

# Stock Price Cycles and Business Cycles

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- **New technologies** often associated with **aggregate instability**:
  - 1990's dotcom; 1920's auto/aviation/electricity, 19<sup>th</sup> cent. railways
  - booms: output + employment + stock prices
  - booms followed by output falls & spectacular asset price collapses

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  - booms: output + employment + stock prices
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- Aggregate instability associated with **low real rates**: Taylor (2007)
  - secular decline in safe interest rates (Laubach & Williams)
  - repeated stock price boom-bust cycles over past 30 yrs....

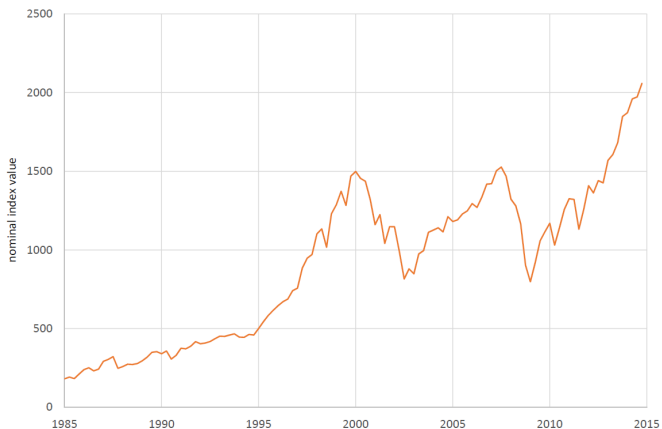


Figure: Price cycles in the S&P 500 (Q1:1985-Q4:2014)

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- Generates occasional boom-bust cycles in stock prices & ec. activity

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  - higher in periods of **high productivity growth**
  - higher in periods of **low real interest rates**
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- Large booms feature '**Minsky moment**':  
Persistent undershooting: depressed ec. activity & stock prices

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## **Subjective expectations about capital gains in the stock market**

- All other expectations rational & all agents maximize
- Learning from experience in line with survey evidence: Malmendier&Nagel (QJE 2011), Adam, Marcet&Beutel (AER 2017)
- *Some* amount of extrapolation from past capital gains:

$$E_t^{\mathcal{P}} \left[ \frac{P_{t+1}}{P_t} \right] = E_{t-1}^{\mathcal{P}} \left[ \frac{P_t}{P_{t-1}} \right] + g \left( \frac{P_t}{P_{t-1}} - E_{t-1}^{\mathcal{P}} \left[ \frac{P_t}{P_{t-1}} \right] \right)$$

Rationalizable as Bayesian learning:  $g > 0$  is the Kalman gain

# Survey Data and Extrapolative Expectations

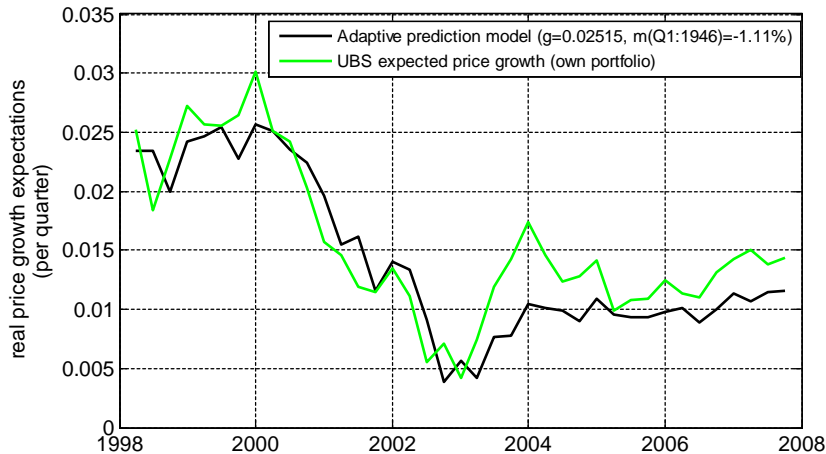


Figure: UBS survey expectations versus adaptive prediction model

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- **Amplification** stronger when interest rates low or tech growth high

# Stock Price Cycles and Business Cycles

- Time-separable household preferences

$$E_0^P \sum_{t=0}^{\infty} \beta^t (\log C_t - H_t)$$

- Standard 2-sector production structure

$$\begin{aligned} Y_{C,t} &= K_t^{\alpha_z} (Z_t H_{C,t})^{1-\alpha_c} \\ Y_{I,t} &\propto (Z_t H_{I,t})^{1-\alpha_c} \end{aligned}$$

- Technology shocks (only source of randomness):

$$Z_t = \gamma Z_{t-1} \varepsilon_t$$

# Quantitative Performance: Real Variables

Moment	Data (StdDev)	Model
$\sigma(Y)$	1.72 (0.25)	1.83
$\sigma(C)/\sigma(Y)$	0.61 (0.03)	0.67
$\sigma(I)/\sigma(Y)$	2.90 (0.35)	2.90
$\sigma(H)/\sigma(Y)$	1.08 (0.13)	1.06
$\rho(Y, C)$	0.88 (0.02)	0.84
$\rho(Y, I)$	0.86 (0.03)	0.89
$\rho(Y, H)$	0.75 (0.03)	0.70

# Quantitative Performance: PD-Ratio and Return Volatility

Moment	Data (StdDev)	Model
$E[P/D]$	152.3 (25.3)	149.95
$\sigma(P/D)$	63.39 (12.39)	44.96
$\rho(P/D)$	0.98 (0.003)	0.97
$\sigma(r^e)$	7.98 (0.35)	7.07

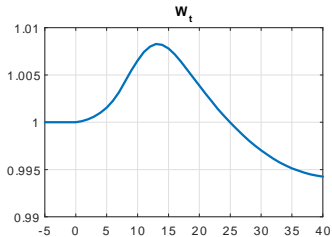
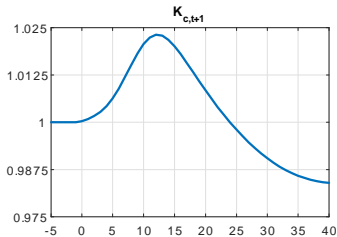
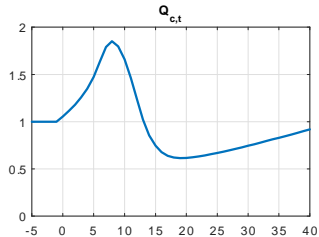
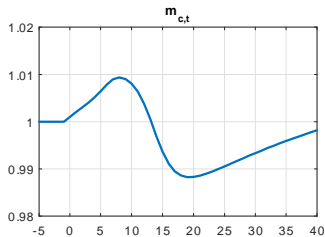
# Comovement: PD-Ratio with Real Side/Expectations

Moment	Data (StdDev)	Model
$\rho(P/D, H)$	0.51 (0.17)	0.79
$\rho(P/D, I/Y)$	0.58 (0.31)	0.69
$\rho(P/D, E^{\mathcal{P}}[r^e])$	0.79 (0.07)	0.52

# Equity Premium & Risk-Free Rate Volatility

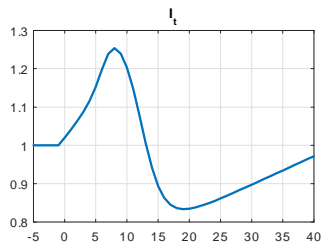
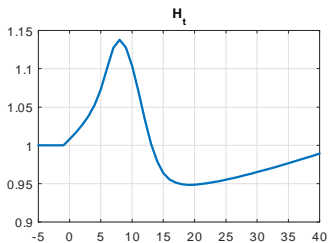
Moment	Data (StdDev)	Model
$E[r^e]$	1.87 (0.45)	1.25
$E[r^f]$	0.25 (0.13)	0.78
$\sigma(r^f)$	0.82 (0.12)	0.06

# Belief-Driven Propagation (Estimated Model)



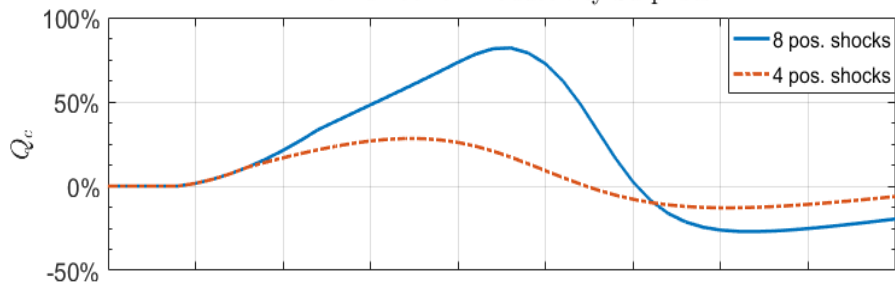


# Boom-Bust Cycles & Belief-Driven Propagation



# Boom-Bust Cycles from Technology Shocks

The Number of Productivity Surprises



# Aggregate Growth and Macro Instability

- Model predicts more boom-bust episodes with high technology growth or low real interest rates

# Aggregate Growth and Macro Instability

- Model predicts more boom-bust episodes with high technology growth or low real interest rates
- Equilibrium capital price equation (slightly simplified):

$$Q_t = \frac{X_t}{1 - \beta\gamma \cdot m_t},$$

where

$m_t$  : subjective capital gain expectations  $E_t^{\mathcal{P}} [Q_{t+1} / Q_t]$

$\beta$  : discount factor ( $\beta < 1$ )

$\gamma$  : gross aggregate growth rate ( $\gamma > 1$ )

$X_t$  : end. variable that depend on parameters, technology, path of capital stock

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- Higher technology growth or higher discount factor:

$\beta\gamma$  moves closer to 1

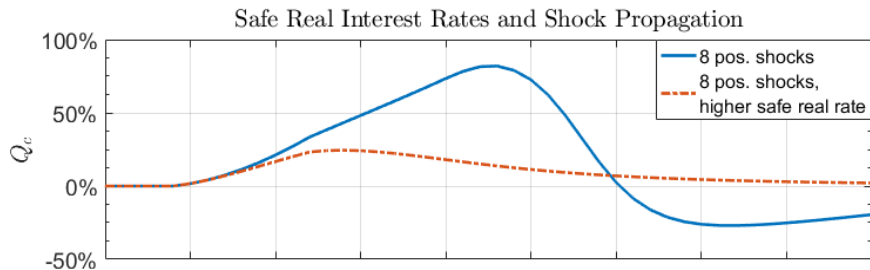
⇒  $\beta\gamma \cdot m_t$  closer to one

⇒ any given movement in  $m_t$  generates larger price effect

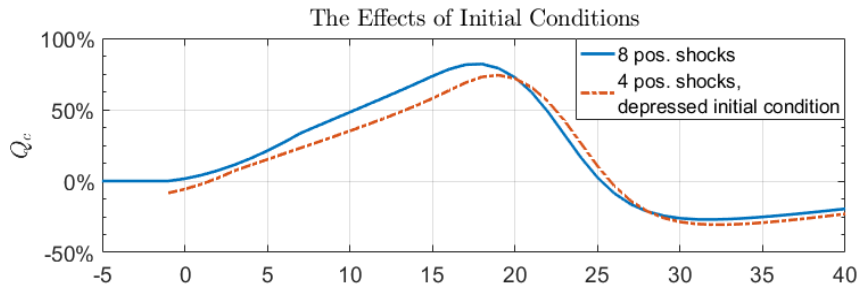
⇒ fundamental price movements get amplified more!

⇒ more boom-bust episodes

# Higher Steady-State Safe Rate (1.4% vs. 0.8%)



# Boom-Bust Cycles: Repeat Cycles





- Extrapolation in asset markets :  
A powerful amplification mechanism of fundamental shocks
- Simple and otherwise standard model:  
Quantitatively consistent with BC & stock price evidence
- Model features boom and bust cycles:  
Persistent over & under-shooting of long-run growth trends  
Higher risk of booms with strong tech. growth / low real rates