

Investing Psychology and Behavioral Finance

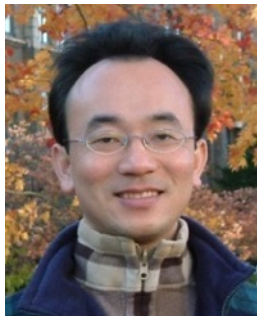
1121AIFQA03

MBA, IM, NTPU (M5276) (Fall 2023)

Tue 2, 3, 4 (9:10-12:00) (B3F17)



<https://meet.google.com/paj-zhhj-mya>



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Associate Professor

Institute of Information Management, National Taipei University

<https://web.ntpu.edu.tw/~myday>



Syllabus

Week Date Subject/Topics

1 2023/09/12 Introduction to Artificial Intelligence in Finance and Quantitative Analysis

2 2023/09/19 AI in FinTech: Metaverse, Web3, DeFi, NFT, Financial Services Innovation and Applications

3 2023/09/26 Investing Psychology and Behavioral Finance

4 2023/10/03 Event Studies in Finance

5 2023/10/10 National Day (Day off)

6 2023/10/17 Case Study on AI in Finance and Quantitative Analysis I

Syllabus

Week	Date	Subject/Topics
7	2023/10/24	Finance Theory and Data-Driven Finance
8	2023/10/31	Midterm Project Report
9	2023/11/07	Financial Econometrics
10	2023/11/14	AI-First Finance
11	2023/11/21	Industry Practices of AI in Finance and Quantitative Analysis
12	2023/11/28	Case Study on AI in Finance and Quantitative Analysis II

Syllabus

Week	Date	Subject/Topics
13	2023/12/05	Deep Learning in Finance; Reinforcement Learning in Finance
14	2023/12/12	Algorithmic Trading; Risk Management; Trading Bot and Event-Based Backtesting
15	2023/12/19	Final Project Report I
16	2023/12/26	Final Project Report II

Investing Psychology and Behavioral Finance

Outline

- **Investing Psychology**
 - **Investor Sentiment**
 - **Consumer Psychology and Behavior**
- **Behavioral Finance**
 - **Prospect Theory: An Analysis of Decision Under Risk**
 - **Behavioral Heuristics and Biases in Decision Making**
 - **Herding Behavior in Finance**

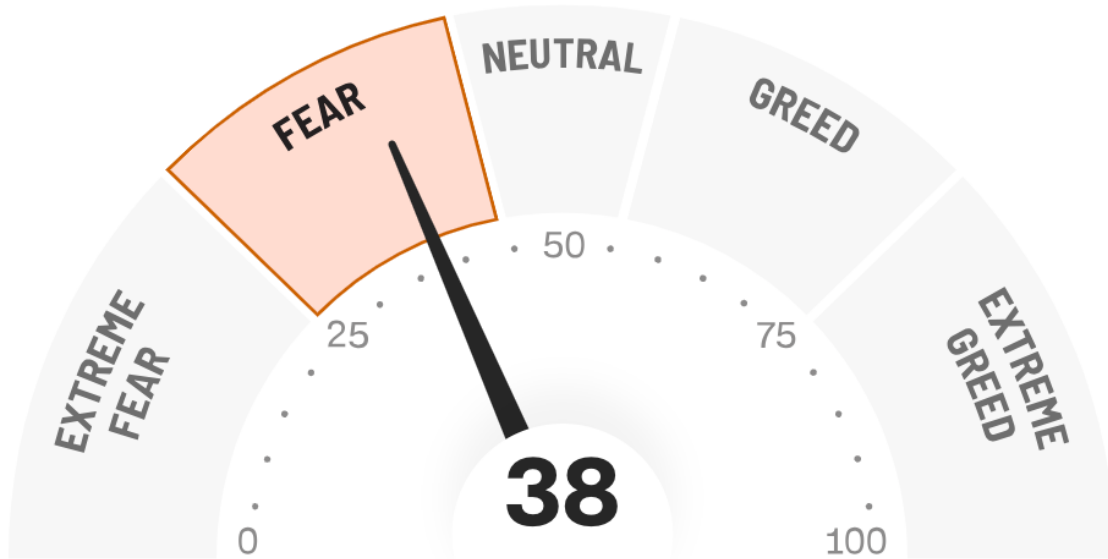
Investor Sentiment

Fear & Greed Index

What emotion is driving the market now?



Overview Timeline



Previous close

Fear

35

1 week ago

Neutral

48

1 month ago

Neutral

46

1 year ago

Extreme Fear

21

Last updated Sep 25 at 4:51:28 PM ET



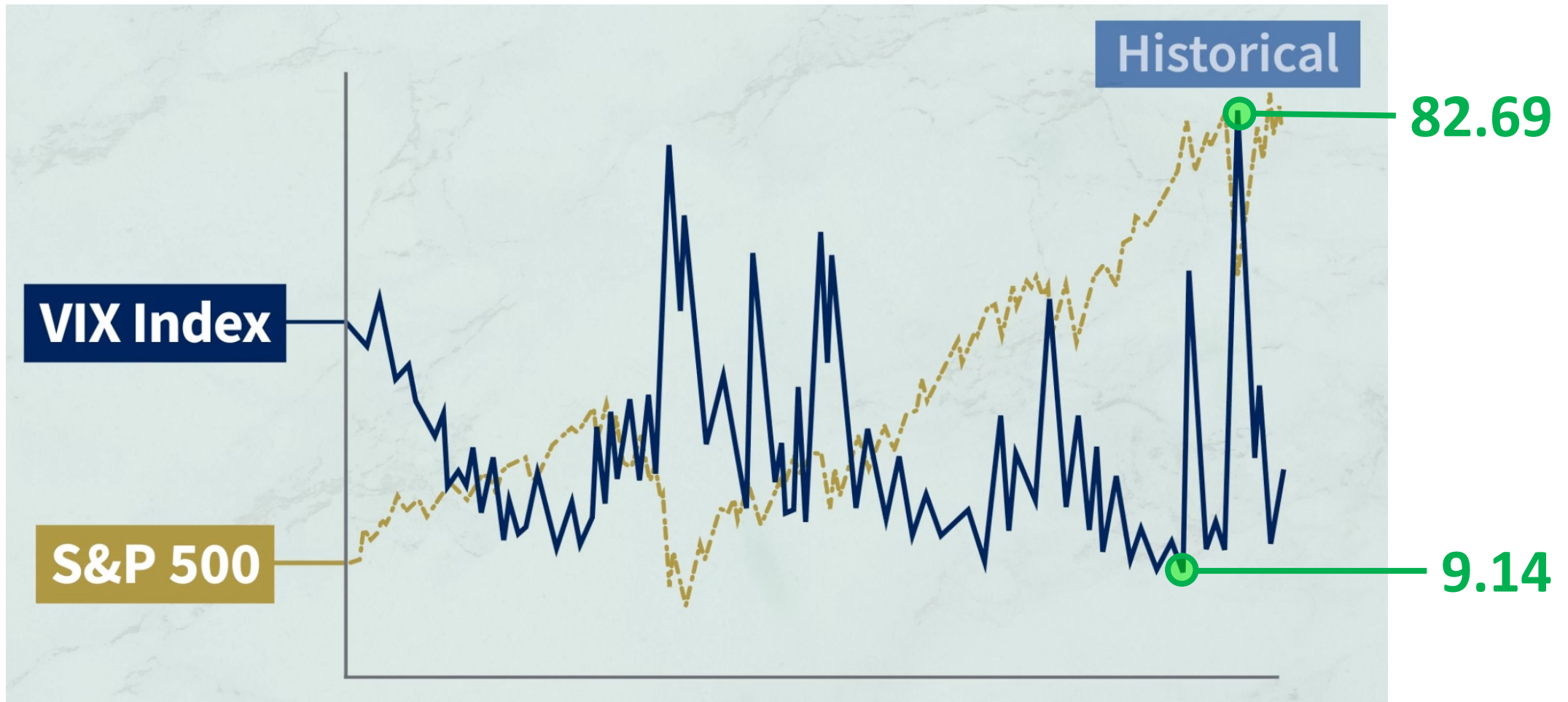
Last updated Sep 25 at 4:55:15 PM EDT



Cboe

VIX (Volatility Index)

An Indicator of Expected Market Volatility



Min-Yuh Day and Yensen Ni (2023),

Be greedy when others are fearful: Evidence from a two-decade assessment of the NDX 100 and S&P 500 indexes,

International Review of Financial Analysis, 90, 102856.



International Review of Financial
Analysis

Volume 90, November 2023, 102856



Be greedy when others are fearful:
Evidence from a two-decade
assessment of the NDX 100 and S&P
500 indexes

Min-Yuh Day^a, Yensen Ni^b  

Consumer Psychology and Behavior

How consumers think, feel, and act

Fintech Impact on Consumer Behavior



Source: <http://bitcoinist.com/fintech-impact-consumer-behavior-mobile-payments/>

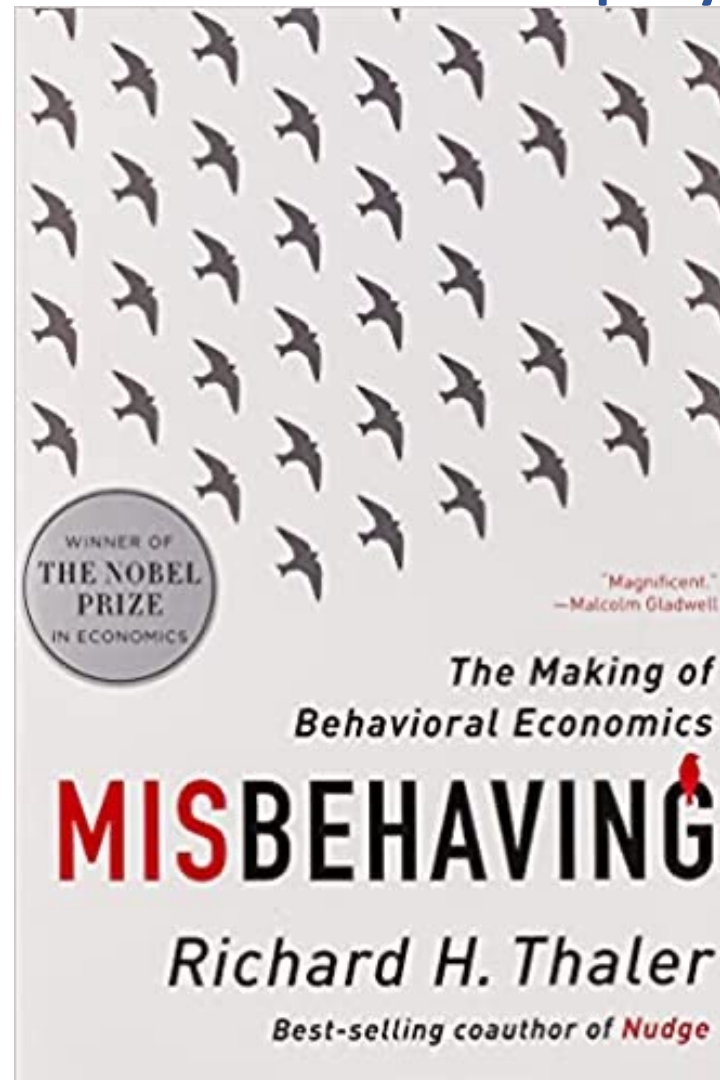
Behavioral Finance

Richard H. Thaler (2016),
Misbehaving: The Making of Behavioral Economics,

W. W. Norton & Company



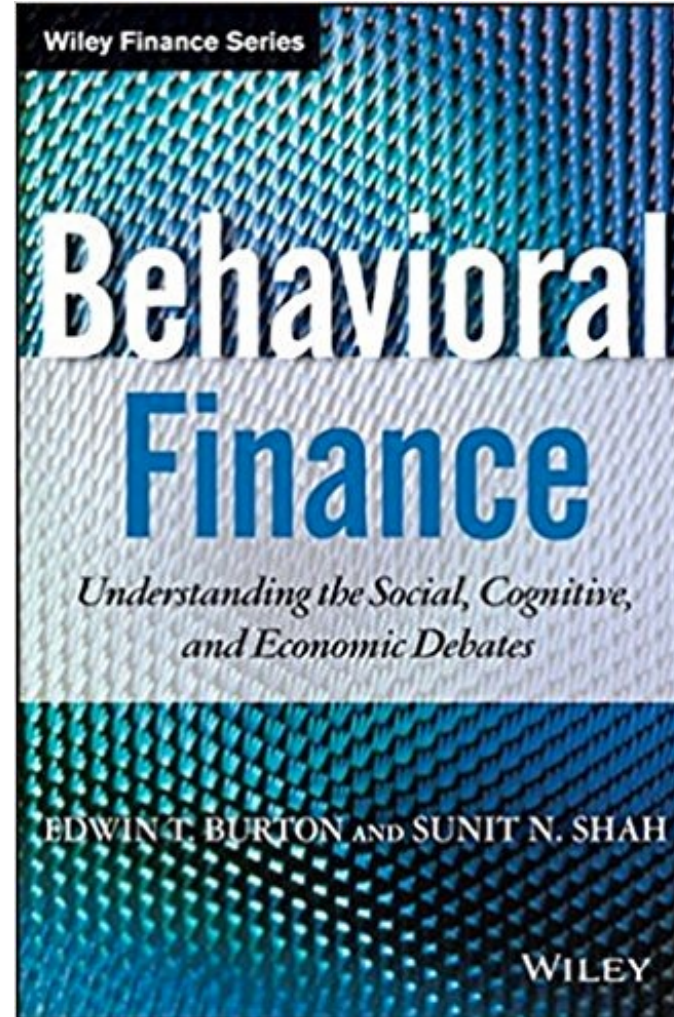
Richard H. Thaler



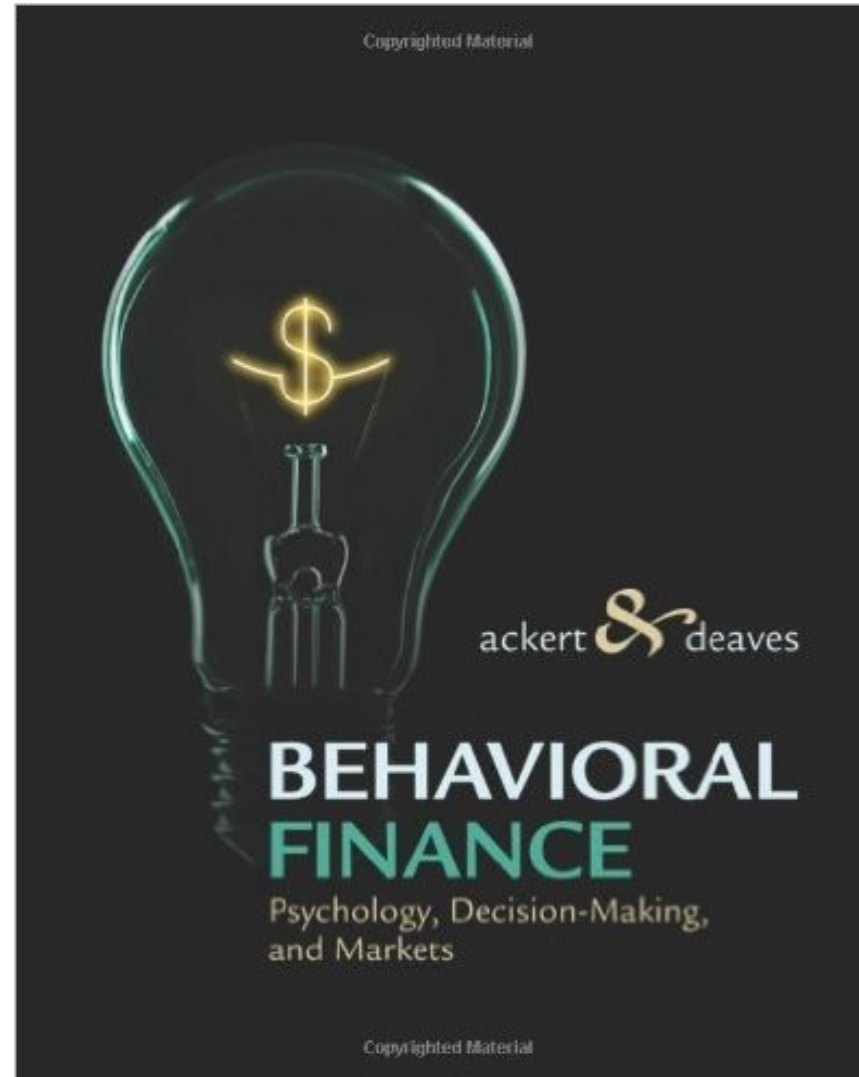
Edwin Burton and Sunit N. Shah (2013)

Behavioral Finance:

Understanding the Social, Cognitive, and Economic Debates,
Wiley



Lucy Ackert and Richard Deaves (2009),
Behavioral Finance: Psychology, Decision-Making, and Markets,
South-Western College Pub

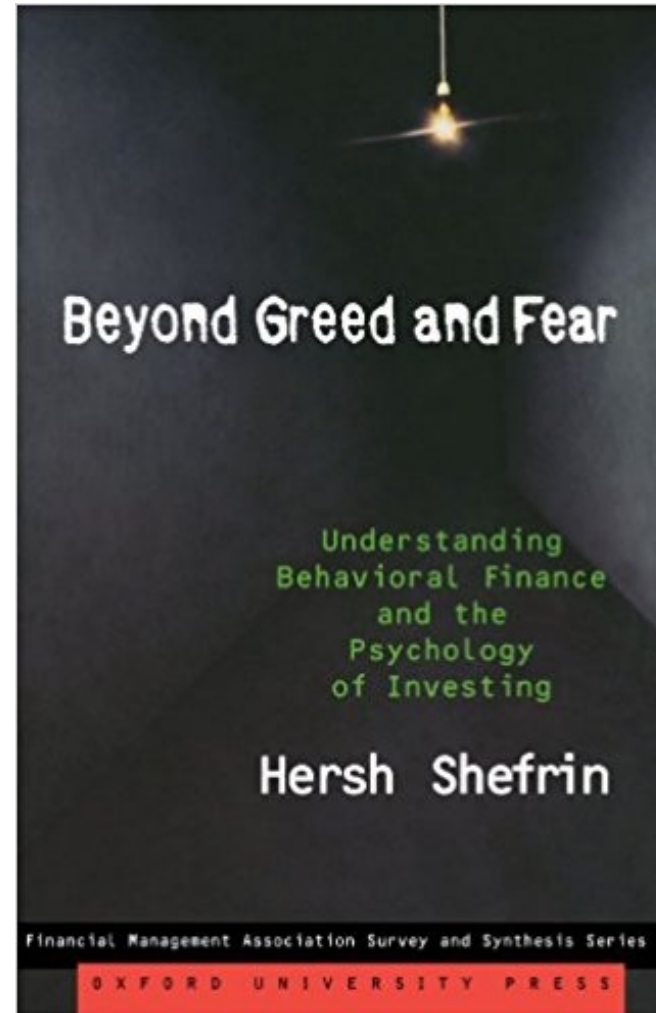


Hersh Shefrin (2007),

Beyond Greed and Fear:

Understanding Behavioral Finance and the Psychology of Investing,

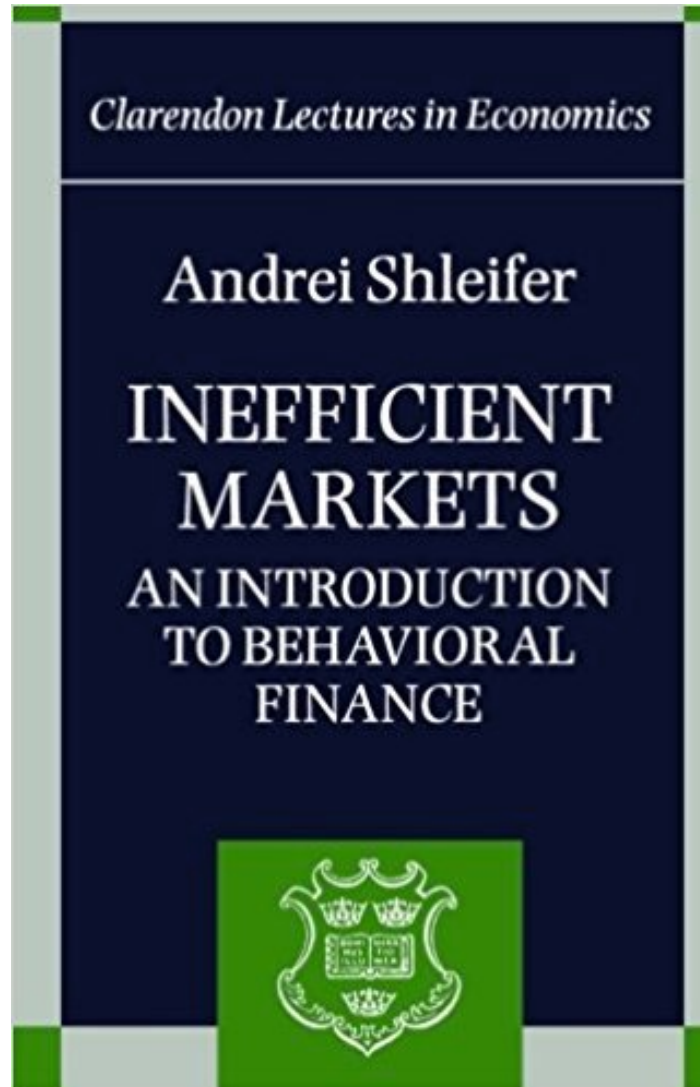
Oxford University Press



Andrei Shleifer (2000),

Inefficient Markets: An Introduction to Behavioral Finance,

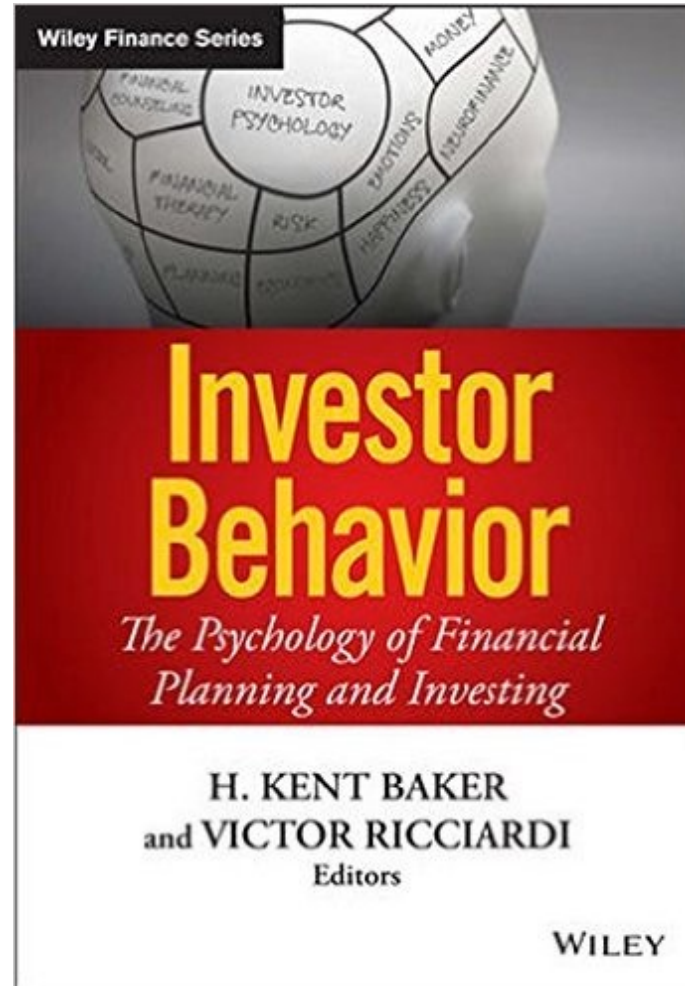
Oxford University Press



H. Kent Baker and Victor Ricciardi (2014)

Investor Behavior: The Psychology of Financial Planning and Investing,

Wiley



Marketing

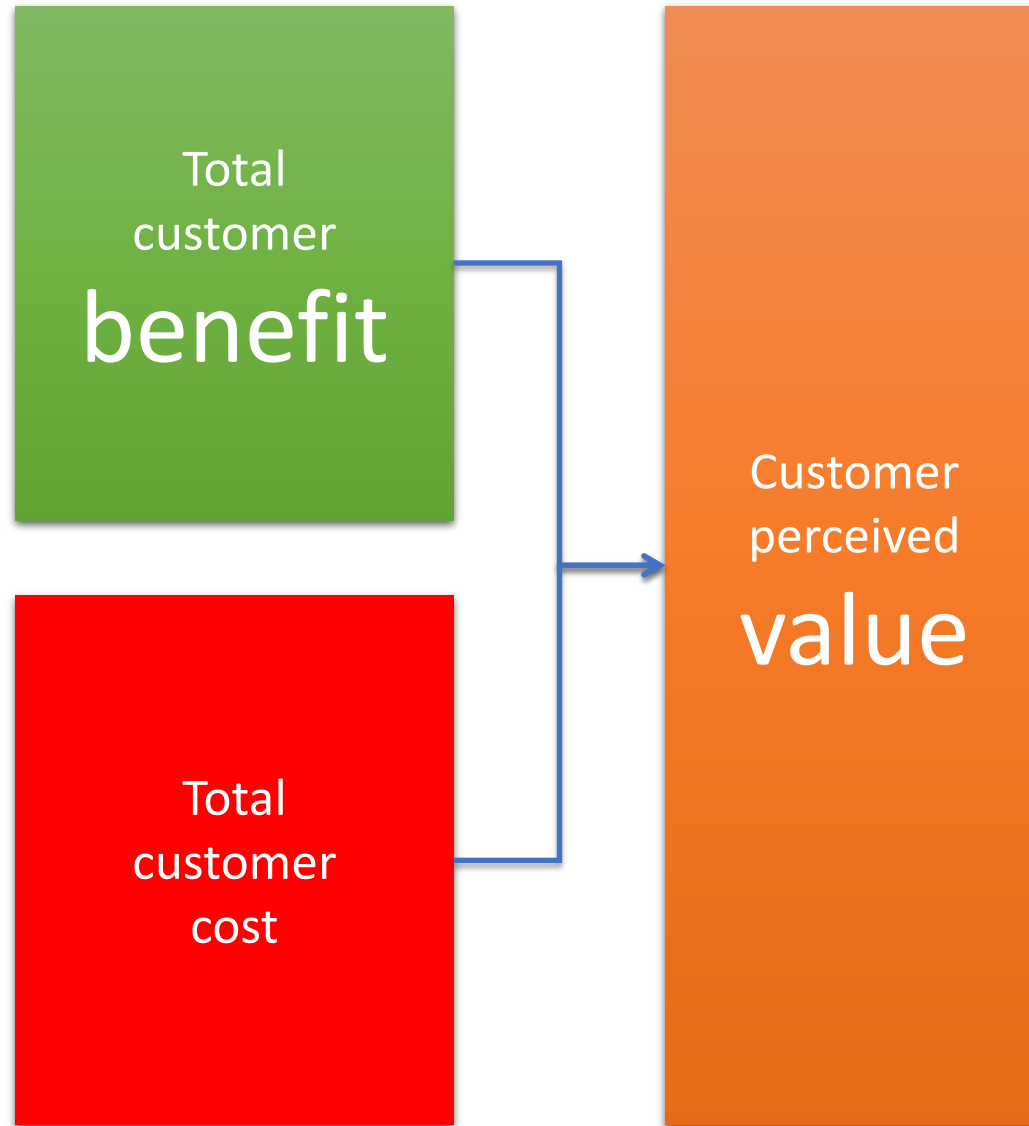
**“Meeting
needs
profitably”**

Value

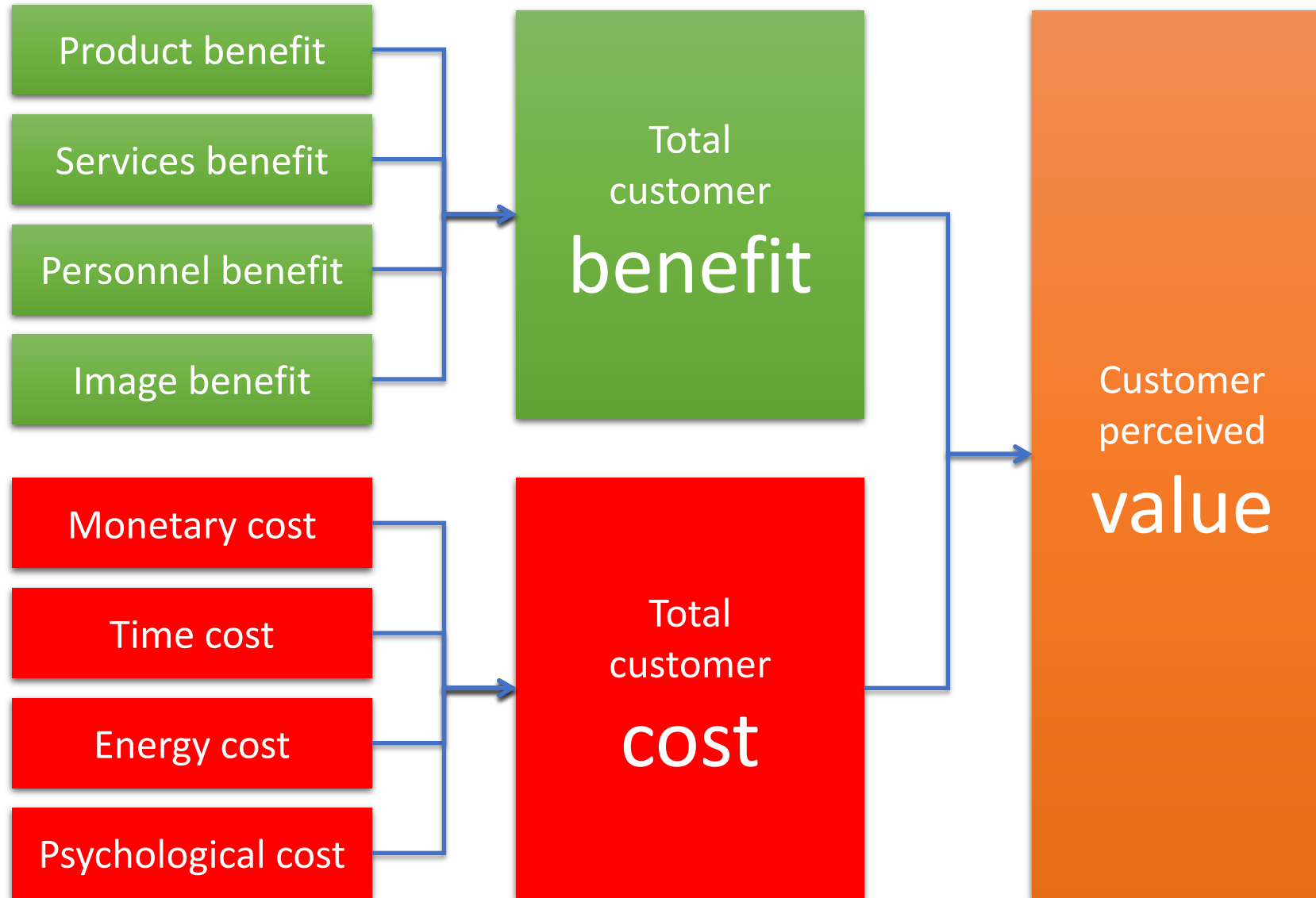
the sum of the
tangible and
intangible

benefits and costs

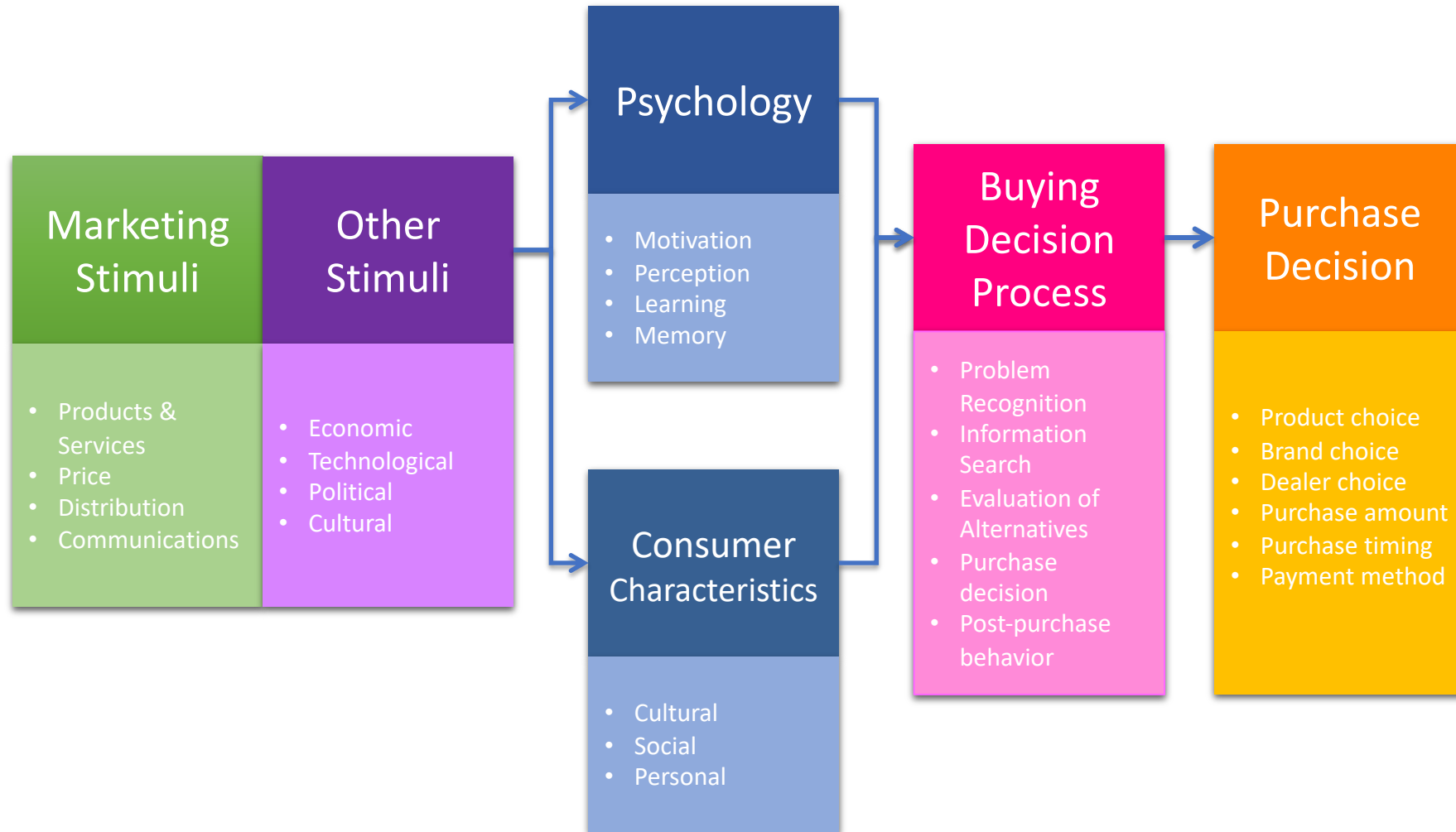
Value



Customer Perceived Value

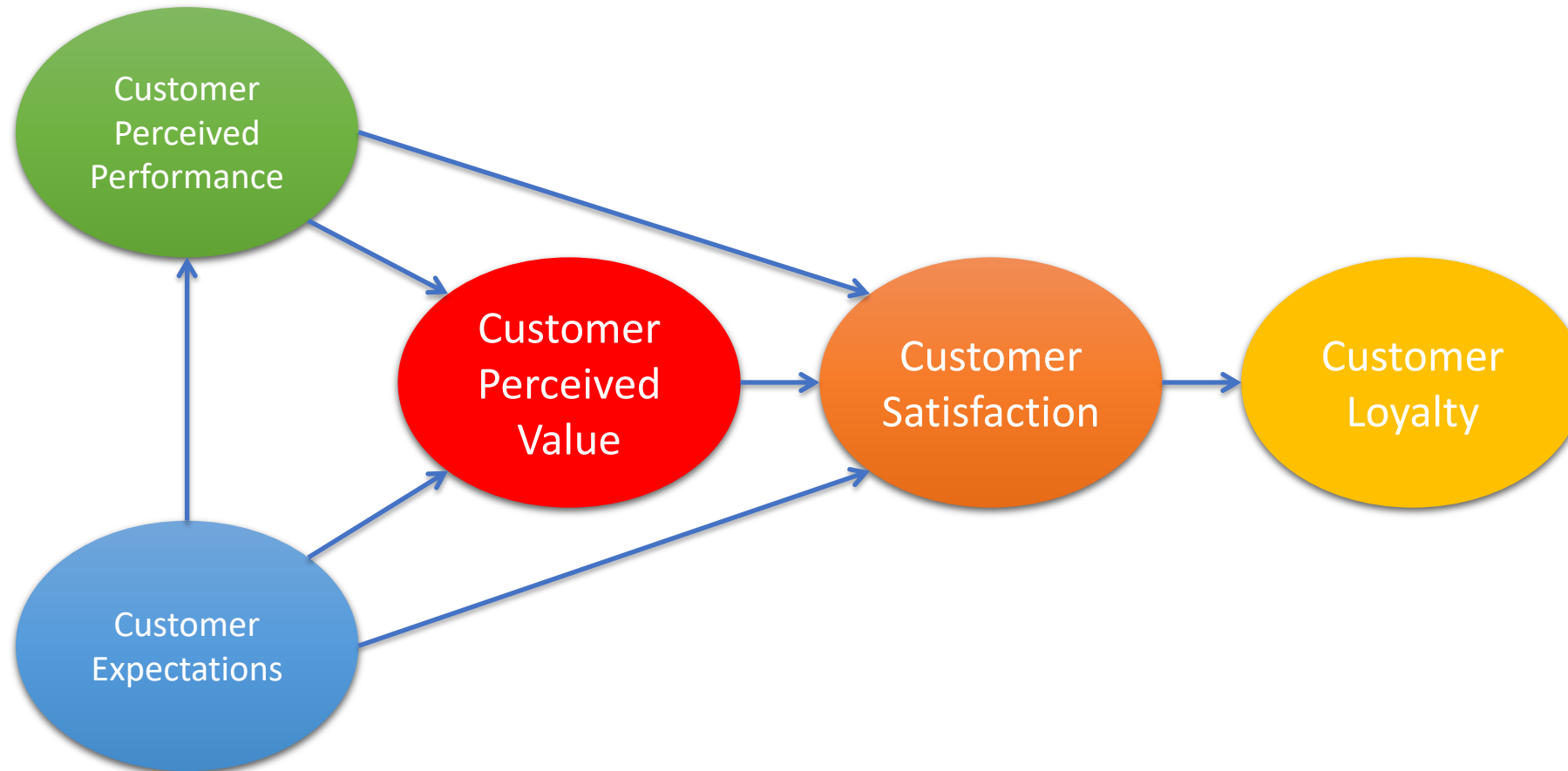


Model of Consumer Behavior



Building
Customer Value,
Satisfaction,
and
Loyalty

Customer Perceived Value, Customer Satisfaction, and Loyalty



Theory of Reasoned Action (TRA)

TRA (1975)

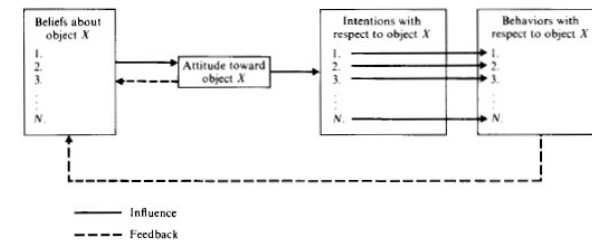


Fig. 1.1 Schematic presentation of conceptual framework relating beliefs, attitudes, intentions, and behaviors with respect to a given object.

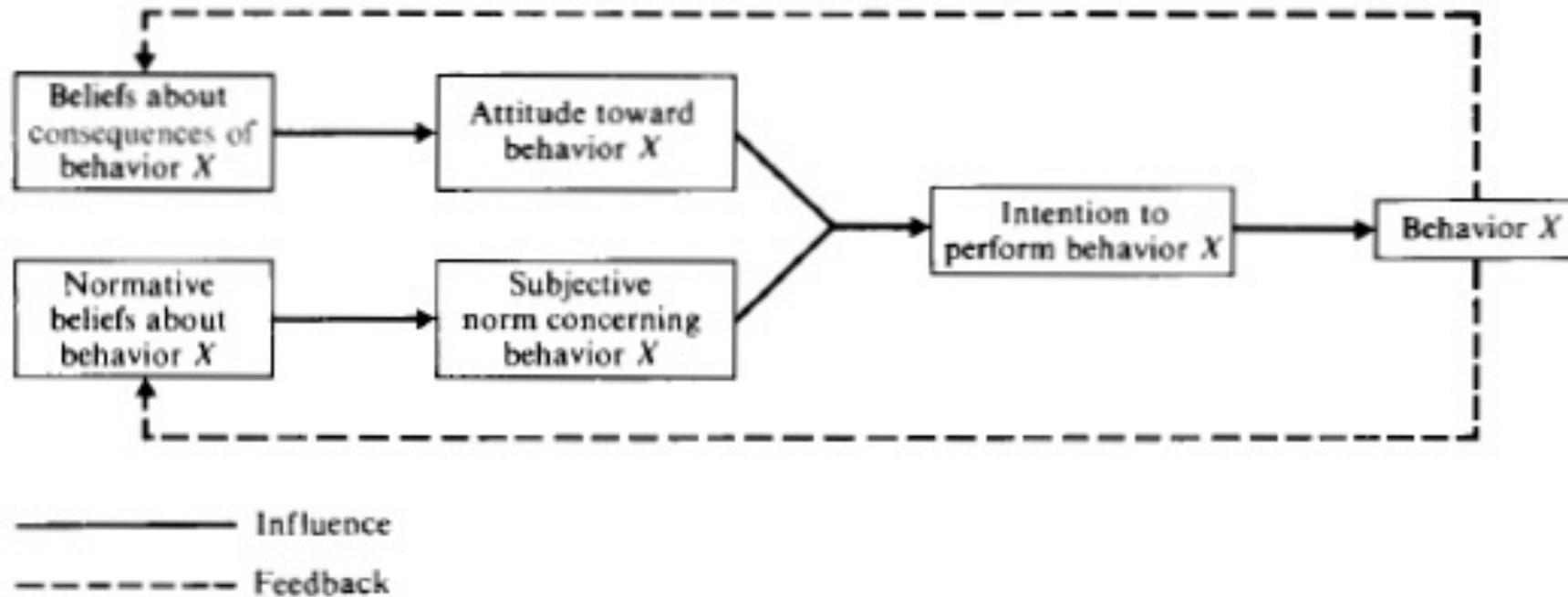


Fig. 1.2 Schematic presentation of conceptual framework for the prediction of specific intentions and behaviors.

TRA (1989)

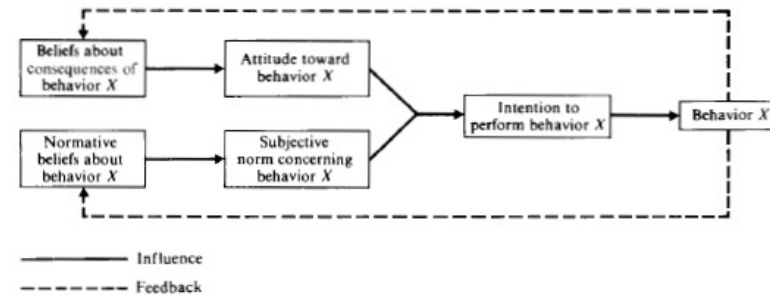


Fig. 1.2 Schematic presentation of conceptual framework for the prediction of specific intentions and behaviors.

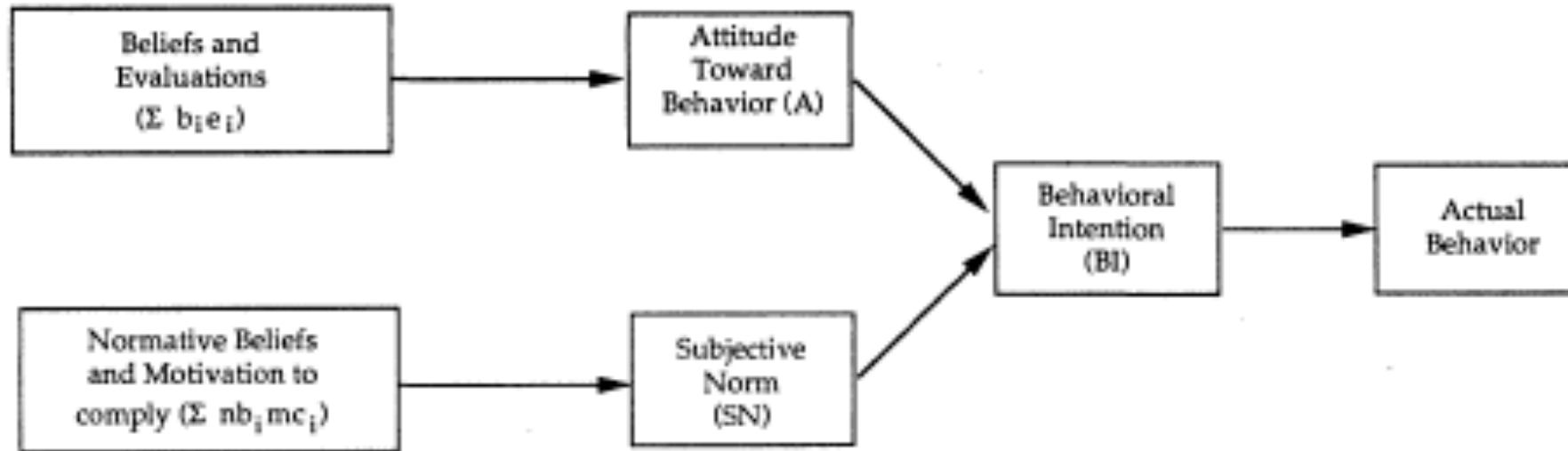


FIGURE 1. Theory of Reasoned Action (TRA).

Theory of Planned Behavior (TPB)

Source: Ajzen, I., (1985) "From Intentions to Actions: A Theory of Planned Behavior," in J. Kuhl and J. Beckmann (Eds.) Action Control: From Cognition to behavior, Springer Verlag, New York, 1985, pp.11-39.

TPB (1985)

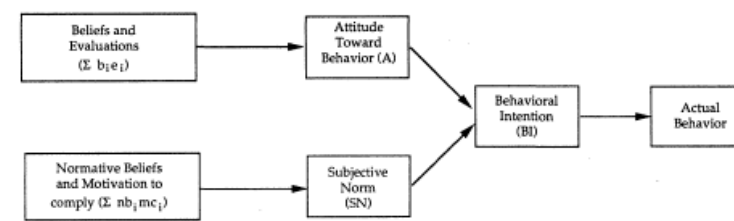


FIGURE 1. Theory of Reasoned Action (TRA).

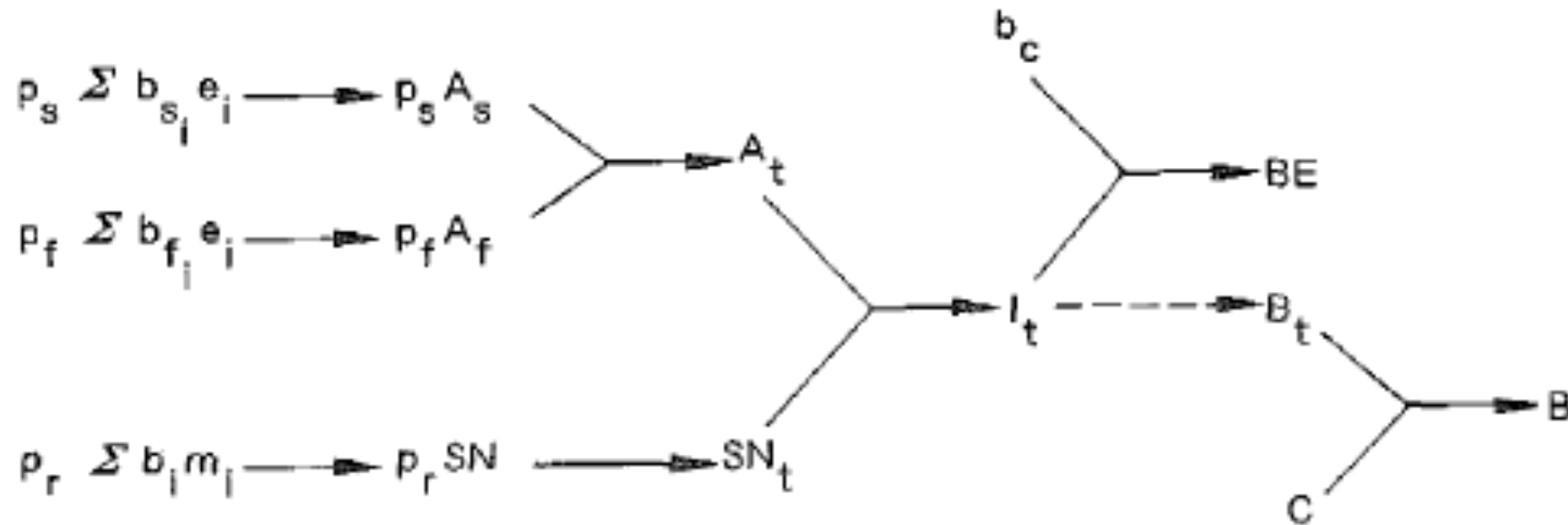


Fig. 2.1. Schematic presentation of the theory of planned behavior

TPB (1989)

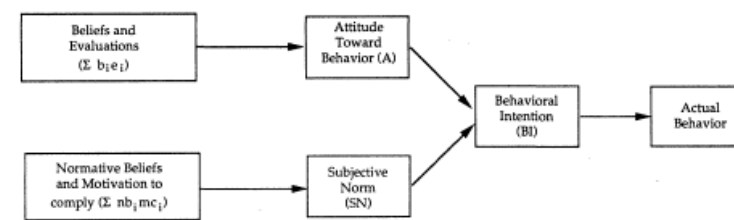


FIGURE 1. Theory of Reasoned Action (TRA).

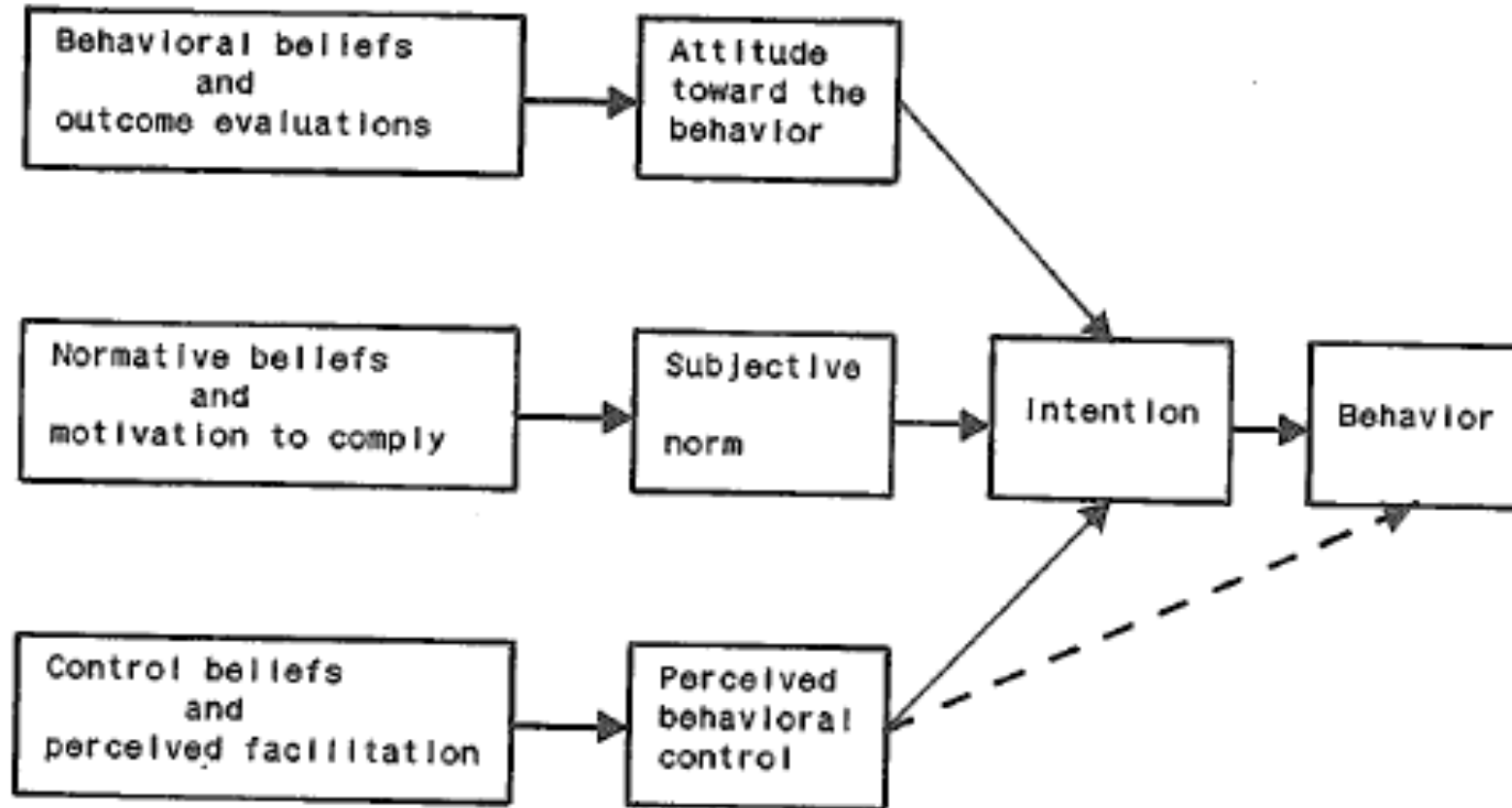


FIG. 10.2. Theory of planned behavior.

TPB (1991)

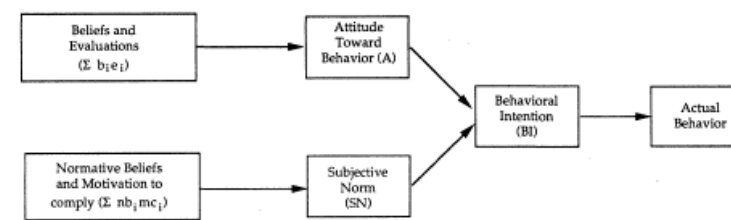


FIGURE 1. Theory of Reasoned Action (TRA).

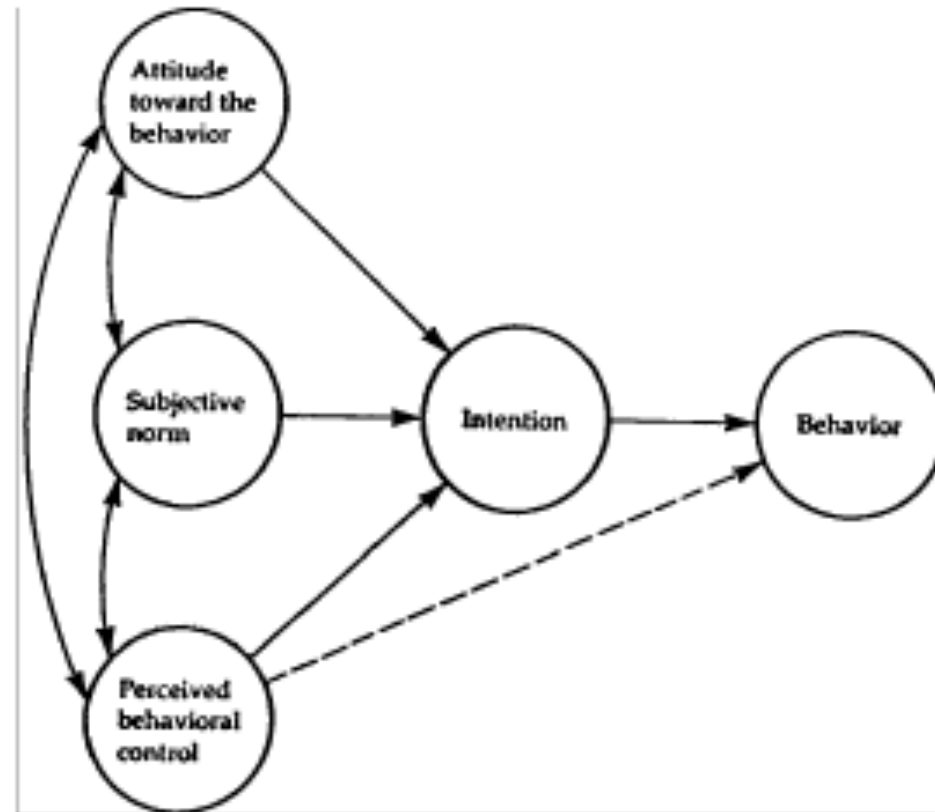



FIG. 1. Theory of planned behavior

Icek Aizen (Ajzen): Homepage - Microsoft Internet Explorer

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網址(D) http://www.people.umass.edu/aizen/index.html



Icek Aizen (Ajzen)

Professor of Psychology
University of Massachusetts

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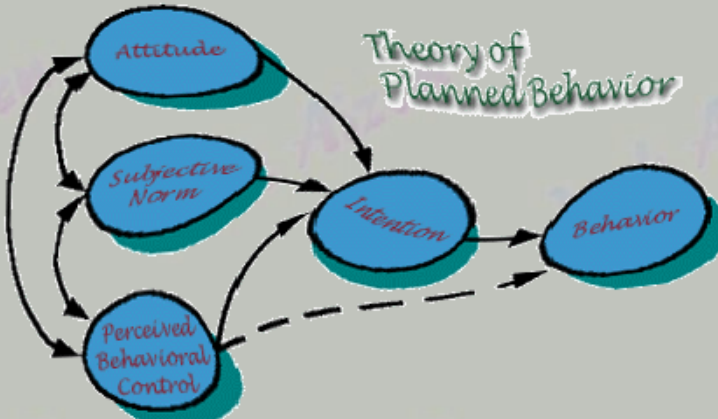
[Teaching](#)

[Research](#)

[Publications](#)

[TpB](#)

[Consulting](#)



Theory of Planned Behavior

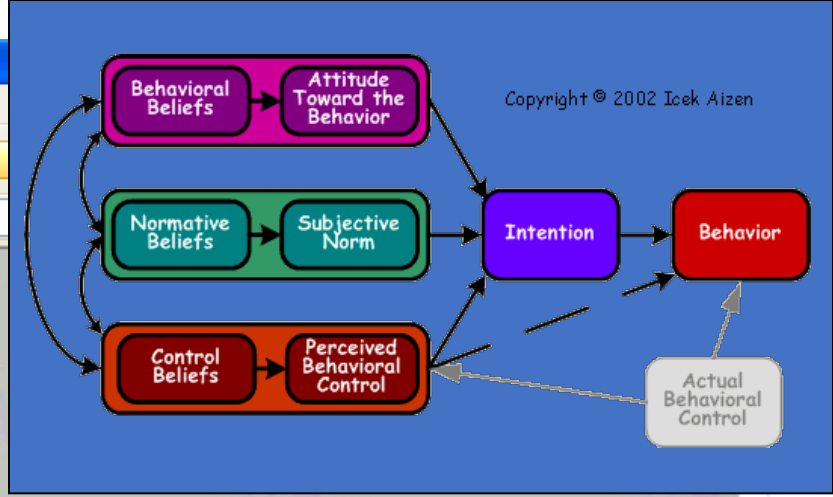
Attitude → Intention → Behavior

Subjective Norm → Intention → Behavior

Perceived Behavioral Control → Intention → Behavior

Perceived Behavioral Control → Behavior

Last modified: April 13, 2005



Technology Acceptance Model (TAM)

TAM (1989)

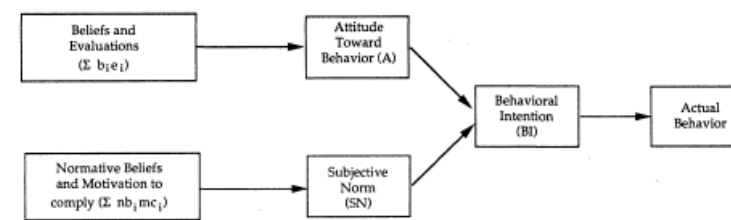


FIGURE 1. Theory of Reasoned Action (TRA).

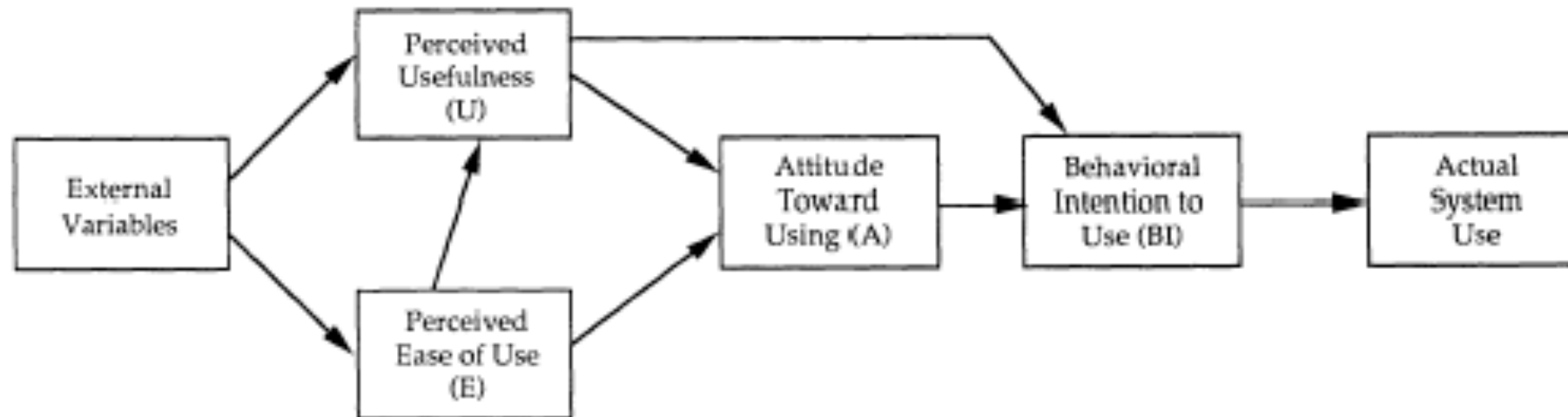


FIGURE 2. Technology Acceptance Model (TAM).

TAM2 (2000)

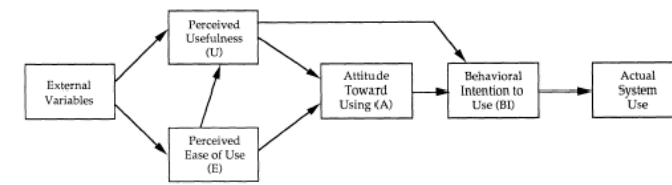
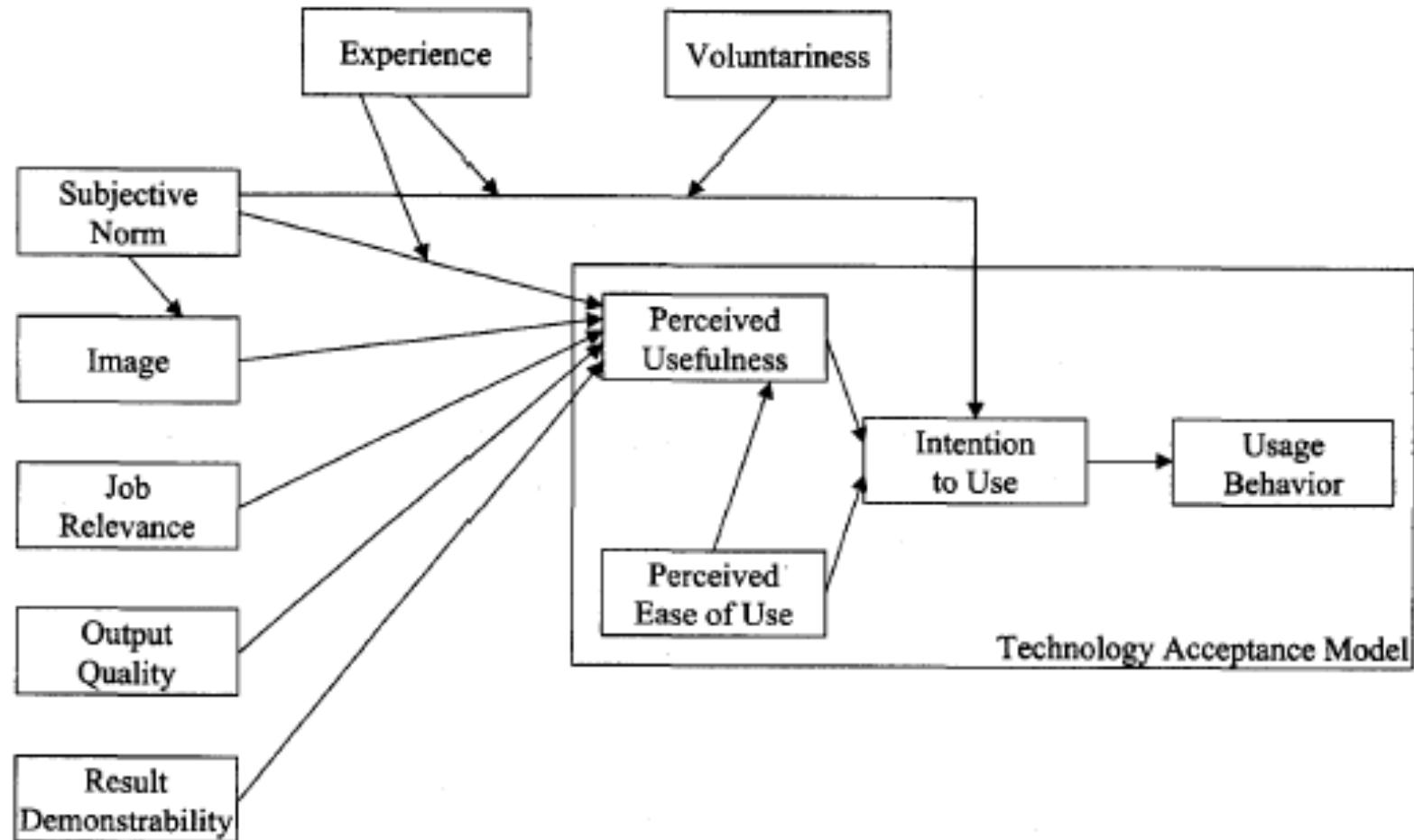


FIGURE 2. Technology Acceptance Model (TAM).

Figure 1 Proposed TAM2—Extension of the Technology Acceptance Model



Venkatesh, V., & Davis, F. D. (2000) "A theoretical extension of the technology acceptance model: Four longitudinal field studies", *Management Science*, 46(2), pp. 186-204.

Behavioral Finance

Rational Behavior

Irrational Behavior

Emotion

Sentiment

Modern Financial Research

- **Theoretical Finance**
 - study of **logical relationships among assets.**
- **Empirical Finance**
 - study of **data in order to infer relationships.**
- **Behavioral Finance**
 - integrates **psychology** into the **investment process.**

Psychology in Behavior Finance

- **Beliefs**
- **Preferences**
 - **Prospect theory**
 - **Ambiguity aversion**

Behavioral Finance Themes

- **Heuristic-Driven Bias**
- **Framing Dependence**
- **Inefficient Markets**

Herding Behavior

- **Herding refers to the lemming-like behavior of investors and analysts looking around, seeing what each other is doing, and heading in that direction.**
- **There may not have been safety in numbers, but there probably was some comfort in them.**

Herding Behavior in Finance

- Gavrilakis, N., & Floros, C. (2023).
ESG performance, herding behavior and stock market returns: evidence from Europe.
Operational Research, 23(1), 3.
- Youssef, M. (2022).
What drives herding behavior in the cryptocurrency market?
Journal of Behavioral Finance, 23(2), 230-239.
- Manahov, V. (2021).
Cryptocurrency liquidity during extreme price movements: is there a problem with virtual money?
Quantitative Finance, 21(2), 341-360.
- Hsieh, S. F., Chan, C. Y., & Wang, M. C. (2020).
Retail investor attention and herding behavior.
Journal of Empirical Finance, 59, 109-132.
- Christoffersen, J., & Staehr, S. (2019).
Individual risk tolerance and herding behaviors in financial forecasts.
European Financial Management, 25(5), 1348-1377.

Efficient Market Hypothesis (EMH)

Expected Utility Theory (EUT)

Prospect theory:

An analysis of decision under risk

Prospect Theory

(Kahneman and Tversky, 1979)

ECONOMETRICA

VOLUME 47

MARCH, 1979

NUMBER 2

PROSPECT THEORY: AN ANALYSIS OF DECISION UNDER RISK

BY DANIEL KAHNEMAN AND AMOS TVERSKY¹

This paper presents a critique of expected utility theory as a descriptive model of decision making under risk, and develops an alternative model, called prospect theory. Choices among risky prospects exhibit several pervasive effects that are inconsistent with the basic tenets of utility theory. In particular, people underweight outcomes that are merely probable in comparison with outcomes that are obtained with certainty. This tendency, called the certainty effect, contributes to risk aversion in choices involving sure gains and to risk seeking in choices involving sure losses. In addition, people generally discard components that are shared by all prospects under consideration. This tendency, called the isolation effect, leads to inconsistent preferences when the same choice is presented in different forms. An alternative theory of choice is developed, in which value is assigned to gains and losses rather than to final assets and in which probabilities are replaced by decision weights. The value function is normally concave for gains, commonly convex for losses, and is generally steeper for losses than for gains. Decision weights are generally lower than the corresponding probabilities, except in the range of low probabilities. Overweighting of low probabilities may contribute to the attractiveness of both insurance and gambling.

Source: Kahneman, Daniel, and Amos Tversky. "Prospect theory: An analysis of decision under risk."

Econometrica: Journal of the econometric society (1979): 263-291.

Decision Making under Risk

Which of the following would you prefer?

- **A:**

- **50% chance to win 1,000,**

- **50% chance to win nothing;**

- **B:**

- **450 for sure.**

Which of the following would you prefer?

A: 50% chance to win 1,000,

B: 450 for sure.

50% chance to win nothing;

Decision

PROBLEM 1: Choose between

A: 2,500 with probability .33,
2,400 with probability .66,
0 with probability .01;

B: 2,400 with certainty.

Decision

PROBLEM 1: Choose between

A: 2,500 with probability .33, B: 2,400 with certainty.
2,400 with probability .66,
0 with probability .01;

$N = 72$

[18]

[82]*

Decision

PROBLEM 2: Choose between

C: 2,500 with probability .33,
0 with probability .67; D: 2,400 with probability .34,
0 with probability .66.

Decision

PROBLEM 2: Choose between

C: 2,500 with probability .33, D: 2,400 with probability .34,
0 with probability .67; 0 with probability .66.

$N = 72$ $[83]^*$ $[17]$

Expected Utility

$$u(2,400) > .33u(2,500) + .66u(2,400) \text{ or } .34u(2,400) > .33u(2,500)$$

Decision

PROBLEM 3:

A: (4,000,.80), or B: (3,000).

Decision

PROBLEM 3:

A: (4,000,.80), or B: (3,000).

$N = 95$ [20] [80]*

Decision

PROBLEM 4:

C: (4,000,.20), or D: (3,000,.25).

Decision

PROBLEM 4:

C: (4,000,.20), or D: (3,000,.25).

$N = 95$ [65]* [35]

Decision

PROBLEM 5:

A: 50% chance to win a three-week tour of England, France, and Italy;

$N = 72$ [22]

B: A one-week tour of England, with certainty.

[78]*

PROBLEM 6:

C: 5% chance to win a three-week tour of England, France, and Italy;

$N = 72$ [67]*

D: 10% chance to win a one-week tour of England.

[33]

Decision

PROBLEM 7:

A: (6,000, .45), B: (3,000, .90).

$N = 66$ [14]

[86]*

PROBLEM 8:

C: (6,000, .001), D: (3,000, .002).

$N = 66$ [73]*

[27]

Preferences Between Positive and Negative Prospects

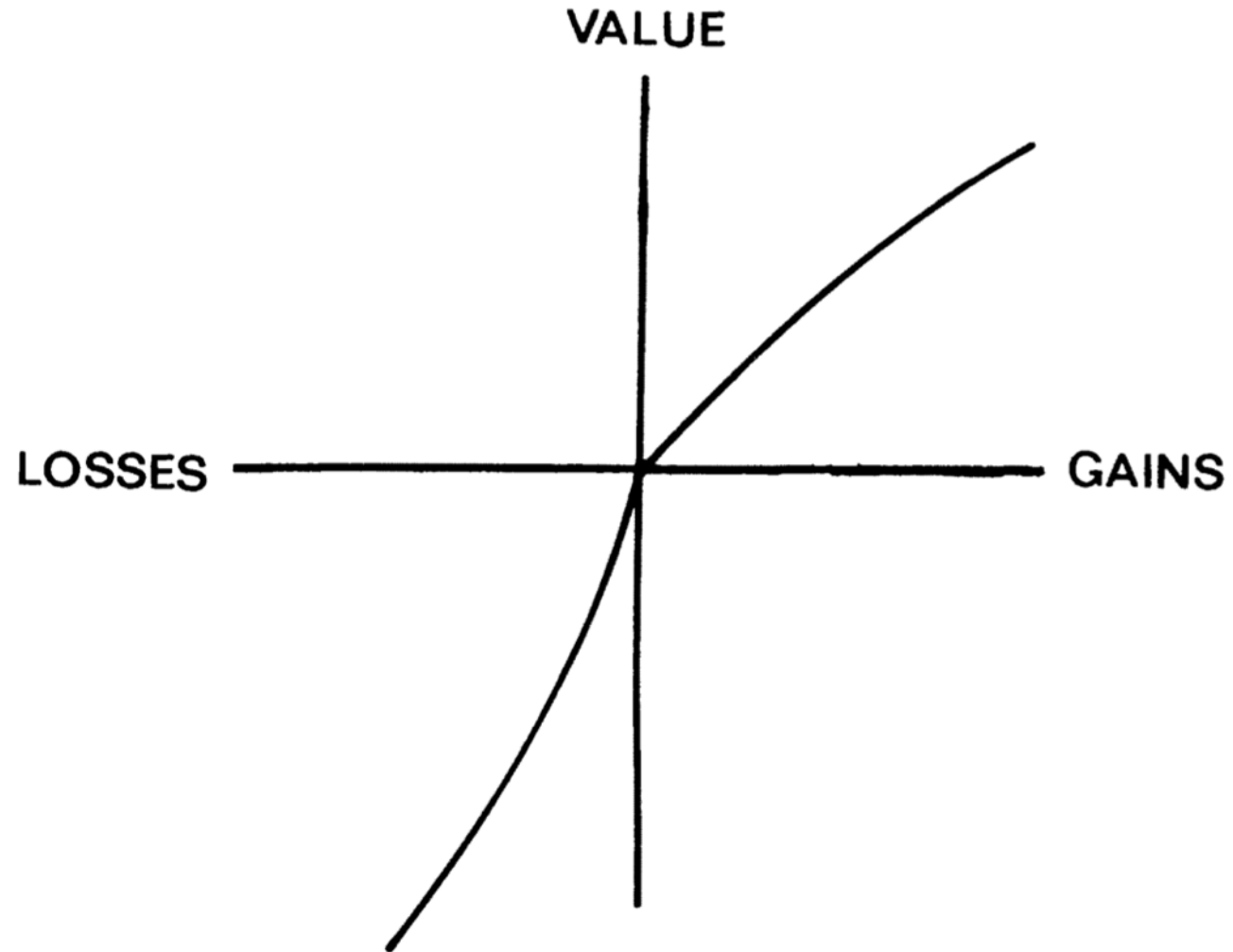
Positive prospects		Negative prospects	
Problem 3: $N = 95$	$(4,000, .80) < (3,000).$ [20] [80]*	Problem 3': $N = 95$	$(-4,000, .80) > (-3,000).$ [92]* [8]
Problem 4: $N = 95$	$(4,000, .20) > (3,000, .25).$ [65]* [35]	Problem 4': $N = 95$	$(-4,000, .20) < (-3,000, .25).$ [42] [58]
Problem 7: $N = 66$	$(3,000, .90) > (6,000, .45).$ [86]* [14]	Problem 7': $N = 66$	$(-3,000, .90) < (-6,000, .45).$ [8] [92]*
Problem 8: $N = 66$	$(3,000, .002) < (6,000, .001).$ [27] [73]*	Problem 8': $N = 66$	$(-3,000, .002) > (-6,000, .001).$ [70]* [30]

Certainty, Probability, and Possibility

Source: Kahneman, Daniel, and Amos Tversky. "Prospect theory: An analysis of decision under risk."
Econometrica: Journal of the econometric society (1979): 263-291.

Prospect theory

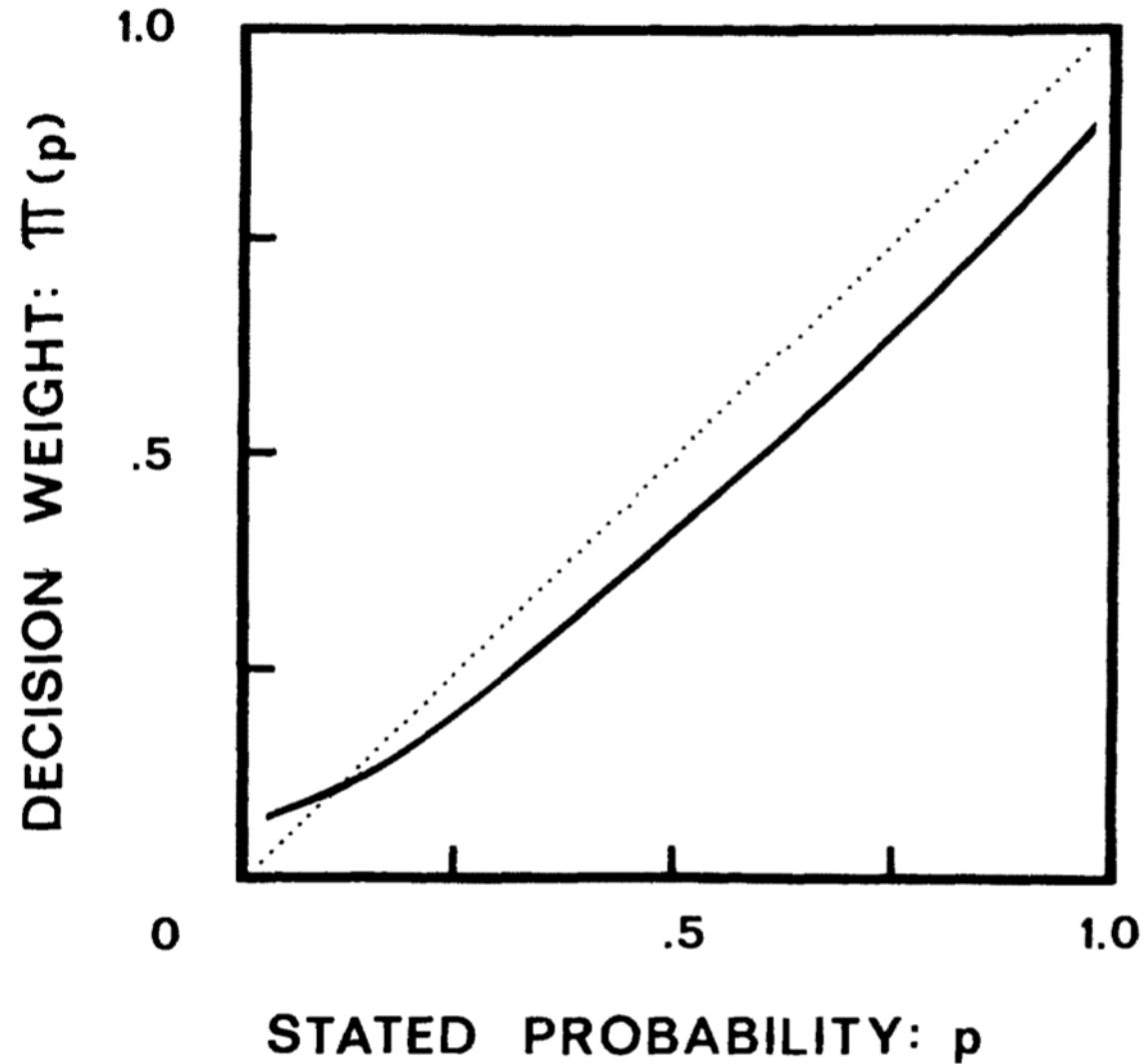
Value Function



Source: Kahneman, Daniel, and Amos Tversky. "Prospect theory: An analysis of decision under risk."
Econometrica: Journal of the econometric society (1979): 263-291.

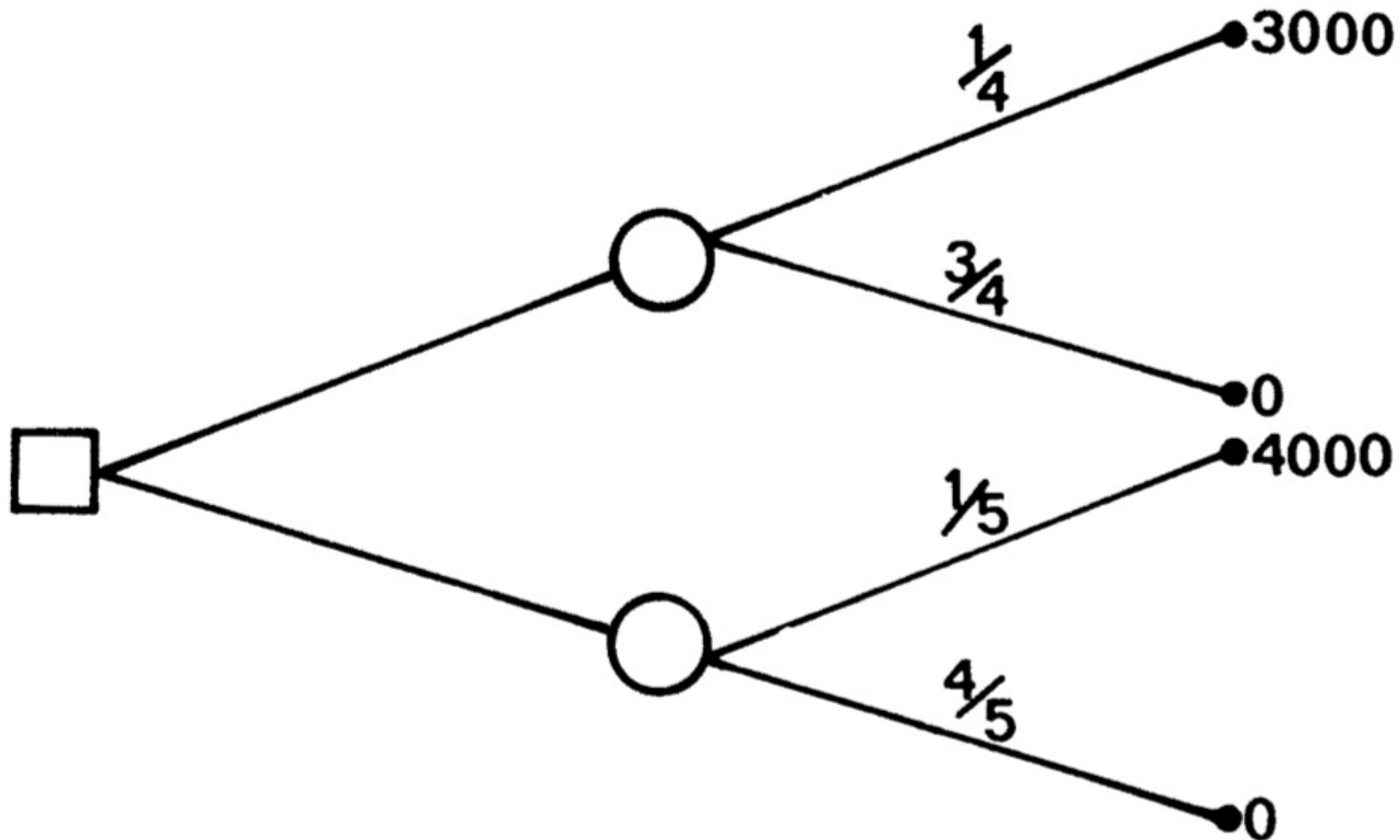
Prospect theory

Weighting Function

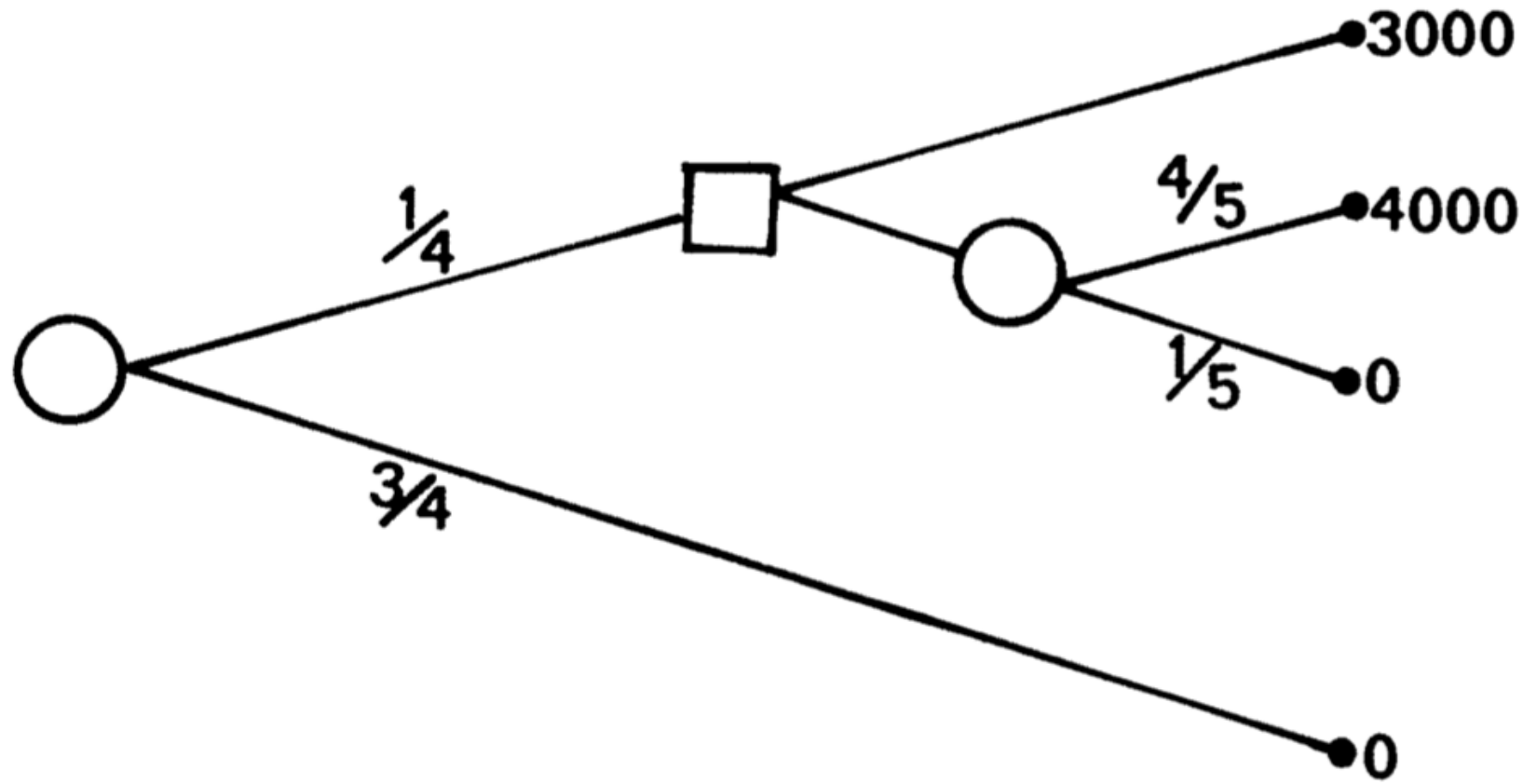


Source: Kahneman, Daniel, and Amos Tversky. "Prospect theory: An analysis of decision under risk." *Econometrica: Journal of the econometric society* (1979): 263-291.

Problem 4 as a decision tree (standard formulation)



Problem 10 as a decision tree (sequential formulation)



Decision

PROBLEM 13:

$(6,000, .25),$ or $(4,000, .25; 2,000, .25).$
 $N = 68$ [18] [82]*

PROBLEM 13':

$(-6,000, .25),$ or $(-4,000, .25; -2,000, .25).$
 $N = 64$ [70]* [30]

Decision

PROBLEM 14:

$(5,000, .001)$, or (5) .
 $N = 72$ $[72]^*$ $[28]$

PROBLEM 14':

$(-5,000, .001)$, or (-5) .
 $N = 72$ $[17]$ $[83]^*$

Prospect theory

- People underweight outcomes that are merely probable in comparison with outcomes that are obtained with certainty.
- This tendency, called the **certainty effect**, contributes to **risk aversion** in choices involving **sure gains** and to **risk seeking** in choices involving **sure losses**.

Prospect theory

- People generally discard components that are shared by all prospects under consideration.
- This tendency, called the **isolation effect**, leads to **inconsistent preferences** when the **same choice** is presented in different form .

Prospect theory

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Prospect theory

- **Value** is assigned to **gains and losses** rather than to **final assets** and in which **probabilities** are replaced by **decision weights**.
- The value function is normally concave for gains, commonly convex for losses, and is generally steeper for losses than for gains.

Prospect theory

- **Decision weights** are generally **lower** than the corresponding probabilities, except in the range of low probabilities.
- **Overweighting** of low probabilities may contribute to the attractiveness of both insurance and gambling.

Behavioral Heuristics and Biases in Decision Making

Behavioral Finance Anomalies

- **The Rational Man**
 - **Consumer Choice with Certainty**
 - **Consumer Choice with Uncertainty**
 - **The Allais Paradox**

Prospect Theory

- **The Reference Point**
- **The S-Curve**
- **Loss Aversion**

Behavioral Finance Anomalies

- **Perception Biases**
- **Inertial Effects**
- **Causality and Statistics**
- **Illusions**

Perception Biases

- **Saliency**
- **Framing**
- **Anchoring**
- **Sunk Cost Bias**

Inertial Effects

- **Endowment Effect**
- **Status Quo Effect**
- **Disposition Effect**

Causality and Statistics

- **Representativeness**
- **Conjunction Fallacy**
- **Reading into Randomness**
- **Small Sample Bias**
- **Probability Neglect**

Illusions

- **Illusion of Talent**
- **Illusion of Skill**
- **Illusion of Superiority**
- **Illusion of Validity**

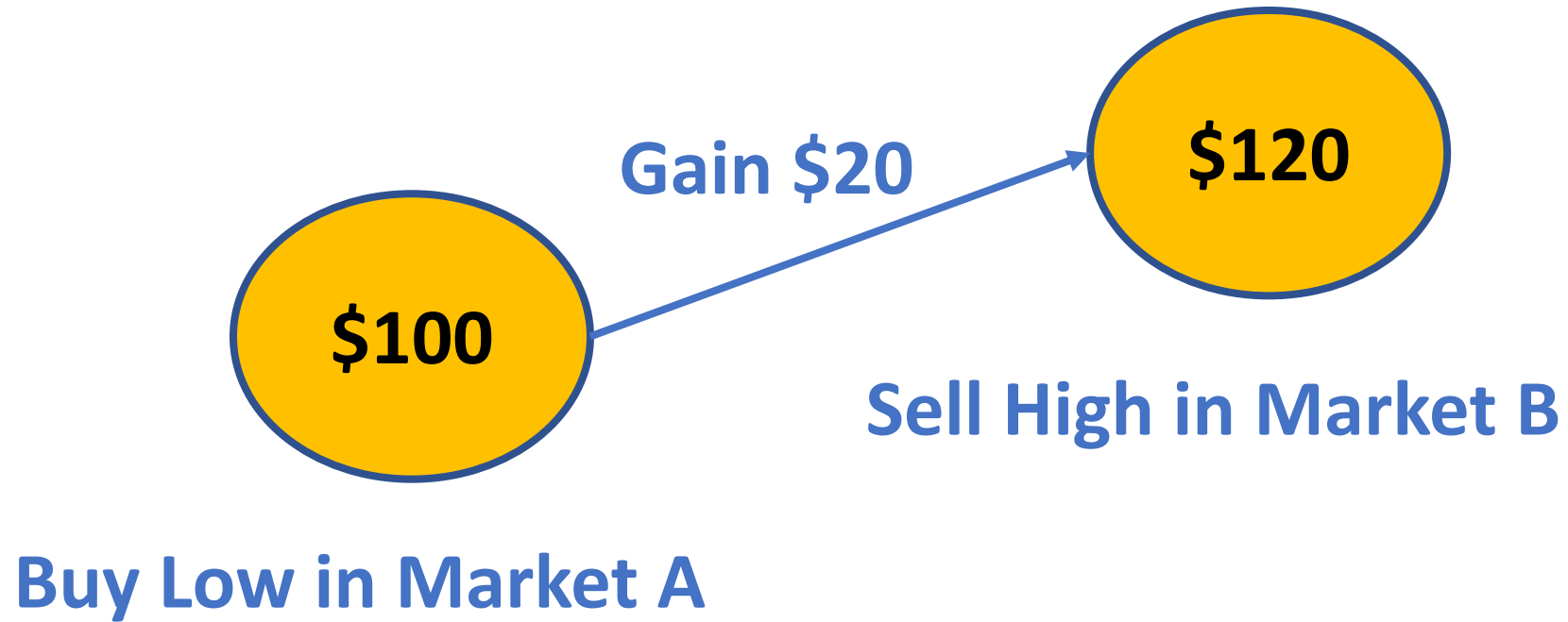
Behavioral Finance: Two Major Foundations

- **Investor Sentiment**
 - **creates disturbances to efficient prices.**
- **Limited arbitrage**
 - **arbitrage is never riskfree, hence it does not counter irrational disturbances.**
 - Prices may not react to information by the “right” amount.
 - Prices may react to non-information.
 - Markets may remain efficient.

Arbitrage



Arbitrage



Heuristics

- **Overconfidence**
 - **people overestimate the reliability of their knowledge.**
- **Excessive trading**
- **Framing Effect**

Heuristics

- **Regret Aversion**
 - **anticipation of a future regret can influence current decision.**
- **Disposition Effect**
 - **sell winners, hold on to the losers.**
- **Anchoring and adjustment: can create under-reaction.**

Fashions and Fads

- **People are influenced by each other. There is a social pressure to conform.**
- **Herding behavior: “safety-in-numbers”.**
- **Informational Cascades**
- **Positive Feedback**
- **Example: excessive demand for internet IPOs. Extremely high opening day returns.**

Social Influences

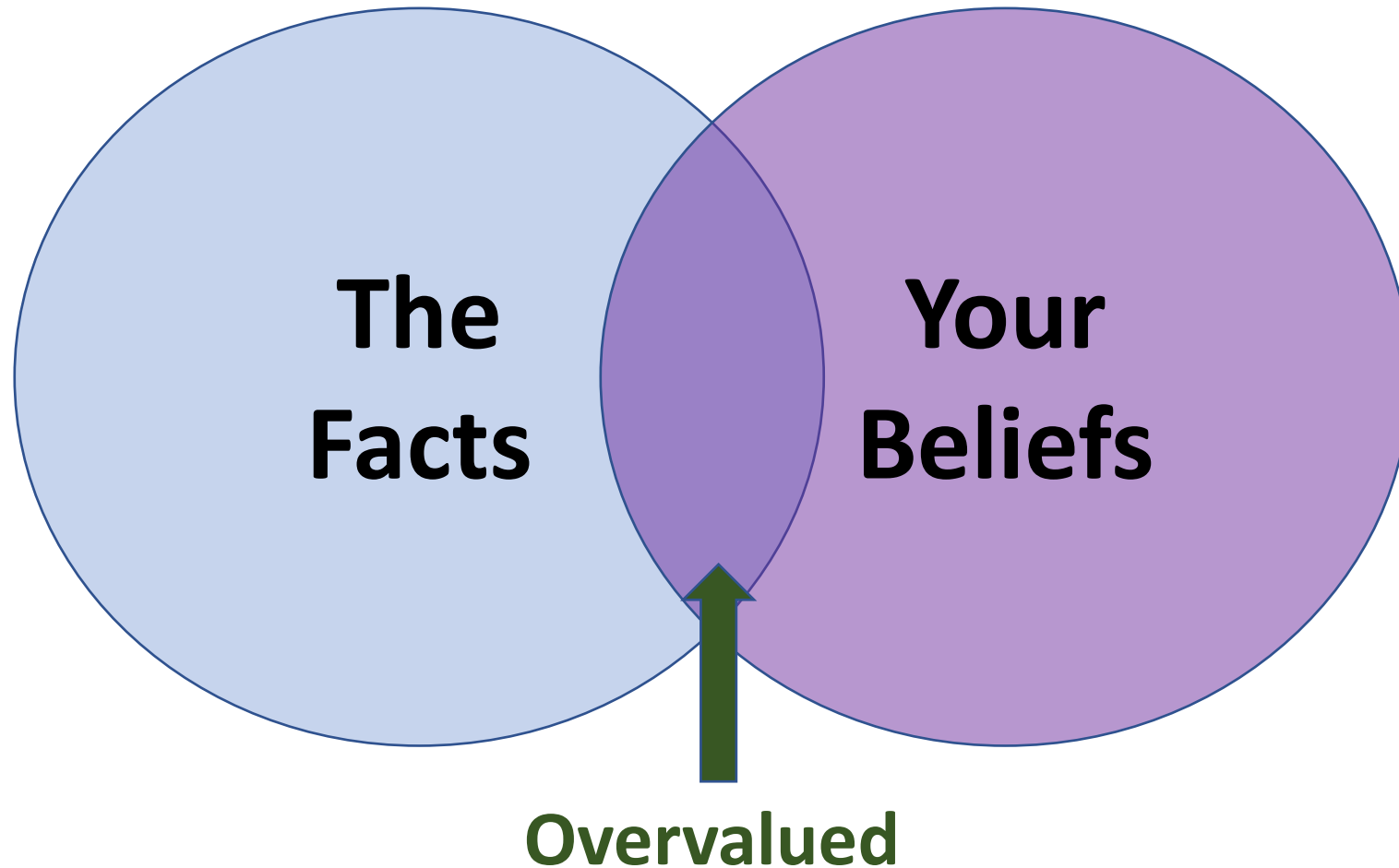
- **Social norms**
 - The informal opinions, rules, and procedures of a group.
 - Your peers and social groups influence your investment participation
- **Herding Behavior**
 - The movement into or out of a stock or industry of companies by large groups of investors.

Psychology of Belief

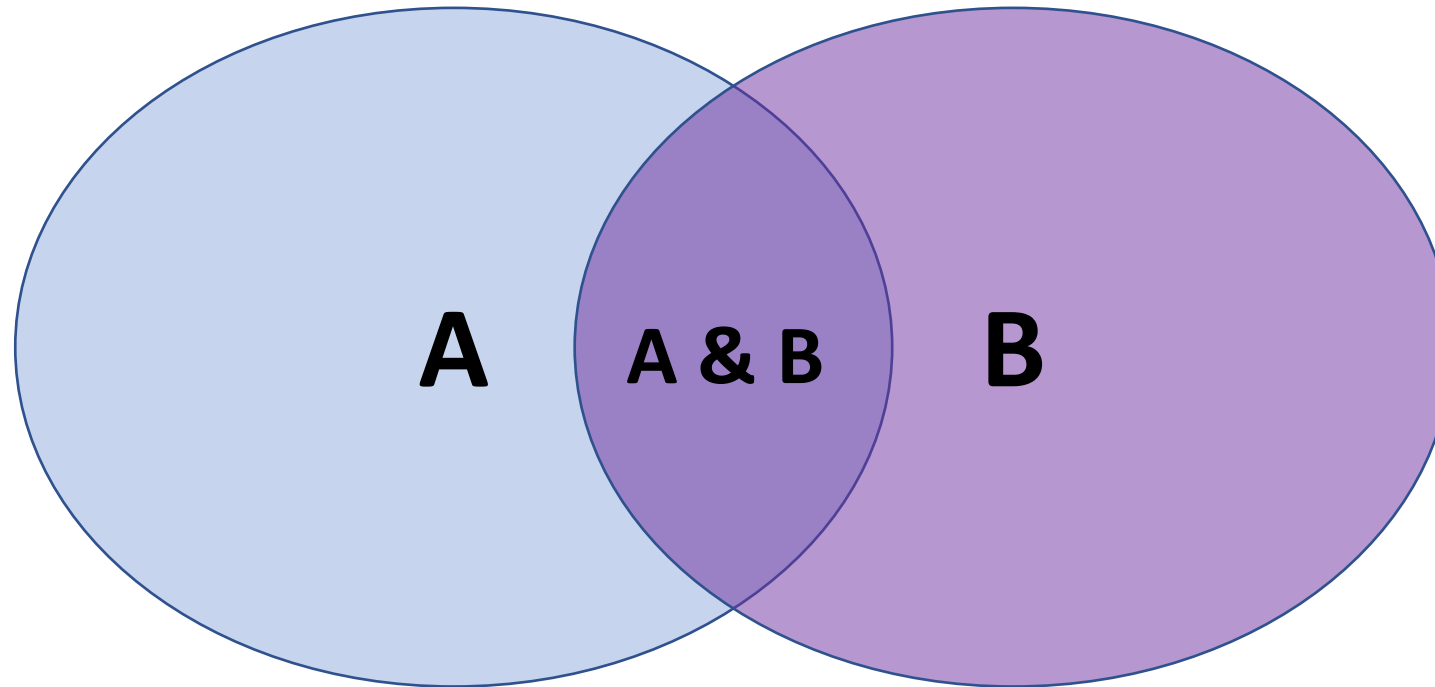
Confirmation Bias



Confirmation Bias



Representativeness Heuristic



$$P(A \& B) < P(A) \text{ or } P(B)$$

Katona's Economic Psychology Model

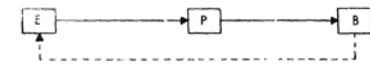
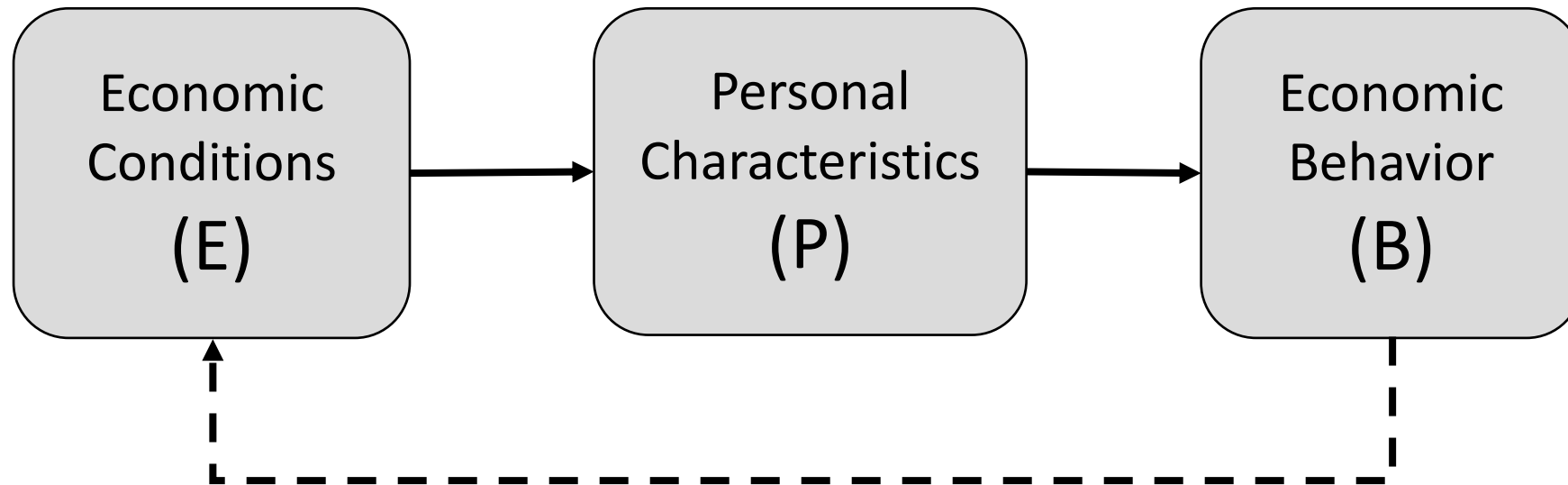
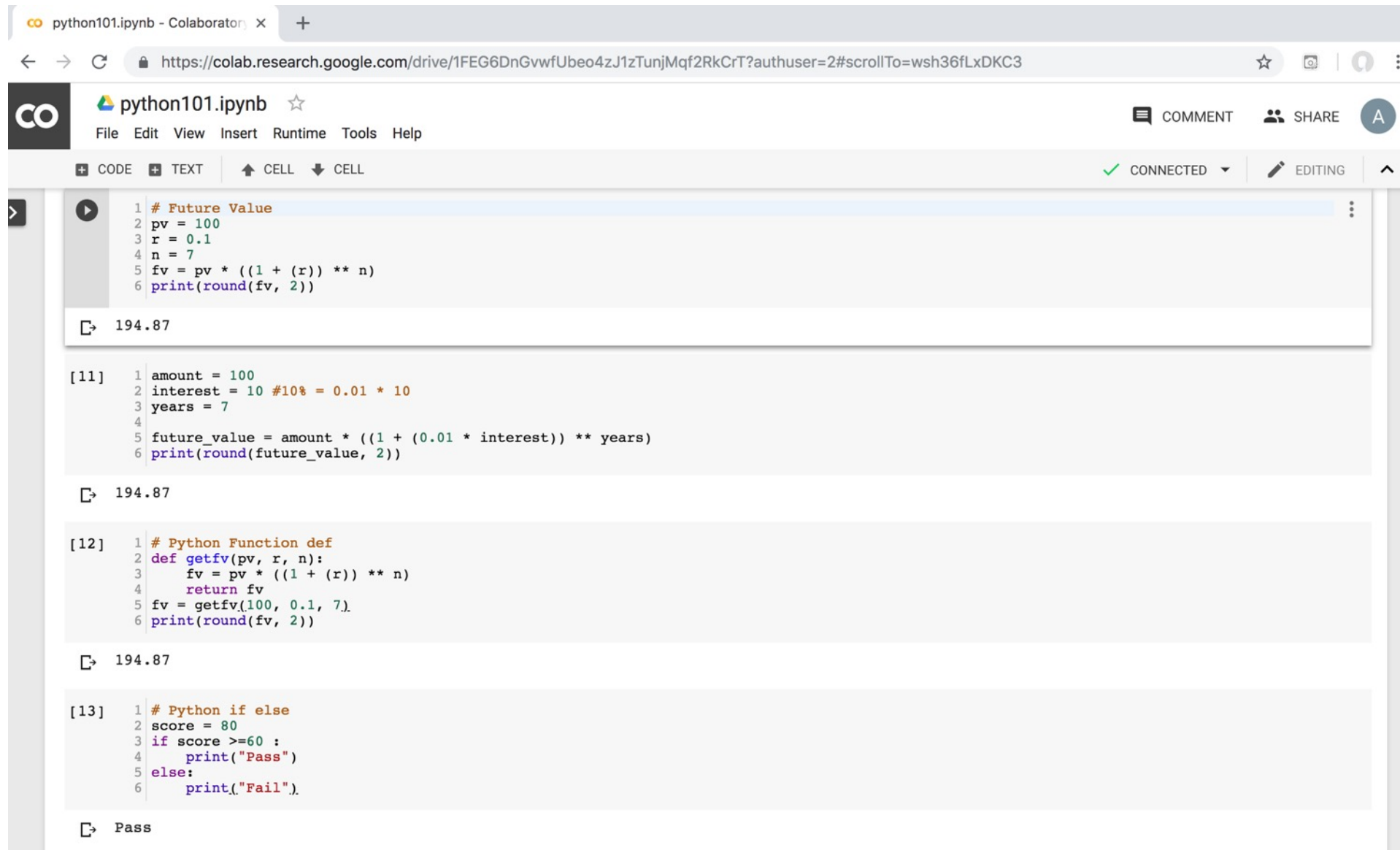


Fig. 1. Katona's model



Python in Google Colab (Python101)

<https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT>



The screenshot shows a Google Colab notebook interface. The browser address bar displays the URL: <https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT?authuser=2#scrollTo=wsh36fLxDKC3>. The notebook title is "python101.ipynb". The interface includes a menu bar (File, Edit, View, Insert, Runtime, Tools, Help) and a toolbar with options for CODE, TEXT, CELL, and a status indicator showing "CONNECTED" and "EDITING".

The notebook contains four code cells, each followed by its output:

```
1 # Future Value
2 pv = 100
3 r = 0.1
4 n = 7
5 fv = pv * ((1 + (r)) ** n)
6 print(round(fv, 2))
```

194.87

```
[11] 1 amount = 100
     2 interest = 10 #10% = 0.01 * 10
     3 years = 7
     4
     5 future_value = amount * ((1 + (0.01 * interest)) ** years)
     6 print(round(future_value, 2))
```

194.87

```
[12] 1 # Python Function def
     2 def getfv(pv, r, n):
     3     fv = pv * ((1 + (r)) ** n)
     4     return fv
     5 fv = getfv(100, 0.1, 7).
     6 print(round(fv, 2))
```

194.87

```
[13] 1 # Python if else
     2 score = 80
     3 if score >=60 :
     4     print("Pass")
     5 else:
     6     print("Fail").
```

Pass

<https://tinyurl.com/aintpupython101>

Summary

- **Investing Psychology**
 - **Investor Sentiment**
 - **Consumer Psychology and Behavior**
- **Behavioral Finance**
 - **Prospect Theory: An Analysis of Decision Under Risk**
 - **Behavioral Heuristics and Biases in Decision Making**
 - **Herding Behavior in Finance**

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