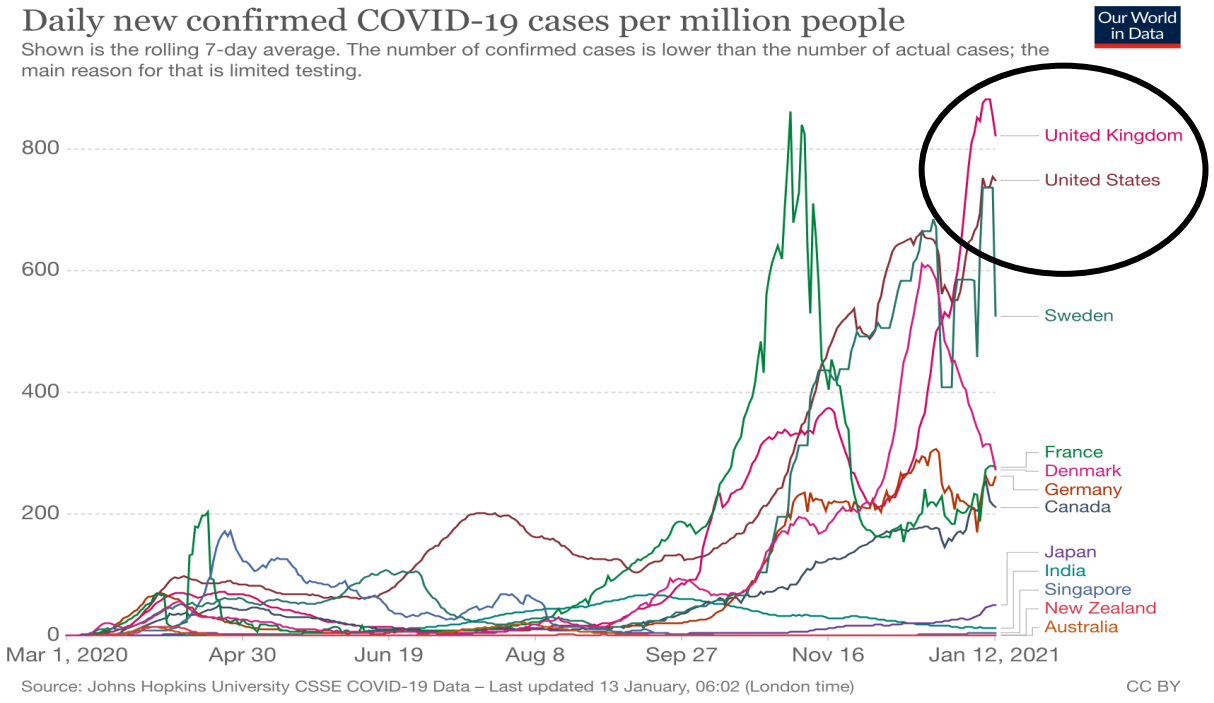
INSEAD
The Business School for the World®

Forecasting:
Data, Discernment, and Diversity

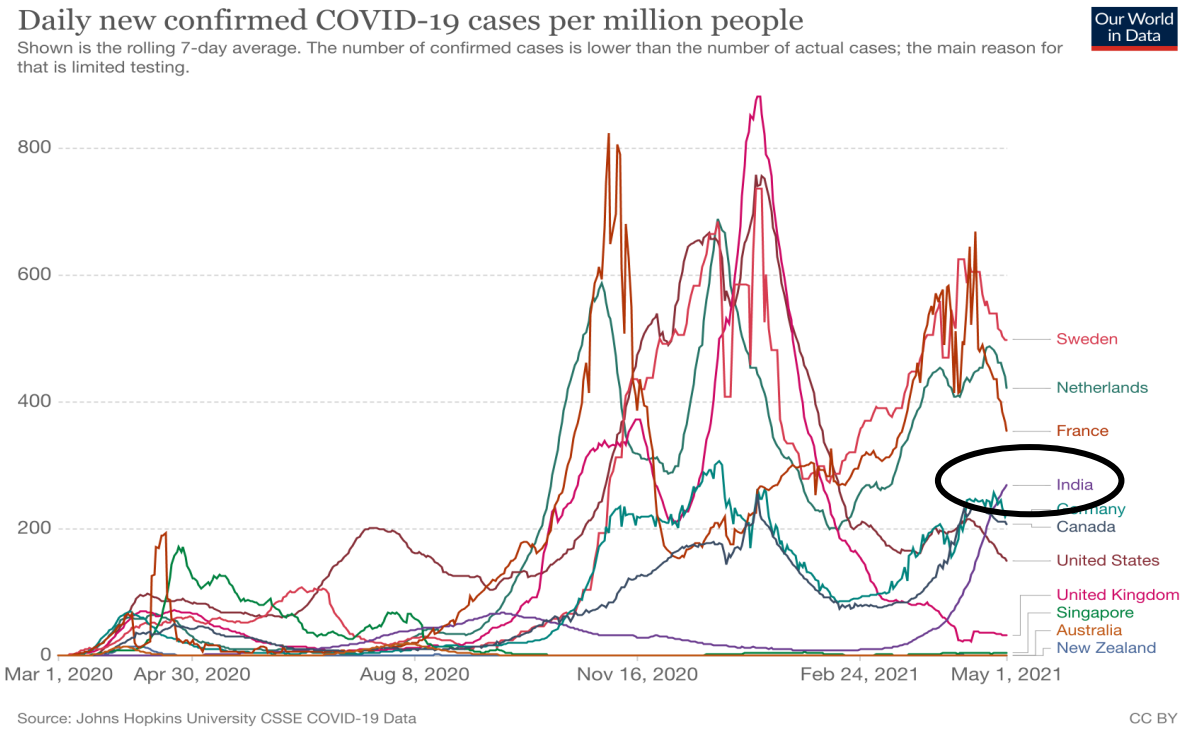
Anil Gaba
The ORPAR Chaired Professor of Risk Management
Professor of Decision Sciences
INSEAD

COVID -19 SNAPSHOTS

Jan 2021

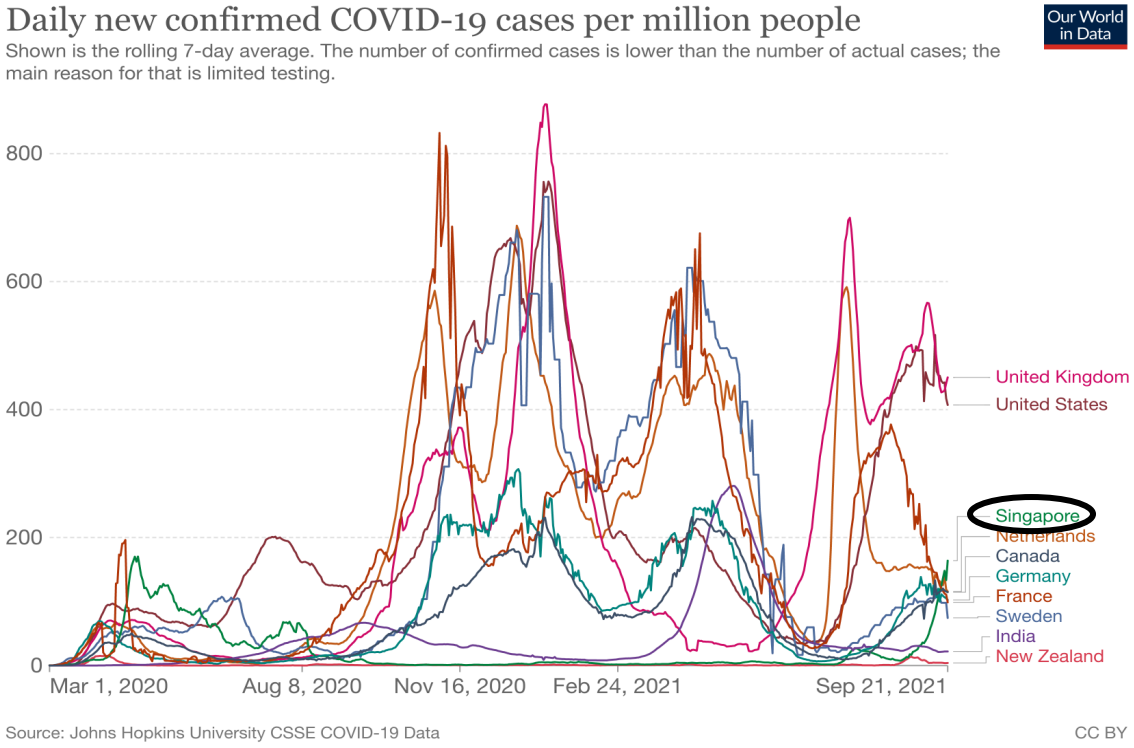


May 2021

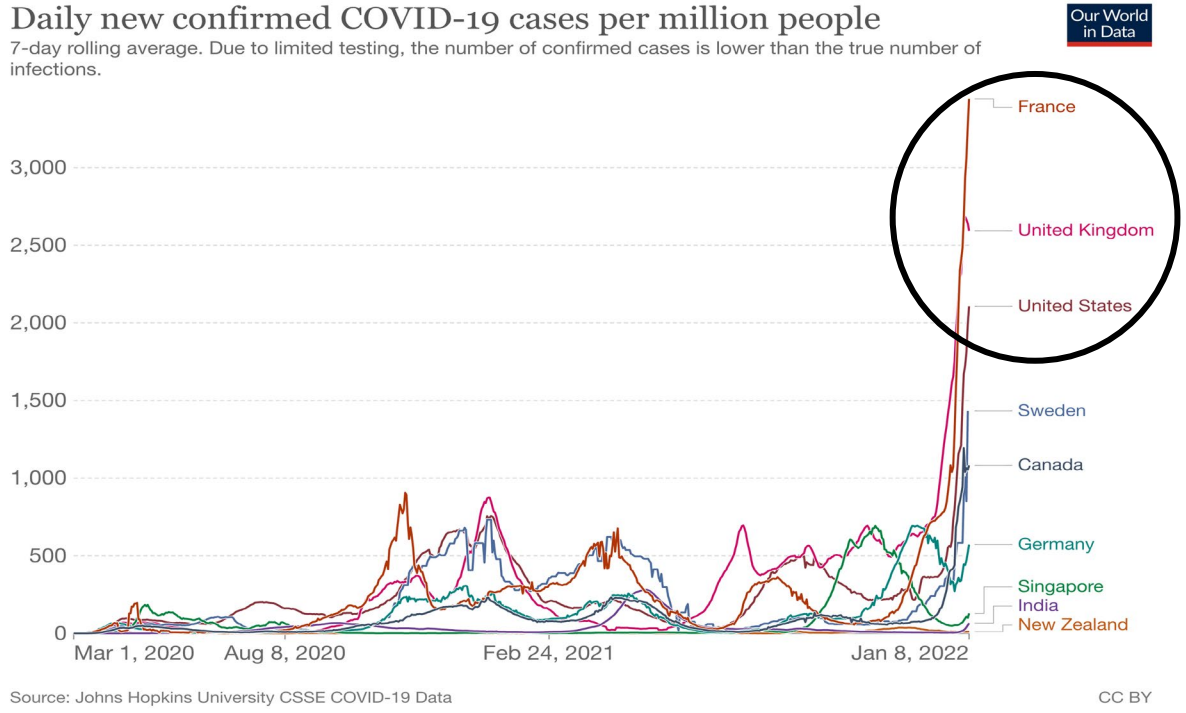


COVID -19 SNAPSHOTS

Sep 2021



Jan 2022



S&P 500 – LAST FIVE YEARS

GOD, CHURCH OF ENGLAND, GOD'S WORK

2002: Pension losses ≈ £400m

2009 (*FT*, November 3, 2009):

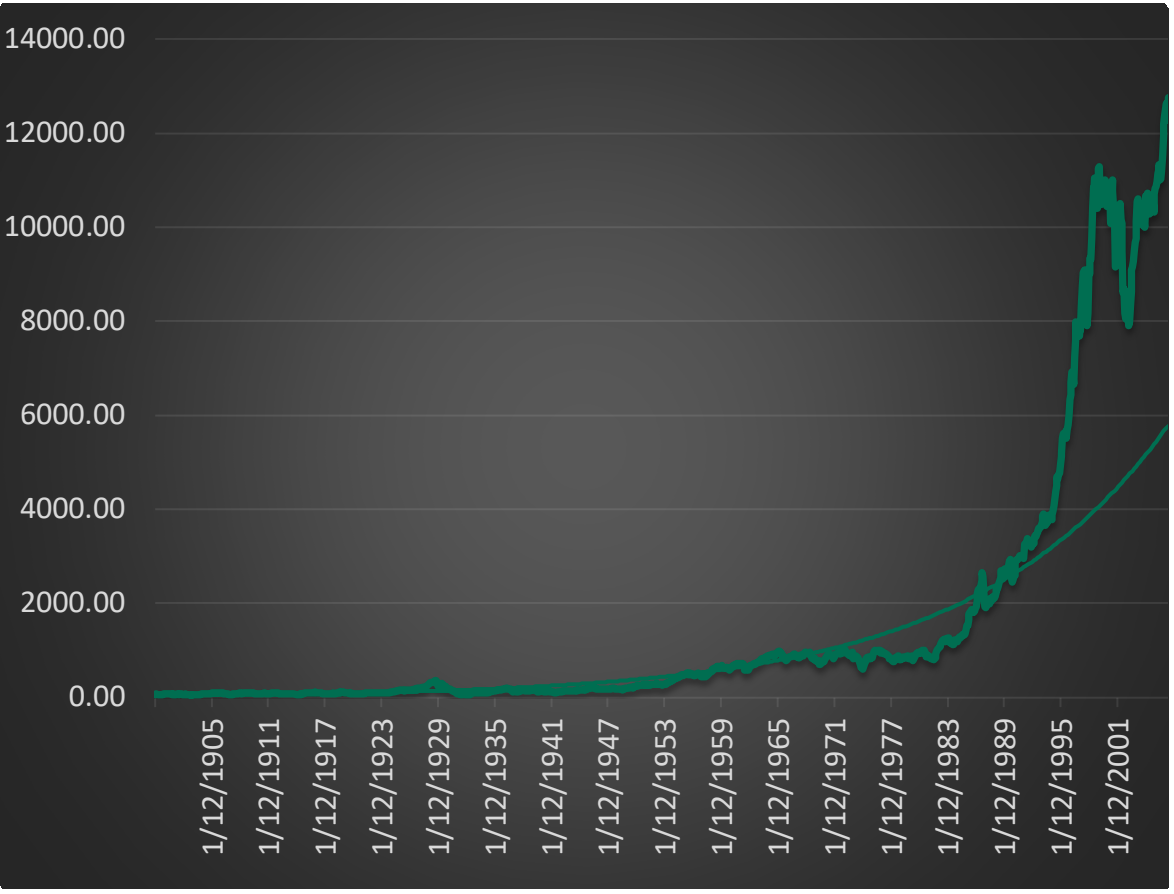
"Vicars' pensions under threat…Benefits for young clergy could be halved"

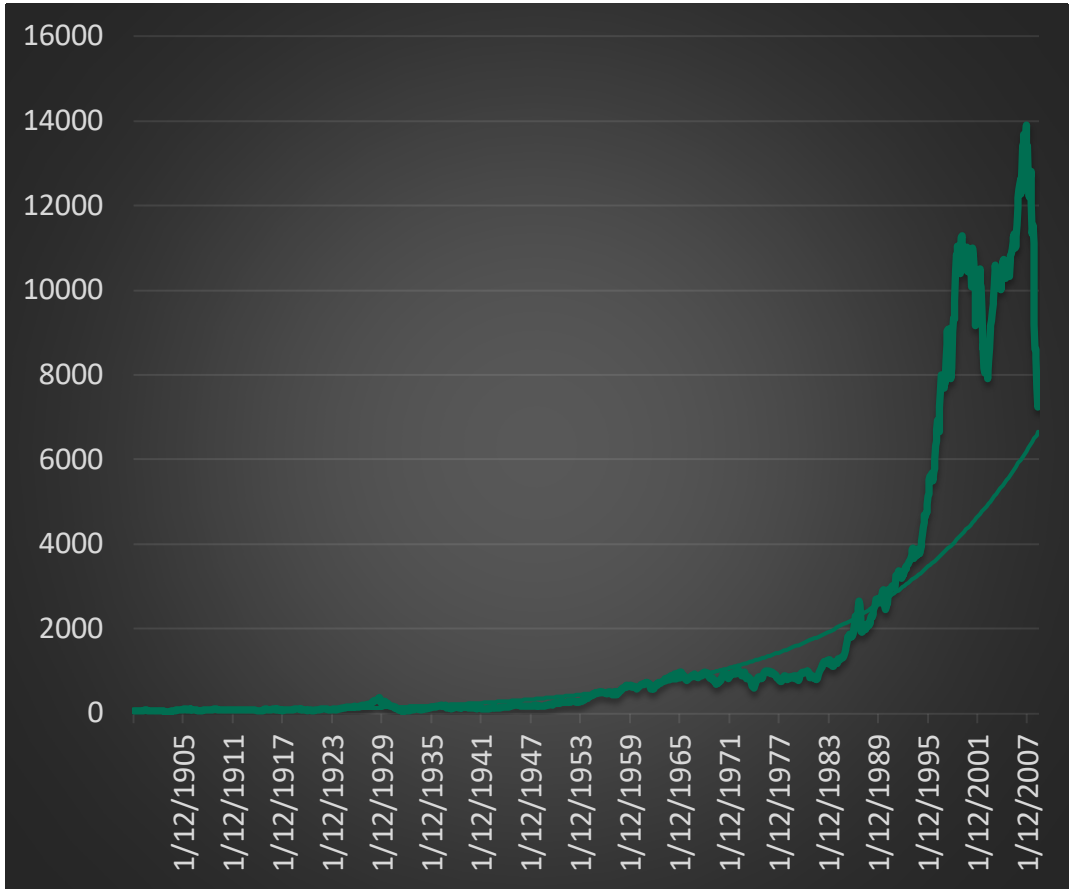
Total Cost of the Financial Crisis

IMF (August 9, 2009):
Globally, $11.9 trillion

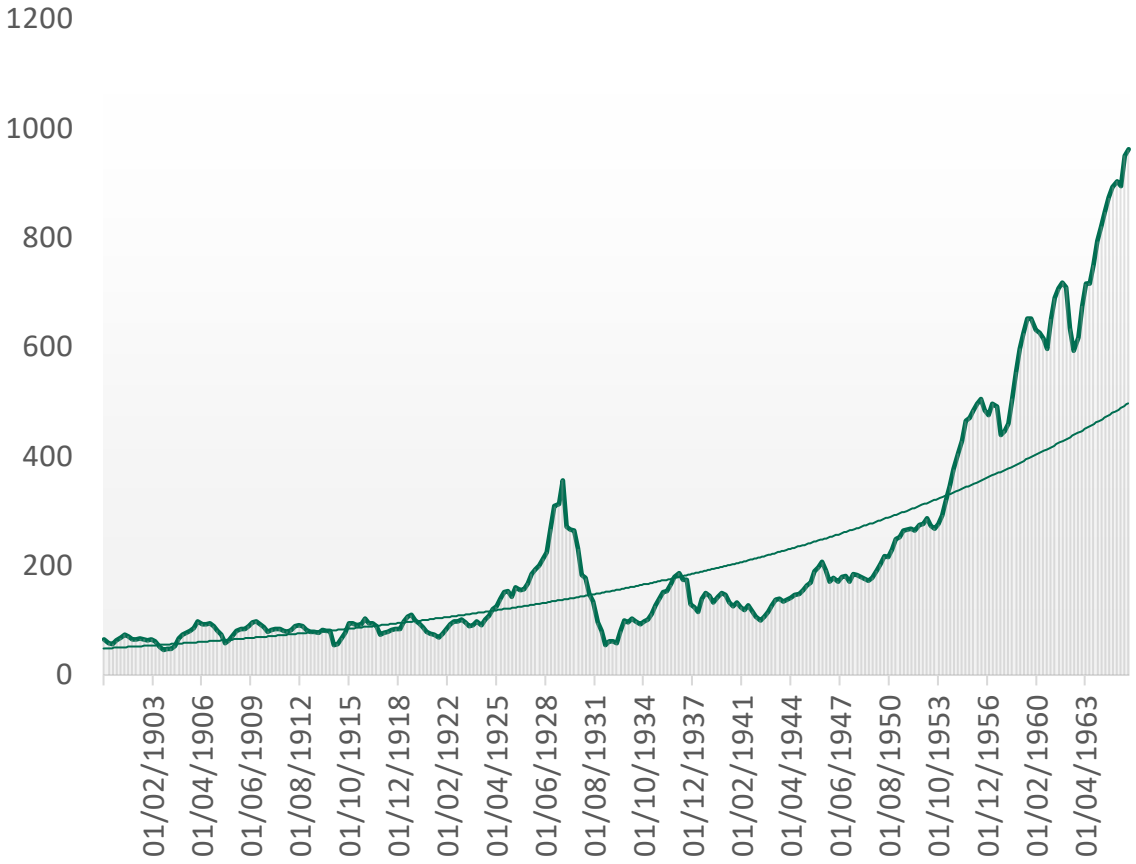
BETTER MARKETS (a nonprofit in Washington DC, Sep 2012):
In the US, $12.8 trillion

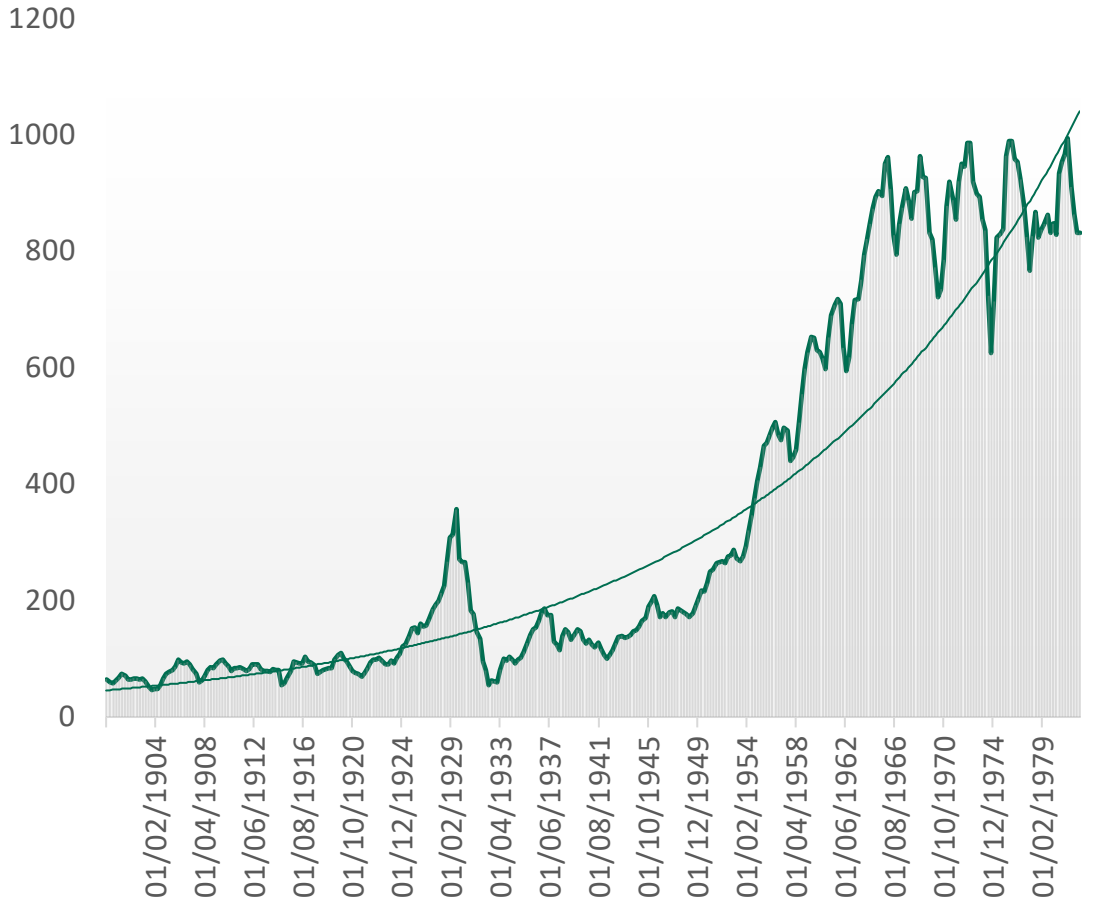
2007 Bubble DJIA



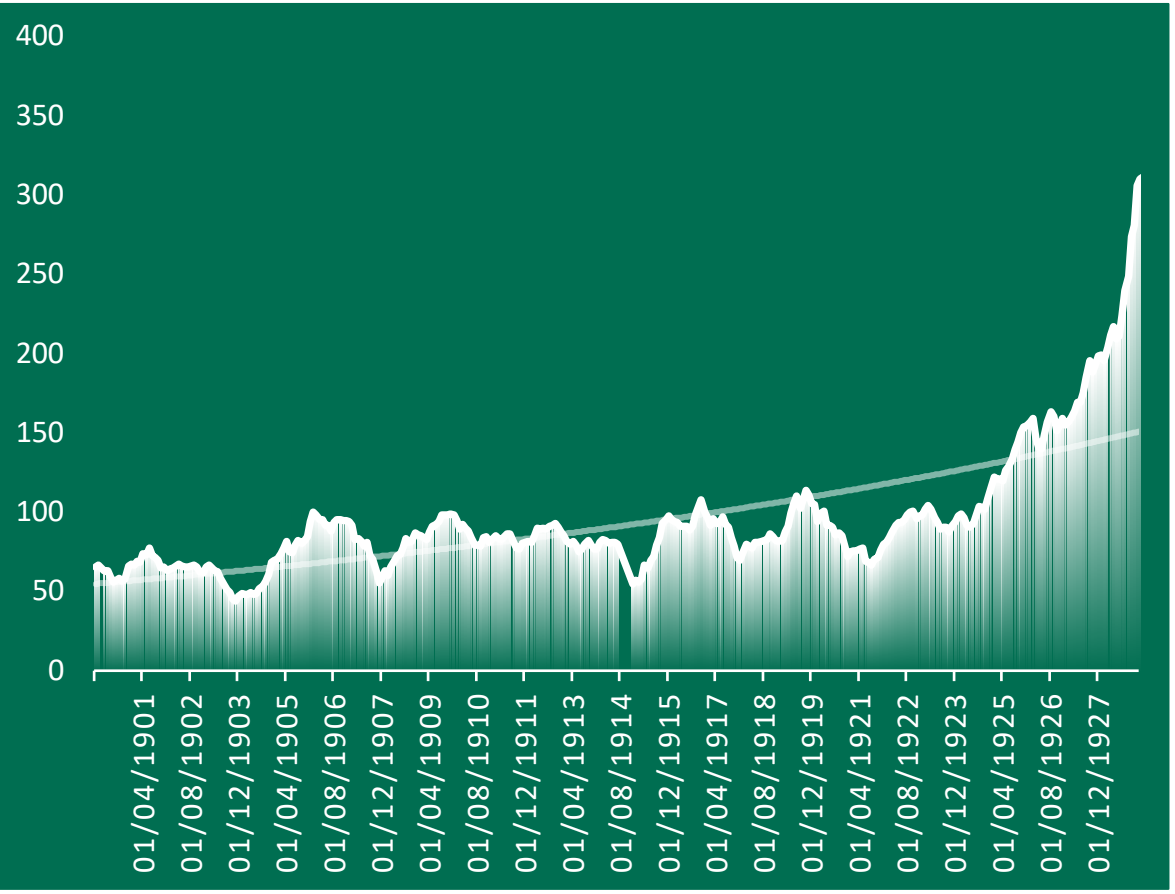


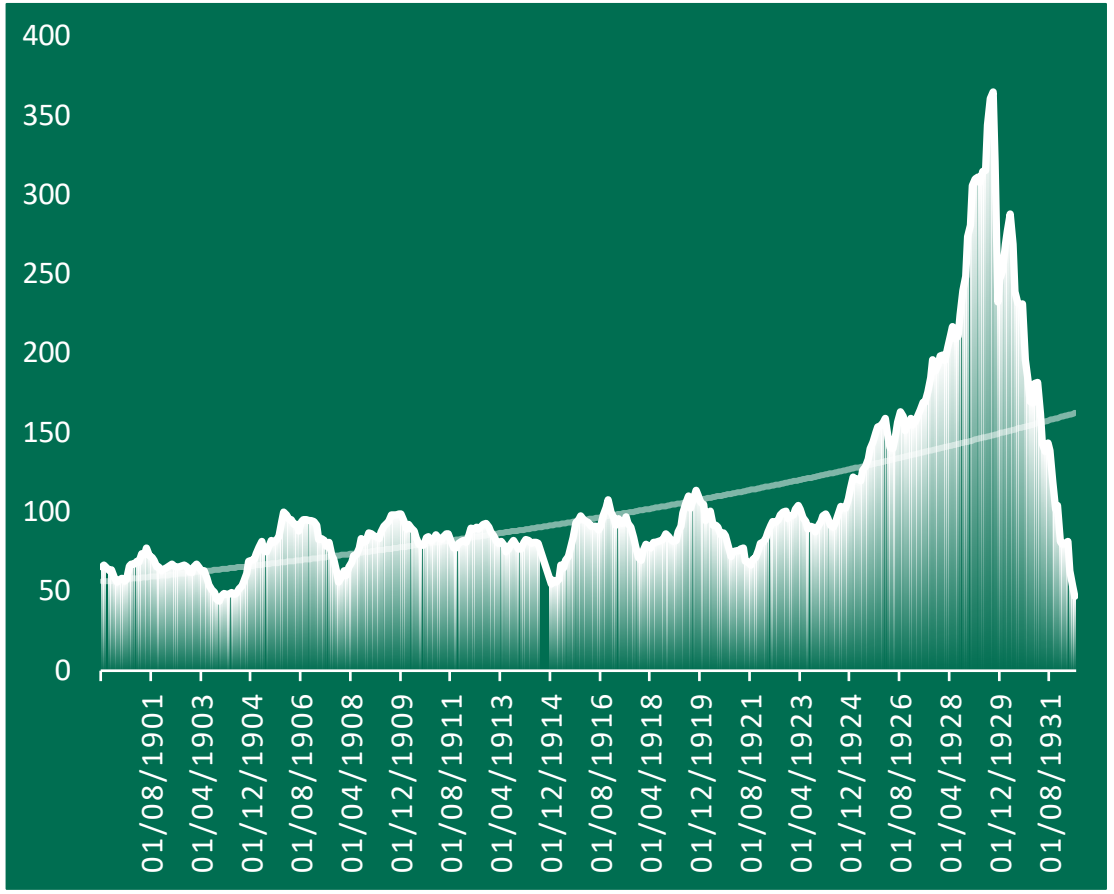
1966 Bubble DJIA





1929 Bubble DJIA



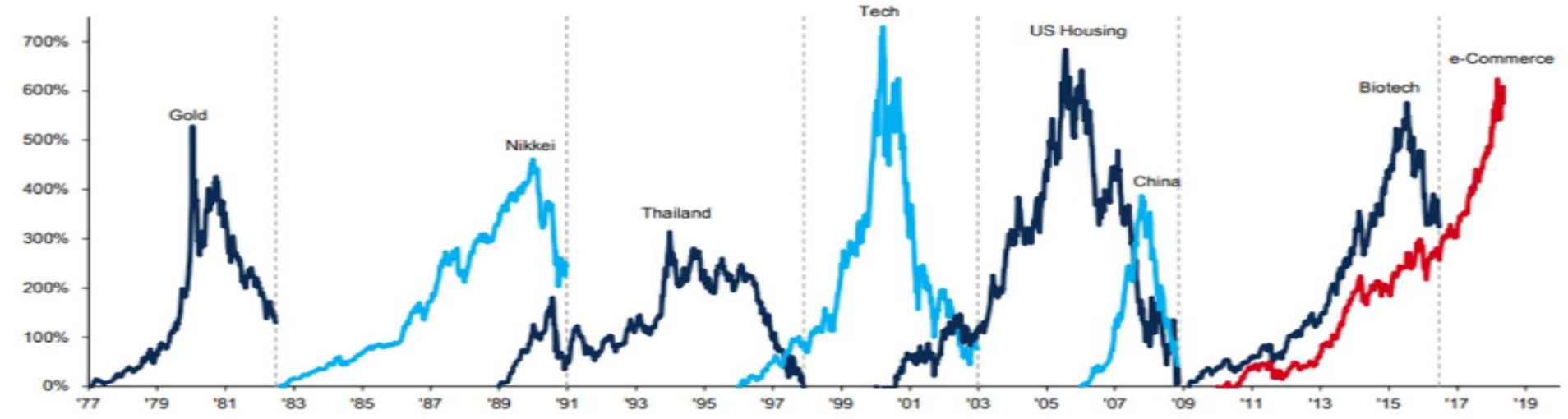


More Equity Bubbles…

Equity Bubbles

- Dow Jones eCom index (Amazon, Netflix, Google and Facebook) up 617%, 3 rd largest bubble of past 40 years
- U.S. tech market cap ($6.0tn) exceeding that of all companies in the Eurozone ($5.0 tn)
- Facebook (25k employees) market cap > MSCI India (1.3 bn people)

Chart 8: Asset price bubbles of the past 40 years

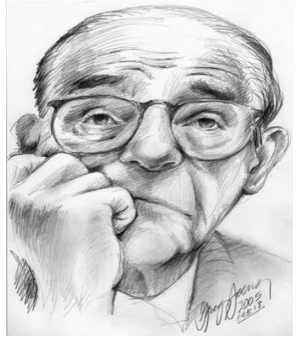


Source: BofA Merrill Lynch Global Investment Strategy, Bloomberg. Note: Gold (XAU Curncy), Japanese Equities (NKY Index), Thai Equities (SET Index), Tech (NDX Index), US Housing (SSHOME Index), Commodities (SHCOMP Index), Biotech (NBI Index),e-Commerce (DJECOM Index)

DoubleLine Total Return Bond Fund owns 0% of Amazon, Netflix, Google or Facebook as of May 31, 2018. MSCI India Index is designed to measure the performance of the large and mid-cap segments of the Indian market. With 79 constituents, the index covers approximately 85% of the Indian equity universe. Gold (XAU) = Gold spot price in U.S> dollars, Nikkei Index = Nikkei 225 stock average is a price weighted average of 225 top=rated Japanese stocks listed on the Tokyo Stock Exchange. Thai Equities (SET Index) is an index that measures returns on securities in the composite of SET Sector Index/Thai Stock Exchange. Tech = NASDAQ 100 stock index is cap-weighted index of 100 largest stocks on the U.S. NASDAQ exchange. US Housing = S&P/Case-Shiller U.S. National Home price Index tracks the value of single-family housing in the U.S. China = SHCOMP is the Shanghai Stock Exchange Composite Index is a cap-weighted for all A and B shares listed on the Shanghai stock market. Biotech = NASDAQ Biotechnology Index is a modified market cap weighted index measuring the performance of all NASDAQ stocks in biotechnology. E-Commerce = Dow Jones Internet Commerce Index is a modified cap-weighted index that tracks the performance of companies involved in internet commerce. You cannot invest directly in an index.

China 2007 (A Senior Govt. Official):

Financial markets are like champagne – if there are no bubbles no one will drink them



FT, March 27, 2009 (A. Greenspan):

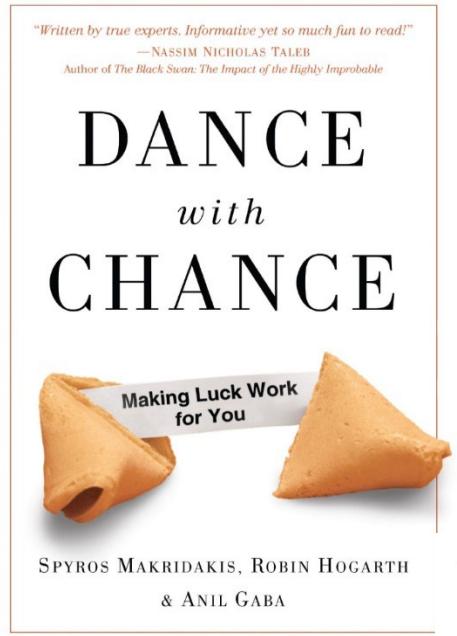
We have never been able to model successfully the transition from euphoria to fear

Dr. Doom:

Nov 2009:	The mother of all carry trade faces an inevitable bust
Feb 2013:	US Market has entered the mother of all asset bubbles
Dec 2014:	We could have this shakeout…2016 I would say
March 2020:	I expect global equities to tank by 30% to 40% this year. My advice is: Put your money into cash and safe government bonds.

Socio-Economic Domains:

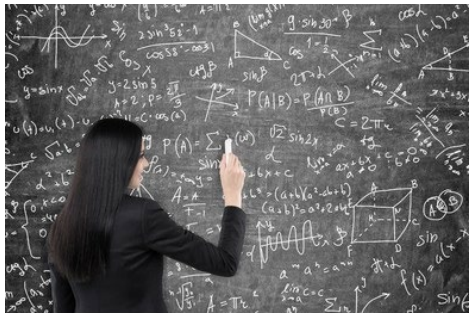
Models, Judgments, Limits to Prediction



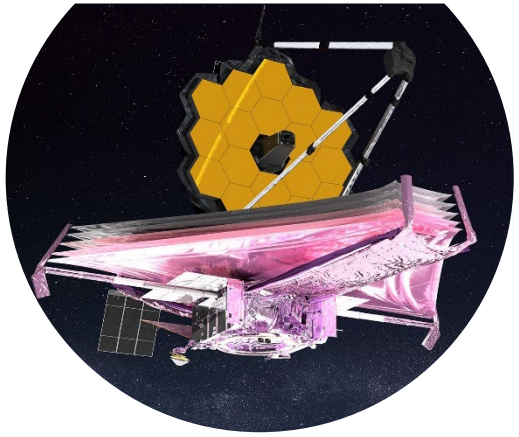
Several Empirical Forecasting Studies from 1978:

- *Complex Models* can fit past data well but don't necessarily predict well relative to *Simple Models*.
- Combining predictions across *models/approaches* improves accuracy
- However, despite the current *best* approach, our prediction power remains limited…

SOME INCONGRUITIES

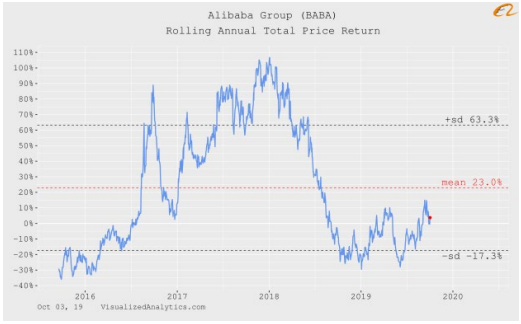


Amazing progress!

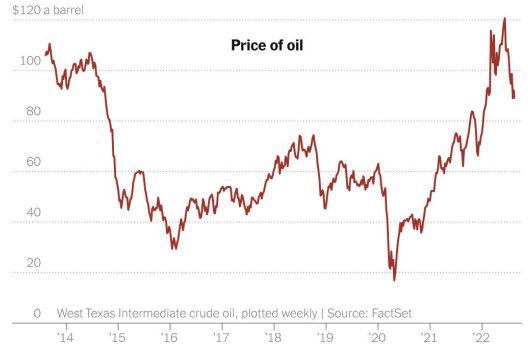


Very limited predictive power!

Alibaba Group



Price of Oil



Who will be happy?

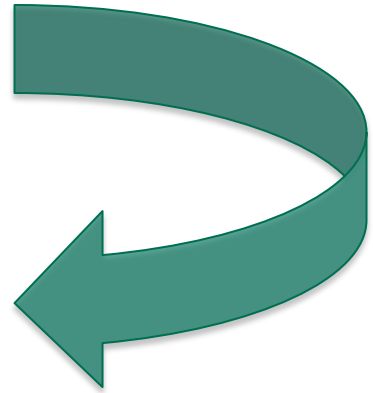
Longevity

SOCIO-ECONOMIC MODELS: PHYSICS ENVY

A common fallacy:

The more mathematically sophisticated the model

The better we can predict, the better we can control risk and uncertainty,…



Economists suffer from a deep psychological disorder that I call 'physics envy'. We wish that 99 percent of economic behavior could be captured by three simple laws of nature. In fact, economists have 99 laws that capture 3 percent of behavior. Economics is a uniquely human endeavor.

Andrew Lo
MIT Professor of financial economics

Economists who adhere to rational-expectations models of the world will never admit it, but a lot of what happens in markets is driven by pure stupidity - or, rather, inattention, misinformation about fundamentals, and an exaggerated focus on currently circulating stories.

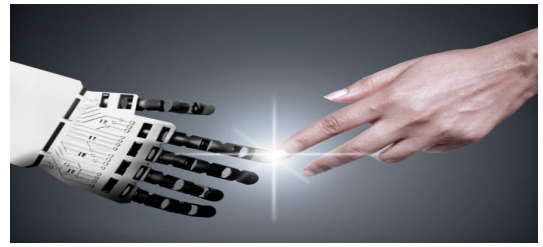
Robert Shiller
Nobel Laureate in 2013

Wall Street indices predicted nine out of the last five recessions !

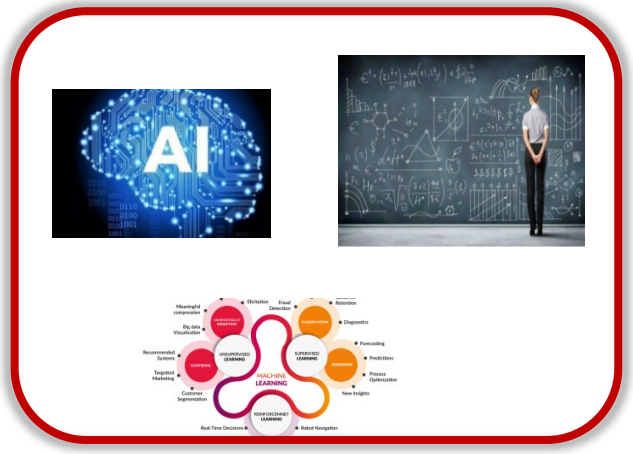
Paul Samuelson
Nobel Laureate in 1970

COMBINING ACROSS APPROACHES :

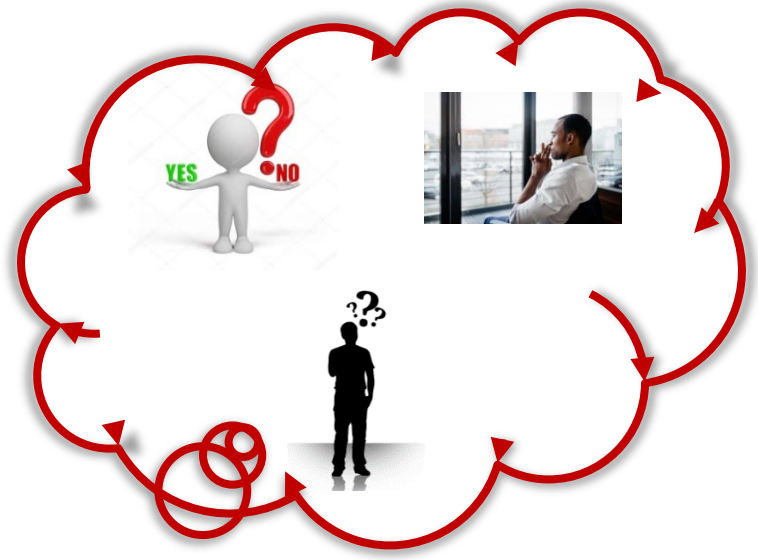
MACHINE (DATA SCIENCE)
+
HUMAN (JUDGMENT)



Procedural Knowledge
(machines)



Contextual Knowledge
(human)

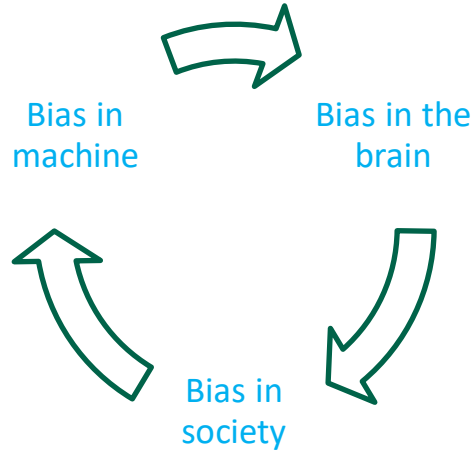


EXAMPLE: REINFORCING NEGATIVE CYCLE

Biases Make People Vulnerable to Misinformation Spread by Social Media

Scientific American, June 21 2018

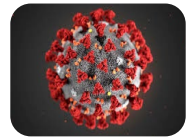
Researchers have developed tools to study the cognitive, societal and algorithmic biases that help fake news spread



COVID-19

Dependent on the interplay between…

Disease dynamics



Policies

Trust in Institutions

Innovation

Luck

JUDGMENTS

700+ CEOs, CFOs, Board Directors since 2021

OVERCONFIDENCE BIAS
Up and Down S&P 500 - 1928-2019 (92 Years)

QUESTION TEXT:

Question 1 (Part I)

Considering the S&P 500 in period from 1928 to 2019 (a total of 92 years), in how many of the 92 years was the annual return up or down by more than 10%?

Question 2 (Part II)

Considering the S&P 500 in period from 1928 to 2019 (a total of 92 years),in how many of the 92 years was the annual return up or down by more than 20%?

Question 3 (Part III)

Considering the S&P 500 in period from 1928 to 2019 (a total of 92 years), in how many of the 92 years was the annual return up or down by more than 30%?

Note: Your answer must be between 0 and 92

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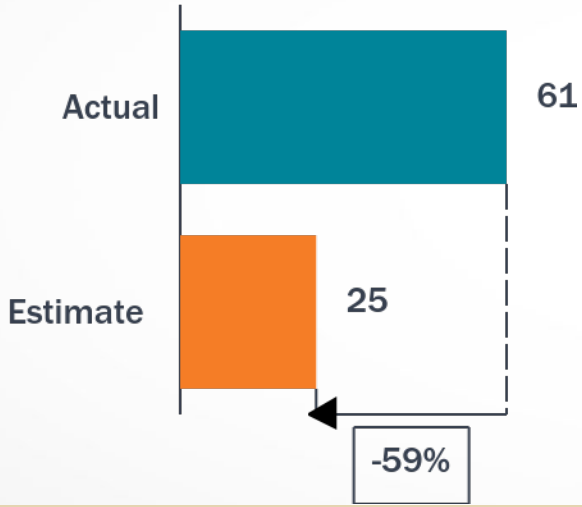
HIGH OVERCONFIDENCE EVERYWHERE; UNDERESTIMATING TAILS

n = 767

S&P 500 ±10%
Number of Years



Share of participants who underestimated risk:

84%

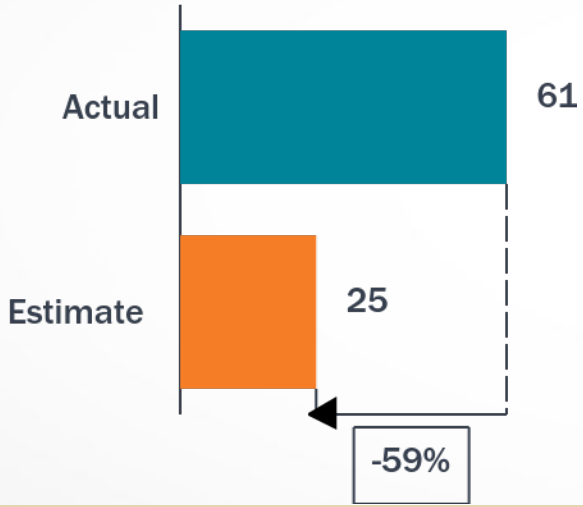
© Anil Gaba

OVERCONFIDENCE BIAS
Up and Down S&P 500 (Part I, II, III)

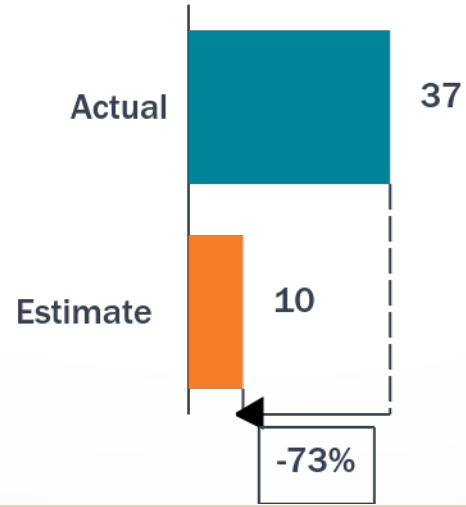
HIGH OVERCONFIDENCE EVERYWHERE; UNDERESTIMATING TAILS

n = 767

S&P 500 ±10%
Number of Years



S&P 500 ±20%
Number of Years



Share of participants who underestimated risk:

84%

88%

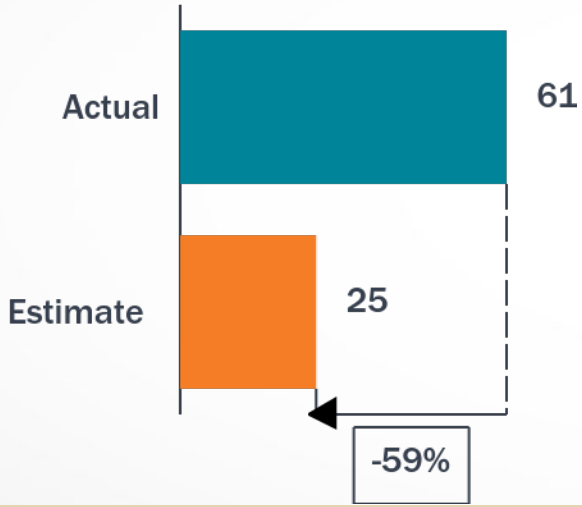
© Anil Gaba

OVERCONFIDENCE BIAS
Up and Down S&P 500 (Part I, II, III)

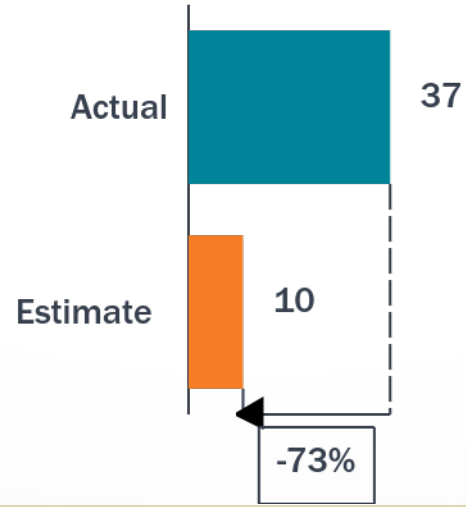
HIGH OVERCONFIDENCE EVERYWHERE; UNDERESTIMATING TAILS

n = 767

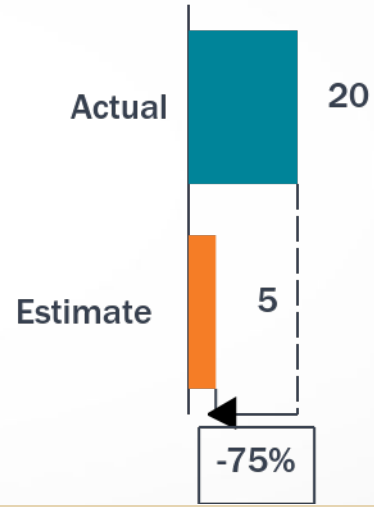
S&P 500 ±10% Number of Years



S&P 500 ±20% Number of Years



S&P 500 ±30% Number of Years



Share of participants who underestimated risk:

84% | 88% | 85%

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ANCHORING BIAS
Euro / USD Exchange Rate Forecast

QUESTION TEXT: Set 1

a Do you believe two years from now the Euro/USD exchange rate will be above or below 0.6 USD per Euro?

b What is your best estimate for the exchange rate two years from now in USD per Euro?

Provide below your answer to Part (2)

QUESTION TEXT: Set 2

a Do you believe two years from now the Euro/USD exchange rate will be above or below 1.6 USD per Euro?

b What is your best estimate for the exchange rate two years from now in USD per Euro?

Provide below your answer to Part (2)

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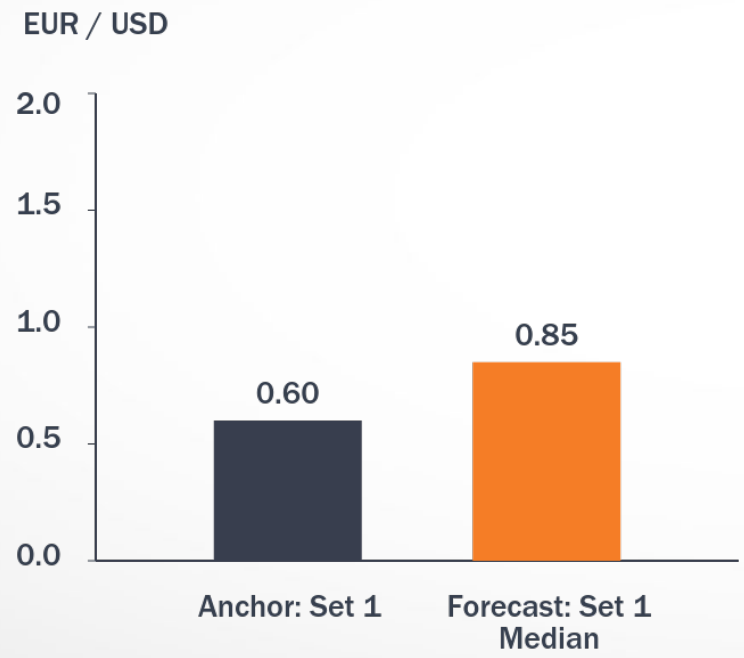
ANCHORING BIAS
Euro / USD Exchange Rate Forecast

SET 1 : Anchor = 0.6

n = 391



SET 2 : Anchor = 1.6

n = 376

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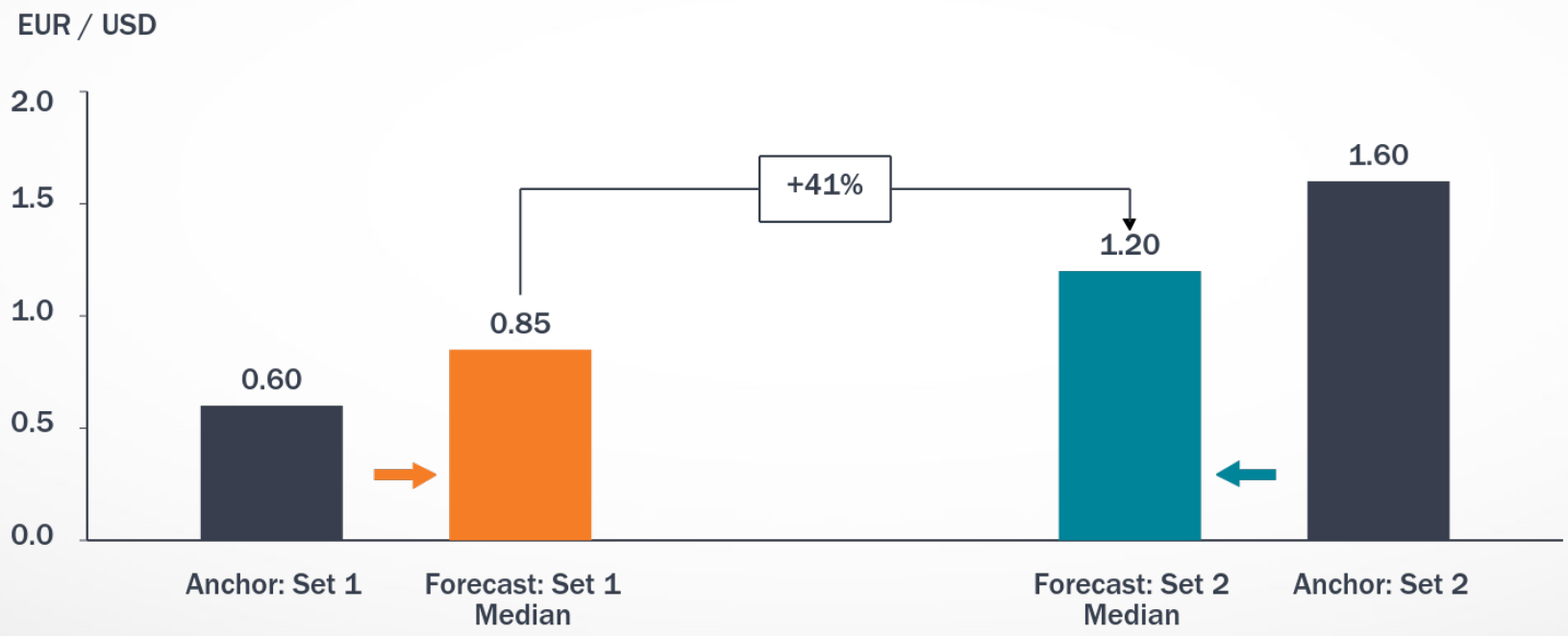
ANCHORING BIAS
Euro / USD Exchange Rate Forecast

SET 1 : Anchor = 0.6

n = 391

SET 2 : Anchor = 1.6

n = 376



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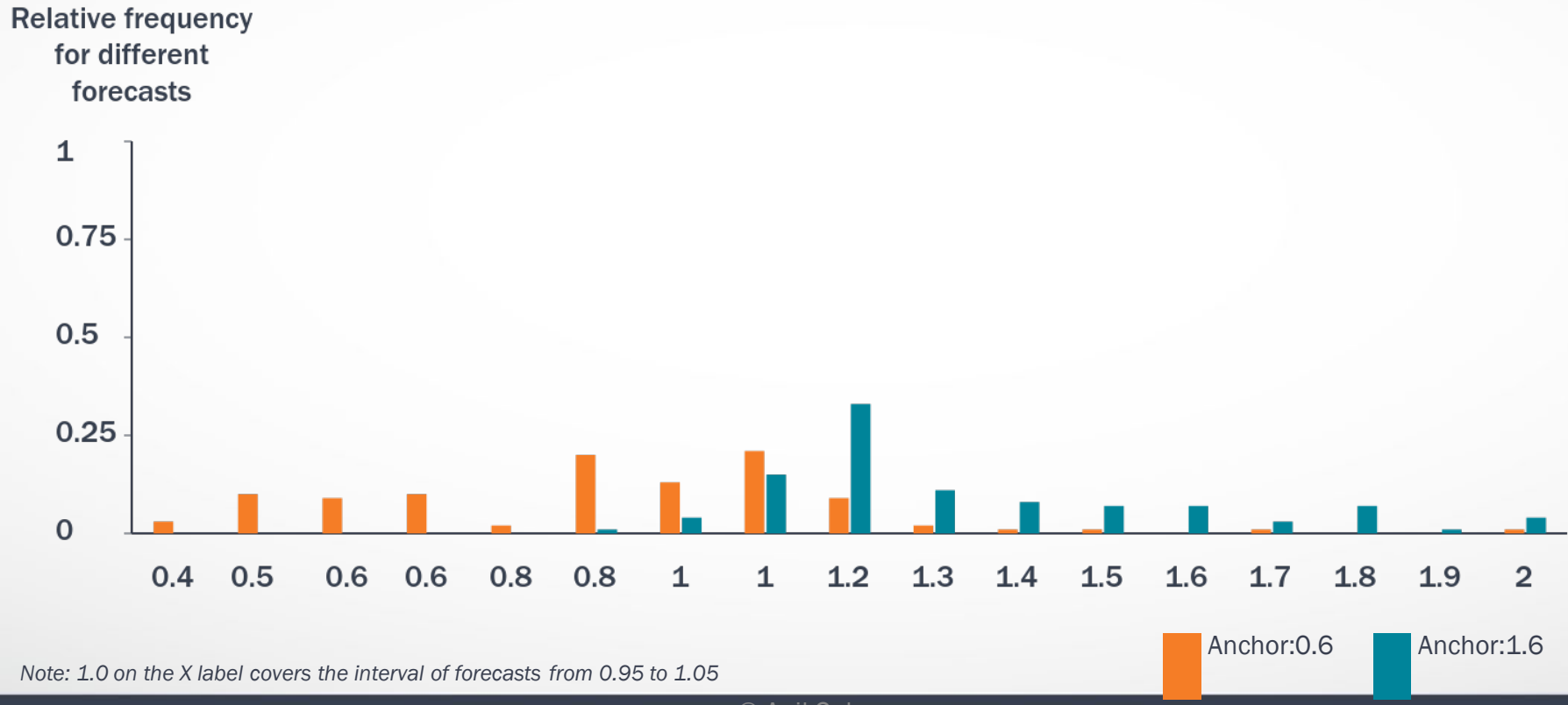
ANCHORING BIAS
Euro / USD Exchange Rate Forecast

FORECAST DISTRIBUTION, DEPENDING ON ANCHOR

Set 1: n = 391 Set 2: n = 376



Note: 1.0 on the X label covers the interval of forecasts from 0.95 to 1.05

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ANCHORING BIAS
Egg Production in US

QUESTION TEXT: Set 1

What is your best guess of the annual U.S. egg production (in millions)?

QUESTION TEXT: Set 2

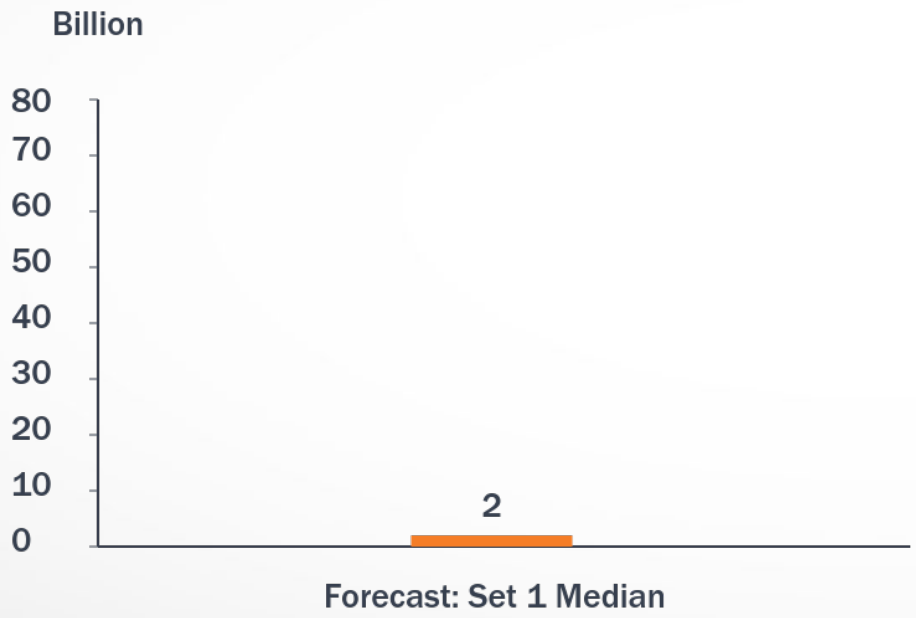
What is your best guess of the annual U.S. egg production (in billions)?

ANCHORING BIAS

Q2: Egg Production in US

SET 1 : Estimate in millions

n = 391



SET 2 : Estimate in billions

n = 376

© Anil Gaba

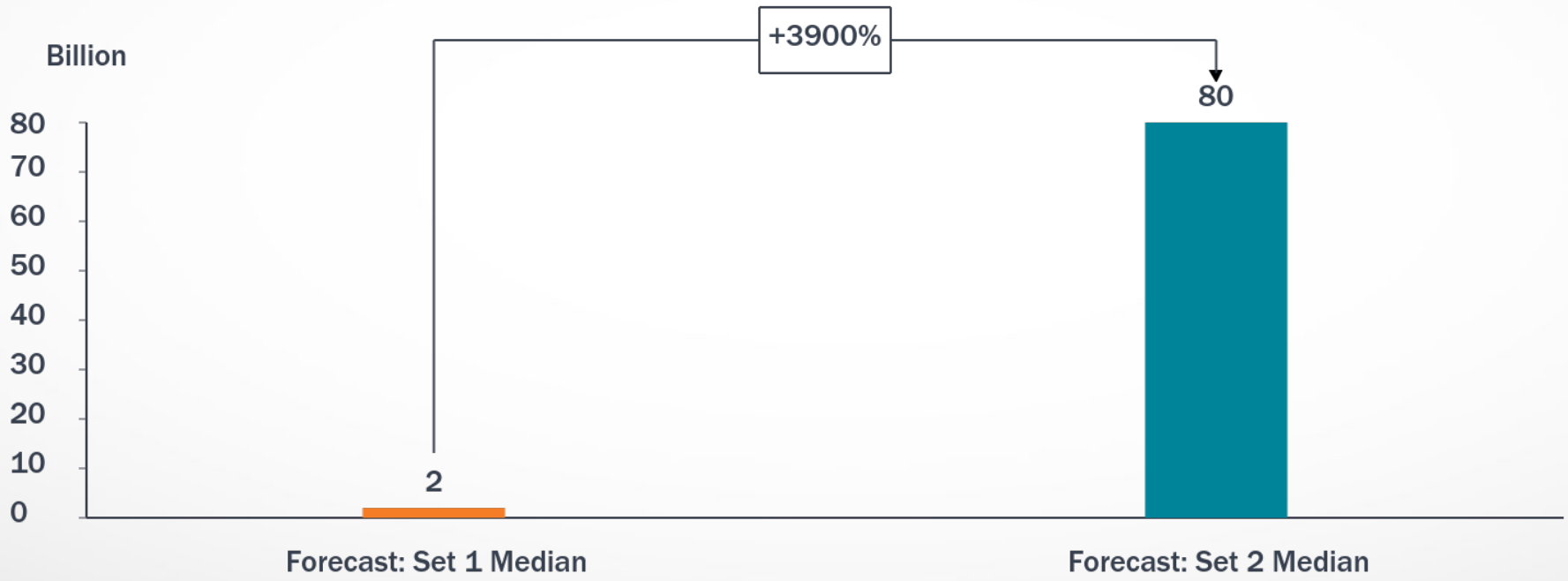
ANCHORING BIAS
Egg Production in US

SET 1 : Estimate in millions

n = 391

SET 2 : Estimate in billions

n = 376



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AVAILABILITY BIAS
Threat of Nuclear Oblivion

QUESTION TEXT:

Please provide your best subjective estimates of the probability of each of the two scenarios below:

Scenario 1 In the next 20 years the United States will be drawn into a nuclear war.

Scenario 2 In the next 20 years, North Korea will initiate a nuclear attack on South Korea, which will draw in other nuclear powers, in particular the United States, in a nuclear war.

© Anil Gaba

AVAILABILITY BIAS
Threat of Nuclear Oblivion

QUESTION TEXT:

Please provide your best subjective estimates of the probability of each of the two scenarios below:

Scenario 1 In the next 20 years the United States will be drawn into a nuclear war.

Scenario 2 In the next 20 years, North Korea will initiate a nuclear attack on South Korea, which will draw in other nuclear powers, in particular the United States, in a nuclear war.

P(Scenario 1) ≥ P(Scenario 2)

© Anil Gaba

AVAILABILITY BIAS

Q2: Threat of Nuclear Oblivion

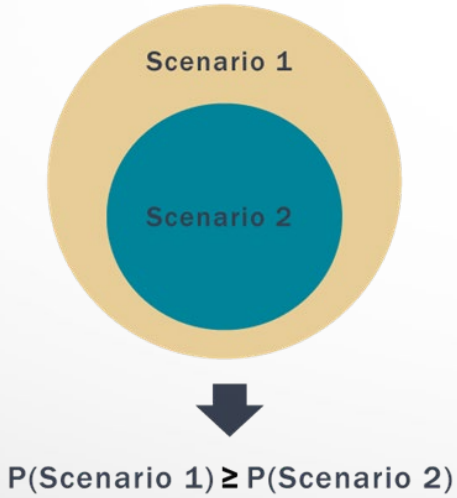
QUESTION TEXT:

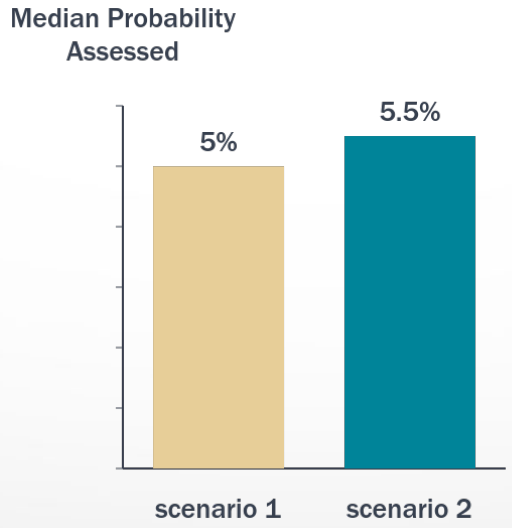
n = 767

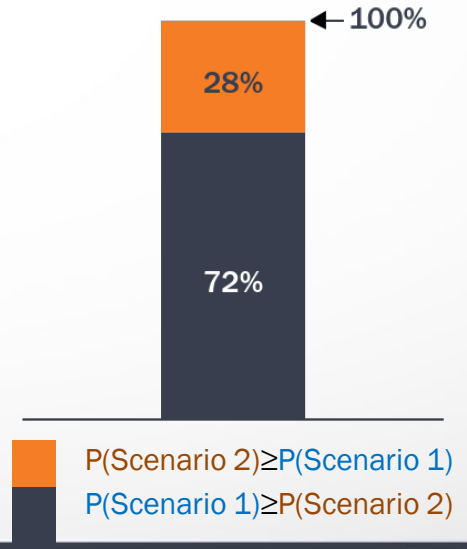
Please provide your best subjective estimates of the probability of each of the two scenarios below:

Scenario 1 In the next 20 years the United States will be drawn into a nuclear war.

Scenario 2 In the next 20 years, North Korea will initiate a nuclear attack on South Korea, which will draw in other nuclear powers, in particular the United States, in a nuclear war.







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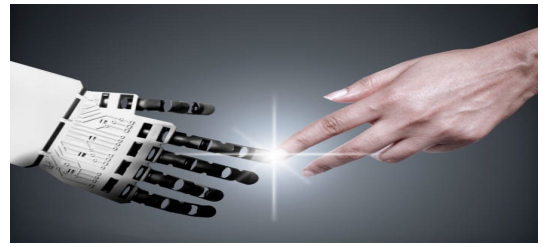
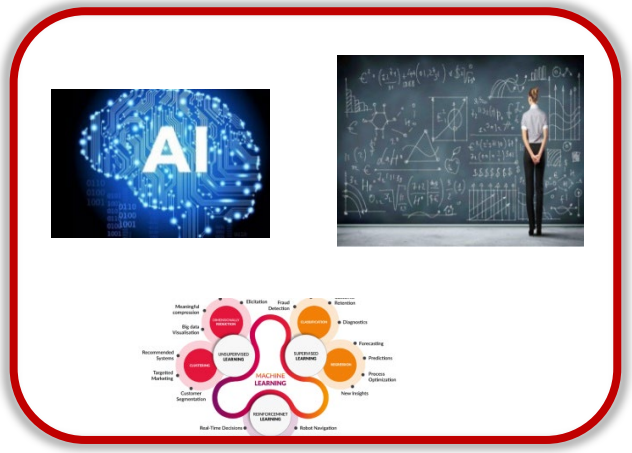
Combining across approaches :

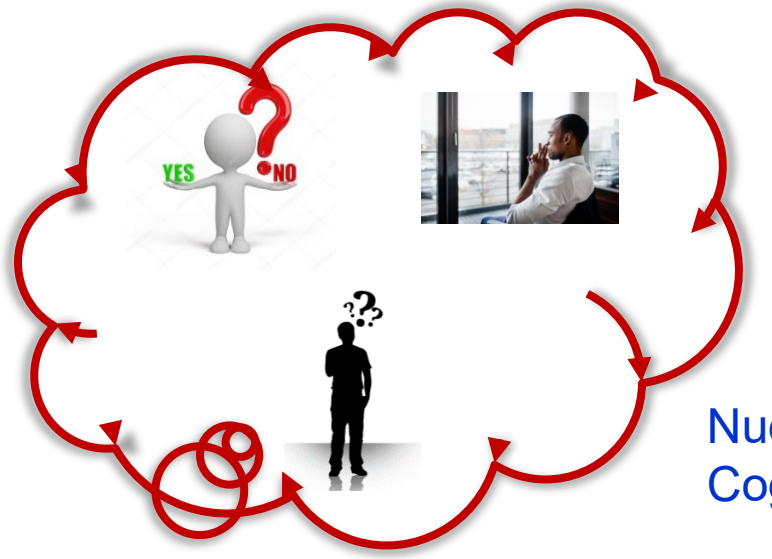
Machine (data Science)
+
Human (judgment)



Procedural Knowledge
(machines)



Contextual Knowledge
(human)



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