Stock Market Fluctuations

Trevor Gallen

Spring, 2016

Introduction

- Households:
  - Want to be able to save
  - Want higher interest rates (risk held constant)
  - Want their funds to be liquid
- Firms
  - Want to be able to borrow
  - Want a flexible debt structure
  - Want to disperse risk from themselves
- Joint stock companies (corporations) are the solution

Idea

- I'm going to sail a boat to get some spices
- I need to buy a boat, get a crew, pay them now
- I don't just want to go into debt myself: it's a risky journey
- Consequently I sell bits (shares) of my profit (and risk), thereby raising money
- "I'll give you X% of my profits when the venture ends if you give me $Y today."
- You can sell your shares to others if you need the money at any point

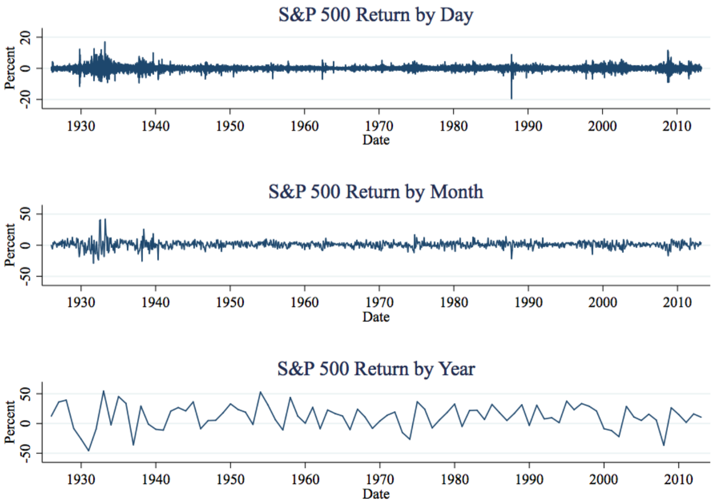
Take idea one step further...

- Maybe we shouldn't shut the company down when the ship comes back
- Maybe if we had tons of ships we could take advantage of economies of scale, learning by doing, etc.
- Let's just have the ship send us some of its profits on each ship (dividends)

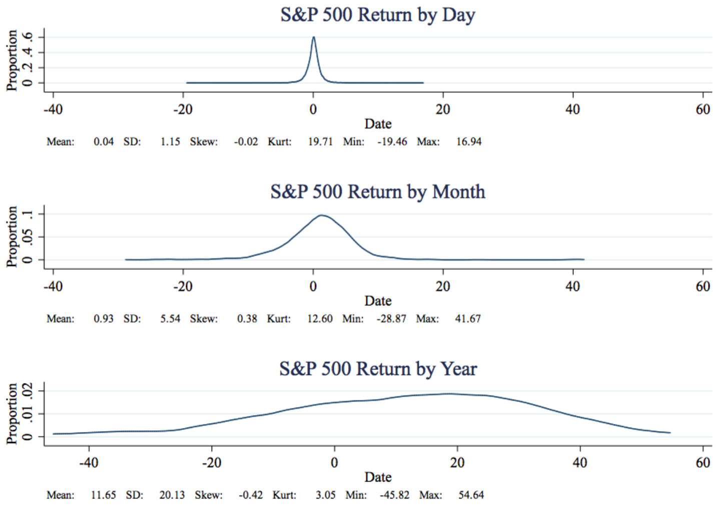
How should a stock be valued?

- I get no joy from owning stock
- Let's ignore risk for a second
- All people care about is how much they get out of it in net present value
- Let's imagine they hold it forever...
- Should this be very volatile?

Stock returns-I



Stock returns-II



Stock Returns

- What do you notice?

Stock Returns

- What do you notice?

    1. Stocks are very volatile!

Stock Returns

- What do you notice?

    1. Stocks are very volatile!
    2. The volatility *increases* with time!

Stock Returns

- What do you notice?

  1. Stocks are very volatile!
  2. The volatility *increases* with time!
  3. 25% of stock market years have a return above 28%

Stock Returns

- What do you notice?

    1. Stocks are very volatile!
    2. The volatility *increases* with time!
    3. 25% of stock market years have a return above 28%
    4. Returns are "fat tailed" (see outliers in daily returns)

Stock Returns

- What do you notice?

    1. Stocks are very volatile!
    2. The volatility *increases* with time!
    3. 25% of stock market years have a return above 28%
    4. Returns are “fat tailed” (see outliers in daily returns)
    5. There are periods of increased volatility (see fat blips in daily returns)

Stock Returns

- What do you notice?

  1. Stocks are very volatile!
  2. The volatility *increases* with time!
  3. 25% of stock market years have a return above 28%
  4. Returns are "fat tailed" (see outliers in daily returns)
  5. There are periods of increased volatility (see fat blips in daily returns)

- What can account for the volatility in stock prices and returns?

How should a stock be valued?

- Price at time t should be the discounted net present value of dividends:

$$P_t = E_t \left(\sum_{j=1}^{\infty} \beta^j D_{t+j} \right)$$

How should a stock be valued?

- Price at time t should be the discounted net present value of dividends:

$$P_t = E_t \left(\sum_{j=1}^{\infty} \beta^j D_{t+j} \right)$$

- Why might prices change?

How should a stock be valued?

- Price at time t should be the discounted net present value of dividends:

$$P_t = E_t \left(\sum_{j=1}^{\infty} \beta^j D_{t+j} \right)$$

- Why might prices change?
  - The nature of expectations E_t might change (mass delusions or hysteria?)

How should a stock be valued?

- Price at time t should be the discounted net present value of dividends:
$$P_t = E_t\left(\sum_{j=1}^{\infty} \beta^j D_{t+j}\right)$$

- Why might prices change?
  - The nature of expectations E_t might change (mass delusions or hysteria?)
  - Discount rate β^j might change (if this includes risk, then definitely)

How should a stock be valued?

- Price at time t should be the discounted net present value of dividends:

$$P_t = E_t\left(\sum_{j=1}^{\infty} \beta^j D_{t+j}\right)$$

- Why might prices change?
  - The nature of expectations E_t might change (mass delusions or hysteria?)
  - Discount rate β^j might change (if this includes risk, then definitely)
  - Dividends might change D_{t+j}

How should a stock be valued?

- Price at time t should be the discounted net present value of dividends:

$$P_t = E_t \left(\sum_{j=1}^{\infty} \beta^j D_{t+j} \right)$$

- Why might prices change?
  - The nature of expectations E_t might change (mass delusions or hysteria?)
  - Discount rate β^j might change (if this includes risk, then definitely)
  - Dividends might change D_{t+j}
- What about selling it to a greater fool? Why aren't future prices in the equation?

Future Prices

- Why aren't future prices in the valuation equation?
- Recall that:

$$E_t(P_{t+10}) = E_t\left(\sum_{j=11}^{\infty} \beta_{t+j}^{D}\right)$$

- Then we can write:

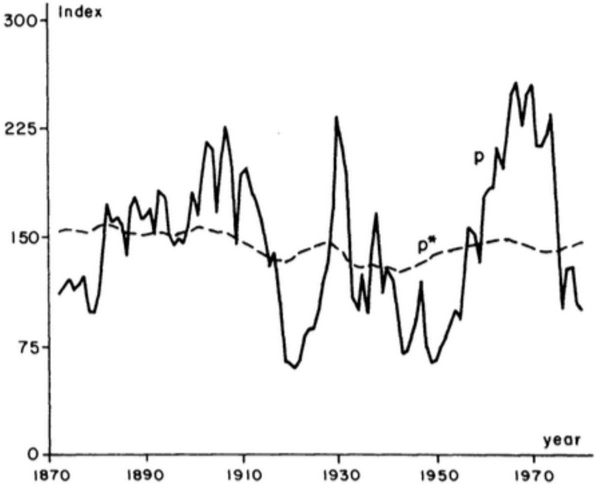
$$\begin{aligned}
P_t &= E_t\left(\sum_{j=1}^{\infty} \beta^j D_{t+j}\right) \\
&= E_t\left(\sum_{j=1}^{10} \beta^j D_{t+j} + \sum_{j=11}^{\infty} \beta^j D_{t+j}\right) \\
&= E_t\left(\sum_{j=1}^{10} \beta^j D_{t+j}\right) + \beta^{10} E_t\left(P_{t+10}\right)
\end{aligned}$$

Price fluctuations

- In other words, prices are tied down by discounted NPV of dividends
- You don't wait around to sell at a higher price because future price is also determined by discounted NPV of dividends
- Stock market fluctuations will come from changes in discount rates and changes in dividends
- Which does it come from?

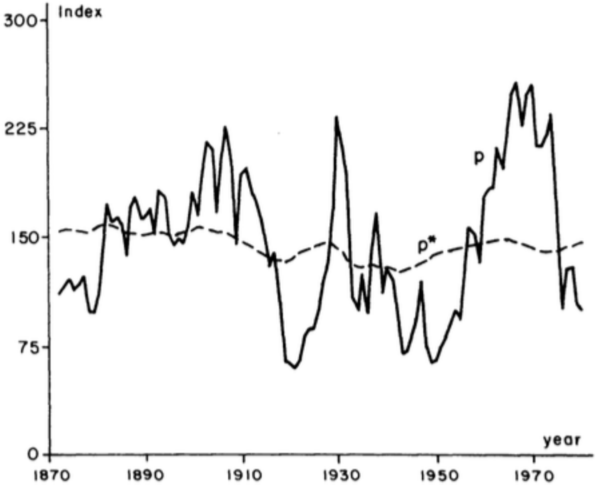
Dividends? Shiller 1981

- Let's look at actual dividends (good measure of what people expected) and actual price fluctuations



Dividends? Shiller 1981

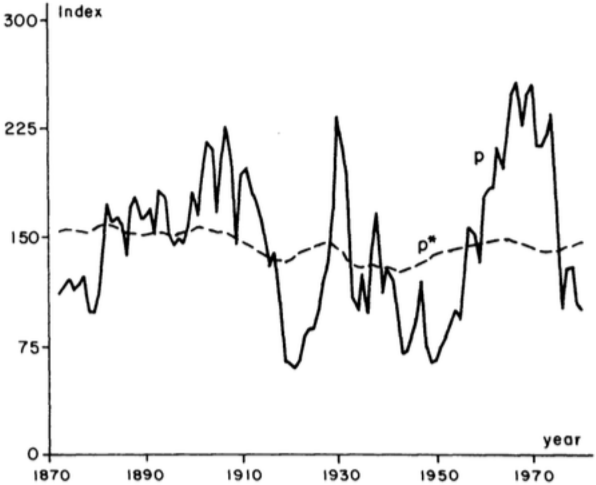
- Let's look at actual dividends (good measure of what people expected) and actual price fluctuations



- MARKETS ARE IRRATIONAL!!!11!!

Dividends? Shiller 1981

- Let's look at actual dividends (good measure of what people expected) and actual price fluctuations



- MARKETS ARE IRRATIONAL!!!11!! (?)

Discount rates

- It's hard for dividends to explain returns

Discount rates

- It's hard for dividends to explain returns
- Much of asset pricing theory tries to do it through β^j

Discount rates

- It's hard for dividends to explain returns
- Much of asset pricing theory tries to do it through β^j
- β^j isn't just time preference: it's risk preferences as well

Discount rates

- It's hard for dividends to explain returns
- Much of asset pricing theory tries to do it through β^j
- β^j isn't just time preference: it's risk preferences as well
- \$1 in dividends isn't made equal in all worlds: 1 apple in a post-apocalyptic world is worth much more than 1 apple in a utopia

Discount rates

- It's hard for dividends to explain returns
- Much of asset pricing theory tries to do it through β^j
- β^j isn't just time preference: it's risk preferences as well
- \$1 in dividends isn't made equal in all worlds: 1 apple in a post-apocalyptic world is worth much more than 1 apple in a utopia
- So stocks that pay the same dividends in different states of the world should have different prices

Discount rates

- It's hard for dividends to explain returns
- Much of asset pricing theory tries to do it through β^j
- β^j isn't just time preference: it's risk preferences as well
- \$1 in dividends isn't made equal in all worlds: 1 apple in a post-apocalyptic world is worth much more than 1 apple in a utopia
- So stocks that pay the same dividends in different states of the world should have different prices
- When your beliefs about the world and probability of different states of the world change prices should change

Why does the stock market fluctuate?

- Stock prices should be the expected discounted (including risk) net present value of all future real dividends.

Why does the stock market fluctuate?

- Stock prices should be the expected discounted (including risk) net present value of all future real dividends.
- Changing nature of expectations may matter (uncommon explanation in econ, common in world)

Why does the stock market fluctuate?

- Stock prices should be the expected discounted (including risk) net present value of all future real dividends.
- Changing nature of expectations may matter (uncommon explanation in econ, common in world)
- Changing probabilities of various states of the world may matter (increased probability of living bad times makes people more willing to pay for stocks that pay real income in those periods (like insurance))

Why does the stock market fluctuate?

- Stock prices should be the expected discounted (including risk) net present value of all future real dividends.
- Changing nature of expectations may matter (uncommon explanation in econ, common in world)
- Changing probabilities of various states of the world may matter (increased probability of living bad times makes people more willing to pay for stocks that pay real income in those periods (like insurance))
- Changing discounting (increased risk aversion, increased impatience) would drive down stock prices

Why does the stock market fluctuate?

- Stock prices should be the expected discounted (including risk) net present value of all future real dividends.
- Changing nature of expectations may matter (uncommon explanation in econ, common in world)
- Changing probabilities of various states of the world may matter (increased probability of living bad times makes people more willing to pay for stocks that pay real income in those periods (like insurance))
- Changing discounting (increased risk aversion, increased impatience) would drive down stock prices
- Changing dividends (lower payments) would drive down stock prices

Why does the stock market fluctuate?

- Stock prices should be the expected discounted (including risk) net present value of all future real dividends.
- Changing nature of expectations may matter (uncommon explanation in econ, common in world)
- Changing probabilities of various states of the world may matter (increased probability of living bad times makes people more willing to pay for stocks that pay real income in those periods (like insurance))
- Changing discounting (increased risk aversion, increased impatience) would drive down stock prices
- Changing dividends (lower payments) would drive down stock prices
- Reconciling the movements in returns over time and between stocks is what asset pricing (finance) is all about.

Fact: We can predict returns!

- Returns and variances are very different by asset type
- Returns by asset class from 1926-2009

Percent Returns and Standard Deviation by Asset Type

Statistic	World Large Stocks	U.S. Large Stocks	U.S. Small Stocks	Long-Term U.S. T-Bonds	Diversified
Arithmetic average return	11.23	11.63	17.43	5.69	10.81
Return standard deviation	19.27	20.56	37.18	9.45	15.79

From Bodie, Kane and Marcus, 9th ed.

Fact: We can predict returns!

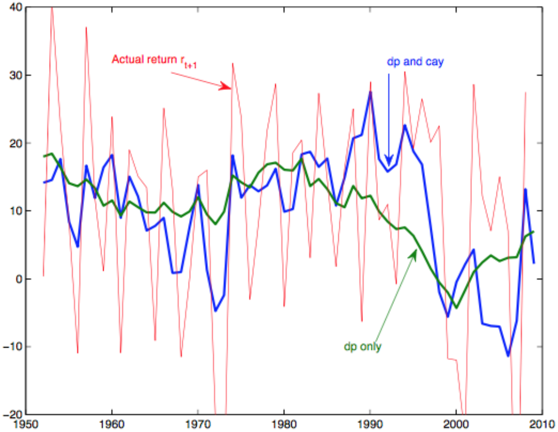
- Stock market returns, both over time and between stocks, are not random
- We can predict stock returns both in the cross-section and in time-series
- When dividend to price ratio is high (stock is "cheap" in terms of $\frac{\text{dollars paid now}}{\text{dollars received in the future}}$) it's likely to be high in the future (time series)
- Some (types of) stocks have higher returns than others (cross-section)

Time series

- High dividend to price ratios today are correlated with high dividend to price ratios tomorrow (high returns)
- If your return is above average today then it's likely to be above average tomorrow
- High prices (relative to dividends) suggest low returns in the future
- Some think this is evidence of bubbles and mispricing: people are getting the discounting wrong
- Others think it's reflecting a time-varying risk premium
  - In bad times I'm more risk averse
  - I discount dividends more
  - So the price of the stock falls
  - Dividends (relative to price) will be high in the future
  - Returns will be high

Returns are predictable

- From Cochrane, Lecture Notes



- Using today's dividend-price (dp) and consumption to wealth (cay), we can predict a lot of the volatility in annual returns (r)!

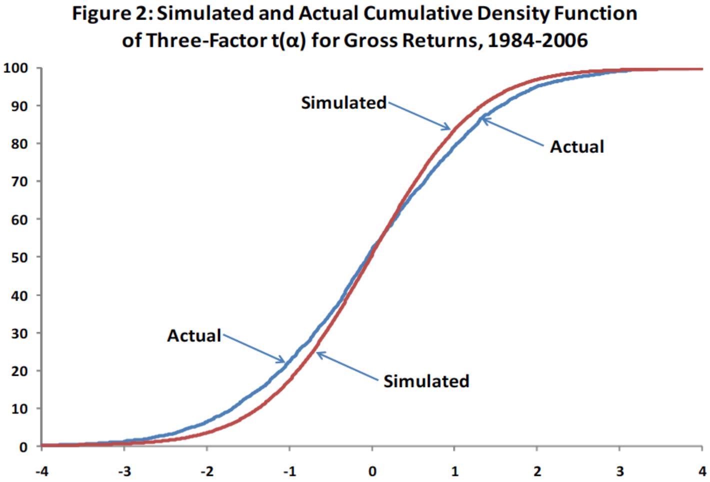
Cross section (Fama French 1992)

- Just as we can predict (explain?) a lot of variation in the time series, we can explain a lot of the cross-sectional variation
- Small-cap and "value" stocks return more, even controlling for market covariance
- Maybe people are irrational
- If that's the case, you might expect to see some people able to beat the market
- Let's look at Mutual Fund Managers

Mutual Fund Managers (Fama French 2010)

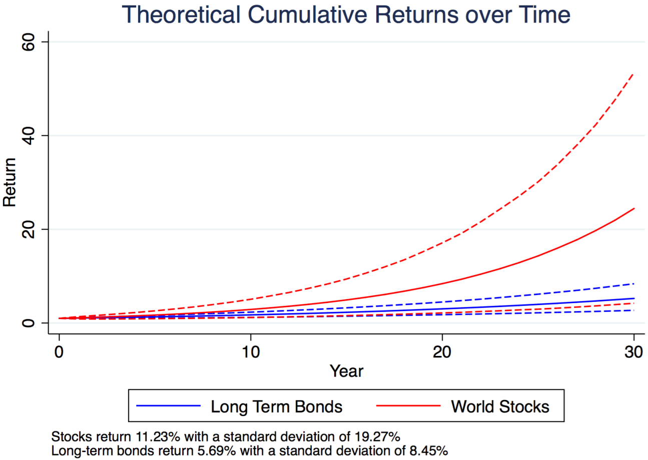
- Take mutual fund managers
- See what we can attribute to well-identified factors (value, small-cap)
- What's left in returns is due to chance and skill
- Simulate a distribution with no skill (just noise) and compare it to reality

Mutual Fund Managers (Fama French 2010)

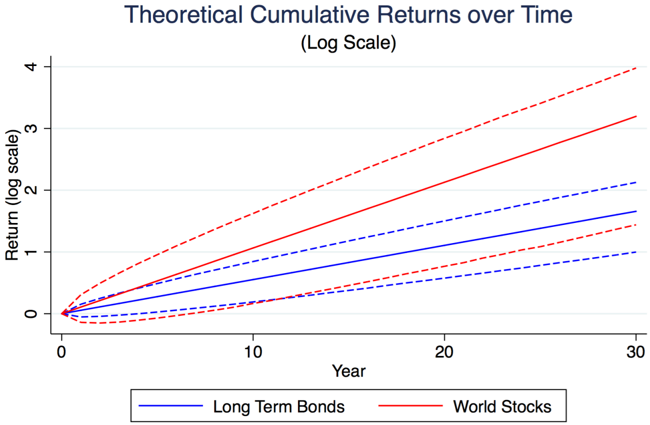


- Our "pure chance after controlling for known factors" model predicts the dispersion of returns pretty darn well!

Why not just invest in value stocks? or the stock market in general?



Why not just invest in value stocks? or the stock market in general?



Stocks return 11.23% with a standard deviation of 19.27%
Long-term bonds return 5.69% with a standard deviation of 8.45%

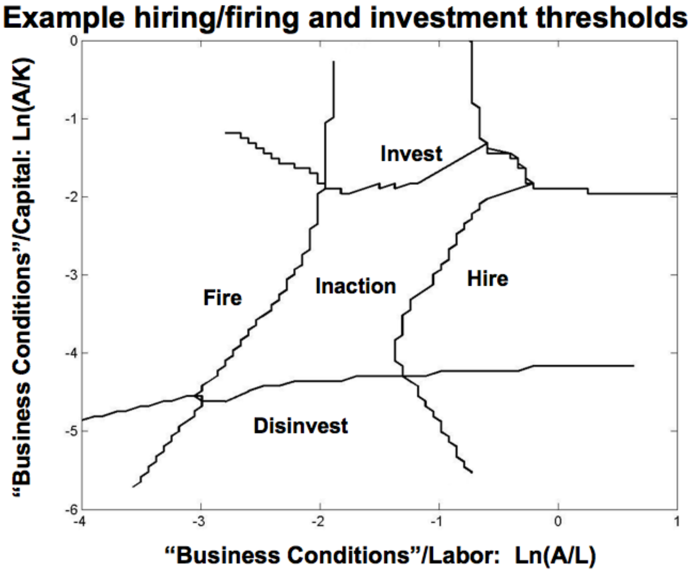
Why not just invest in value stocks? or the stock market in general?

- Exponential growth $>$ central limit theorem for variance
- If you're worried about bottom tail risk, then 30 years isn't enough to guarantee you beat even a portfolio of bonds
- Helps explain why some retirement funds (which have fixed liabilities) invest in bonds rather than stocks, because low tail risk is default & disaster and high tail risk is "just" more return

Thinking about firm investment and uncertainty

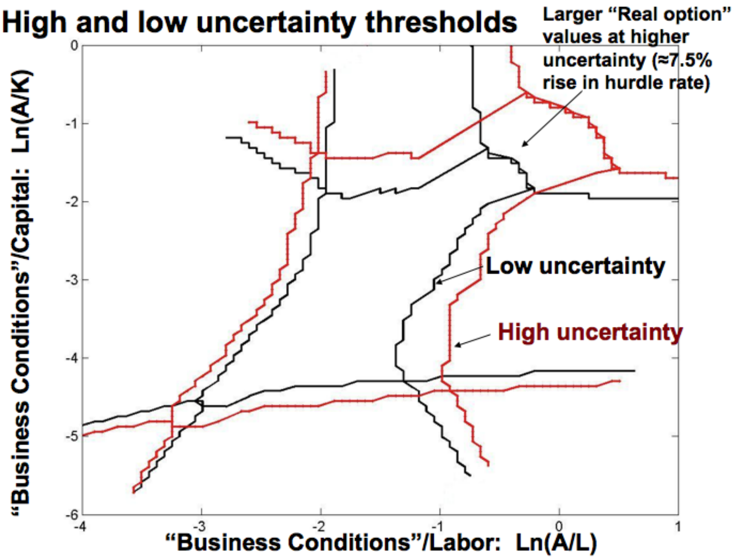
- People (via firms) give up consumption today for consumption tomorrow
- Sometimes the mapping between the two is unclear
- When it is, sometimes it makes sense to wait until the fog clears
- Uncertainty can have powerful impact on investment!

Bloom (2009)

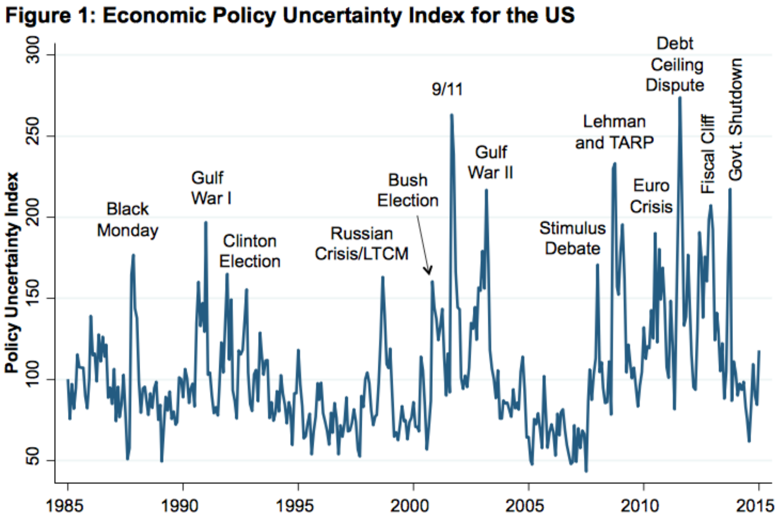


Example hiring/firing and investment thresholds
Invest
Inaction
Fire
Hire
Disinvest
0
-1
-2
-3
-4
-5
-6
-4
-3
-2
-1
0
1
"Business Conditions"/Capital: Ln(A/K)
"Business Conditions"/Labor: Ln(A/L)

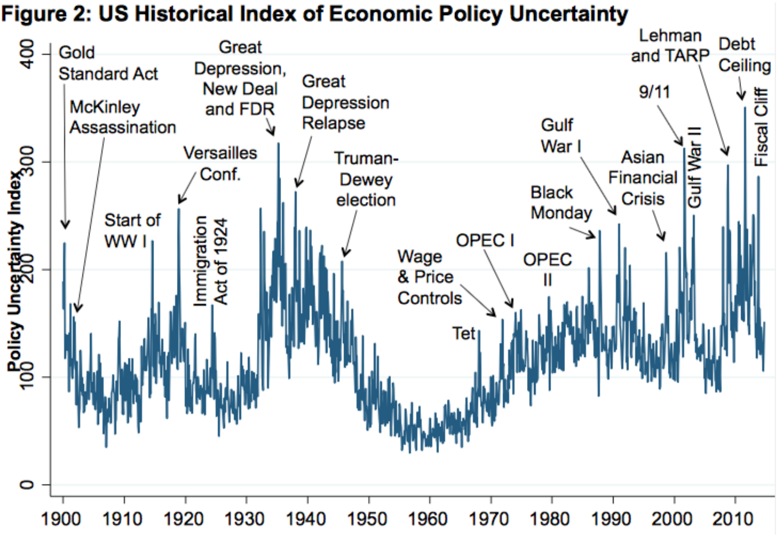
Bloom (2009)


High and low uncertainty thresholds
Larger "Real option" values at higher uncertainty (≈7.5% rise in hurdle rate)
Low uncertainty
High uncertainty
"Business Conditions"/Capital: Ln(A/K)
"Business Conditions"/Labor: Ln(A/L)
0
-1
-2
-3
-4
-5
-6
-4
-3
-2
-1
0
1

Baker Bloom Davis (2016)

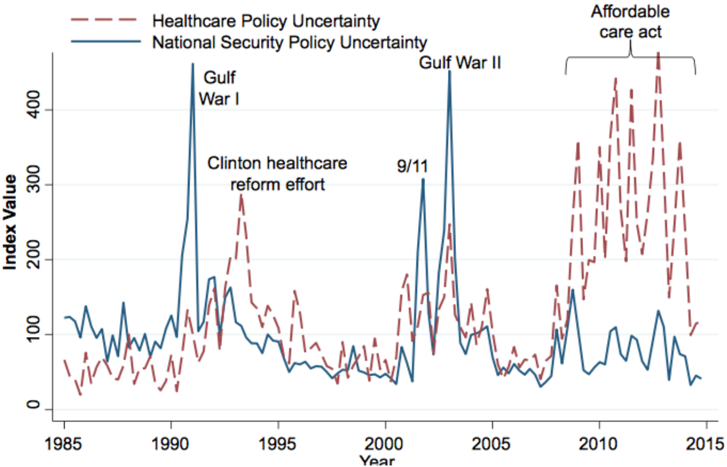


Baker Bloom Davis (2016)



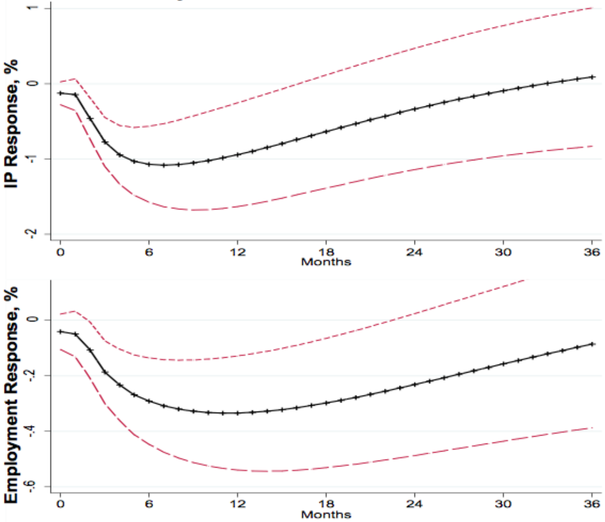
Baker Bloom Davis (2016)

Figure 3: National Security and Healthcare EPU Indices



Baker Bloom Davis (2016)

Figure 8: Industrial Production and Employment Responses to EPU Shock, VAR Fit to Monthly U.S. Data



Notes: VAR-estimated impulse response functions for industrial production and employment to an EPU innovation equal to the increase in the EPU index from its 2005-2006 to its 2011-2012 average value, with 90 percent confidence bands. Identification based on three lags and a Cholesky decomposition with the following ordering: EPU index, log(S&P 500 index), federal reserve funds rate, log employment, log industrial production. Fit to monthly data from 1985 to 2014.