Stock Price Cycles and Business Cycles

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Introduction

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

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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....

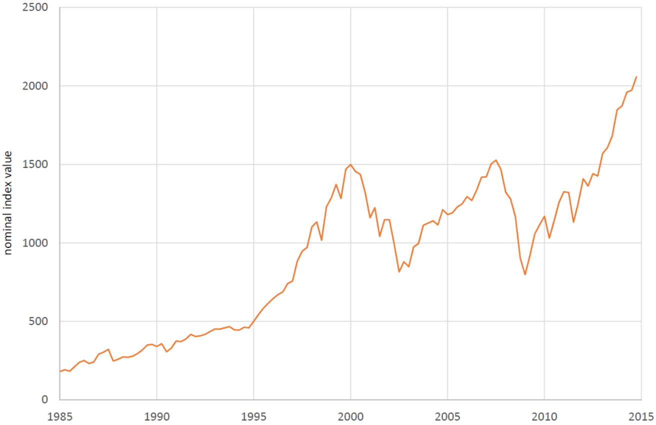

Figure: Price cycles in the S&P 500 (Q1:1985-Q4:2014)

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  - volatility of postwar U.S. stock prices
- Generates occasional boom-bust cycles in stock prices & ec. activity

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- Model predicts likelihood of boom-bust episodes to be

  - 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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- *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

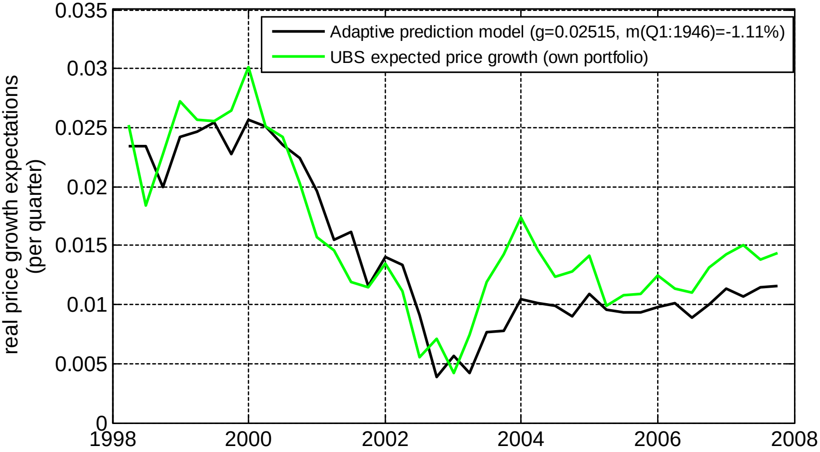

Figure: UBS survey expectations versus adaptive prediction model

Extrapolation as Amplification

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

Stock Price Cycles and Business Cycles

- Time-separable household preferences

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

- Standard 2-sector production structure

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

- 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

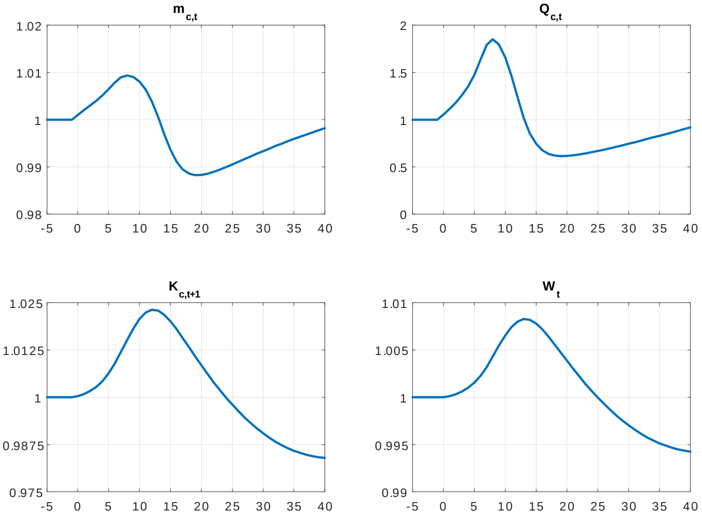
Comovement: PD-Ratio with Real Side/Expectations

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

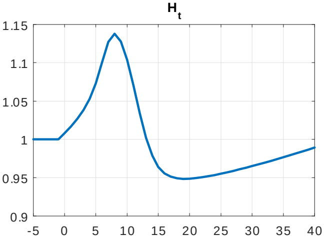
Equity Premium & Risk-Free Rate Volatility

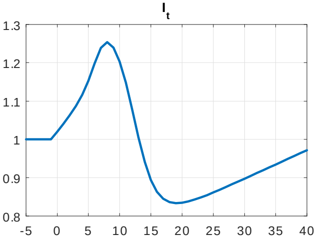
Moment	Data (StdDev)	Model
$E[r^e]$	1.87 (0.45)	1.25
$E[r^f]$	0.25 (0.13)	0.78
$\sigma(r^f)$	0.82 (0.12)	0.06

Belief-Driven Propagation (Estimated Model)

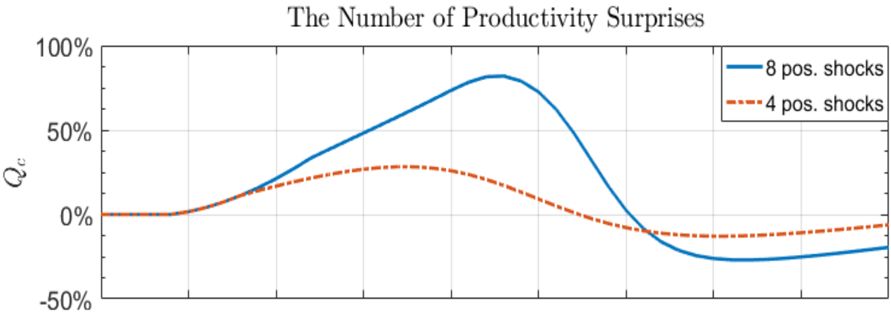


Boom-Bust Cycles & Belief-Driven Propagation





Boom-Bust Cycles from Technology Shocks



Aggregate Growth and Macro Instability

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

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- Equilibrium capital price equation (slightly simplified):

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

where

$$\begin{aligned} m_t &: \text{ subjective capital gain expectations } E_t^{\mathcal{P}}[Q_{t+1}/Q_t] \\ \beta &: \text{ discount factor } (\beta < 1) \\ \gamma &: \text{ gross aggregate growth rate } (\gamma > 1) \\ X_t &: \text{ end. variable that depend on parameters, technology,} \\ & \quad \text{path of capital stock} \end{aligned}$$

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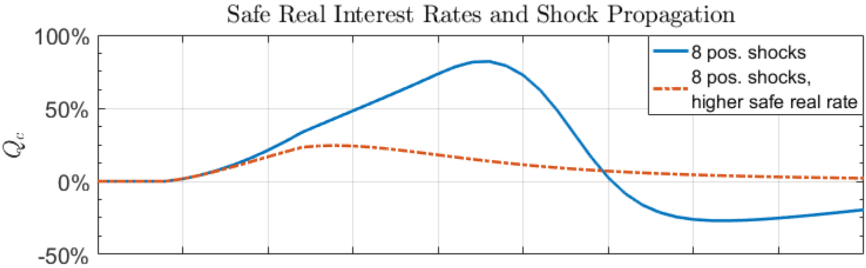
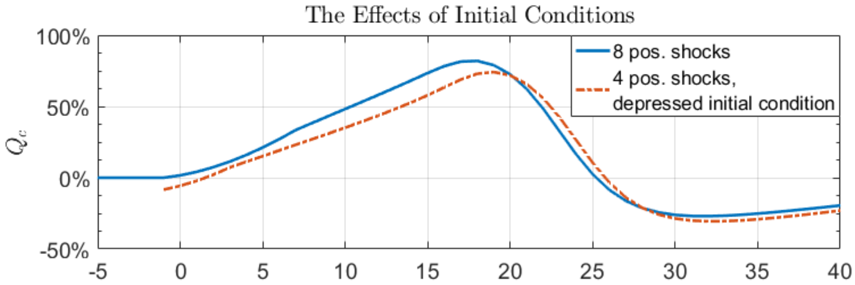
- Higher technology growth or higher discount factor:

$$\begin{aligned} & \beta\gamma \text{ moves closer to 1} \\ \Rightarrow \quad & \beta\gamma \cdot m_t \text{ closer to one} \\ \Rightarrow \quad & \text{any given movement in } m_t \text{ generates larger price effect} \\ \Rightarrow \quad & \text{fundamental price movements get amplified more!} \\ \Rightarrow \quad & \text{more boom-bust episodes} \end{aligned}$$

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



Boom-Bust Cycles: Repeat Cycles



Conclusions

- 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