



University of Zurich
Institute for Empirical Research in Economics



Latest Developments in Asset Pricing Theory

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1. What is Asset Pricing Theory?
2. Classical Asset Pricing Theory
3. Neo-Classical Asset Pricing Theory
4. Behavioral Asset Pricing Theory
5. Evolutionary Asset Pricing Theory



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2. Classical Asset Pricing Theory
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1. What is Asset Pricing Theory?

- Asset Pricing Theory tries to **explain** what determinates asset prices
 - Dividends (Discounted Dividends Model)
 - Book Values
 - Cash Flows
 - The Business Cycle (Aggregate Consumption)
 - Habit Formation
 - Momentum & Reversal
 - Investor Sentiment




1. What is Asset Pricing Theory?

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 - Dividends (Discounted Dividends Model)
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 - Cash Flows
 - The Business Cycle (Aggregate Consumption)
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 - Investor Sentiment
- Ultimately Asset Pricing Theory may help to **predict** asset prices
 - Supposing the factors of the theory are predictable
 - and the theoretical relation is a stable relation over time



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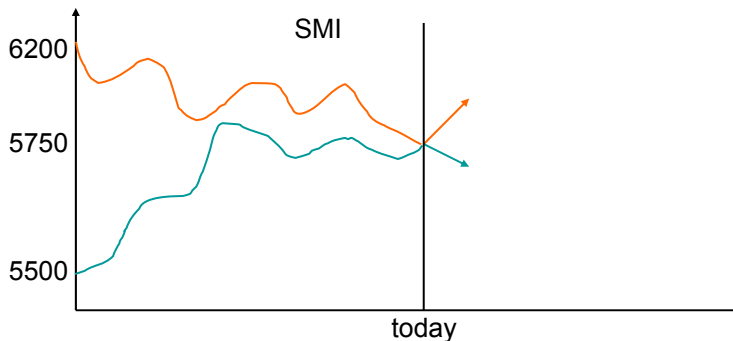
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2. Classical Asset Pricing Theory

Anticipation principle

- The market is always forward looking
 - For the future development of the SMI it is irrelevant whether we reached the current level of 5750 coming from 6200 or rather from 5500.



2. Classical Asset Pricing Theory

Anticipation principle

- The market is always forward looking
 - For the future development of the SMI it is irrelevant whether we reached the current level of 5710 coming from 6200 or rather from 5500.
- Every anticipated trend must be embodied in the current prices
 - Prices change according to the non-anticipated news that hit the market
 - The news process is a totally random process (i.i.d.)

→ Prices are **Random Walks**

$$p_t = \frac{1}{1+r_t} E(p_{t+1} + Div_{t+1})$$



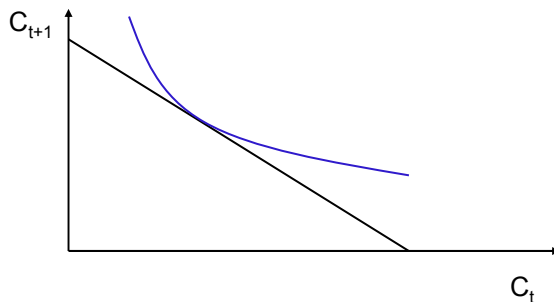
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3. Neo-Classical Asset Pricing Theory

- Is based on the inter-temporal optimization of **Expected Utility**
- The Marginal Rates of inter-temporal substitution equal price ratios



$$p_t = \frac{1}{1+r_t} E \left[mrs_{C_t, C_{t+1}} (p_{t+1} + Div_{t+1}) \right]$$



An Example

Transitory movements in aggregate (human and non-human) household wealth (a proxy for the log consumption-wealth ratio) **explains 80%** of the (excess) stock returns.

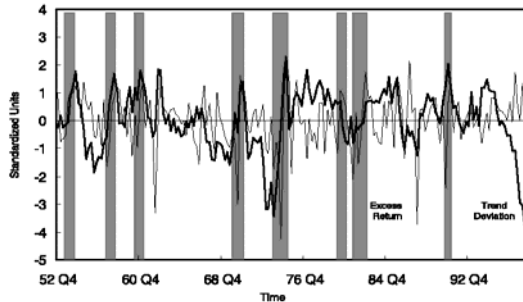


Figure 1. Excess returns and trend deviations. Excess return is the return on the S&P Composite Index less the return on the three-month Treasury bill rate. Trend deviation is the estimated deviation from the shared trend in consumption c , labor income y , and asset wealth a : $\hat{a} = \alpha \hat{c} + \beta_c \hat{c}_t + \beta_y \hat{y}_t$. Both series are normalized to standard deviations of unity. The sample period is fourth quarter of 1952 to third quarter of 1998. Shaded areas denote NBER recessions.

Lettau and Ludvigson (2001): "Consumption, Aggregate Wealth and Expected Stock Returns", The Journal of Finance, Vol. LVI No 3, pp. 815-849.



Some Challenges to the Neo-Classical Theory

- **Equity Premium Puzzle**
 - The excess return of stocks is too high as compared to reasonable levels of risk aversion



Test for the Equity Premium Puzzle

Which X does make you indifferent to the following lottery?

Doubling your income with 50% probability

Loosing X% of your income with 50% probability



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Typical answer: $X = 23\%$

Expected utility maximizing investor who chooses the risk free asset instead of stocks chooses $X = 4\%$.

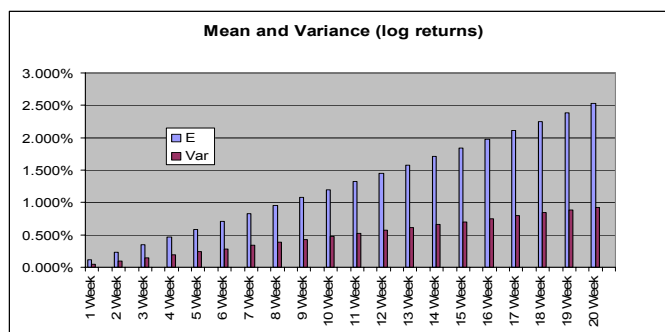


Some Challenges to the Neo-Classical Theory

- **Equity Premium Puzzle**
 - The excess return of stocks is too high as compared to reasonable levels of risk aversion
- **Momentum and Reversal**
 - Variances of returns increase less than proportionally with time



Evidence for Momentum and Reversal on DJIA



Ratios of Means to Variances **are increasing over time !**

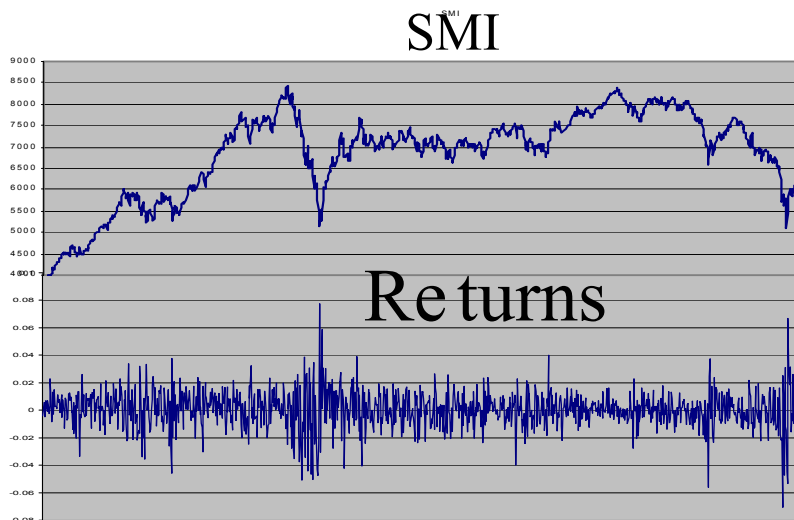


Some Challenges to the Neo-Classical Theory

- **Equity Premium Puzzle**
 - The excess return of stocks is too high as compared to reasonable levels of risk aversion
- **Momentum and Reversal**
 - Variances of returns increase less than proportionally with time
- **Asymmetric Volatility Puzzle**
 - The volatility of stock prices is higher when stock prices go down
- **Stochastic Volatility Puzzle**
 - Volatility of stock prices is not constant
 - Volatility of stock prices is clustered



Asymmetric and Clustered Volatility



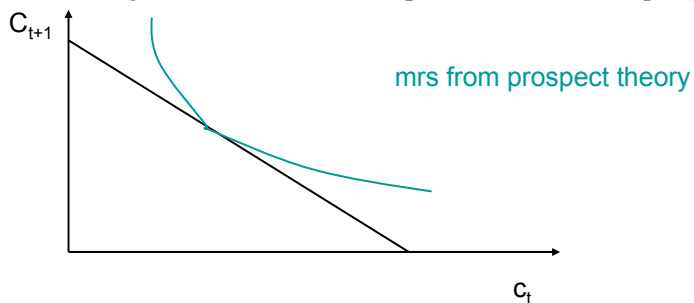
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4. Behavioral Asset Pricing Theory (BAP)

- Is based on the inter-temporal optimization of **Non-Expected Utility**
- The Marginal Rates of Inter-temporal Substitution equal price ratios



$$p_t = \frac{1}{1+r_t} E \left[mrs_{c_t, c_{t+1}} (p_{t+1} + Div_{t+1}) \right]$$



Equity Premium Puzzle explained by BAP

Loss Aversion explains equity premium puzzle:

A Loss of 10.000 needs to be compensated by a gain of at least 22.500:

Compare two investors, Nick who calculates the gains and losses in his portfolio every day, and Dick who only looks at his portfolio once per decade. Since, on a daily basis, stocks go down in value almost as often as they go up, Nick's loss aversion will make stocks appear very unattractive to him. In contrast, loss aversion will not have much effect on Dick's perception of stocks since at ten year horizons stocks offer only a small risk of losing money.

Benartzi and Thaler (1995) "Myopic Loss Aversion", Journal of Political Economy.



Momentum and Reversal explained by BAP

- Representativeness Bias generates Momentum and Reversal

A Test

A fund manager is known to beat the market in 2 of 3 years.

Which of the following protocols is most likely?

a) *BLBBB*

b) *LBLBBB*

c) *LBBBBB*

Barberis, Shleifer and Vishny (1998): A Model of Investor Sentiment, JoFE



Asymmetric Volatility Puzzle explained by BAP

- Asymmetric Volatility Puzzle
 - When markets plunge prospects of stocks become more ambiguous

Lottery A:

„Draw a ball from urn with
50 red and 50 blue balls“.

Payoff:

(100 if blue, 0 if red)

Lottery B:

„Draw a ball from urn with
red and blue balls in unknown proportion“

Payoff:

(100 if blue, 0 if red)

Which lottery do you prefer?

Sbuelz, Trojani (2002): Equilibrium Asset Pricing with Time Varying Pessimism



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1) So far: Representative agent models

Now: Interaction of strategies in **heterogenous agents** models

2) So far: Time Runs backwards: Future prices determine current price!

Now: The asset market is modelled as a dynamical system, i.e. **time is running forwards and hence predictions are conceptually easier.**

The price of asset k is the (wealth) average strategy for asset k

$$q_t^k(\omega^t) = \sum_{i=1}^I \lambda_{i,t}^{i,k}(\omega^t) w_t^i(\omega^t) \text{ and } \lambda_{i,t}^{i,k}(\omega^t) = F^{i,k}(q_{t-1}(\omega^{t-1}), q_{t-2}(\omega^{t-2}), \dots)$$



Example Heterogenous Time Horizons

Several types of strategies with different sample period (memory):

short run

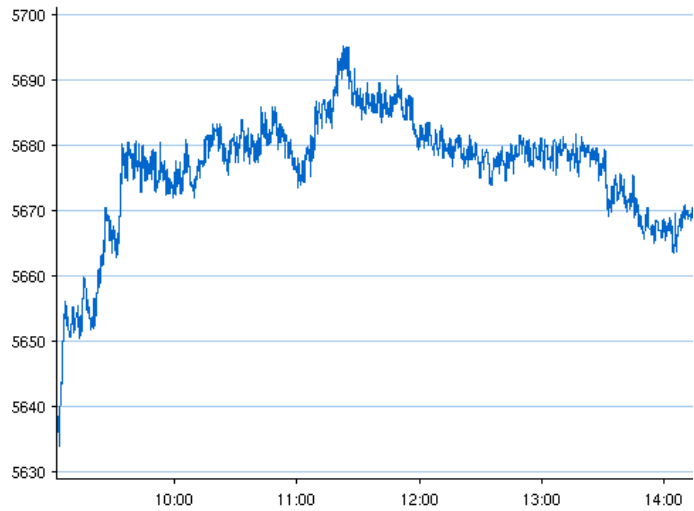
medium run

long run

Le Baron (2001): Evolution and time horizons in an agent based stock market,
Macroeconomic Dynamics.



Sample Period: Intraday



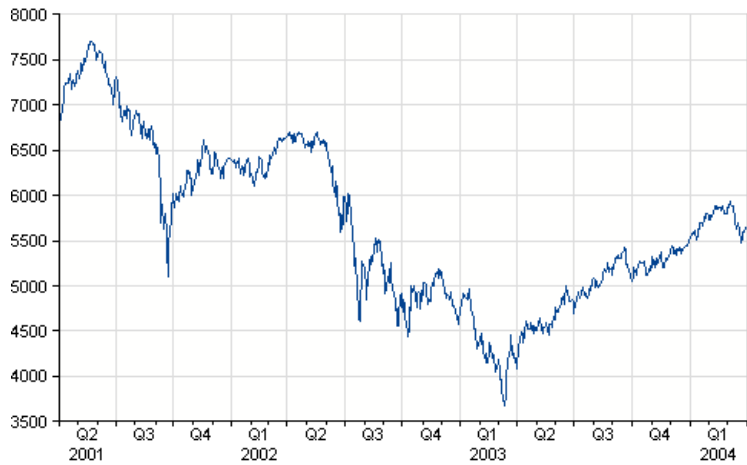
Sample Period: 1 Year

Price trend SMI unadj. for div. (EXC), 1 year

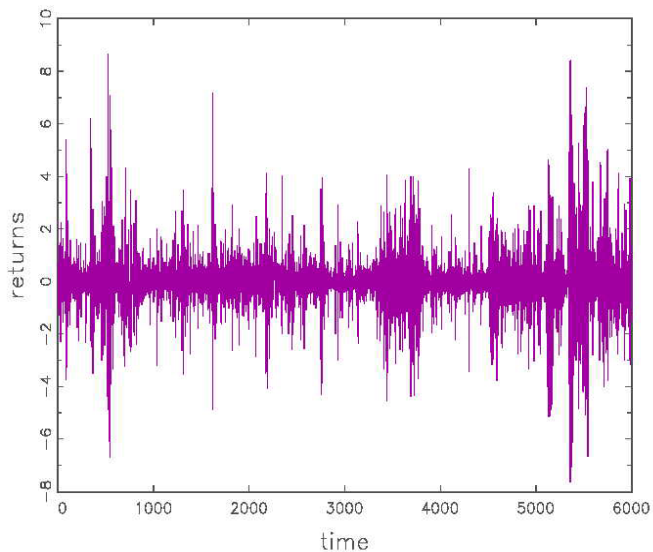


Sample Period: 3 Years

Price trend SMI unadj. for div. (EXC), 3 years



Model generates Stochastic Volatility



Is predicting asset prices possible?

- Classical Theory: No!
- Neo-Classical Theory: One needs to predict the business cycle!
- Behavioral Theory: Yes, there is momentum and reversal!
- Evolutionary Theory: One needs to capture the market interaction.

