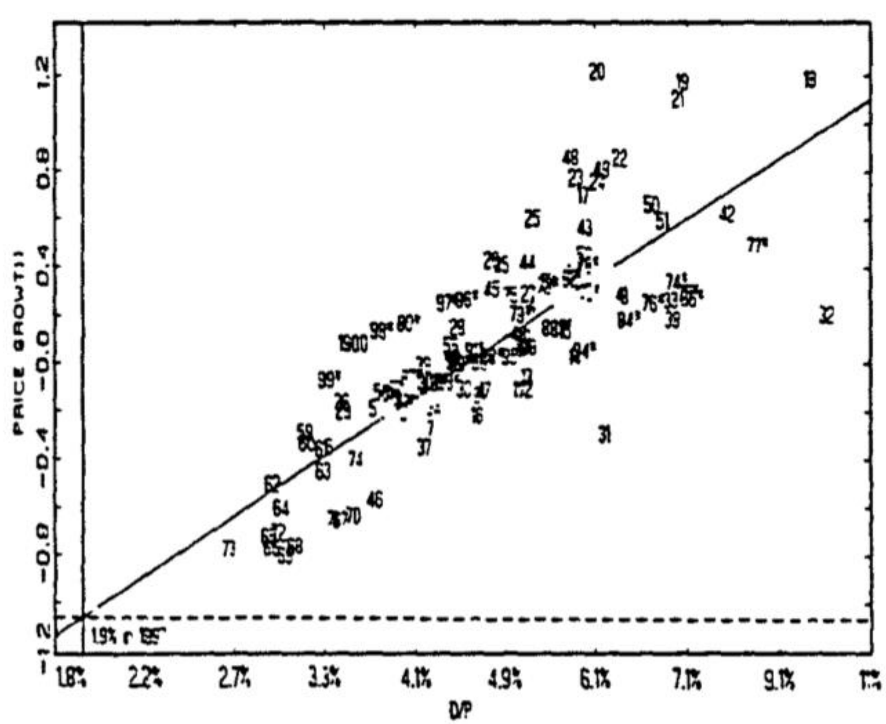
- Cross Section vs. Time-Series
  - Cross-Sectional studies refer to data collected at the same point in time, or regardless of differences in time
  - Time-Series studies refer to a sequence of data points and look at how the data changed through time
- To test market predictability:
  - Cross-Sectional studies look at whether some factors can explain the stock price changes, potentially in contradiction to the random walk hypothesis
  - Time-Series studies look at the existence of time-related patterns (e.g. trends, seasonality) or event-specific behavior that would invalidate the random walk hypothesis

Dividend/Price Ratio and Stock Prices

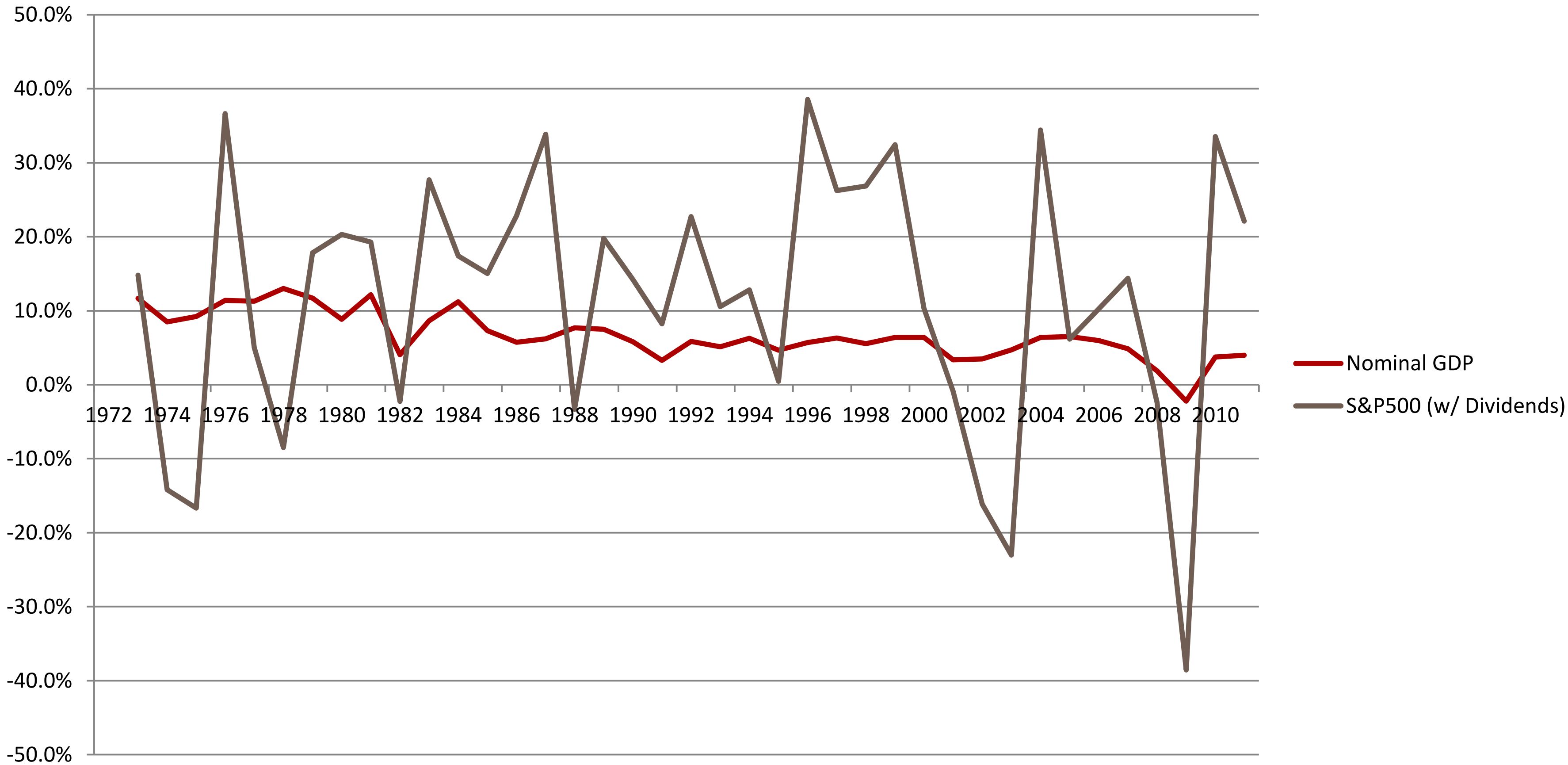
A regression of the S&P 500 index price growth on the dividend/price ratio shows that the D/P ratio is a good predictor of future price growth

Campbell and Shiller (1986)

PANEL B. PRICE GROWTH UNTIL NEXT TIME D/P CROSSES ITS MEAN VERSUS D/P



Stocks are more volatile than consumption growth



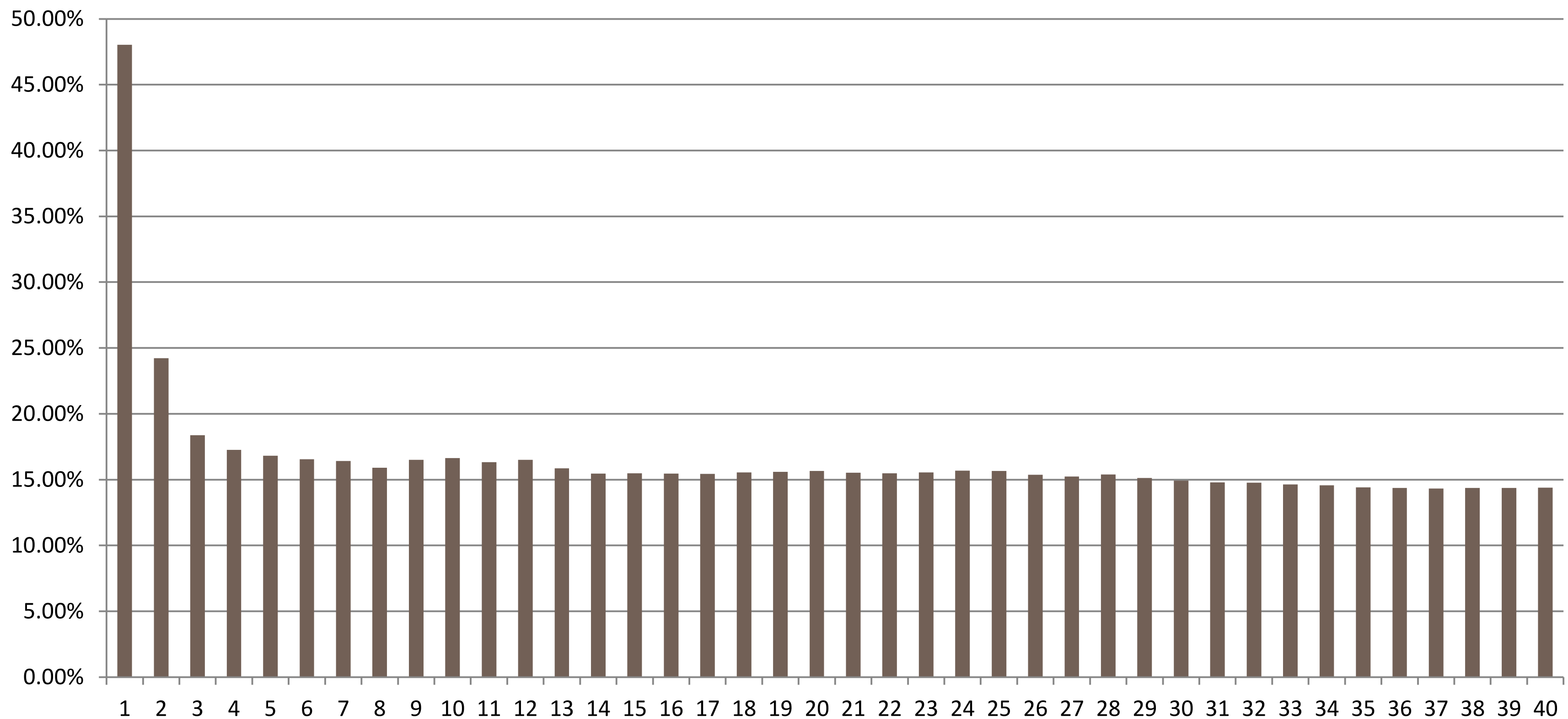
In the cross section: return & risk

Table 2: Idiosyncratic Volatility and Expected Returns in G7 Countries

	Canada	France	Germany	Italy	Japan	U.K.	U.S.
Panel A: USD Denominated Returns							
Constant	1.723	0.602	0.753	0.425	0.948	0.480	1.746
	[3.68]	[1.13]	[1.87]	[0.76]	[1.25]	[1.03]	[3.83]
W-FF Idiosyncratic Volatility	-1.224	-1.439	-2.003	-1.572	-1.955	-0.871	-2.014
	[-2.46]	[-2.14]	[-3.85]	[-2.10]	[-5.18]	[-2.54]	[-6.67]
$\beta(MKT^W)$	0.344	0.059	0.277	-0.083	0.323	0.178	0.376
	[2.20]	[0.44]	[1.93]	[-0.32]	[3.12]	[1.46]	[4.52]
$\beta(SMB^W)$	0.009	0.015	-0.083	0.116	0.050	0.032	-0.049
	[0.12]	[0.17]	[-0.82]	[0.56]	[0.76]	[0.42]	[-1.19]
$\beta(HML^W)$	-0.070	-0.069	0.076	-0.221	-0.025	-0.077	-0.051
	[-0.95]	[-0.94]	[1.00]	[-1.98]	[-0.35]	[-1.30]	[-1.69]
Size	-0.253	-0.067	-0.044	-0.031	-0.132	-0.058	-0.157
	[-4.81]	[-1.08]	[-1.09]	[-0.47]	[-1.72]	[-1.16]	[-3.14]
Book-to-Market	0.369	0.569	0.176	0.239	0.550	0.365	0.282
	[3.68]	[4.59]	[1.35]	[1.48]	[3.84]	[4.46]	[3.87]
Lagged Return	0.014	0.001	0.003	0.001	-0.011	0.012	-0.001
	[3.57]	[0.10]	[1.01]	[0.15]	[-2.85]	[4.07]	[0.28]
Adjusted R^2	0.118	0.108	0.114	0.147	0.124	0.078	0.046
Percentiles of W-FF Idiosyncratic Volatility							
25th Percentile	20.8	21.4	16.3	21.5	23.1	13.9	25.0
75th Percentile	46.0	39.2	34.8	38.4	39.6	31.3	61.1
Economic Effect of Moving from the 25th to the 75th W-FF Idiosyncratic Volatility Percentiles							
25% → 75%	-0.31%	-0.26%	-0.37%	-0.27%	-0.32%	-0.15%	-0.73%

Source: Ang, Hodrick, Xing, Zhang 2008

Adding stocks in alphabetic order



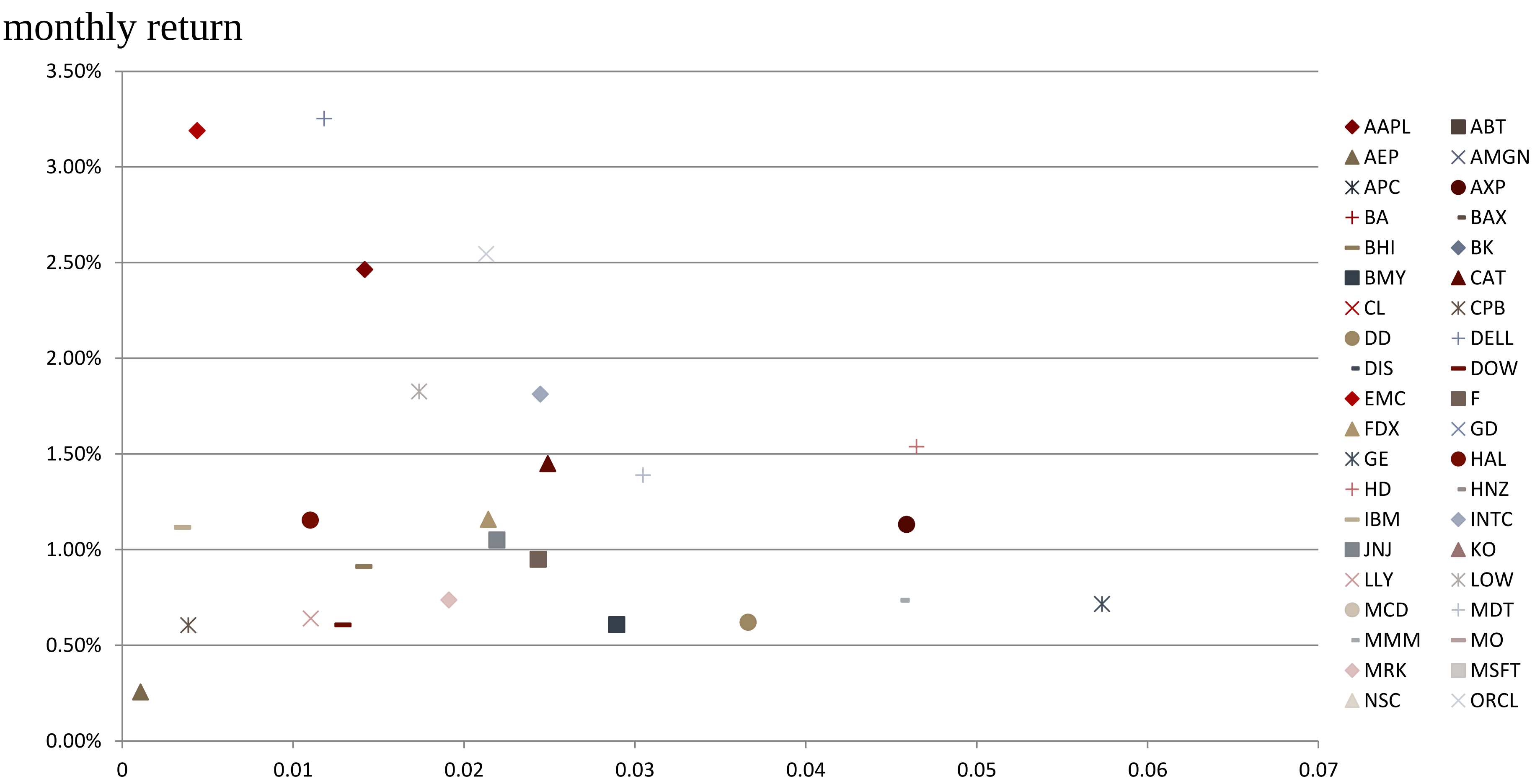
S&P 100 Stocks from 1990-2011

Measuring Risk differently

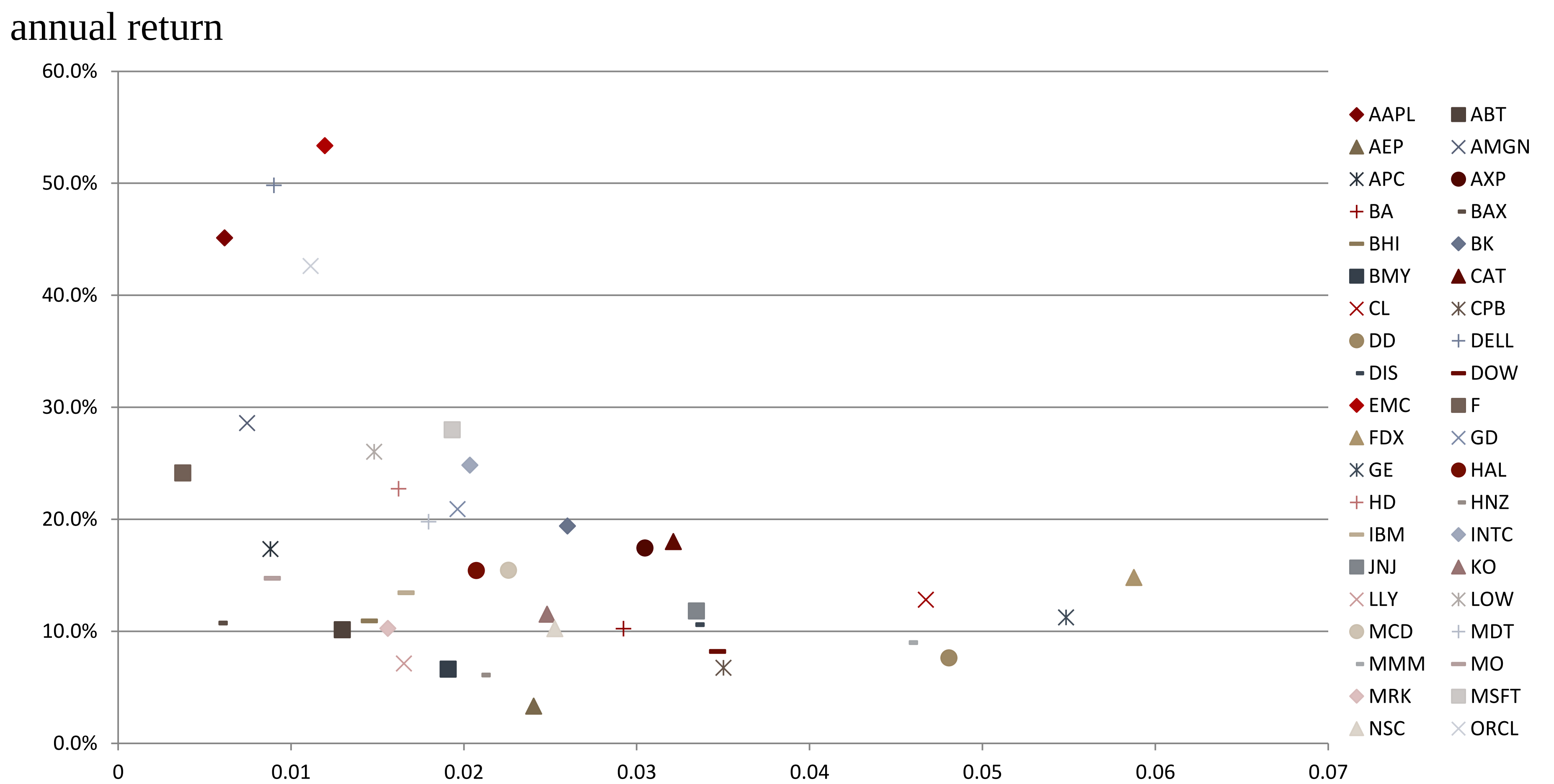
- When combining assets to a portfolio
  - Idiosyncratic component diversifies away
  - Covariance captures contribution of asset to portfolio’s risk

- Use Covariance as risk measure

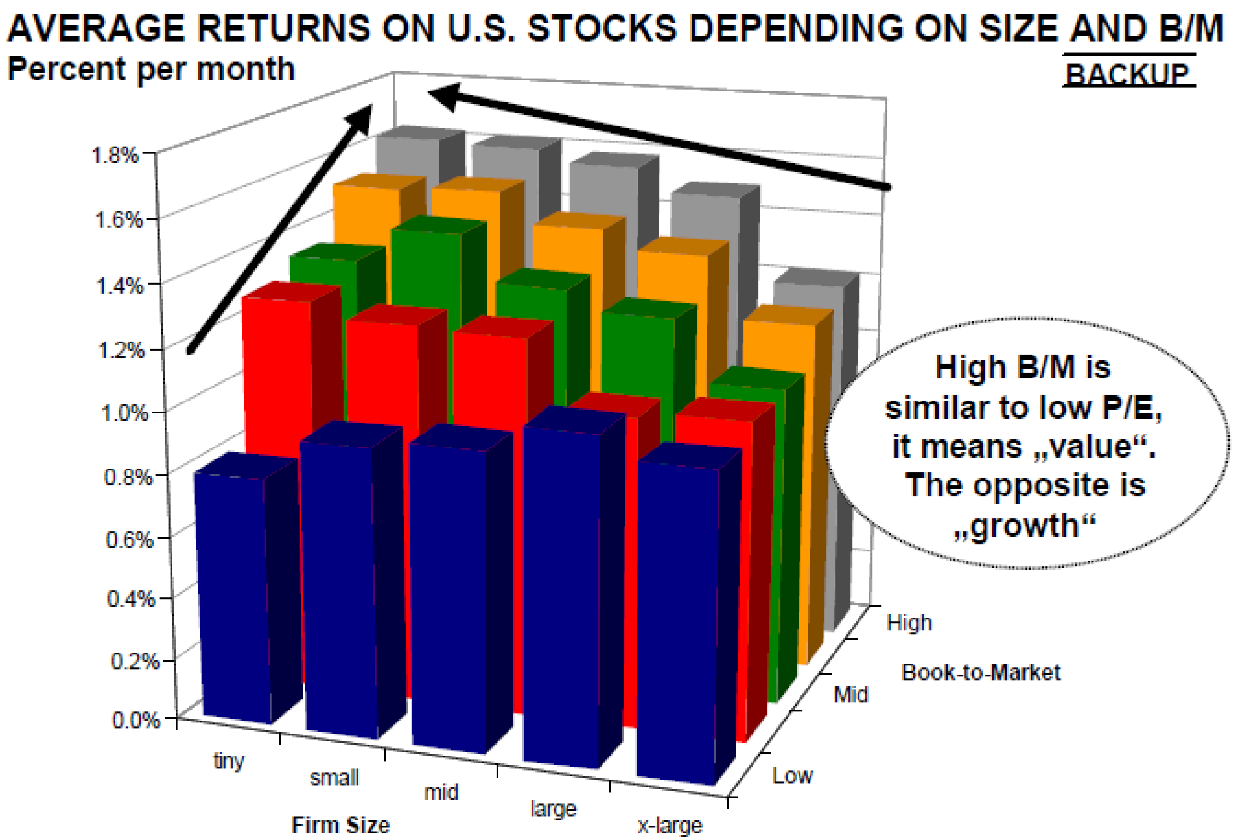
Covariance with market



Covariance with consumption

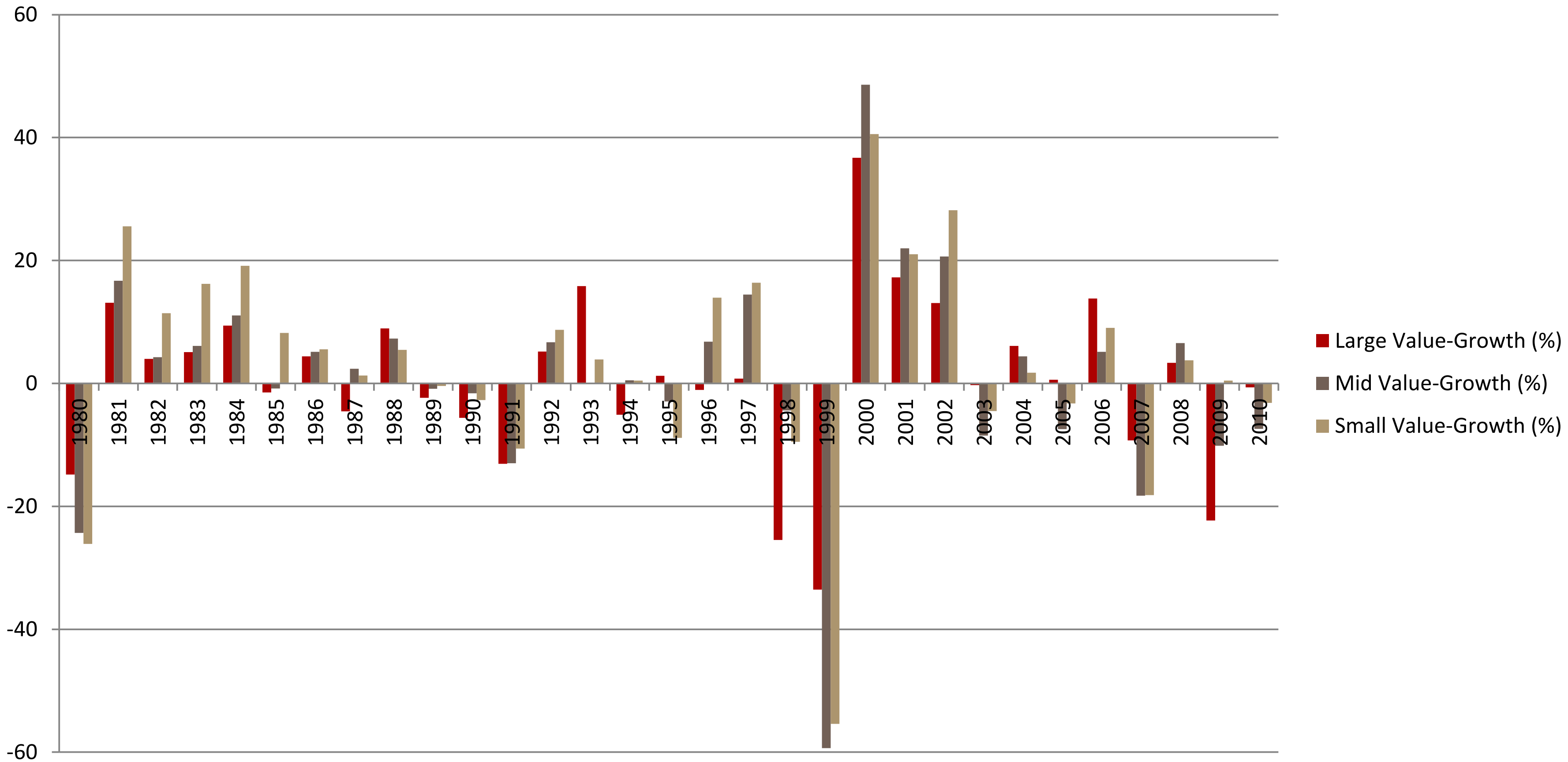


Size and value effect of stock returns



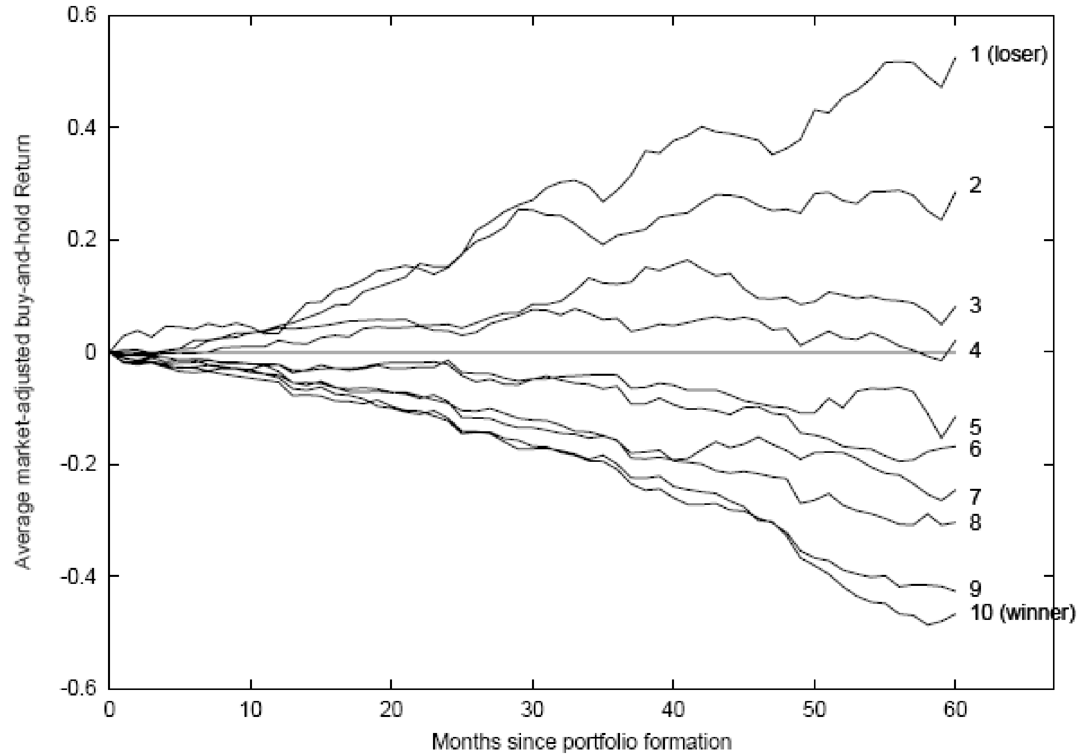
Source: Mertens, Data from Fama and French (1992)

Value vs. Growth Stocks



Winner vs. Losers

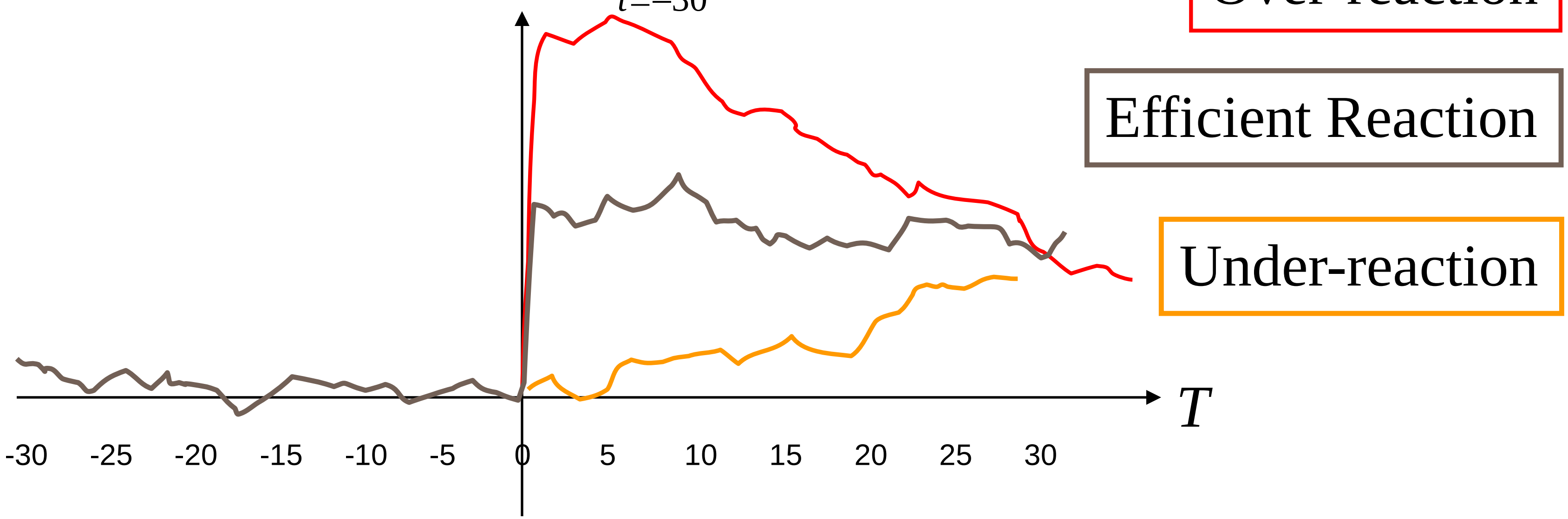
- All shares are ranked each year on basis of five-year holding returns
  - Includes companies that de-list
- Assigned to portfolio by decile of performance
  - Graph shows average performance of equally weighted portfolios adjusted by equally weighted market portfolio
- Momentum or mean-reversion?
  - Short-run
  - Intermediate
  - Long-term



- UK Stocks 1960-2002 – see paper http://papers.ssrn.com/sol3/papers.cfm?abstract_id=998418.
- Original article: DeBondt & Thaler 1985

Market Efficiency in Event Studies

$$CAAR_T = \sum_{t=-30}^{T} AAR_t$$



Important: Information has to become public at a single moment

Event Studies

Objective: Examine if new (company specific) information is incorporated into the stock price in one single price jump upon public release?

1. Calculate the daily excess returns $AR_t = R_{it} - R_{mt}$ relative to the market or benchmark for 30 days prior and after release

$$t = -30, -29, \dots, -1, 0, 1, \dots, 29, 30$$

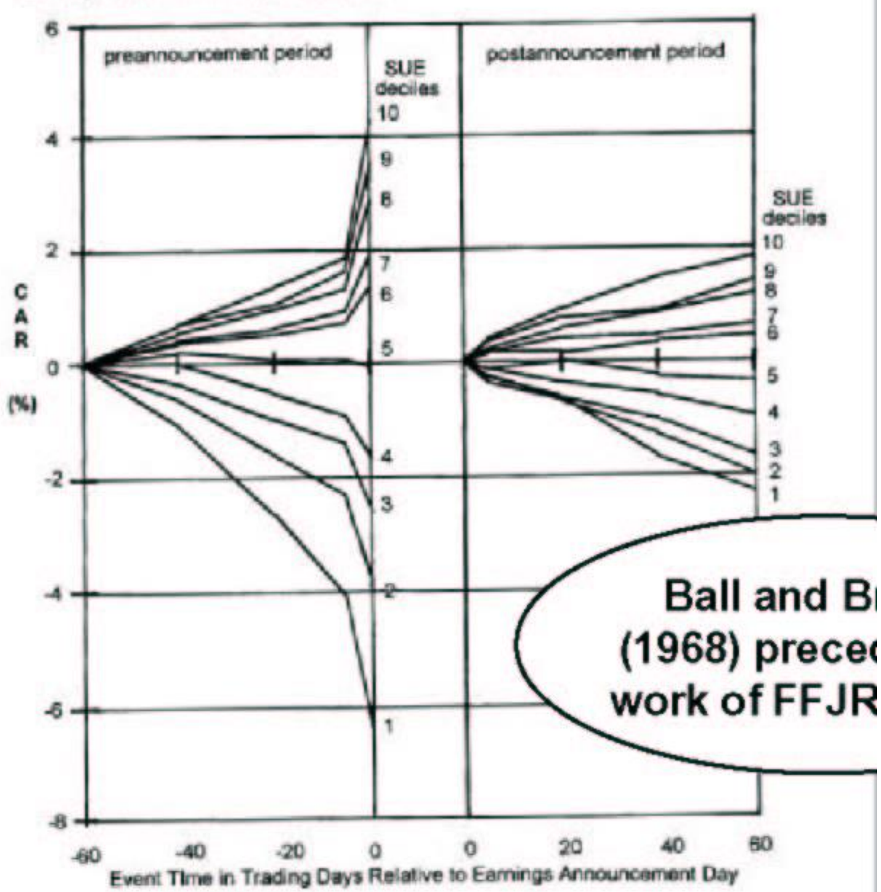
2. For each relative date t, calculate average returns and cumulative returns across events

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it}$$

$$CAAR_T = \sum_{t=-30}^{T} AAR_t$$

Event Study: Earning Announcements

Figure 1 Cumulative Abnormal Returns (CAR) for SUE Portfolios (84,792 earnings announcements, 1974–1986)



Event Study by
Ball and Brown (1968)
Pre-announcement drift prior to earnings due to insider trading

$\rightarrow$ against strong-form

Post-announcement drift

$\rightarrow$ against semi-strong form

Event Study: Earning Announcement

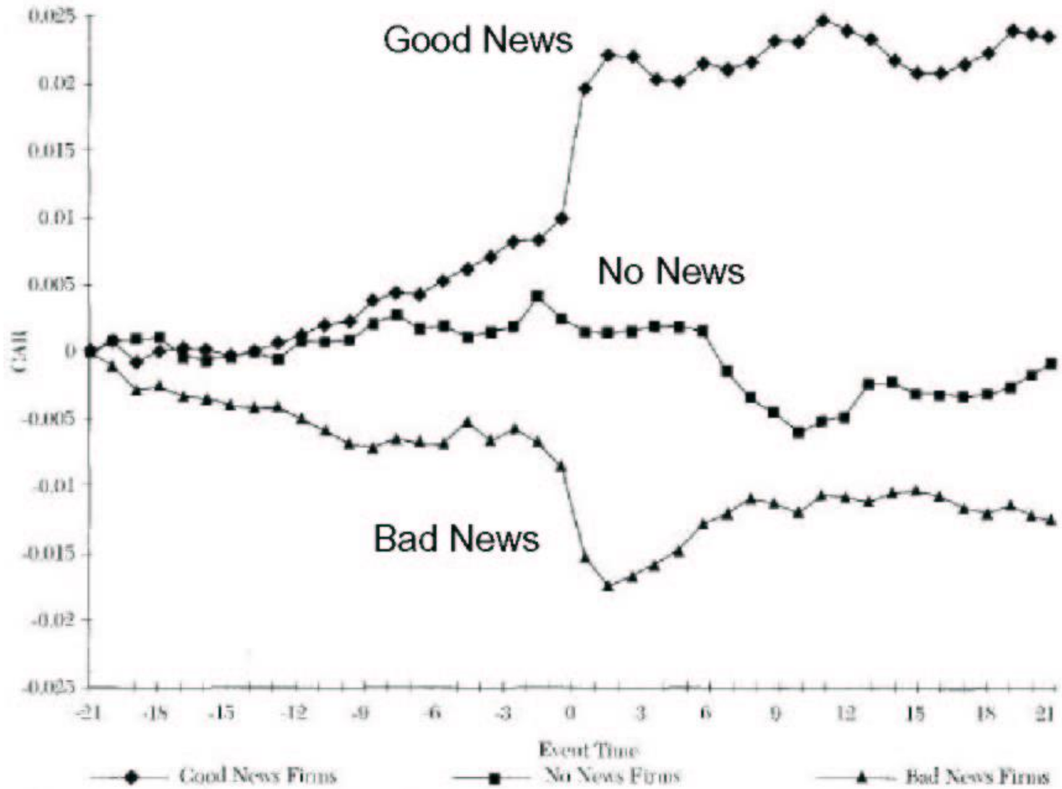
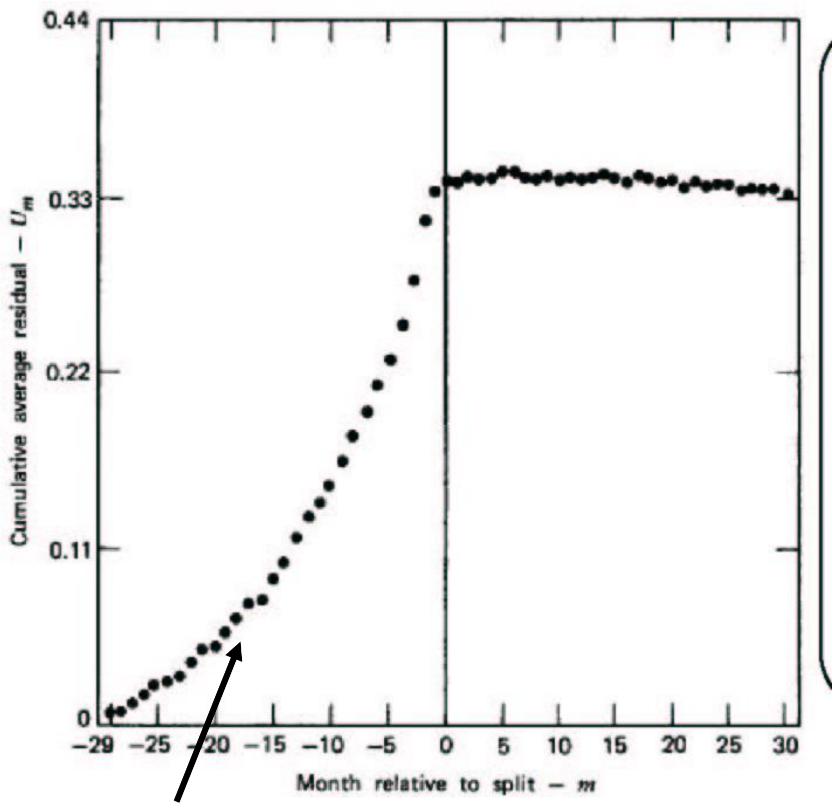


Figure 2a. Plot of cumulative abnormal return for earning announcements from event day -20 to event day 20. The abnormal return is calculated using the market model as the normal return measure.

Cumulative abnormal returns around earning announcements

(MacKinlay 1997)

Event Study: Stock Splits



Selection bias or
Insider trading

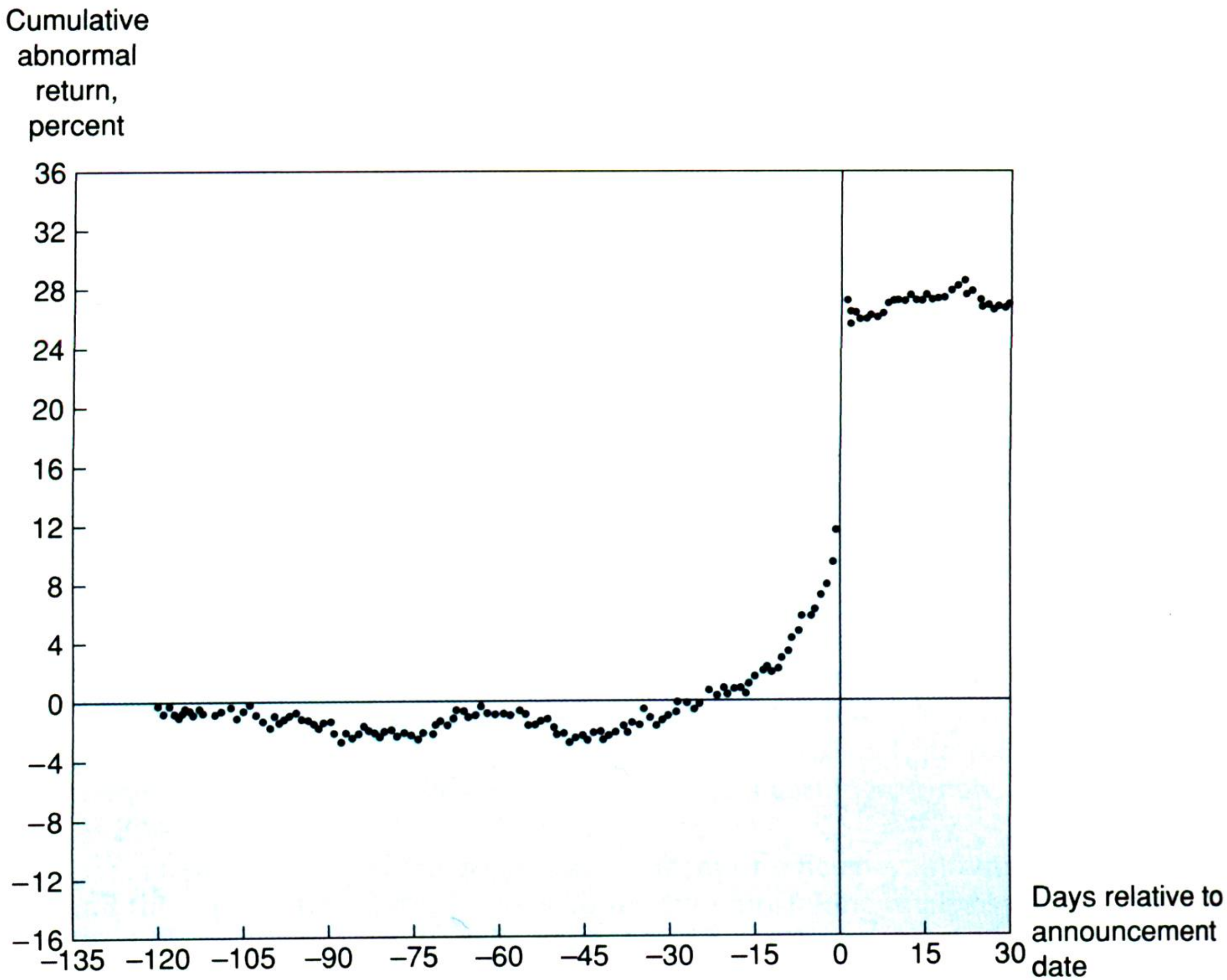
Event Study on Stock Splits by Fama-French-Fischer-Jensen-Roll (1969)

Split is a signal of good profit

Pre-announcement drift can be due to selection bias (only firms whose price rose) or insider trading.
→ inconclusive

No post-announcement drift
→ for weak form

Event Study: Take-over Announcement



Government Bonds

- The Expectations Hypothesis is the proposition that the long-term yield is determined only by the market's expectations of future short-term yield
- Let $Z(s,t)$ and $y(s,t)$ be the discount factor (zero-coupon price) and the yield for a zero-coupon price bought at s that matures at t.
- The 1-year return on a 1-year bond

$$r_{1,1} = E_t\left[\ln \frac{1}{Z(t,t+1)}\right] = \ln \frac{1}{e^{-y(t,t+1)1}} = y(t,t+1)$$

- The 1-year return on a m-year bond bought at t and sold at $t+1$.

$$r_{1,m} = E_t\left[\ln \frac{Z(t+1,t+m)}{Z(t,t+m)}\right] = E_t\left[\ln \frac{e^{y(t+1,t+m)(m-1)}}{e^{-y(t,t+m)m}}\right]$$
$$= my(t,t+m) - (m-1)E_t[y(t+1,t+m)]$$

Government Bonds

- By the EH, single-period holding on bonds of all maturities are equal in expectation. Therefore setting $r_{1,1} = r_{1,m}$ and rearranging we get

$$y(t, t+m) - y(t, t+1) = (m-1)E_t[y(t+1, t+m) - y(t, t+m)]$$

- According to the EH, the yield spread $y(t, t+m) - y(t, t+1)$ has a positive relation with short-term changes in the long-term bond yield. However, this does not hold empirically

Table 2
Regression Coefficients

	Long bond maturity (months)						
Dependent variable	*2*	*3*	*6*	*12*	*24*	*48*	*120*
Short-run changes in long yields	0.019 (0.194)	−0.135 (0.285)	−0.842 (0.444)	−1.443 (0.598)	−1.432 (0.996)	−2.222 (1.451)	−4.102 (2.083)

- Source: Campbell 1995

Corporate Bonds

A very popular model to value corporate debt is the Merton Model, which postulates that the assets of a firm follow a geometric Brownian motion process.

$$\frac{dA_t}{A_t} = \mu \cdot dt + \sigma \cdot dW_t^P$$

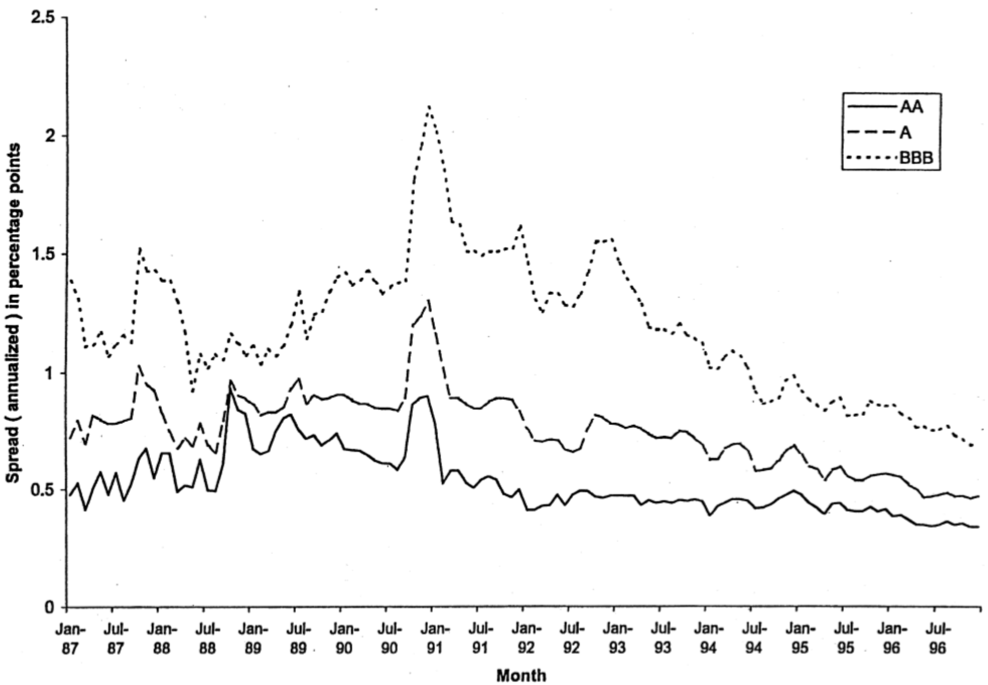
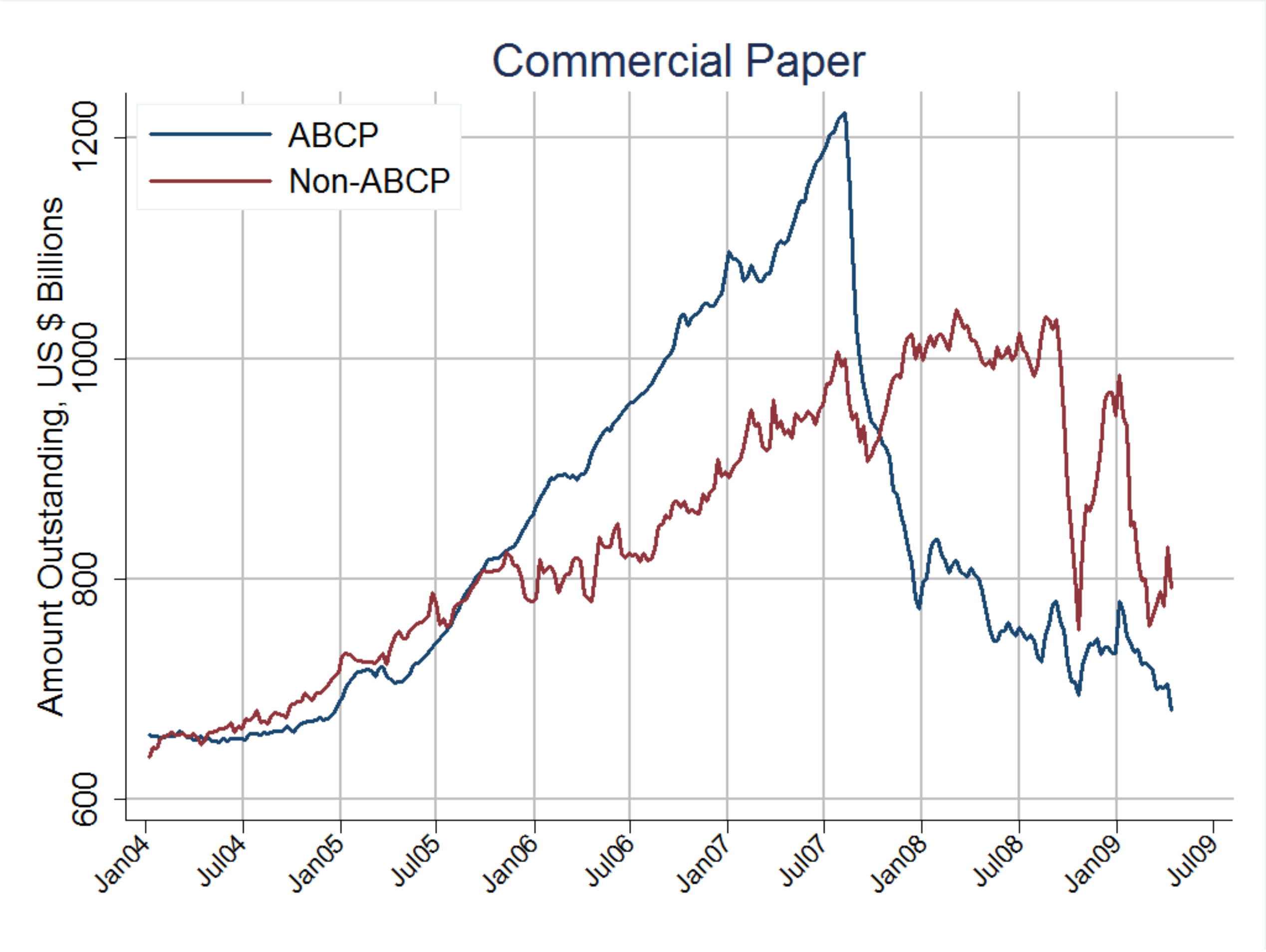


Figure 1. Empirical spreads on industrial bonds of six years maturity.

Explaining the Rate Spread on Corporate Bonds 255

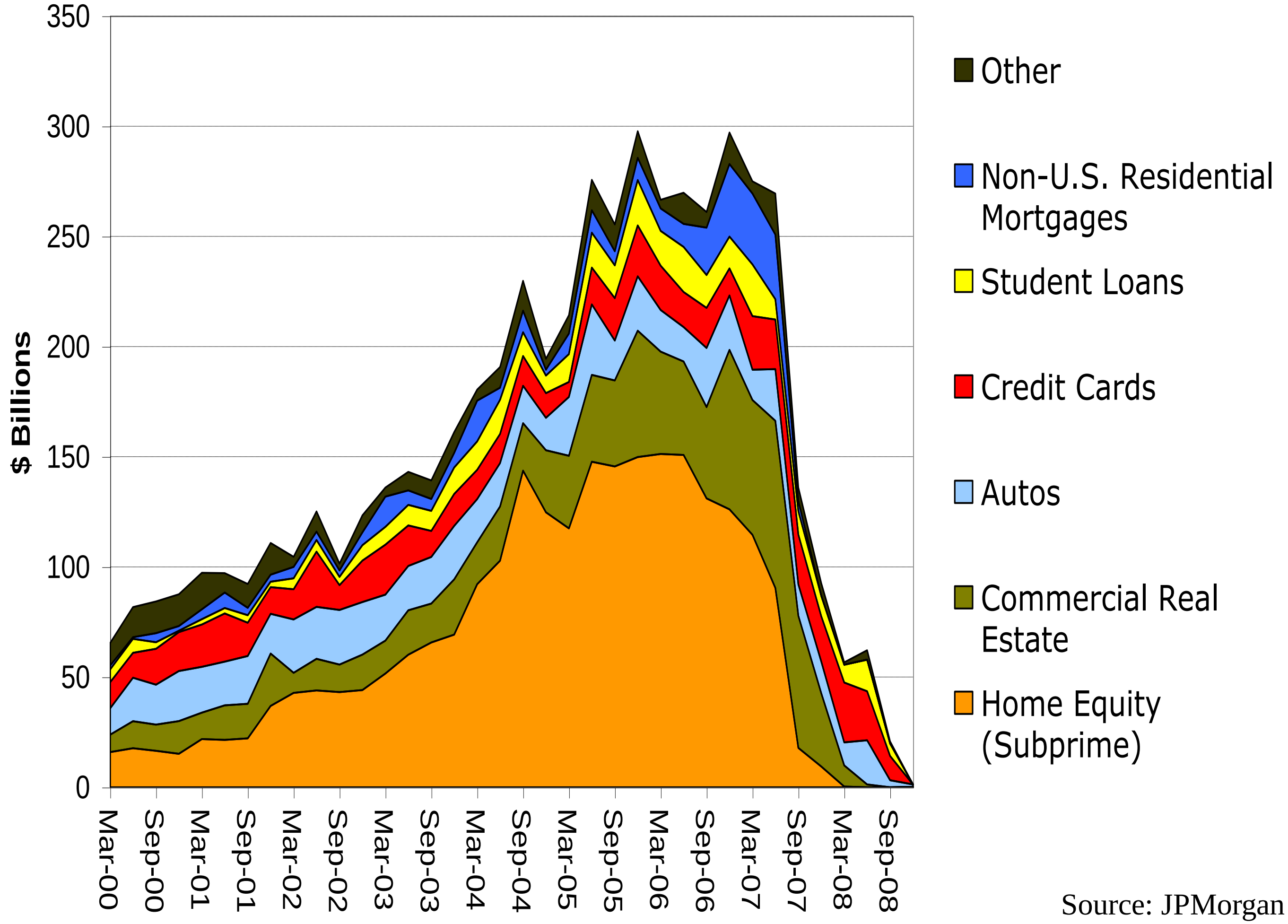
However, this model implies a credit spread to Treasuries that is consistently lower than the observed credit spreads.

Fixed income: Commercial paper



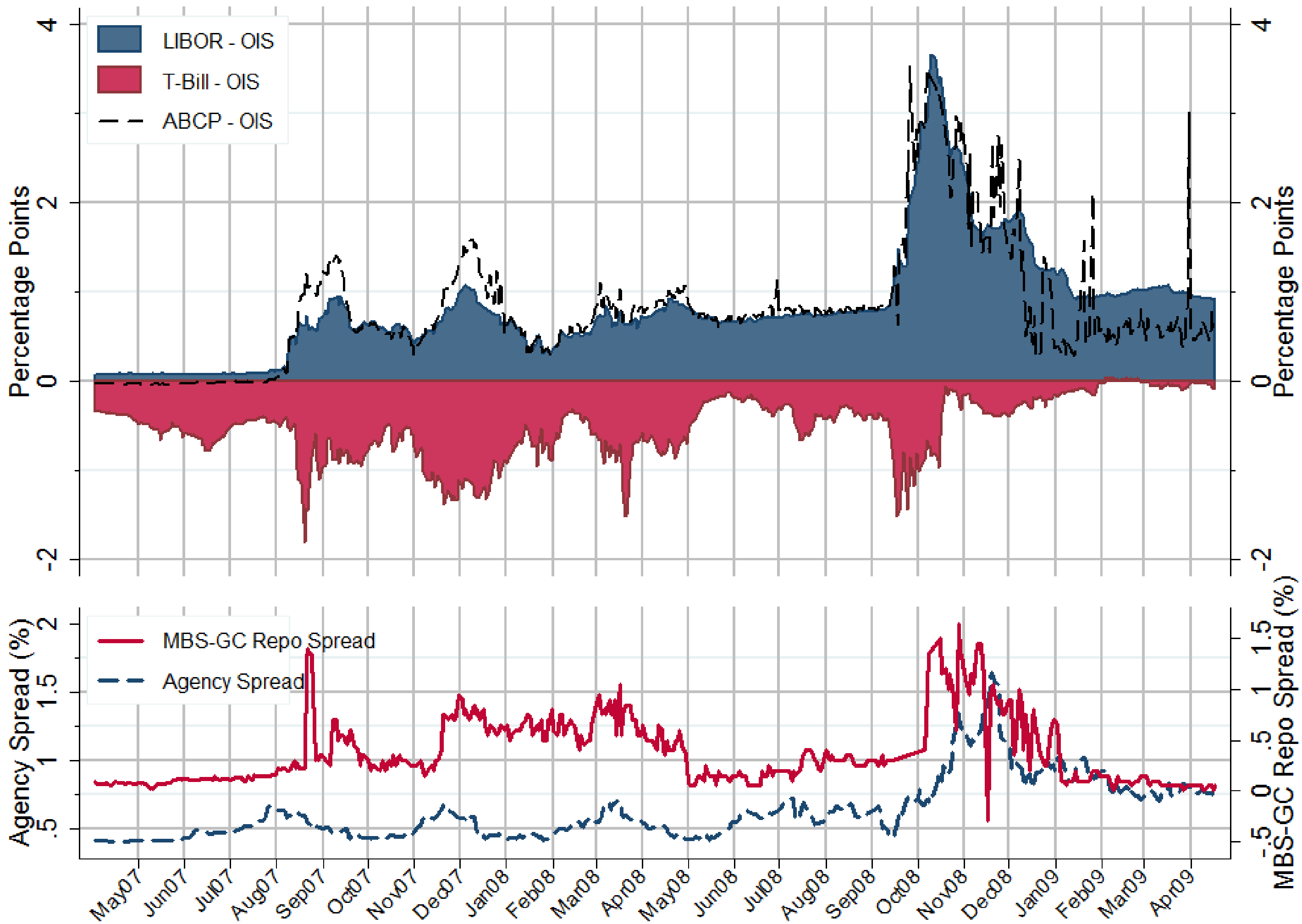
Rollover risk: Composition of ABCP

ABS issuance



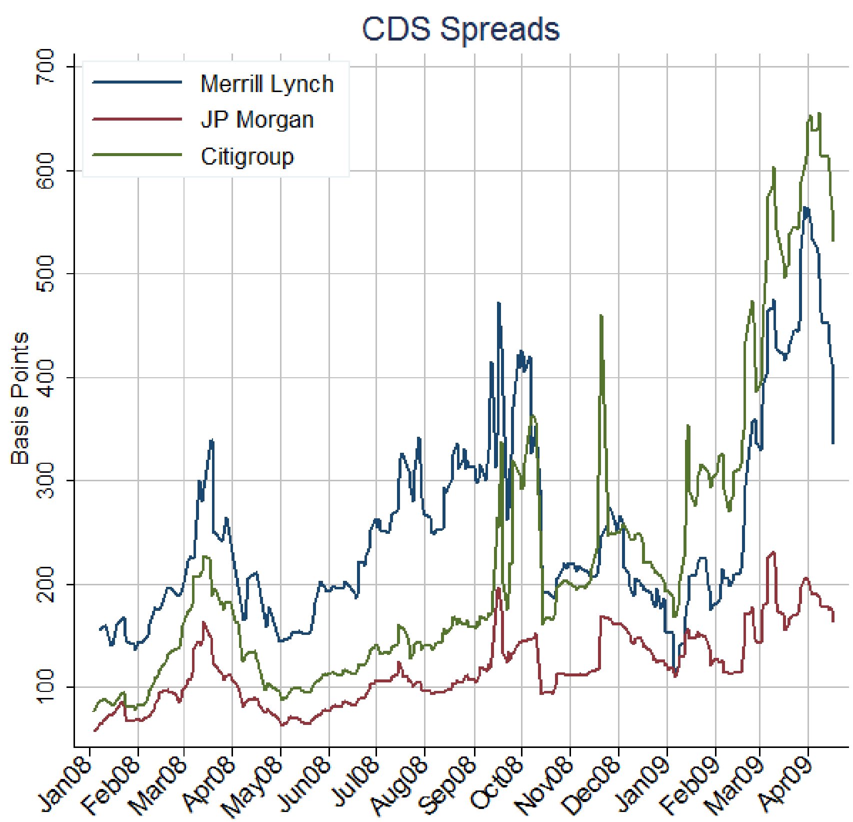
Source: JPMorgan

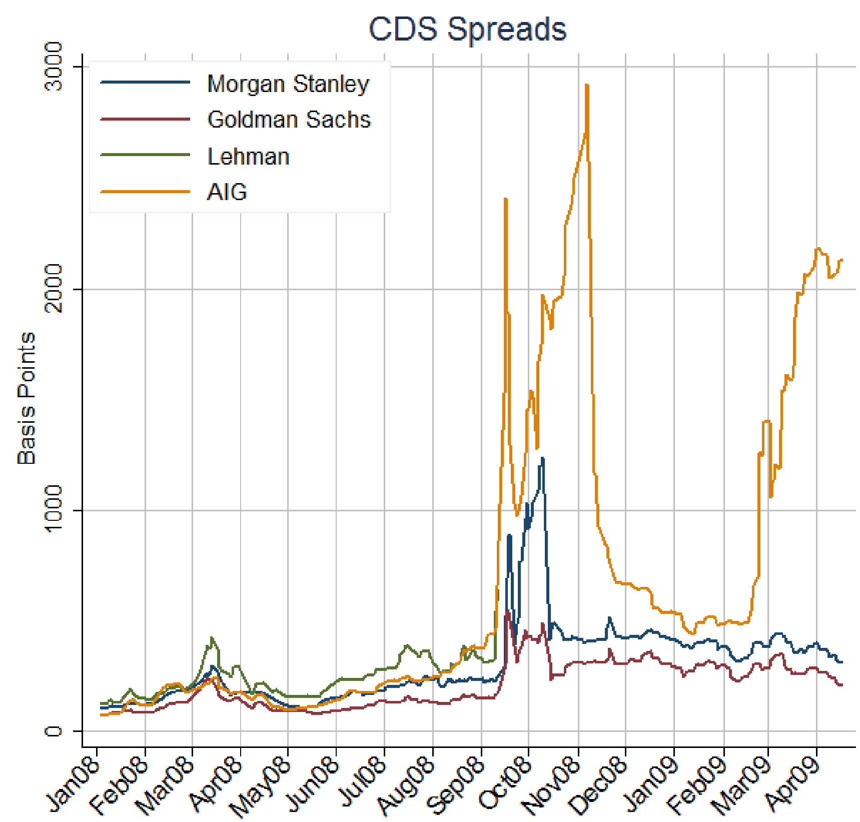
Important spreads



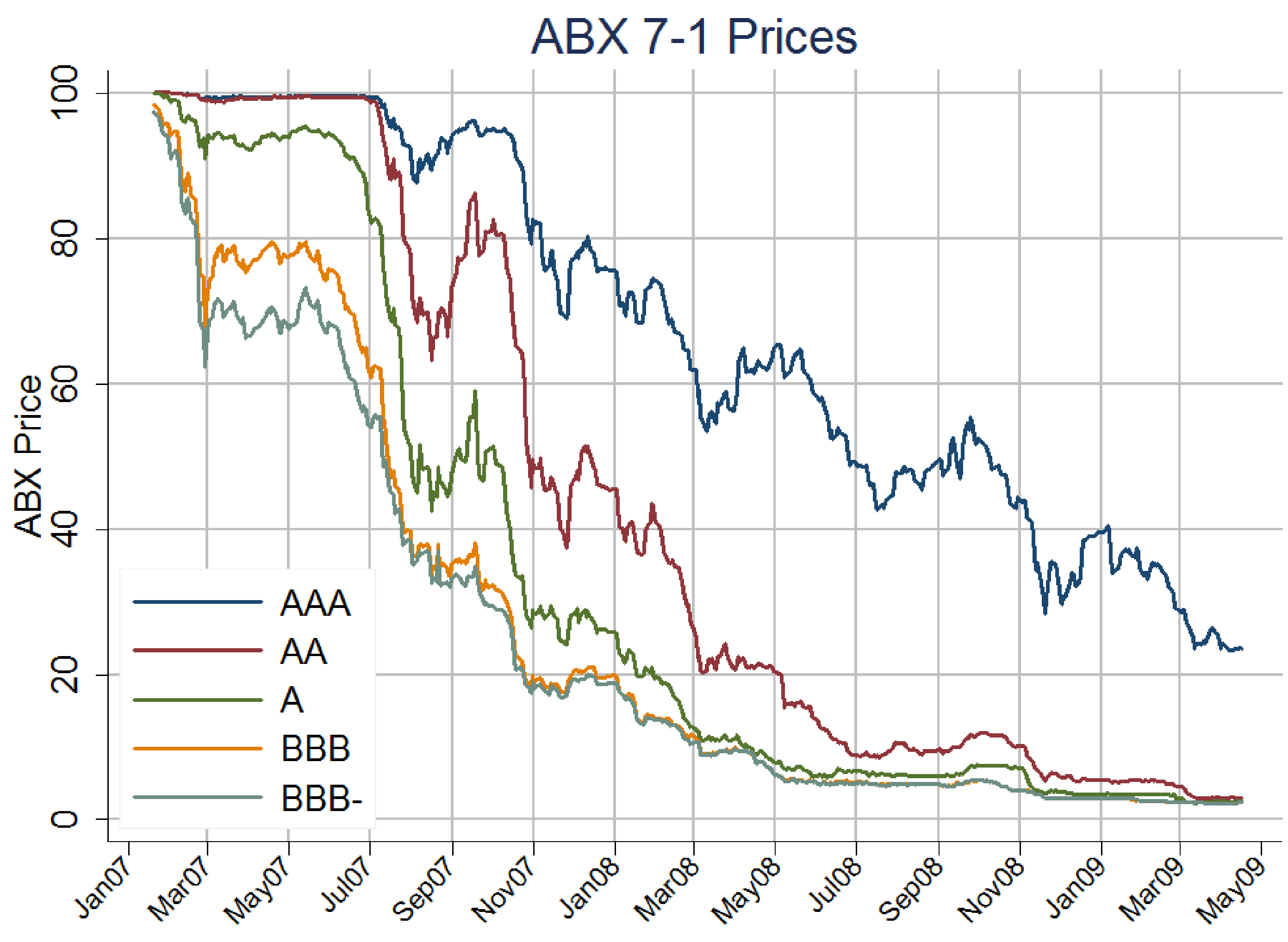
Derivatives

- What's a Credit Default Swap?





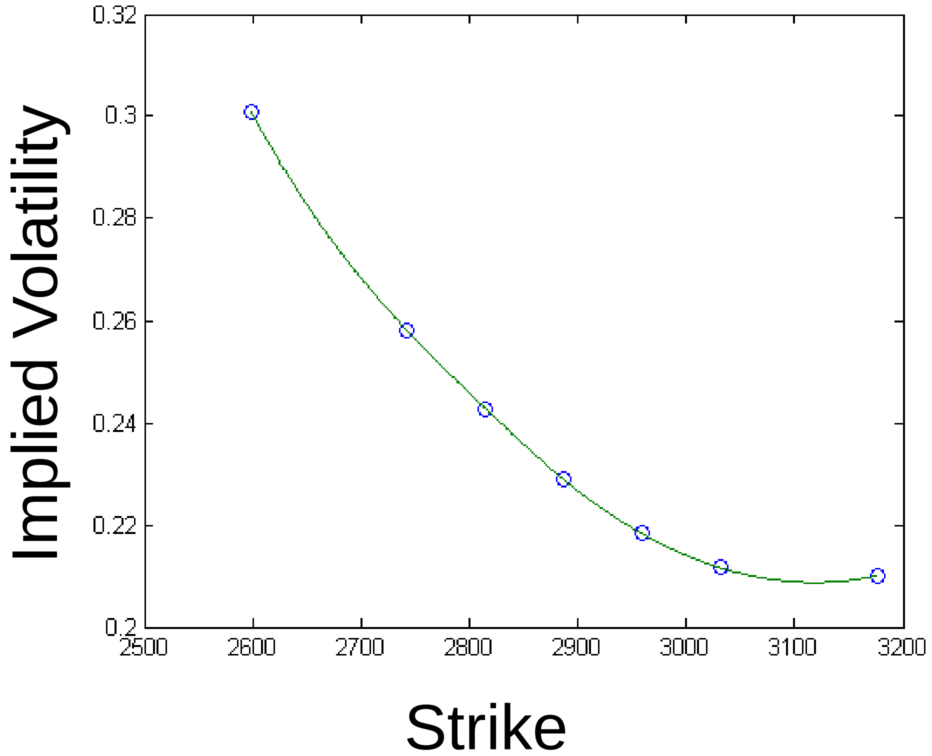
ABX index


ABX 7-1 Prices
ABX Price
0
20
40
60
80
100
Jan07
Mar07
May07
Jul07
Sep07
Nov07
Jan08
Mar08
May08
Jul08
Sep08
Nov08
Jan09
Mar09
May09
AAA
AA
A
BBB
BBB-

Derivatives

In the Black-Scholes model for options pricing, a European call option on a stock worth S with strike K and maturity T today is worth:

$$S\Phi\left(\frac{\ln\frac{S}{K}+\frac{\sigma^2}{2}T}{\sigma\sqrt{T}}\right)-K\Phi\left(\frac{\ln\frac{S}{K}-\frac{\sigma^2}{2}T}{\sigma\sqrt{T}}\right)$$



back out the volatility for different strikes with observed option prices.

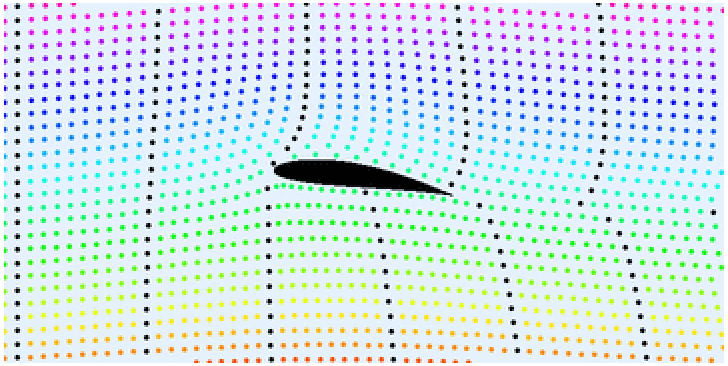
- Implied volatility
  - Model ⇒ constant
  - Reality ⇒ smile

The VIX


90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
12/26/03
12/26/04
12/26/05
12/26/06
12/26/07
12/26/08
12/26/09
12/26/10
12/26/11

Frictions

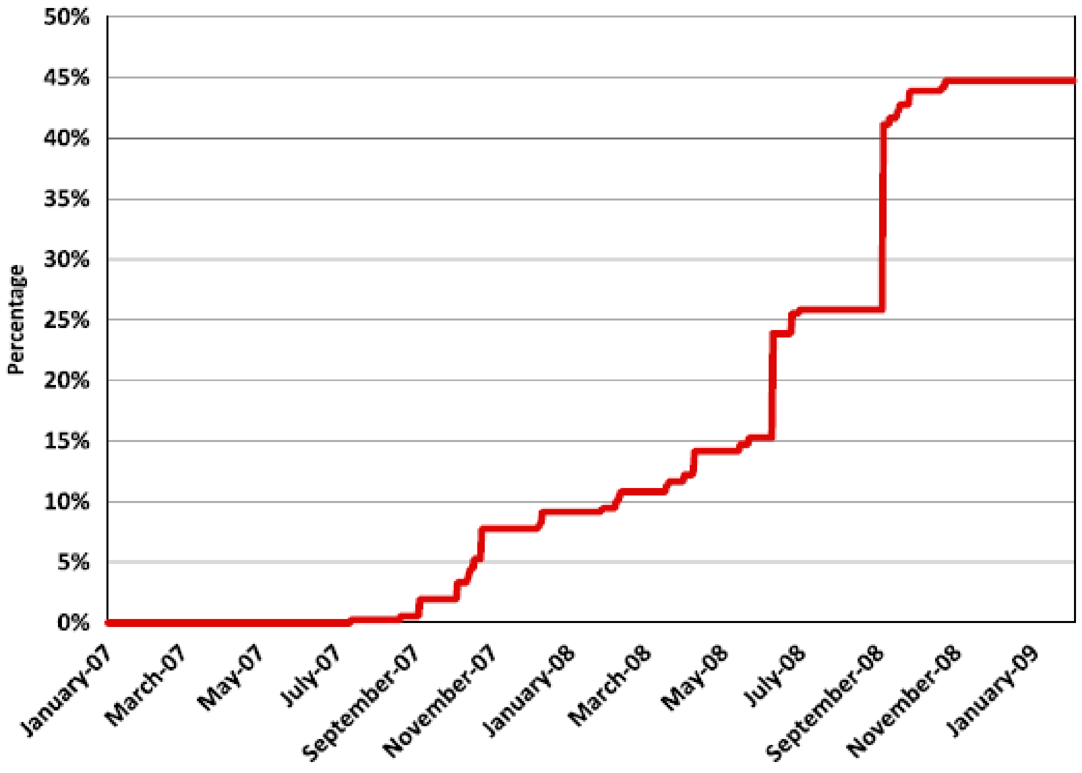
- In Physics
  - Drop of a stone = drop of a feather
  - Aviation wouldn't work without frictions



- In Finance
  - Walrasian auctioneer
  - Asymmetric information
    - Margins/haircuts/
    - Limited risk bearing capacity, limited (risky) borrowing, …

Beyond prices: Margins/Haircuts

- Margin/haircut/LTV determines max leverage ratio



Gorton-Metrick (2011)
"Repo Run"

But …

Copeland,Martin, Walker (2011)

Margins **very stable** in tri-party repo market

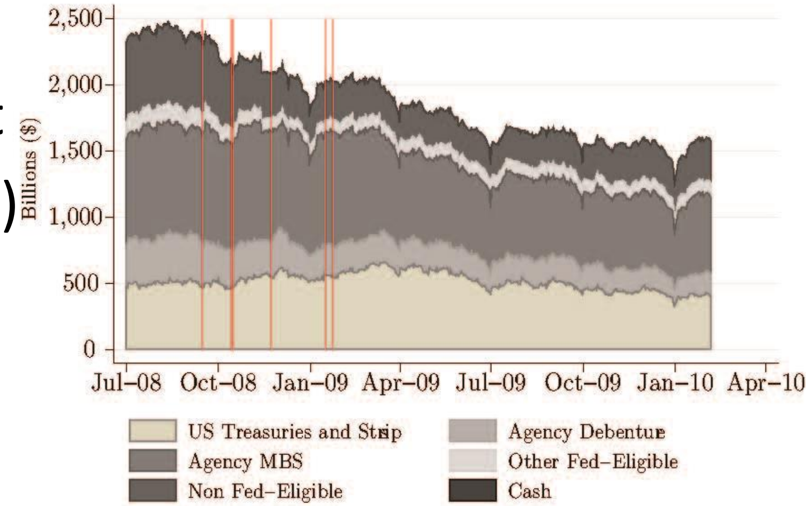
- contrasts with Gorton&Metrick (2011)
- **no general run on certain types of collateral**
  - http://www.ny.frb.org/research/staff_reports/sr477.pdf

Run (non-renewed financing) only on select **counterparties**

- Bear Stearns (anecdotally)
- Lehman (in the data)

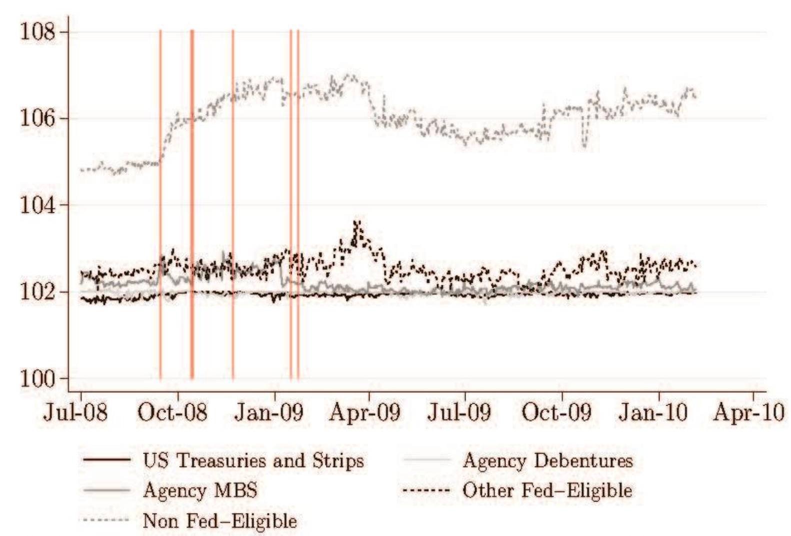
Like 100% haircut… (**counterparty specific!**)

Figure 6: Stacked Graph of Collateral



Note: July 17, 2008 excluded because no data was available for BNYM on that date. Red lines correspond to important market events. From left to right: 9/15/08 (Lehman), 10/14/08 (9 banks receive aid), 10/16/08 (UBS), 11/23/08 (Citi), 1/16/09 (B of A), 1/24/09 (Citi).

Figure 7: Median Haircuts by Asset Type



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Liquidity mismatch: sensitivity of wealth shifts

A	L

Technological liquidity
▪ Reversibility of investment
Market liquidity
▪ Specificity of capital
Price impact of capital sale
	Funding liquidity
	▪ Maturity structure of debt
	  ▪ Can't roll over short term debt
	▪ Sensitivity of margins
	  ▪ Margin-funding is recalled

Liquidity
~~Maturity~~ mismatch

- Macro: real projects techno + market liquidity
  - Total supply in economy irreversibility + specificity
- Finance: financial claims market liquidity
  - How liquidity is distributed in economy – intermediation chain
    - Shifts in wealth distributions → affects costs of liquidity (amplification)

Conclusion

- Risk & Return
  - What is risk?
- Fixed income – risky borrowing/lending
- Derivatives (CDS)
- Market efficiency
  - Asymmetric information
- Friction Finance
  - Margins/haircuts/LTV

Overview

- Frictionless Finance

One period model	Part I
Multi-period model	Part II

- Friction Finance Part III