Behavioral Decision Making

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What we will see in this workshop

i.   Different types of decisions / methods

ii. Decision Theory

iii. Phycology and judgment

iv. Behavioral models of decision making

v.   Behavioral Finance

Different types of decisions / methods

- We are making decisions all the time

- Problems in business / economics are different in terms of:
  - Static VS. Dynamic
  - Continuous VS. Discrete time
  - Stochastic VS. Deterministic
  - One player VS. More than one player
  - The role of information

- Choices between lotteries

  – Choice under uncertainty

  – Intertemporal choice

- Expected value VS. Expected utility

  – St. Petersburg Paradox:

    - Flip a fair coin until it shows H. Mark the number of flips you needed i. The lottery pays 2^i. But people are not willing to pay more than $40.

Decision Theory

- WHO is a Rational Decision Maker?

- vNM preferences:

  – Completeness

  – Continuity

  – Transitivity

  – Independence

- Normative (prescriptive) VS. Positive (descriptive)

- Expected Utility Theory

  – If preferences satisfy the above axioms, there exists a continuous, increasing function such that preferences can be represented by the sum of utility of outcomes times their probability of happening.

Decision Theory

- Risk aversion / risk seeking / risk neutral

- Absolute / relative risk aversion

- Certainty Equivalent / Risk premium

- Violations of EU

  - Buying insurance and lottery at the same time

  - Ellsberg paradox

  - Allais paradox

- # Ellsberg Paradox

  - An urn containing 30 red balls, 60 other balls either yellow or black.

    - Gamble A: you receive 1$ if a red ball comes out

    - Gamble B: you receive 1$ if a black ball comes out

    - Gamble C: you receive 1$ if a red or a yellow ball comes out

    - Gamble D: you receive 1$ if a black or a yellow ball comes out

- # Ambiguity aversion / market participation

- Allais Paradox

  - Gamble A=($1M,1)

  - Gamble B=($0,1% ; $1M,89% ; $5M,10%)

  - Gamble C=($0,89% ; $1M,11%)

  - Gamble D=($0,90% ; $5M,10%)

- Violation if Independence axiom

Machina, M "Expected Utility Analysis without the Independence Axiom",
Econometrica, 1982, v.50, pp 277-323.
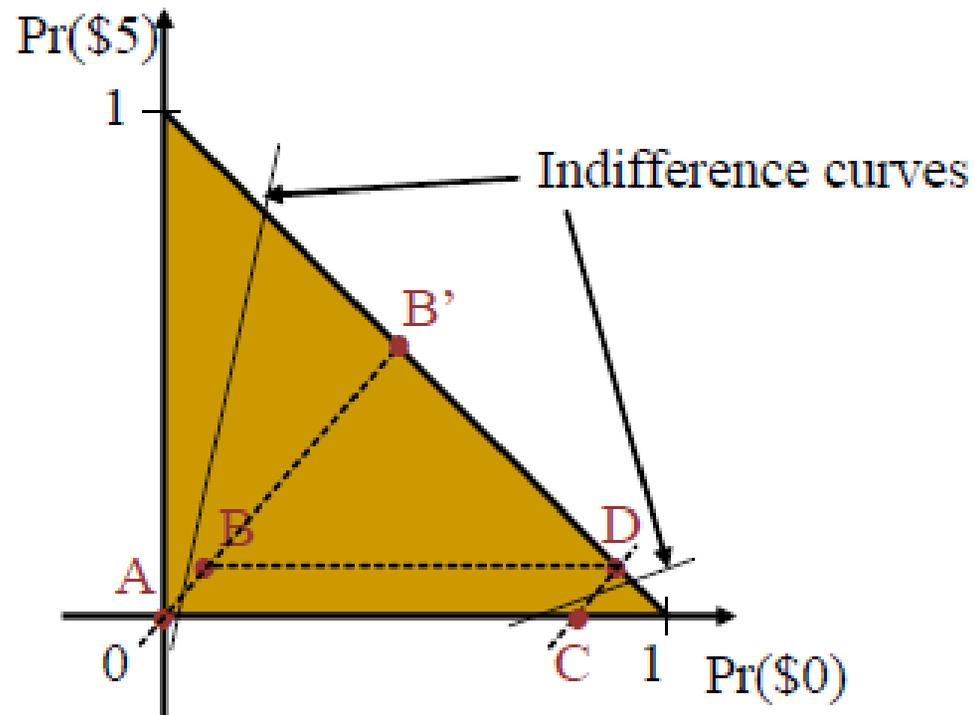
- Betweenness instead of Independence

Decision Theory

- Alternatives for EUT

  – Weighted Utility Theory

  – Rank-dependent Utility Theory

  – Disappointment Aversion

  – Regret Theory

  – Prospect Theory

- Weighted Utility Theory (Chew 1982)

$$W\left(p\right) = \sum_{x \in C} w\left(x|p,g\right) u\left(x\right)$$

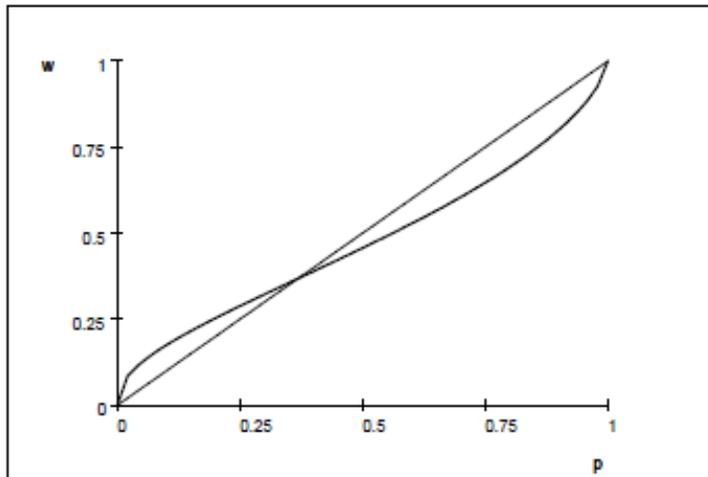$$w\left(x|p,g\right) = \frac{g\left(x\right) p\left(x\right)}{\sum_{y \in C} p\left(y\right) g\left(y\right)}$$

– Utilities are weighted according to not only the probabilities of consequences but also consequences themselves.

- Rank Dependent Utility

$$U\left(x|w\right)=\int u\left(x\right)dw\left(F\left(x\right)\right)$$

  - One possible/common weighting probability function is $w\left(p\right)=e^{-\left(-\ln p\right)^{\alpha}}$

- Disappointment Aversion

  – Putting a weight $(1+\beta)$ for outcomes less than the CE.

Gul F. "A Theory of Disappointment Aversion",1991, Econometrica, v. 59, No. 3, pp 667-686.

- Generalized DA

- Regret Theory

Loomes G. and Sugden R. "Regret Theory: An Alternative Theory of Rational Choice under Uncertainty",1982, Economic Journal, v. 92, pp 805-824.

- **System 1**: operates automatically and quickly, with little or no effort and no sense of voluntary control.

- **System 2**: allocates attention to the effortful mental activation that demand it, including complex computation . The operation of system 2 are often associated with the subjective experience of agency, choice and concentration.

Thinking Fast and Slow, Daniel Kahneman, 2011

- System 1 is always working, giving inputs to lazy system 2. System 1 is often the source of systematic errors/biases.

- Example: Which one is longer?
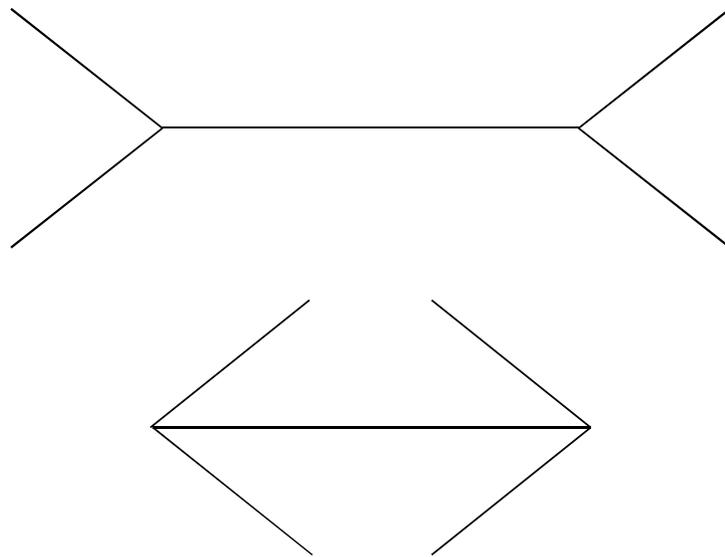
- Priming:

  – i) Voting pattern: polling station in a school VS. other locations.

  – ii) Honesty box
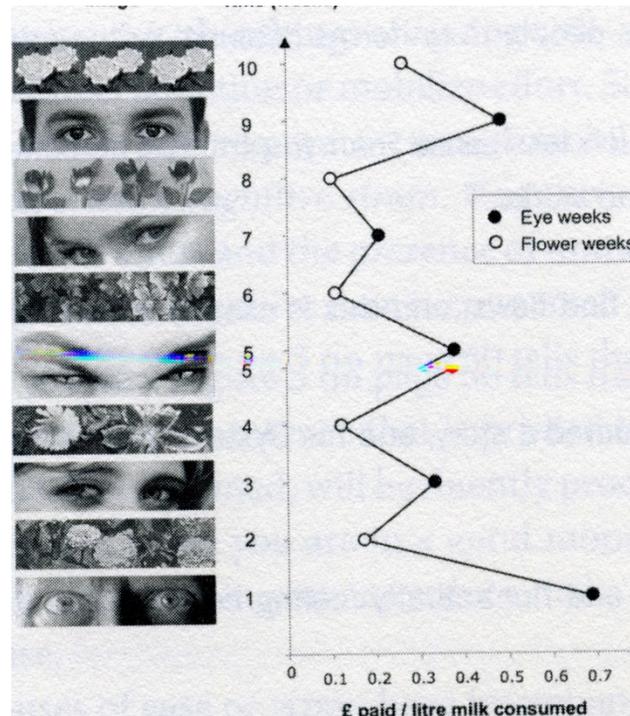
- Cognitive ease/Strain:
  - i) A question: it takes 5 machines 5 minutes to make 5 widgets. How long does it take 100 machines to make 100 widgets? 100 minutes or 5 minutes.
    - 90% of students failed to answer it when it was in a normal font while only 35% made mistake when the font was barely legible.
  - ii) Happy mood increase logical errors
  - iii) Thinking in a foreign language makes cognitive strain so ...

  http://www.wired.com/wiredscience/2012/04/language-and-bias

- Heuristics/Substitution:

  – Sometimes system 1 tries to answer to an easier question

    - How happy are you these days? / How many dates did you have last month?

    - Investing in a stock? How do you like its product?

- Heuristics & Biases:

  – Law of small numbers / are we good at statistics?

    - A study of the incidence of kidney cancer in the 3141 countries of the united states reveals a remarkable pattern. The countries in which the incidence of kidney cancer is lowest are mostly rural, sparsely populated and located in traditionally Republican states in the Midwest, the South and the west. What do you make of it?

    - The same statement is also true replacing lowest with highest!!!

  – The law of small numbers is a manifestation of a general bias that favors certainty (what sys1 is prone to) over doubt (what sys2 capable of).

- # Heuristics & Biases:

  - ## Less is More

    - Linda is a 31 years old, single, outspoken and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice and also participated in antinuclear demonstrations.

    - Rank the following statements, which one is more likely?

      Linda is a teacher in elementary school

      Linda is active in the feminist movement

      Linda is a bank teller

      Linda is a social worker

      Linda is a sales person

      Linda is a bank teller and is active in the feminist movement

- Heuristics & Biases:

  – Regression to the mean

    • Flight instructor case, reward VS. punishment

    • Golf players / ski jumpers

    • Two equivalent statements:

      – Highly intelligent women tend to marry men who are less intelligent than they are.

      – The correlation between the intelligence scores of spouses is les than perfect.

    • We tend to make a story out of everything.

- Heuristics & Biases:

  - Anchors

    - Was Gandhi more than 114 when he died?

    - How old was he when he died?

  - The first thing which comes to mind when faced with such a question is an *anchor*. You then adjust most probably in the right direction but the anchor has its own effect.

  - Ask price for a house, first estimate in an auction and also stock price!

  - Willingness to pay for saving seabirds / public policy

  - Dot come bubble!!!

- Heuristics & Biases:

  – The science of availability

    – Like other heuristics, substitution of one question for another: you wish to estimate the size of a category or the frequency of an event, but you report an impression of the ease with which instances come to mind.

  - Always staying in a longer line / self-estimated contributions add up to more than 100%

- The illusion of understanding:

  - Nassim Taleb's *narrative fallacy*

    - We tend to make sense of the world, usually assign a larger role to talent, stupidity and intentions than to luck.

      - Google case / Lehman case

      - Different market crashes/crisis and they are still inevitable.

    - Hindsight bias (I-Knew-It-All-Along): imperfect ability of human mind to recognize past states of knowledge or beliefs that have changed.

      - 9/11 case / many economists who predicted financial crises

      - Near misses

Dillon R. L. and Tinsley C. H. "How Near-Misses Influence Decision Making Under Risk: A Missed Opportunity for Learning", 2008, MANAGEMENT SCIENCE, pp 1-16.

- The illusion of Validity/skill:

  – The case of training army for leadership

  – Intuition VS. Formulas

  – Stock-picking skill

    • Individual traders

    • Mutual funds

- The illusion of control/overconfidence

  – Competitor neglect

  – Case of Entrepreneurs

- Prospect Theory
  - Expected value of gambles before Bernoulli
  - Bernoulli
    - The notion of utility instead of value
    - The diminishing marginal value of wealth
  - What is wrong?
    - Today Jack and Jill each have 5 million
    - Yesterday Jack had 1 million and Jill had 9 million
    - Are they equally happy?
  - **So changes (comparing to a reference point) matter not the absolute value**

- Prospect Theory
  - Another problem
    - Anthony's current wealth is 1 million
    - Betty's current wealth is 4 million
    - They are both offered a choice between a gamble and a sure thing
      - The gamble: equal chances to end up owning 1 million or 4 million
      - The sure thing: owning 2 million for sure
  - **People show risk seeking in losses & risk aversion in gains**
  - Why hedging is good?
    - Financial distress costs / asset substitution

- # Prospect Theory
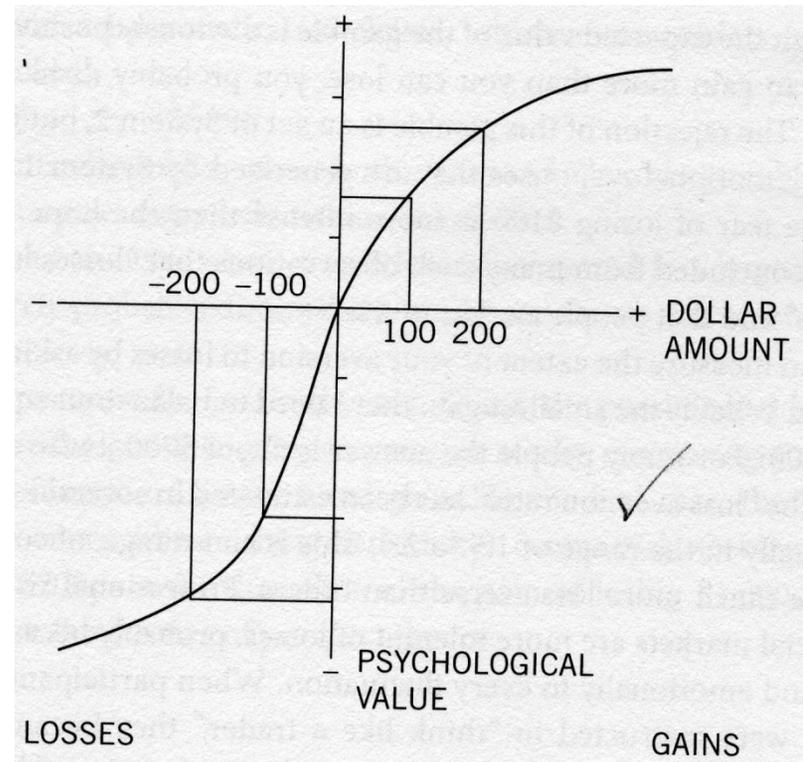
- – Loss aversion

- – Prospect Theory: disappointment and regret

- # Prospect Theory

  - ## Probabilities VS. decision weights

	GAINS	LOSSES
HIGH	95% chance to win $10000	95% chance to lose $10000
probability	fear of disappointment	hope to avoid loss
certainty effect	RISK AVERSE	RISK SEEKING
	accept unfavorable settlement	reject unfavorable settlement
LOW	5% chance to win $10000	5% chance to lose $10000
probability	hope of large gain	fear of large loss
possibility effect	RISK SEEKING	RISK AVERSE
	reject unfavorable settlement	accept unfavorable settlement

- Prospect Theory

    – Endowment effect

        - Richard Thaler case for endowment effect

        - "for exchange" goods VS. "for use" goods

    – Framing

        - There are 2 plans, A and B

            – If A is adopted 200 people will be saved.

            – If B is adopted there is 1/3 probability that 600 people will be saved and 2/3 probability that no people will be saved.

            – If A' is adopted 400 people will die.

            – If B' is adopted there is 1/3 probability that nobody will die and 2/3 probability that 600 people will die.

- # Prospect Theory

  - Mental accounts

    - You are going to a concert.

      - A: You already bought a $80 ticket for it. At the door you realize you lost the ticket. Will you bye another one and go inside?

      - B: You don't have the ticket and want to bye it at the door. When you open your wallet you realize you lost $80. Will you buy the ticket and go inside?

    - **Mental accounts are a form of narrow framing**

      - "Sunk" cost is form of mental account

      - *Sunk-cost fallacy* is a costly mistakes in organizations

        » Agency problems/ changing CEOs

      - Stock prices typically rise when a project termination is announced, Statman & Sepe (1989)

- # Prospect Theory

  - ## Mental accounts

    - You invested in two companies. Both of them are now worth $5000. You bought A's stock for $6000 and B's stock for $4000. Now you need $5000. Which one do you sell more likely?

    - Finance literature has documented a massive preference for selling the winners rather than losers. This bias is called *disposition effect,* an instance of narrow framing.

    - At least two reasons that selling the winner doesn't make sense:

      - Tax reasons

      - Well-documented market anomaly that winners will be still winners ate least for a short while.

- # Introduction

  - ## Traditional Finance

    - ### Agents are rational which means:

      - When they receive new information they updates their beliefs correctly (according to Bayes' rule)

      - Given their beliefs they make choices that are normatively acceptable (according to SEU)

  - ## Behavioral Finance

    - ### At least one of the above conditions is violated

    - ### **Behavioral finance has two building blocks:** *limits of arbitrage* **and** *psychology*

Scaled Word Counts for "Behavioral Finance" and "Efficient Markets" 1985-2006
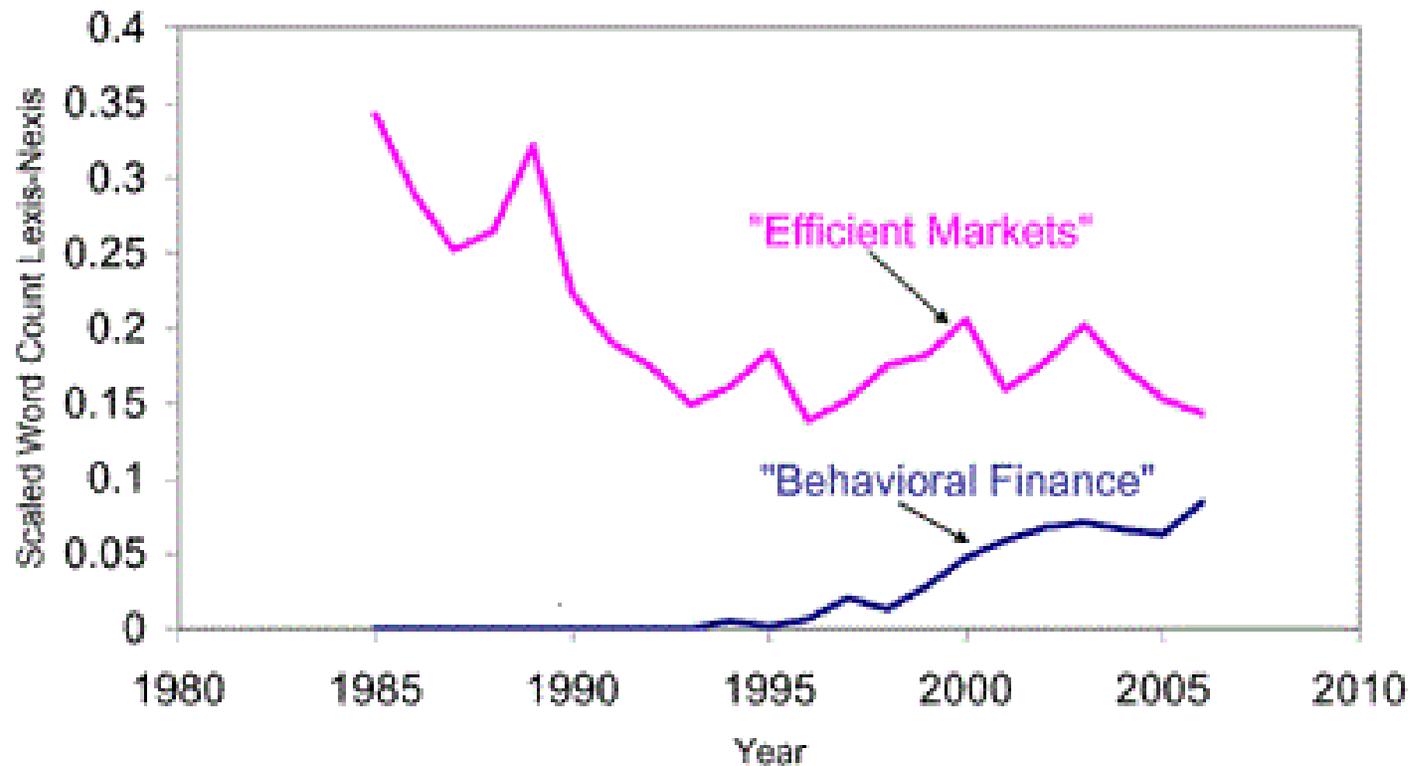
Source: Robert J. Shiller, Yale University

Limits of arbitrage

- Arbitrage: an investment strategy that offers riskless profit at no cost
- An example:
  - Ford's fundamental value $20.
  - There are some irrational traders who are pessimistic about Ford so selling the share pushed its price to $15.
  - What would be a rational trader's strategy then?
  - Will the share price of Ford stay below $20?
  - Is the strategy used by rational traders risk free and without cost?
- LTCM case
- Arbitrageurs VS. Noise traders

Prices are right <u>implies</u> no free lunch

No free lunch <u>doesn't imply</u> prices are right

- Limits of arbitrage
  - Theory
  - Strategies arbitrageurs use are both costly and risky
    - Fundamental risk
    - Noise trader risk
    - Implementation cost
      - Bid-ask spread
      - Short selling is costly or not allowed
      - Cost of learning and finding misprices

Behavioral Finance

- ## Limits of arbitrage

  – ### Royal Dutch and Sell Transport

    - Royal Dutch 60% and Shell Transport 40% of the generated cash flow
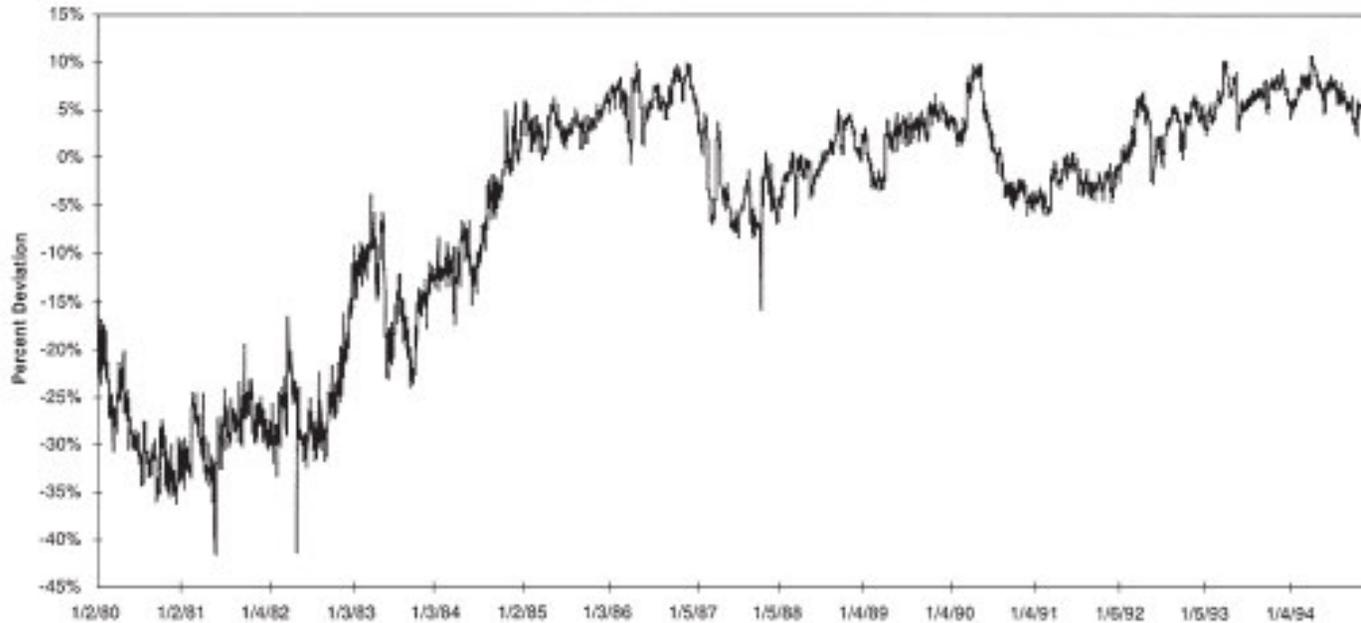

Fig. 1. Log deviations from Royal Dutch/Shell parity. Source: Froot and Dabora (1999).

- Limits of arbitrage

  – Index inclusion

    - when a stock is added to the index, it jumps in price by an average of 3.5%, and much of this jump is permanent. (Harris and Gurel (1986) and Shleifer (1986))

    - When Yahoo was added to the index, its shares jumped by 24% in a single day.

    - Standard and Poor's emphasizes that in selecting stocks for inclusion, they are simply trying to make their index representative of the U.S. economy, not to convey any information about the level or riskiness of a firm's future cash flows.

- Application: Investor Behavior

  - Insufficient diversification

    - Home bias

    - Investing in your own company

    - Ambiguity and familiarity

  - Naive diversification

    - *Benartzi and Thaler (2001)*

      - Simple allocation of *1/n* of saving to each stock

      - Allocation decision to invest in stock funds, bond funds and balanced funds

Behavioral Finance