

Section 6: Behavioral Finance Part II

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Game Theory in Behavior Finance

Game Theory

- In traditional economics, actors optimize by making decisions independent of what the other actors are doing
- Examples:
 - Consumption decision
 - Production decision
 - Input decision
- Game theory explores interaction of players decisions and payoffs

Game Theory

- ▶ Simple games involve
 - ▶ Two players
 - ▶ Two “strategies”
- ▶ Create a two by two payoff matrix
- ▶ Classic games
 - ▶ Prisoners Dilemma (public goods) game
 - ▶ Stag and Hare (assurance, pure cooperation) game
 - ▶ Hawk and Dove (conflict) game

Hawk or Dove?



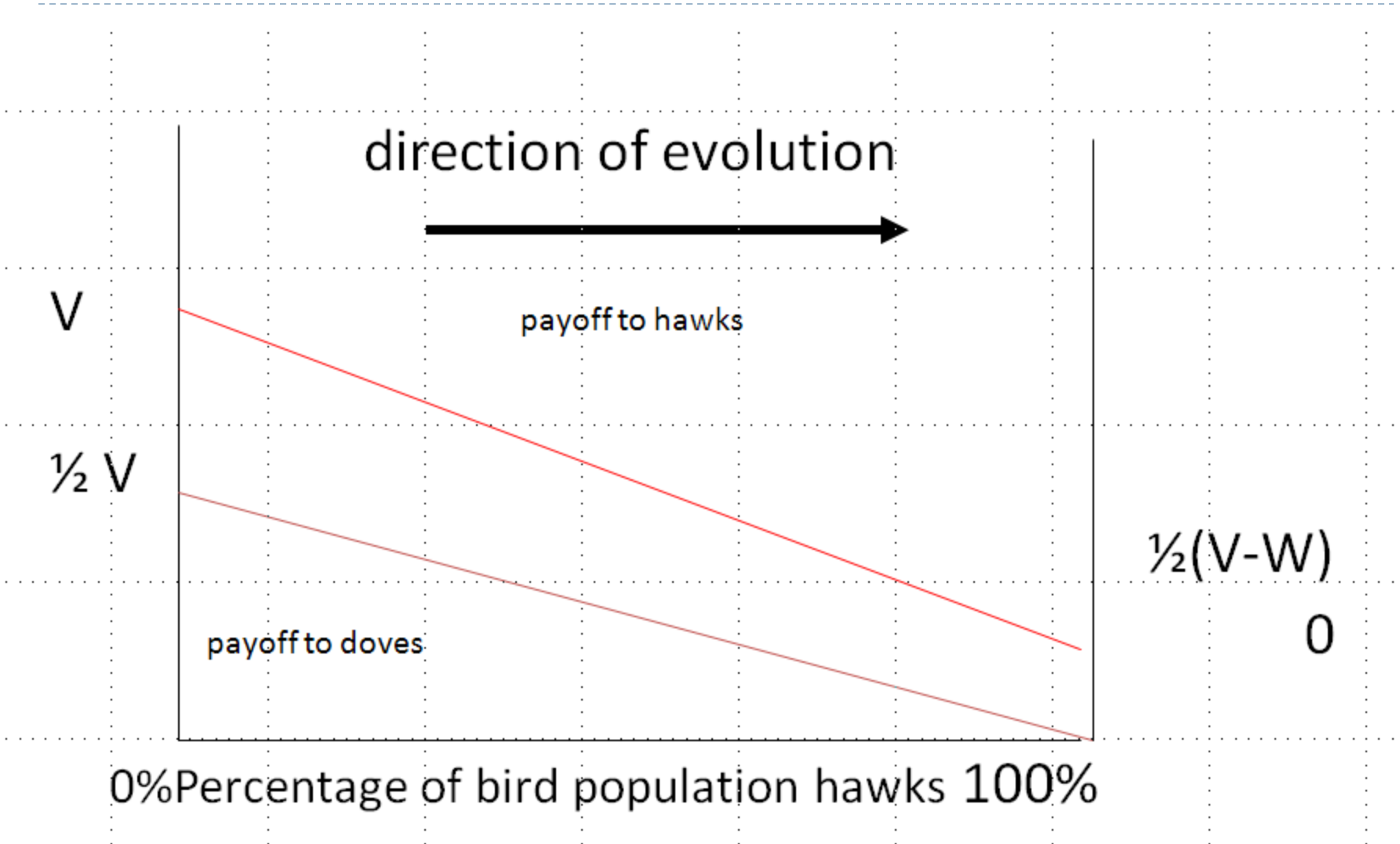
Payoffs

	Hawk	Dove
Hawk	$\frac{1}{2} (V-W)$ $\frac{1}{2} (V-W)$	0 V
Dove	V 0	$\frac{1}{2} V$ $\frac{1}{2} V$

Payoffs if $V > W$

	Hawk	Dove
Hawk	$\frac{1}{2}(V-W)$ $\frac{1}{2}(V-W)$	0 V
Dove	V 0	$\frac{1}{2}V$ $\frac{1}{2}V$

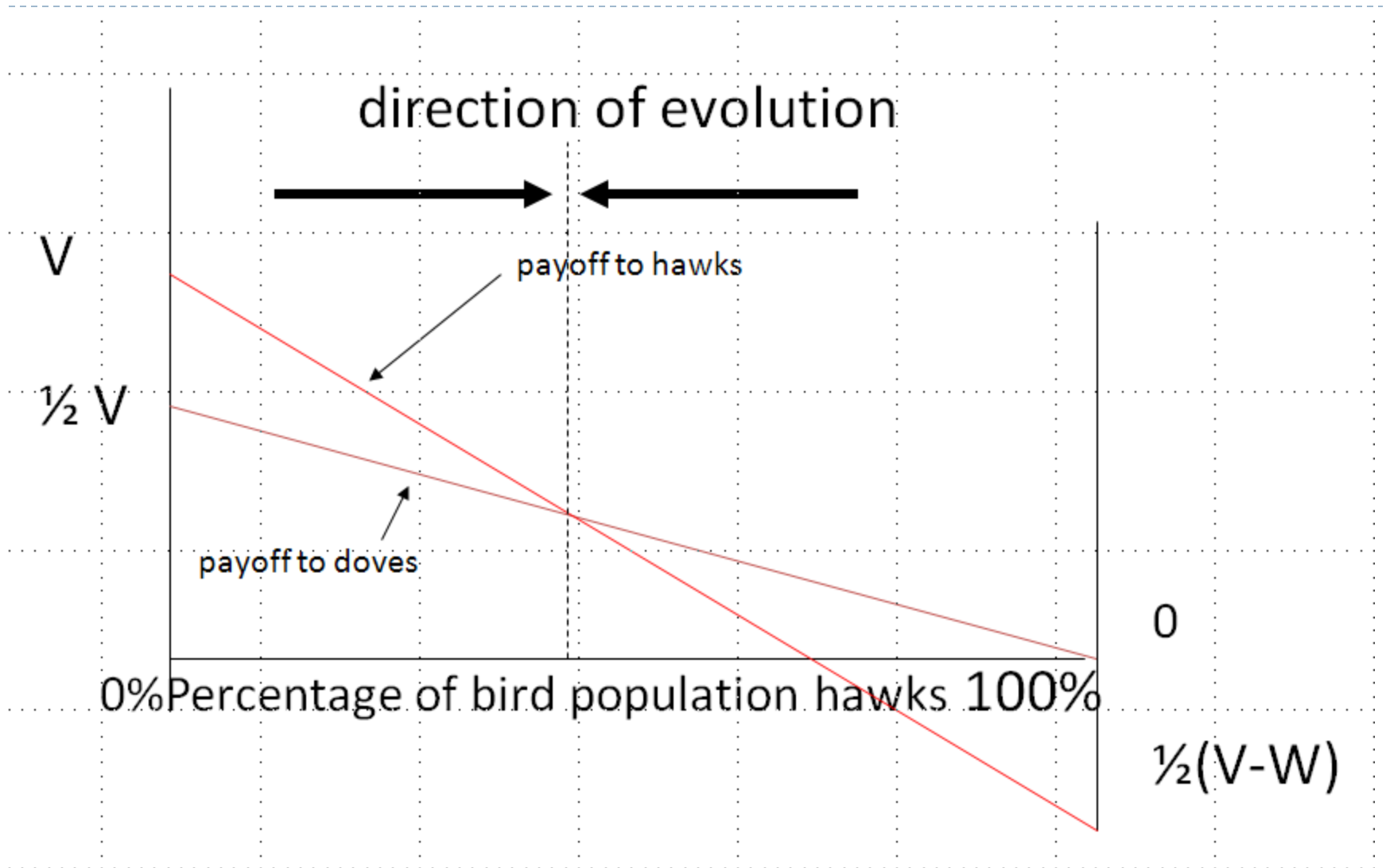
If $V > W$



If $V < W$, which is best?

	Hawk	Dove
Hawk	$\frac{1}{2}(V-W)$ $\frac{1}{2}(V-W)$	0 V
Dove	V 0	$\frac{1}{2}V$ $\frac{1}{2}V$

If $V < W$



Frequency Dependent Strategies

- ▶ If alternative strategies coexist in equilibrium and, we say that the strategy's success is “frequency dependent”
- ▶ For you game theory buffs, it's the same as “mixed strategy”

Investment Strategies

- ▶ Suppose you are a fund manager: there are two sources of information
 - ▶ Your independent research
 - ▶ The price of the stock
- ▶ If you believe in efficient markets, you have to believe that the current stock price is correct, so you should ignore your independent research

Investment Strategies

(Grossman and Stiglitz)

- ▶ Suppose research is costly.
- ▶ You can choose one of two strategies:
 - ▶ Active: do research and follow its results
 - ▶ Passive: buy the market bundle
- ▶ In a world of Actives, it pays to be passive
- ▶ In a world of Passives, it pays to be active
- ▶ Strategy is frequency dependent

Noise Traders

- ▶ Now, suppose that you choose to undertake research and uncover a mispricing in an asset
- ▶ How do you make money?
- ▶ Who do you trade with?
- ▶ Liquidity traders VS Noise Traders
 - ▶ Do noise traders exist?
 - ▶ Do they matter?

A Beauty Contest

- ▶ What does this game have to do with noise trader risk and the limits of arbitrage?
- ▶ What is the Nash equilibrium for this game?
- ▶ What happens if you play the Nash equilibrium play and no one else does so?

Biases and Heuristic

Investment mistakes

- ▶ Thousands of years of evolution have made us into very intelligent problem solvers
- ▶ Yet the problems that we faced for those thousands of years did not include investing in the stock market, saving for retirement, dealing with financial markets, dealing with randomness

Biases, heuristics, and the individual investor

- ▶ Why should we care?
 - ▶ Asset prices
 - ▶ Investor welfare
 - ▶ Own welfare

Investor's problem

- ▶ Choose portfolio of assets:
 - ▶ Estimate probabilities (e.g., risks and rewards)
 - ▶ Estimate covariance
 - ▶ Match with own preferences (e.g., choose)
 - ▶ Integrate new information

Estimating Probabilities

- ▶ It happened to me
- ▶ It happened to my friends
- ▶ I can easily remember it happening
- ▶ It happened recently
- ▶ I can easily imagine how it could happen

Randomness



One way thoughts come to mind

17 X 24 is

Another way thoughts come to mind



What is happening here?

- ▶ The product 17×24
 - ▶ A sequential computation, governed by a rule
- ▶ The impression that the woman is angry
 - ▶ Simply comes to mind
 - ▶ She looks angry just as she looks dark-haired
- ▶ The subjective experience of intuitive thinking resembles that of seeing
 - ▶ It feels like something that happens to us
 - ▶ Not something we do

Intuition
System 1

Reasoning
System 2

Fast
Parallel
Automatic
Effortless
Associative
Slow-learning
Emotional

Slow
Serial
Controlled
Effortful
Rule-governed
Flexible
Neutral

Most judgments and actions are governed by System 1, unproblematic, skilled, and adequately successful

“A bat and a ball together cost \$1.10. The bat costs a dollar more than the ball. How much does the ball cost?”

Automatic

- ▶ In Shane Frederick's bat-and-ball problem, "10 cents" comes automatically to everyone's mind
- ▶ The question: Is system 2 monitoring system 1?
- ▶ If monitoring is effective, the error will be blocked

Effortless or Effortful

- ▶ How to tell whether a mental activity is effortful:
 - ▶ Can you do it while making a left turn into traffic?
- ▶ Effortful actions interfere with each other
- ▶ Self-monitoring is effortful
 - ▶ We make more silly mistakes when tired or busy
 - ▶ We make fewer mistakes when we care

Bounded Rationality

- ▶ Limited processing ability
- ▶ Limited information
- ▶ Limited time
- ▶ Heuristics and biases

Randomness

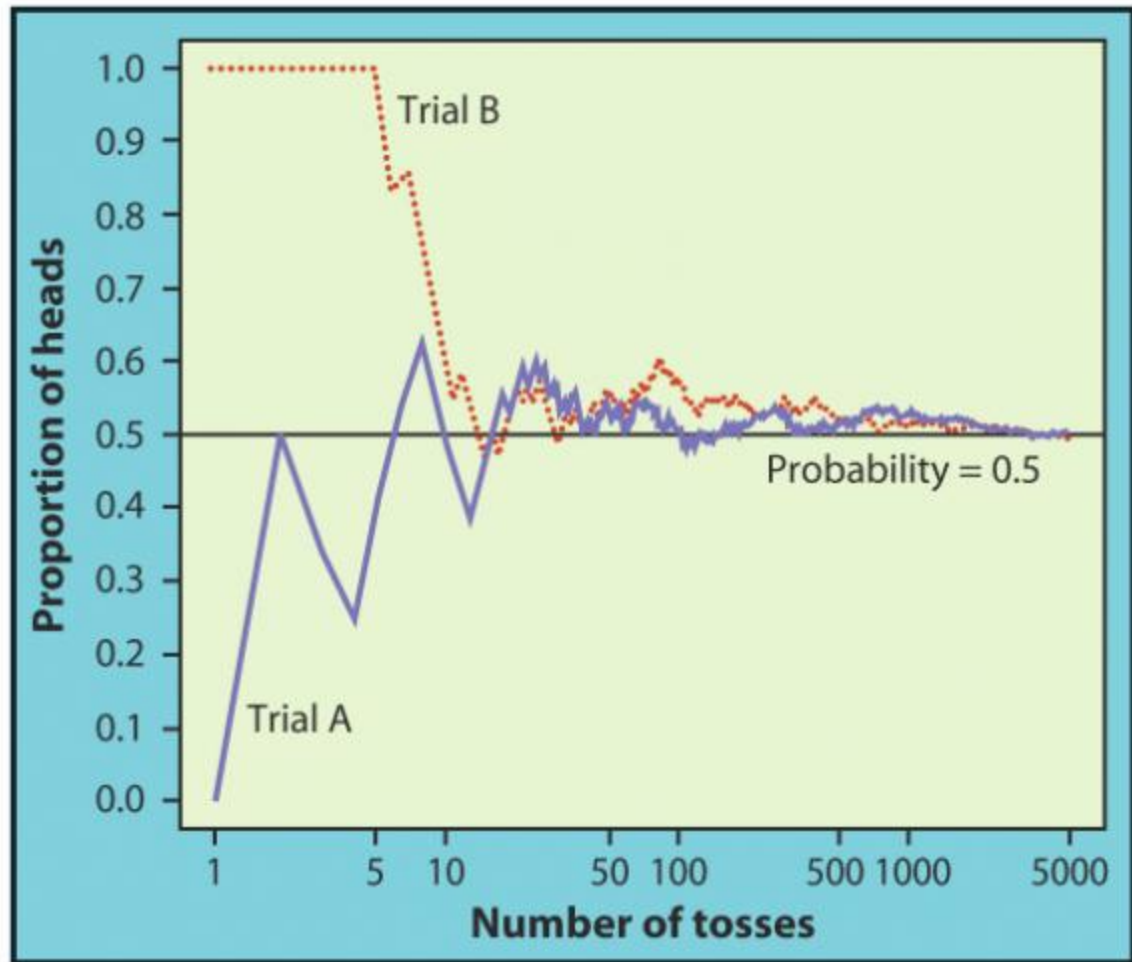
- ▶ In a series of coin flips, using a fair coin, which is a more likely sequence?

HHHH

HTTH



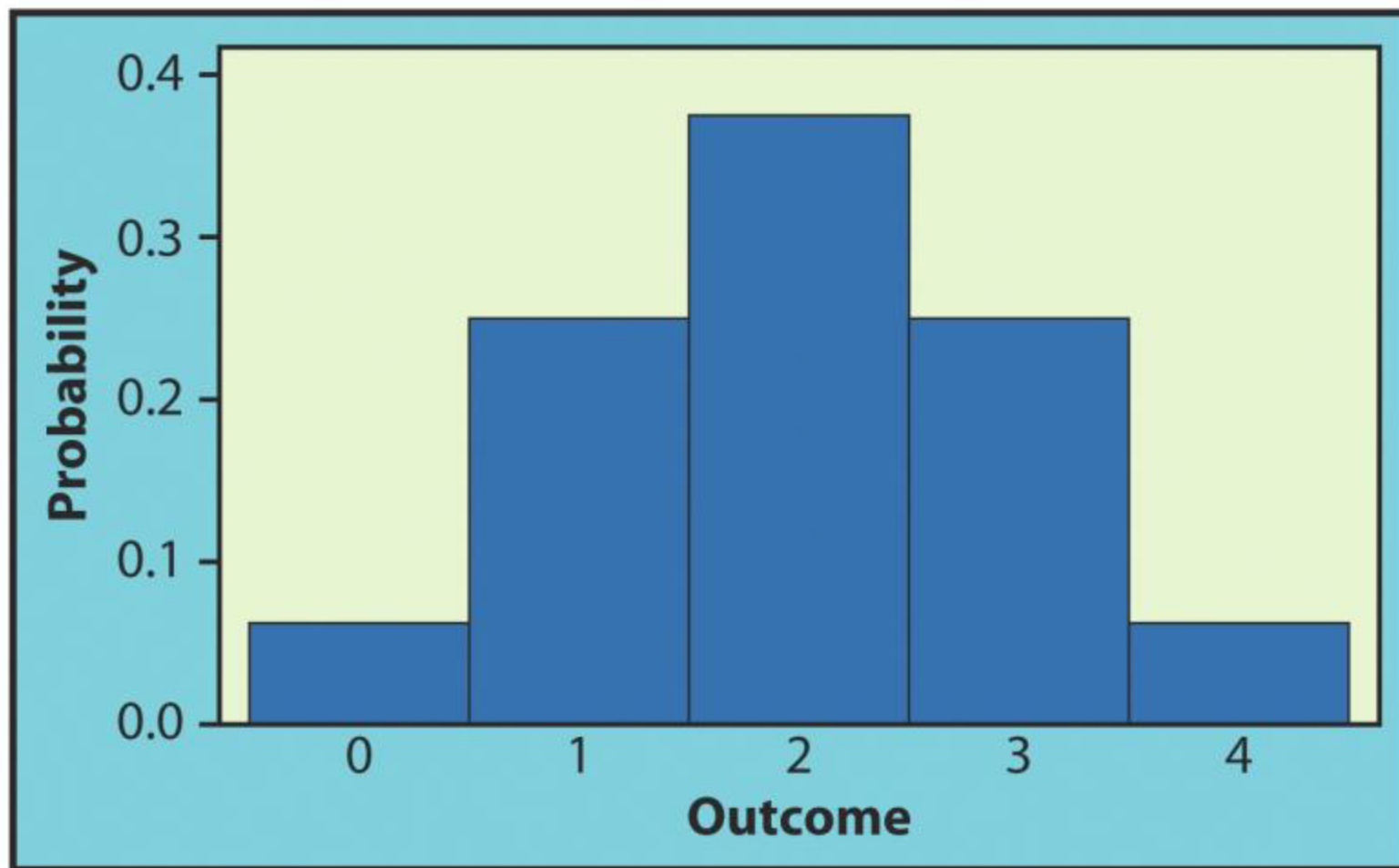
Coin Tossing



Randomness and Probability

- ▶ **Randomness**: Something is random if individual outcomes are uncertain but there is nonetheless a regular distribution of outcomes in a large number of repetitions
- ▶ The **probability** of any outcome in a random process is the proportion of times the outcome would occur in a long series of repetitions

Coin Toss Example



Birthdays and Coincidences

- ▶ Look to the person next to you
- ▶ What is the probability that he or she shares your birthday?
- ▶ Now what is the probability that someone in the class has your birthday?

Biases, heuristics, and investors

- ▶ **Representativeness, Availability, Anchoring & Adjustment**
 - ▶ Hot hand and gamblers fallacy
 - ▶ Ignoring sample size
 - ▶ Regression to the mean
 - ▶ Conjunction fallacy
 - ▶ Ignoring base rates
 - ▶ Anchoring
 - ▶ Hindsight bias
 - ▶ Confirmation bias

Misconceptions of chance

Individuals expect that a sequence of data generated by a random process will look “random”, even when the sequence is too short for those expectations to be statistically valid.

Example: The hot hand

The Hot Hand

- ▶ Player A and Player B historically have the same shooting percentage. It's the end of the game and your team is down by one point. You have the ball with a time out
 - ▶ Player A has made her last three shots
 - ▶ Player B has missed her last three shots
- ▶ Who should you call the play for?



The Hot Hand in Basketball

TABLE 3
Probability of Making a Second Free Throw Conditioned on the Outcome of the First Free Throw for Nine Members of the Boston Celtics during the 1980–1981 and 1981–1982 Seasons

Player	$P(H_2/M_1)$	$P(H_2/H_1)$	Serial correlation r
Larry Bird	.91 (53)	.88 (285)	– .032
Cedric Maxwell	.76 (128)	.81 (302)	.061
Robert Parish	.72 (105)	.77 (213)	.056
Nate Archibald	.82 (76)	.83 (245)	.014
Chris Ford	.77 (22)	.71 (51)	– .069
Kevin McHale	.59 (49)	.73 (128)	.130
M. L. Carr	.81 (26)	.68 (57)	– .128
Rick Robey	.61 (80)	.59 (91)	– .019
Gerald Henderson	.78 (37)	.76 (101)	– .022

Note. The number of shots upon which each probability is based is given in parentheses.

Gambler's Fallacy

- ▶ You are watching the roulette wheel getting ready to play.
- ▶ You observe that the last three spins have resulted in a “Red” number winning
- ▶ If you place a bet right now, which should you bet on?
 - ▶ Black or Red?



Which direction is it headed?



Takeaway

- ▶ We are not very good at identifying or understanding randomness
- ▶ We have a tendency to see trends where there are none
- ▶ We tend to see illusory causes
- ▶ We frequently confuse “signal” and “noise”

Insensitivity to sample size

Individual frequently fail to appreciate the role of sample size in assessing the reliability of sample information

Example: Hospitals

Probabilities

- ▶ Hospital A has 45 births a day
- ▶ Hospital B has 15 births a day
- ▶ Which hospital is more likely to have 60% boys in any given day?

Regression to the Mean

- ▶ You are the coach of a football team
- ▶ Every time your quarterback does a terrible job, you yell at him, and in the next game he usually does better
- ▶ Every time your quarterback does a great job, you praise him, and in the next game he usually does worse
- ▶ You conclude that negative feedback is more effective than positive feedback
- ▶ Are you right?



There must be 50 ways to die

- ▶ Which is a more likely cause of death in the United States – being killed by falling airplane parts or by a shark
- ▶ For each pair, circle the cause of death that is the most common in the United States:
 - ▶ Diabetes/Homicide
 - ▶ Tornado/Lightning
 - ▶ Car Accidents/Stomach Cancer

Availability

- ▶ Individuals judge events that are more easily recalled from memory or imagined to be more numerous than events of equal frequency whose instances are less easily recalled
- ▶ Example: 50 ways to die
- ▶ Vividness and recentness

Availability Heuristic

The rule of thumb by which people assess the frequency of a class or the probability of an event by the ease with which instances or occurrences can be brought to mind

Simpson's Paradox

- ▶ Simpson's paradox: an association that holds for all of several groups can reverse the direction when the data are combined
- ▶ Which airline is on time?

	Alaska		America West	
	On Time	Delayed	On Time	Delayed
LAX	497	62	694	117
PHX	221	12	4840	415
SAN	212	20	383	65
SFO	503	102	320	129
SEA	1841	305	201	61

Which airline is on time?

	Alaska	America West
On Time	3274	6438
Delayed	501 13.3%	787 10.9%
Total	3775	7225

Key takeaway: our gut instincts aren't always so good when it comes to numbers.

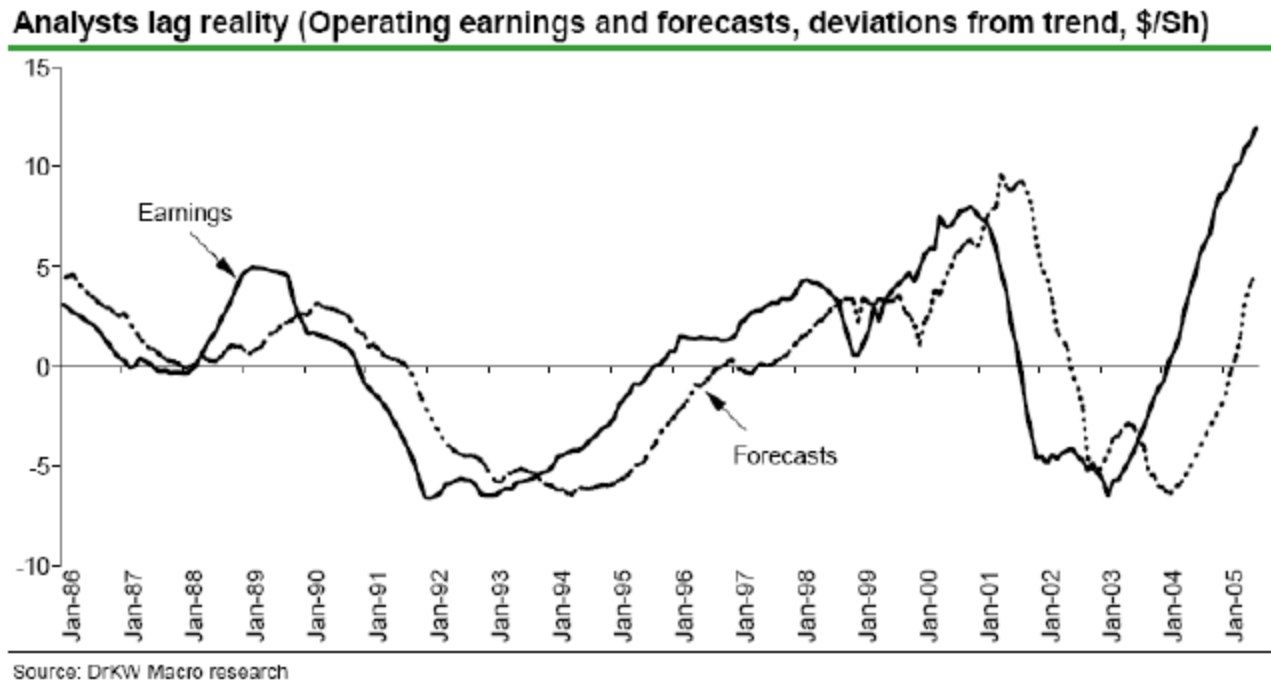
Anchoring and Adjustment

- ▶ If you fold a piece of paper in half 20 times, how thick it would be?
- ▶ St. Petersburg Paradox:
 - ▶ How much would you pay to receive the following payoff?
 - ▶ I will flip a coin:
 - ▶ If it turns up heads on the first toss, you get 10 baht, game over
 - ▶ If it turns up tails and then heads, you get 20 baht and game over
 - ▶ If it turns up tails, then tails, then heads, you get 40 baht and game over

Insufficient Anchor Adjustment

Individual make estimates for values based upon an initial value (derived from past events, random assignment, or whatever information is available) and typically make insufficient adjustments from that anchor when establishing a final value

Anchoring and Forecasting



Confirmation Bias

- ▶ Once a theory has been developed, information is gathered which could confirm or undermine that theory.
- ▶ Not all new information is given equal weight

Confirmation bias

- ▶ **Examples:**
 - ▶ Doctor's diagnosis
 - ▶ I am a good investor
- ▶ **Feeds into overconfidence**
- ▶ **Self-generated anchors**
- ▶ **Evidence is sifted:**
 - ▶ Evidence of positive attributes get through
 - ▶ Evidence of negative attributes are screened out
- ▶ **People attribute success to skill, failure to bad luck**

Self serving reasoning

- ▶ People tend to arrive at conclusions first and then “reverse engineer” reasons
- ▶ Everyone is a lawyer!
 - ▶ Determinations of fairness
 - ▶ Evaluating referees
- ▶ People cannot determine which evaluative criteria to use until they know what is the desired outcome
 - ▶ Accountants, etc.

Parsing Overconfidence

- ▶ **Overestimation:**
 - ▶ Overestimate performance, likelihood of success
- ▶ **Overplacement:**
 - ▶ Incorrect ranking of self as better than others
- ▶ **Inconsistencies:**
 - ▶ People are more likely to overestimate their performance on difficult tasks
 - ▶ But are more likely to overplace themselves on easy tasks
- ▶ **Example: driving cars VS riding unicycles**

What's wrong with overconfidence?

- ▶ Decision makers who use incorrect probabilities will make mistakes
- ▶ Decision makers who fail to leave room for error will over commit
- ▶ They may act on the belief that they have abilities which they lack and suffer consequences

Why might we expect those who trade in financial markets to be overconfident?

- ▶ Most people are overconfident
- ▶ Slow, noisy feedback
- ▶ High difficulty
- ▶ Selection bias
- ▶ Survivorship bias

Summary

- ▶ Lesson learnt from today class in personal finance and investment perspective
- ▶ Do's and Don'ts
- ▶ What should we avoid?