

DO THE MATH!

ON GROWTH, GREED,
AND STRATEGIC THINKING

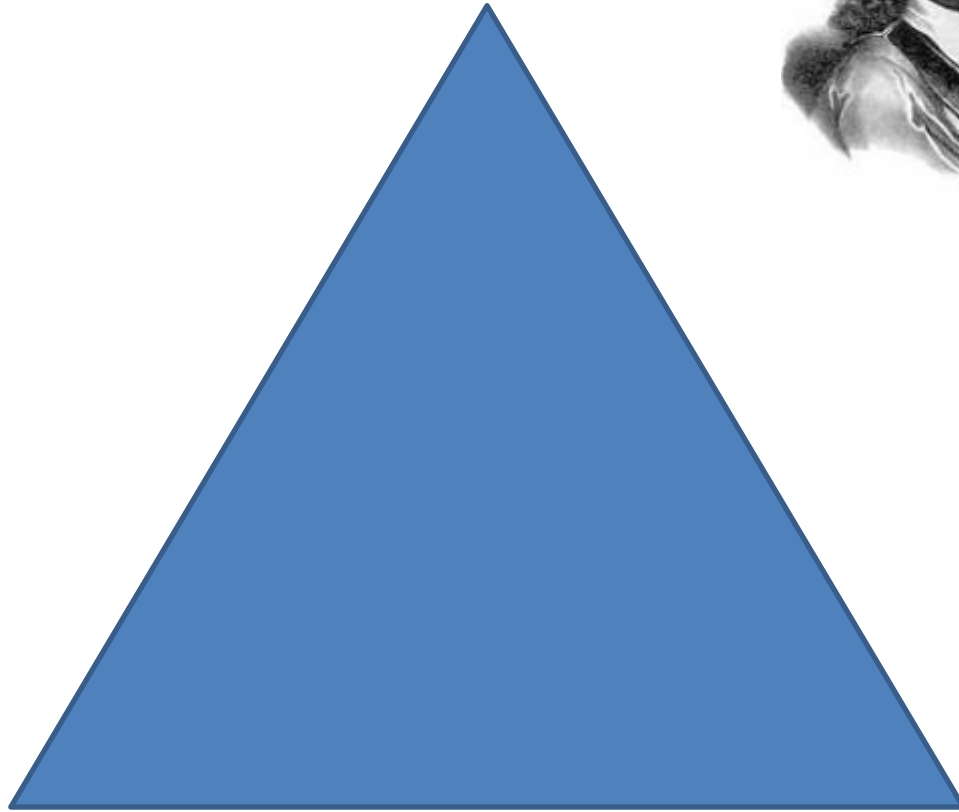


JOHN K. WHITE

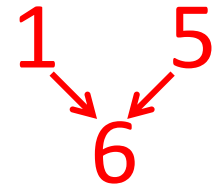
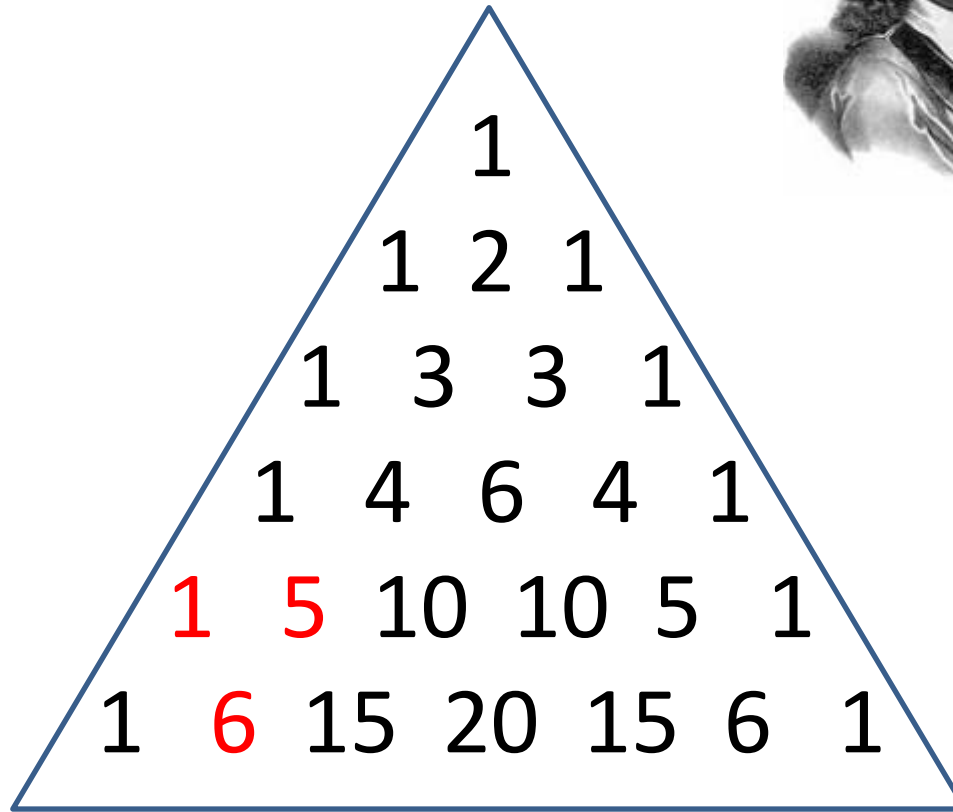


Forever doubling?

1. **Pascal → Gauss → M. King Hubbert, *Do The Math* tidbits**
2. **Some oil stats**
3. ***Crude* by Joe Berlinger**



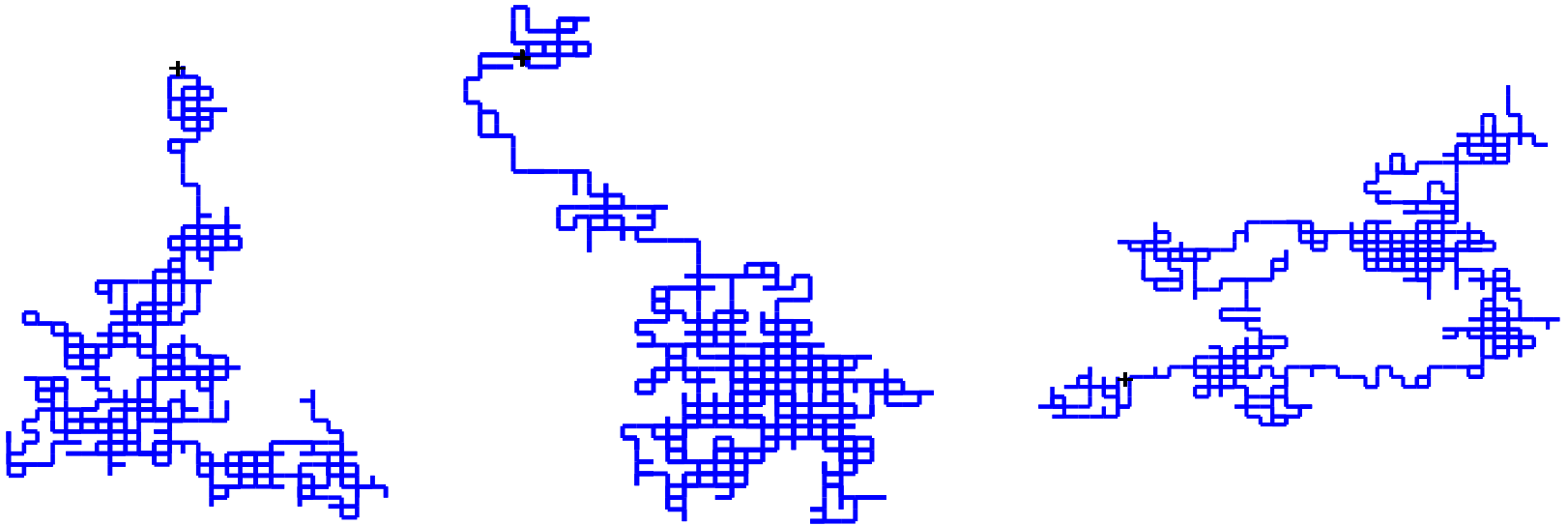
- a gentleman's wager
- flipping coins, roulette spins, random walks (drunks, weather, stocks, ...)



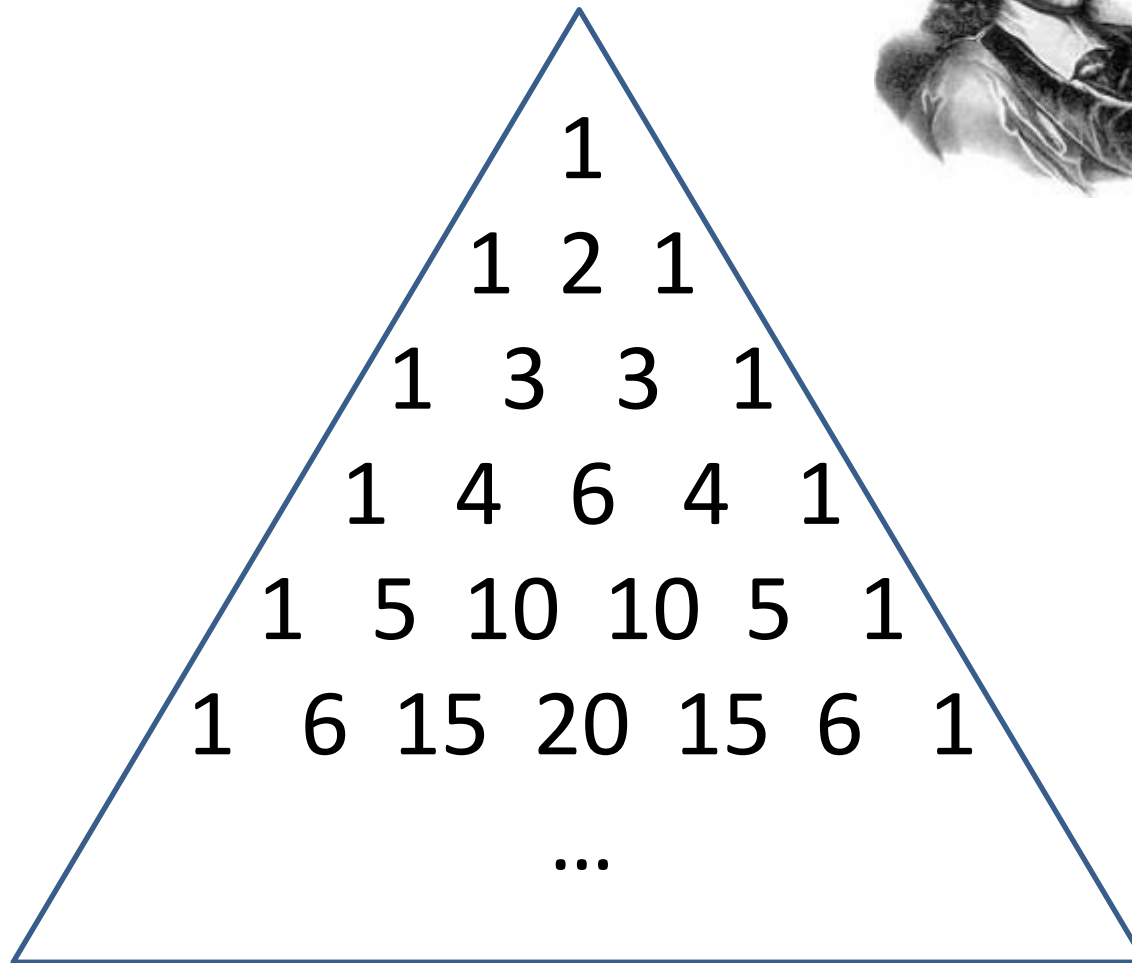
- add from previous row to get next row, e.g., row 5: $1 + 5 = 6$
- **flipping coins**, roulette spins, [random walks](#) (drunks, weather, stocks, ...)

Forever doubling?

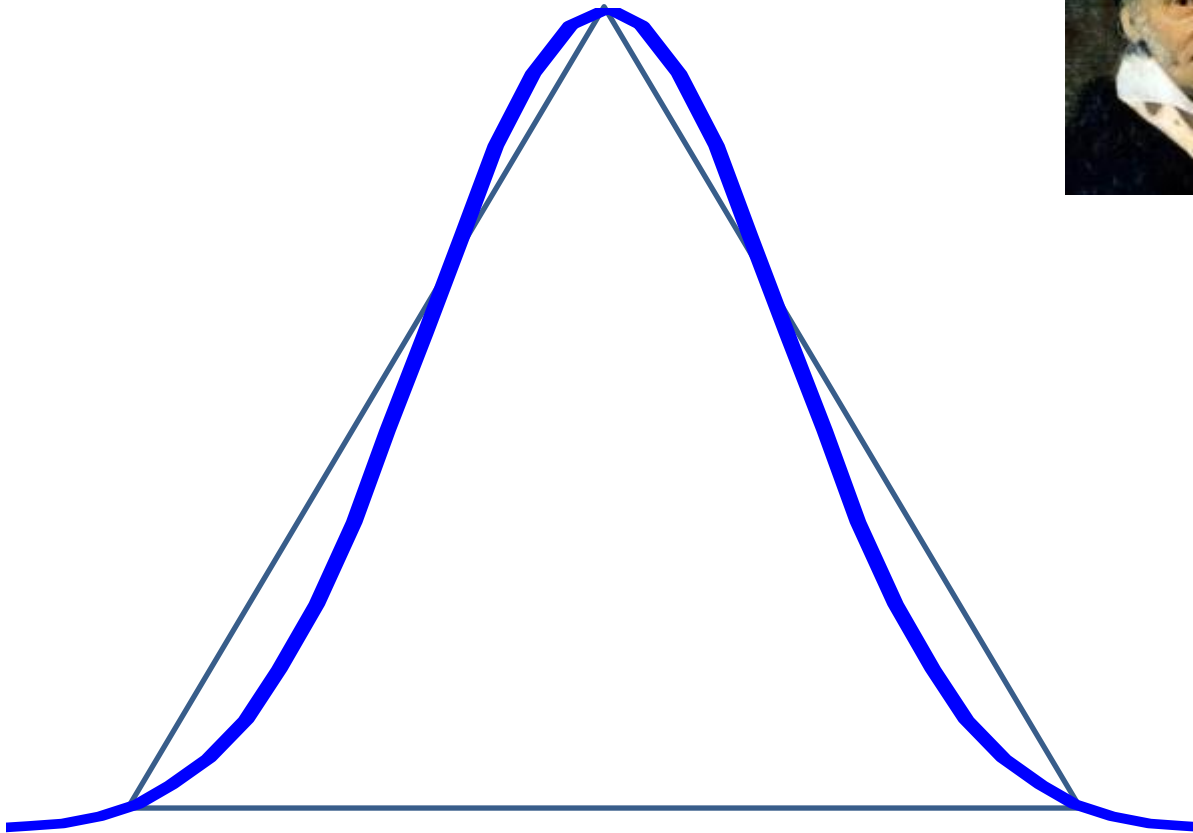
Random walks – a flip of a 2D coin



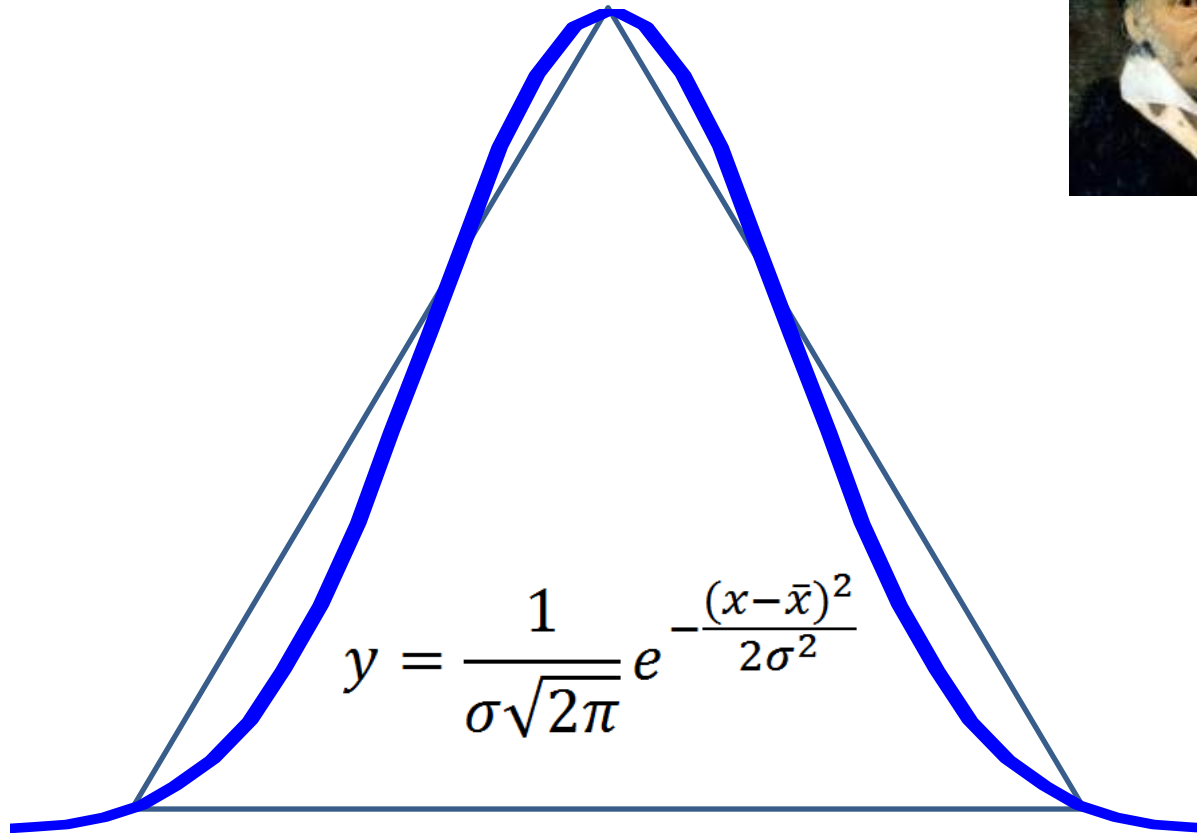
Random walks (equal chance in any direction) describe the motion of molecules in a gas or liquid, fluctuating stocks, roulette winnings, animal search paths, even weather.



- But how to get higher rows? Difficult to calculate above 20 rows.



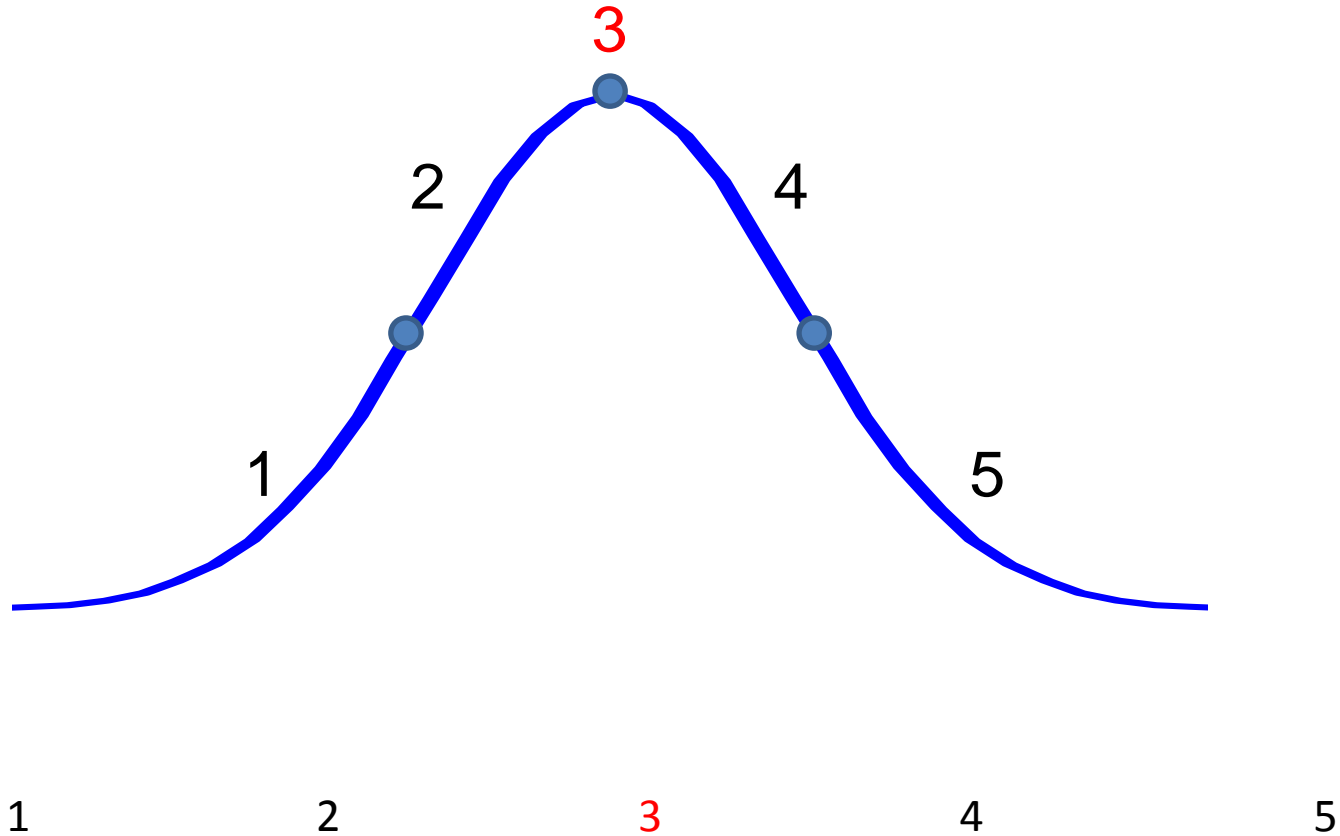
- the Gaussian curve (continuous) instead of Pascal's triangle (discrete)
- the dreaded normal curve (or bell)



- Napoleon's army, breadstick weights, basketball scores, test normalizing

Forever doubling?

Up, peak, down



- increasing increase, decreasing increase, **peak**, increasing decrease, decreasing decrease



NUCLEAR ENERGY AND THE FOSSIL FUELS

BY

M. KING HUBBERT

CHIEF CONSULTANT (GENERAL GEOLOGY)

Presented before the
Spring Meeting of the Southern District
Division of Production
American Petroleum Institute
Plaza Hotel, San Antonio, Texas
March 7-8-9, 1956

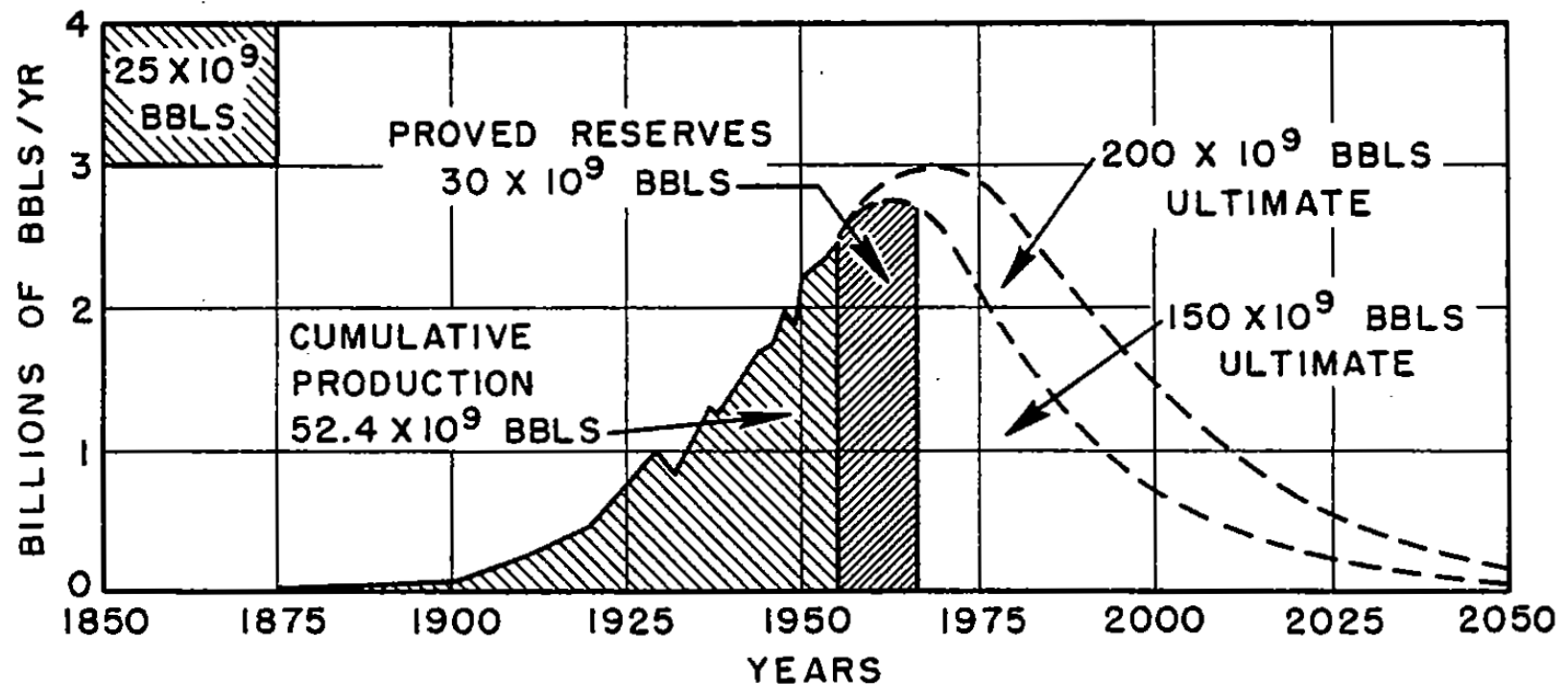


Figure 21 – Ultimate United States crude-oil production based on assumed initial reserves of 150 and 200 billion barrels.

- In 1956, M. King Hubbert predicted that **the U. S.** would reach maximum production (*peak oil*) in the **1970s** (which it did).

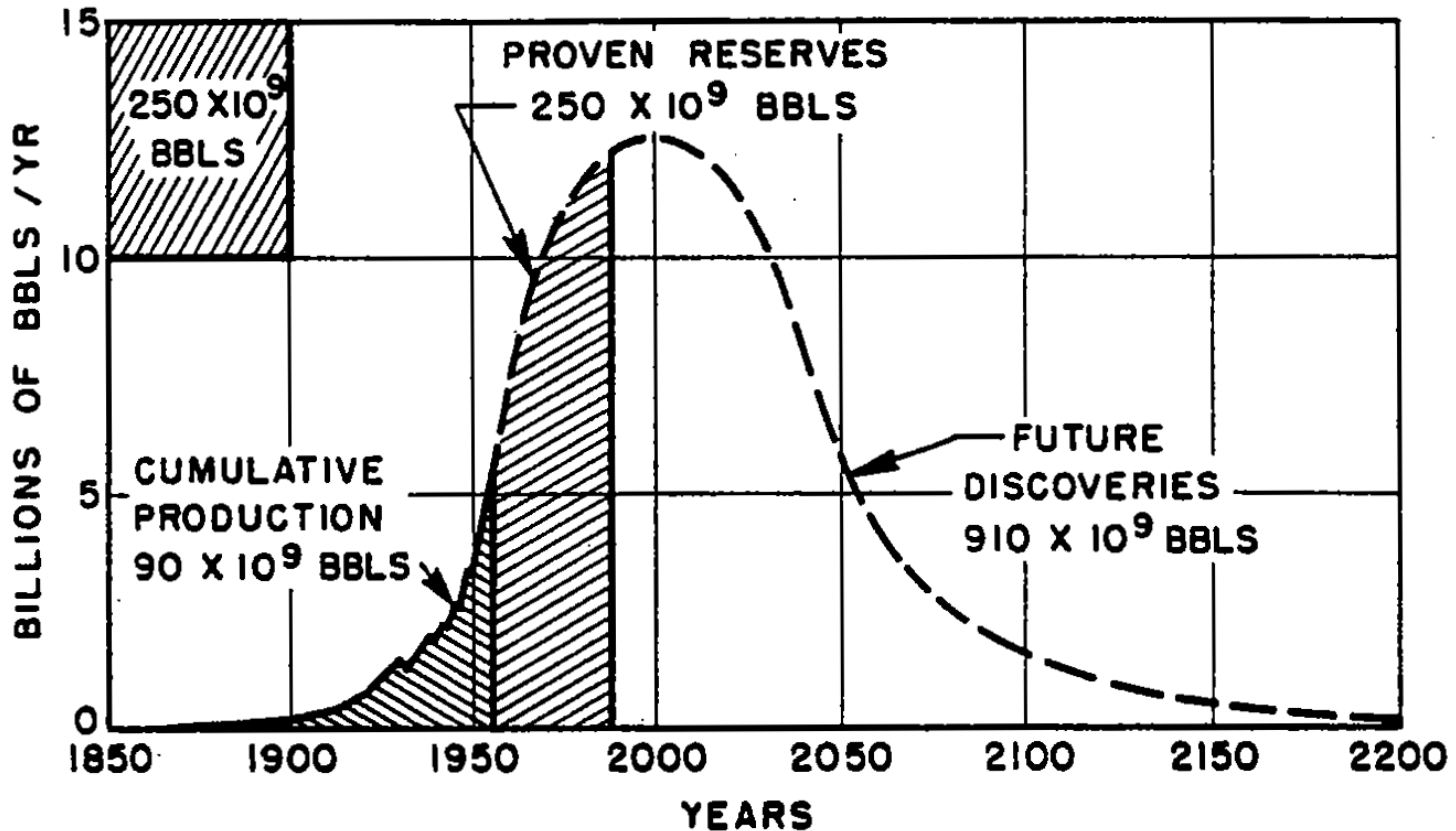
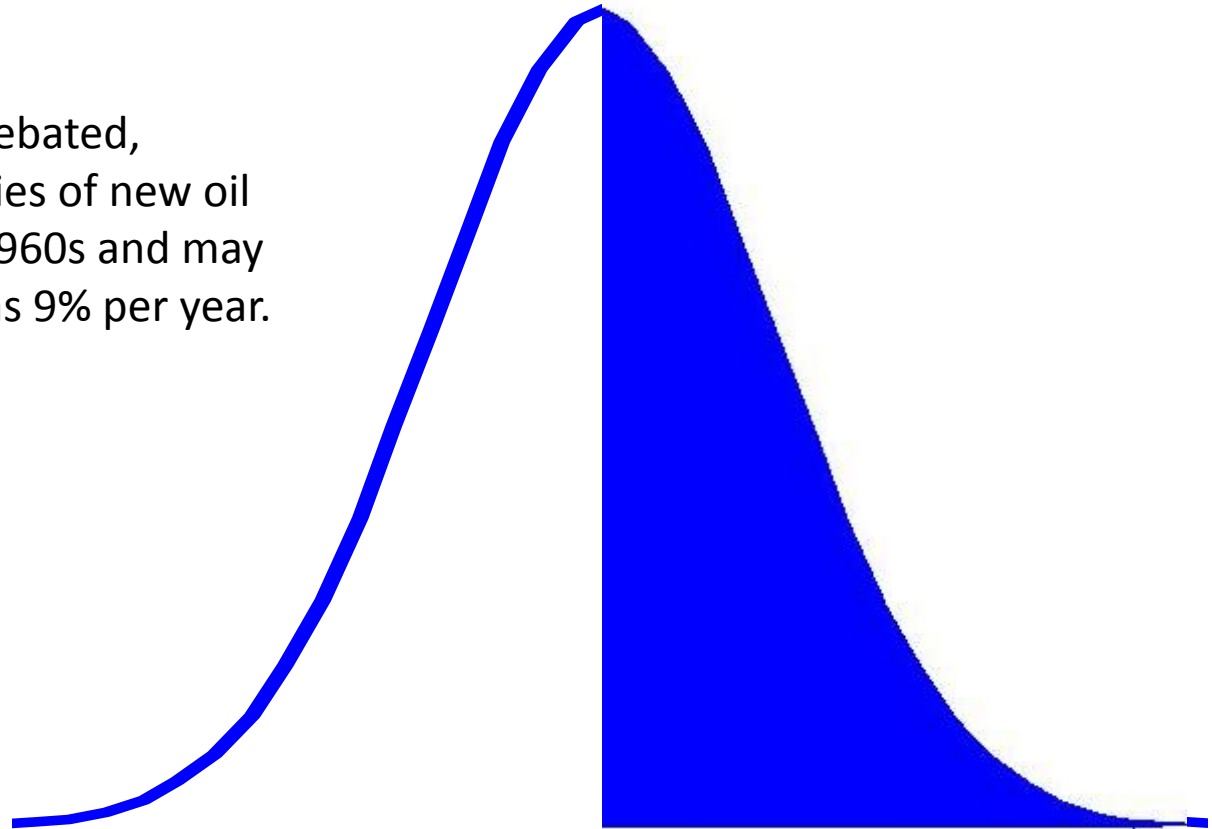


Figure 20 - Ultimate world crude-oil production based upon initial reserves of 1250 billion barrels.

- In 1956, M. King Hubbert also predicted that **the world** would reach *peak* oil around **2000**.

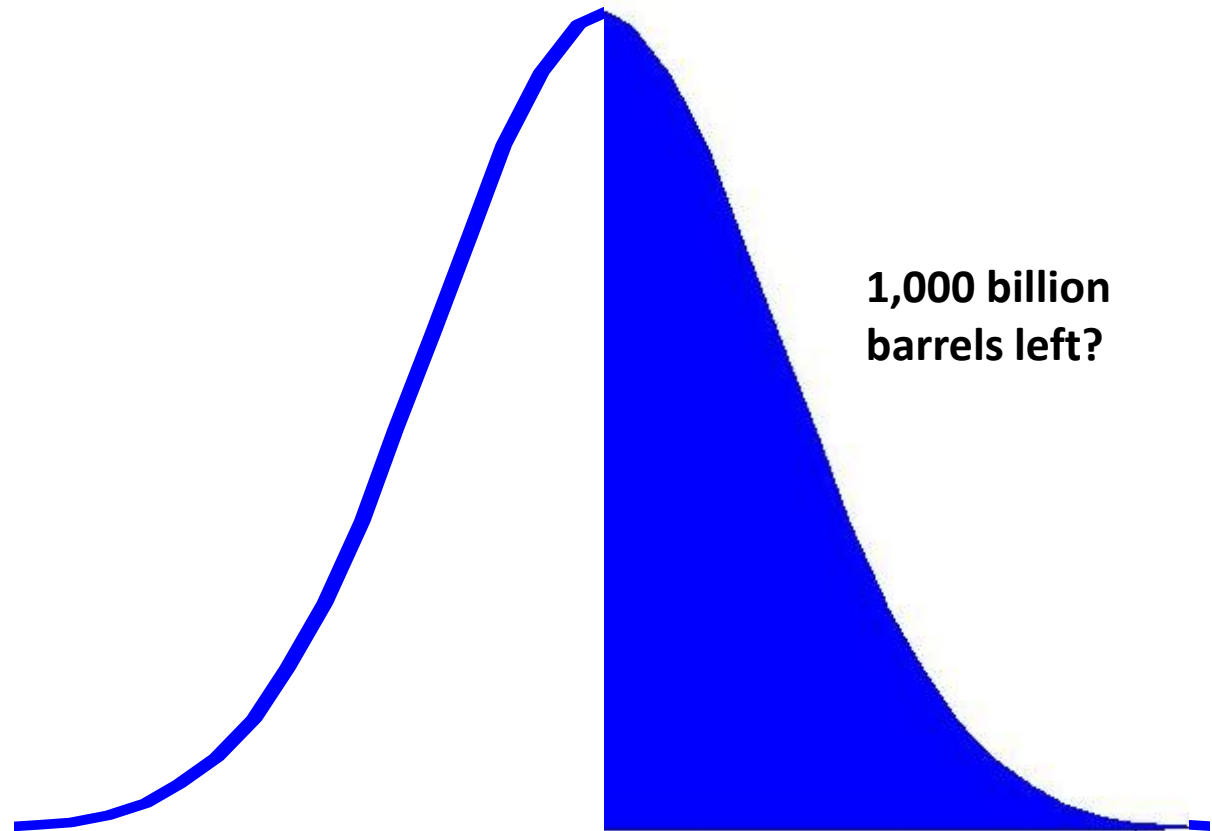
Globally, **peak oil** is still debated, although annual discoveries of new oil have declined since the 1960s and may be declining by as much as 9% per year.



The **International Energy Agency** predicts “a significant potential gap between supply and demand by 2015.” Peak oil stated as 2006.

Forever doubling?

Peak oil?



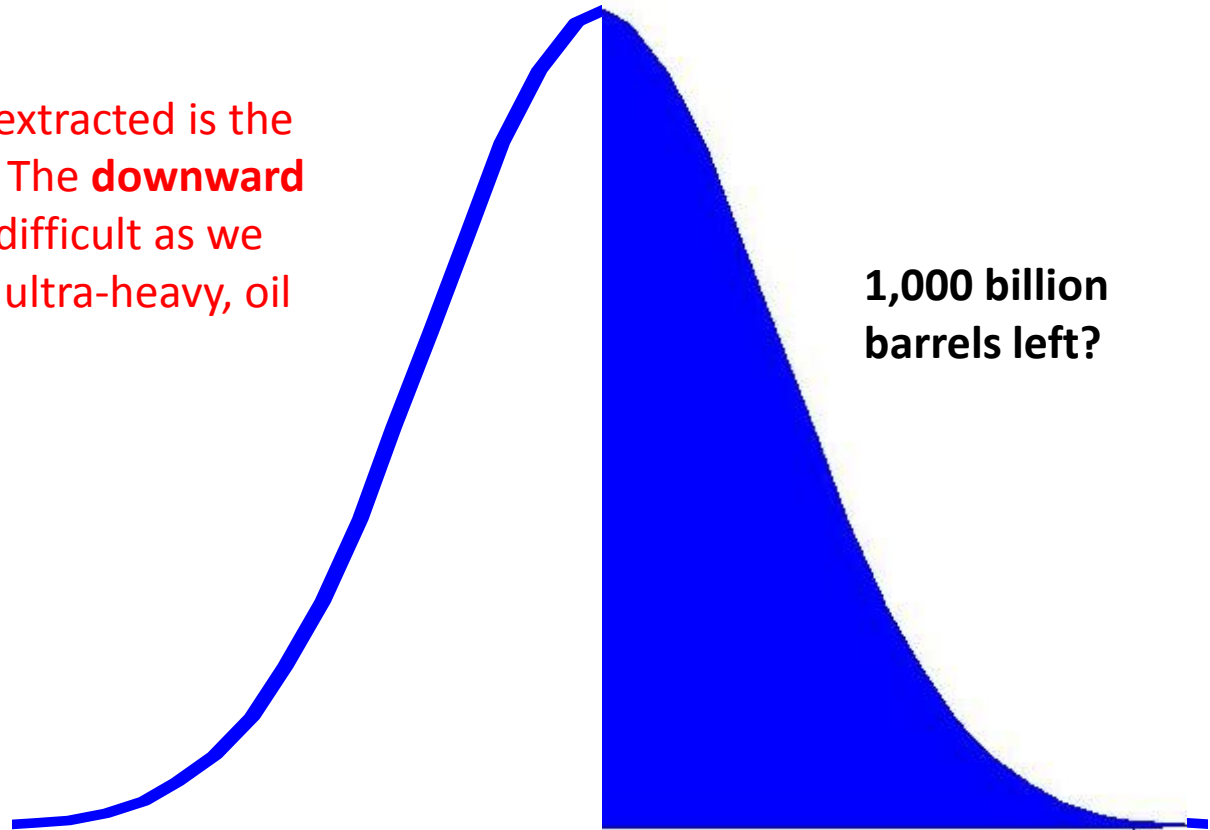
80 million barrels per day (8 billion people = 1 barrel / 100 persons per day).

1,000 billion barrels left. At ~35 billion per year = **less than 40 years.**

Forever doubling?

Peak oil?

What has already been extracted is the easier half—the upside. The **downward half** will be much more difficult as we approach “end” oil) → ultra-heavy, oil sands, shale (fracking).



Europeans use **about half** as many resources per person as their North American counterparts. But China and India now increasing growth rates.

Top World Oil Producers, Exporters, Consumers, and Importers, 2006 (millions of barrels per day)

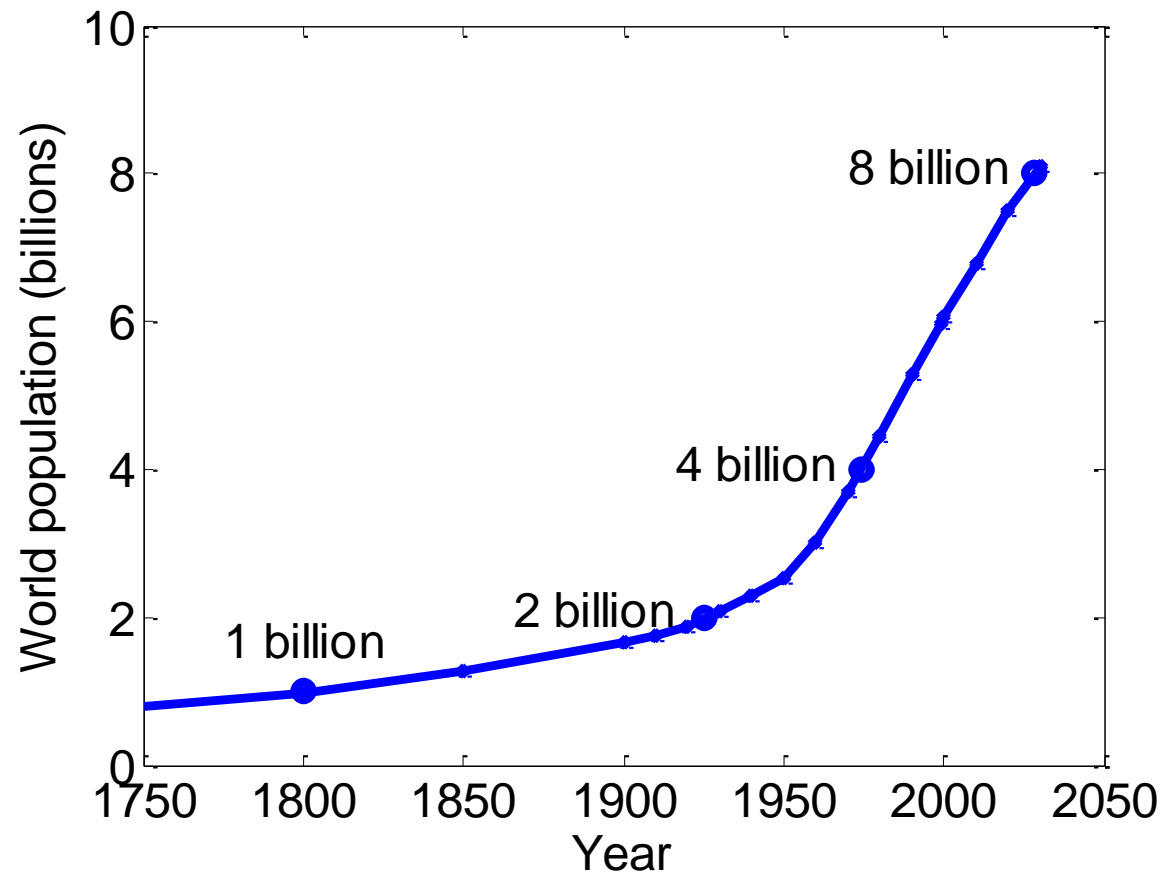
Producers ¹	Total oil production	Exporters ²	Net oil exports	Consumers ³	Total oil consumption	Importers ⁴	Net oil imports
1. Saudi Arabia	10.72	1. Saudi Arabia	8.65	1. United States	20.59	1. United States	12.22
2. Russia	9.67	2. Russia	6.57	2. China	7.27	2. Japan	5.10
3. United States	8.37	3. Norway	2.54	3. Japan	5.22	3. China	3.44
4. Iran	4.12	4. Iran	2.52	4. Russia	3.10	4. Germany	2.48
5. Mexico	3.71	5. United Arab Emirates	2.52	5. Germany	2.63	5. South Korea	2.15
6. China	3.84	6. Venezuela	2.20	6. India	2.53	6. France	1.89
7. Canada	3.23	7. Kuwait	2.15	7. Canada	2.22	7. India	1.69
8. United Arab Emirates	2.94	8. Nigeria	2.15	8. Brazil	2.12	8. Italy	1.56
9. Venezuela	2.81	9. Algeria	1.85	9. South Korea	2.12	9. Spain	1.56
10. Norway	2.79	10. Mexico	1.68	10. Saudi Arabia	2.07	10. Taiwan	0.94
11. Kuwait	2.67	11. Libya	1.52	11. Mexico	2.03		
12. Nigeria	2.44	12. Iraq	1.43	12. France	1.97		
13. Brazil	2.16	13. Angola	1.36	13. United Kingdom	1.82		
14. Iraq	2.01	14. Kazakhstan	1.11	14. Italy	1.71		

“During the last two centuries of unbroken industrial growth we have evolved what amounts to an exponential-growth culture. Our institutions, our legal system, our financial system, and our most cherished folkways and beliefs are all based upon the premise of continuing growth. Since physical and biological constraints make it impossible to continue such rates of growth indefinitely, it is inevitable that with the slowing down in the rates of physical growth, cultural adjustments must be made.”

National Energy Conservation Policy Act of 1974, Hearings before the Subcommittee on the Environment of the committee on Interior and Insular Affairs House of Representatives.
[June 6, 1974]

Forever doubling?

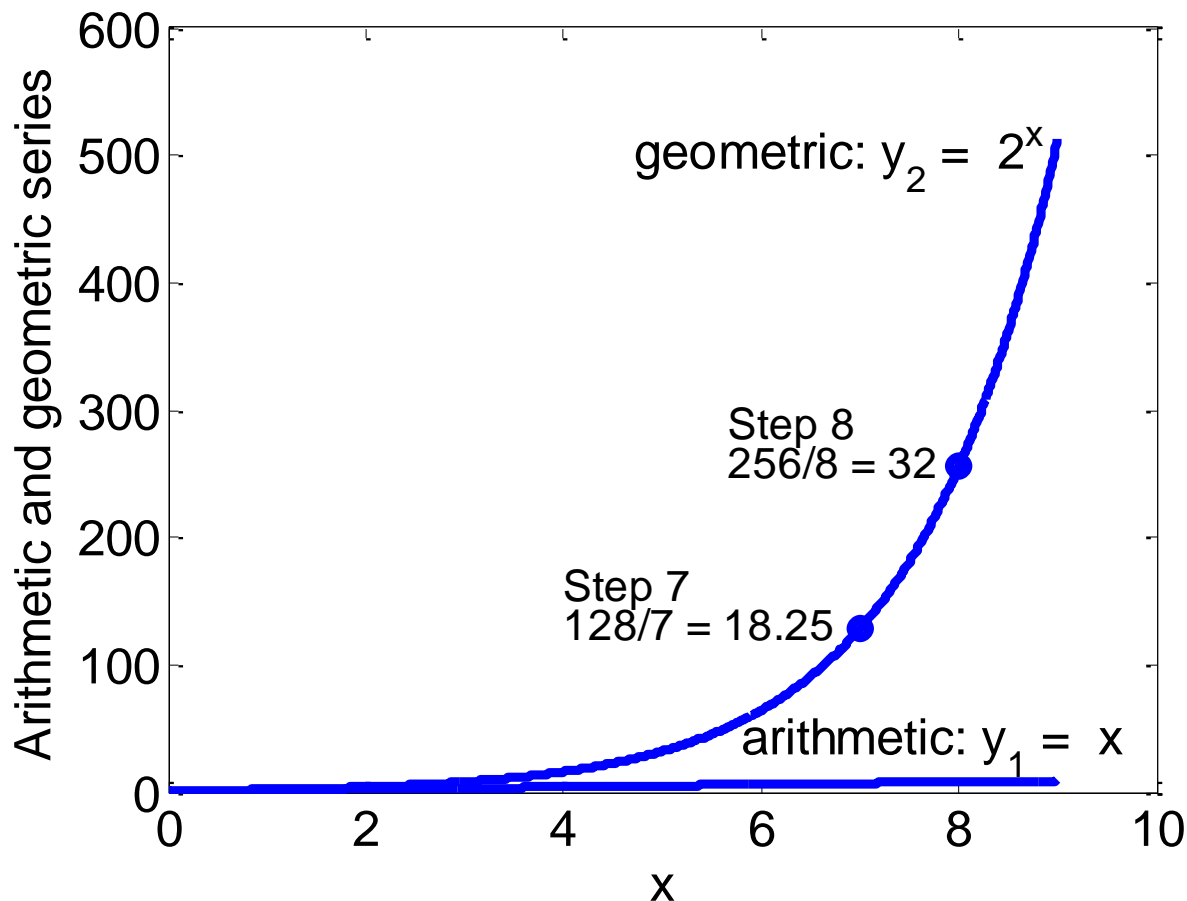
World population



- 300 years from 500 million to 1 billion (1500 to 1800)
- 125 years from 1 billion to 2 billion (1800 to 1925)
- 50 years from 2 billion to 4 billion (1925 to 1975)

Forever doubling?

World population and food



Thomas Malthus (1798)
Essay on the Principle of Population

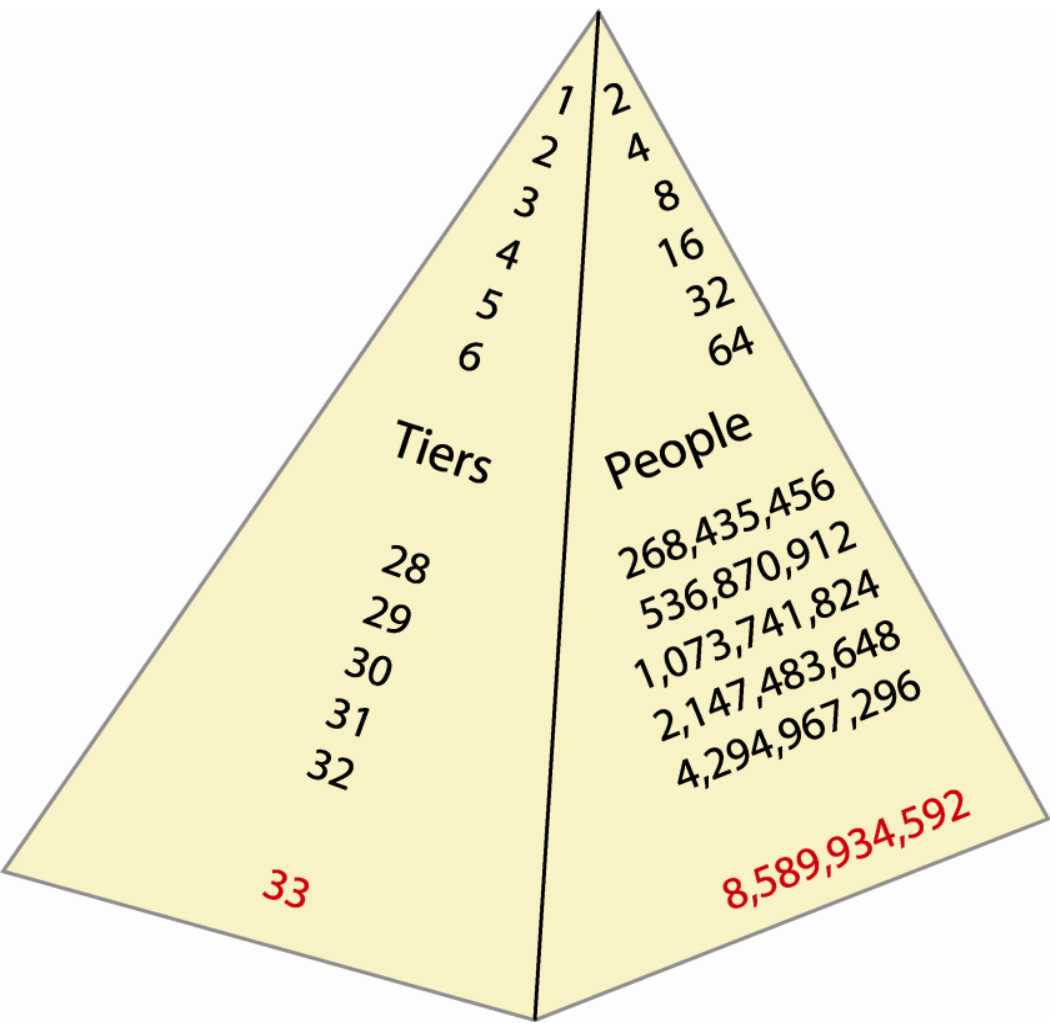
Thomas Malthus's description

$y = 2^x$ is the world population

$y = x$ is the food supply

Forever doubling?

Bernie Madoff
(prisoner # 61727-054)



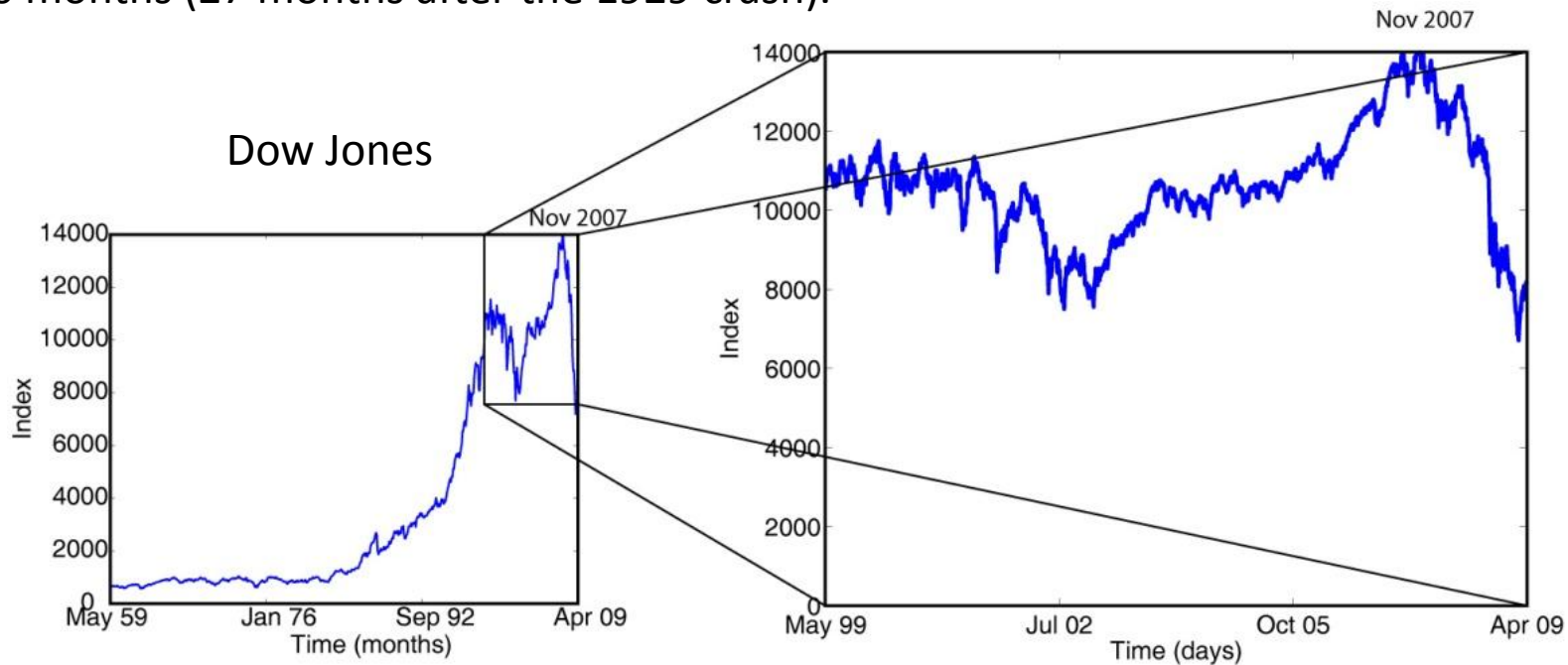
Pyramid scams, chain letters, Amway selling, six degrees of Kevin Bacon

She told two friends, and they told two friends, and they told two friends, . . .

Forever doubling? 2009: New scam, old scam

U.S. foreclosures increased by 80% to 1.3 million, an estimated 8.8 million homeowners (11%) were in negative equity, Bear Sterns stock worthless.

More than half the value of all global stocks wiped out -- \$63 trillion to \$31 trillion in 10 months (27 months after the 1929 crash).



In Ireland, two million homes, 1.5 million households.

By early 2010, half of all homeowners in negative equity. A year later, house prices dropped by more than half from their peak 3 years earlier.

Forever doubling? 2009: New scam, old scam

Thick-walled bubbles – ordinary recession, tech bubbles (expand and contract)

Thin-walled bubbles – over-leveraged back loans (systemic failure, i.e., blow up)



Forever doubling? 2009: New scam, old scam

Thick-walled bubbles – ordinary recession, tech bubbles (expand and contract)

Thin-walled bubbles – over-leveraged back loans (systemic failure, i.e., blow up)



Forever doubling? 2009: New scam, old scam

Thick-walled bubbles – ordinary recession, tech bubbles (expand and contract)

Thin-walled bubbles – over-leveraged back loans (systemic failure, i.e., blow up)

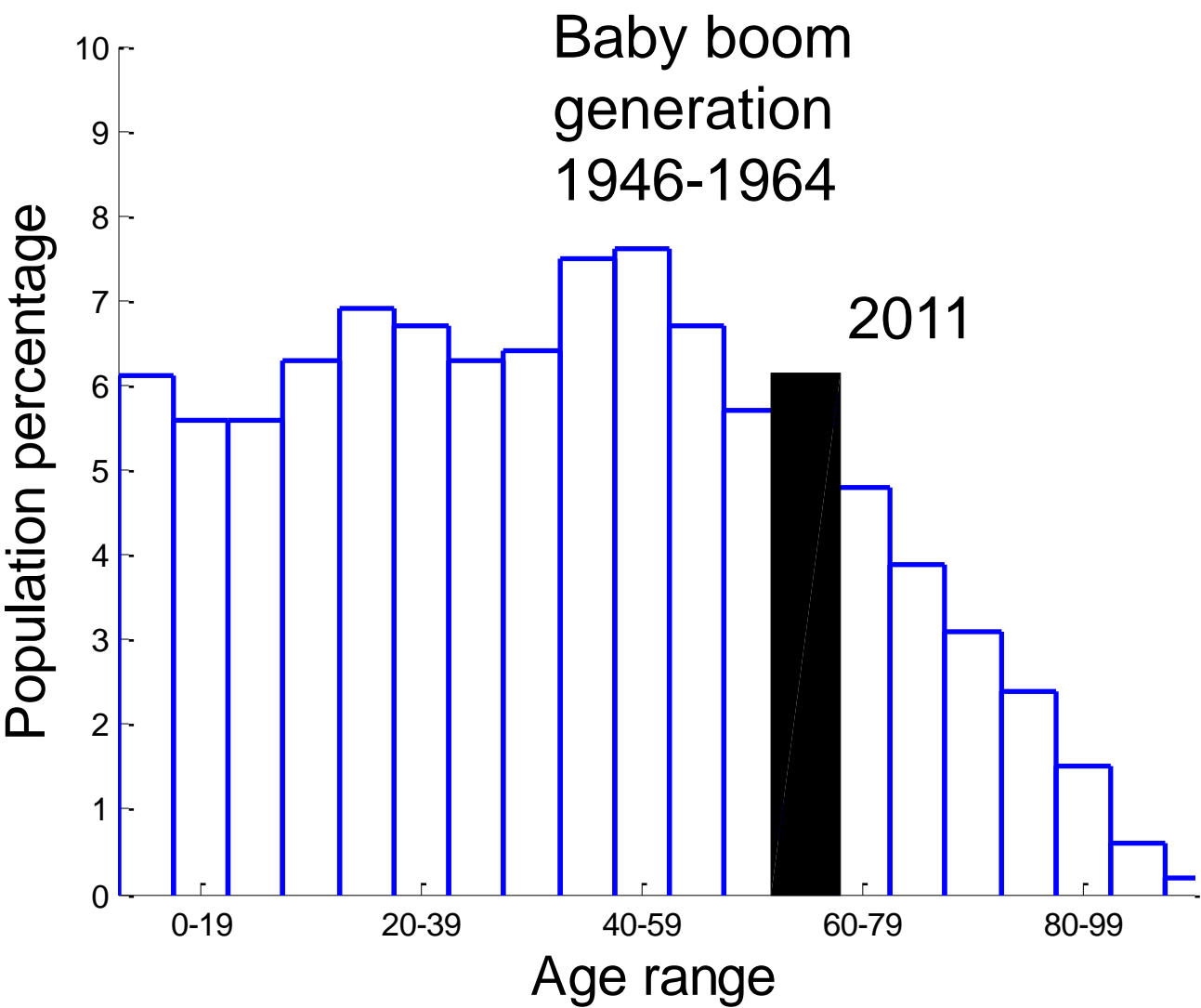


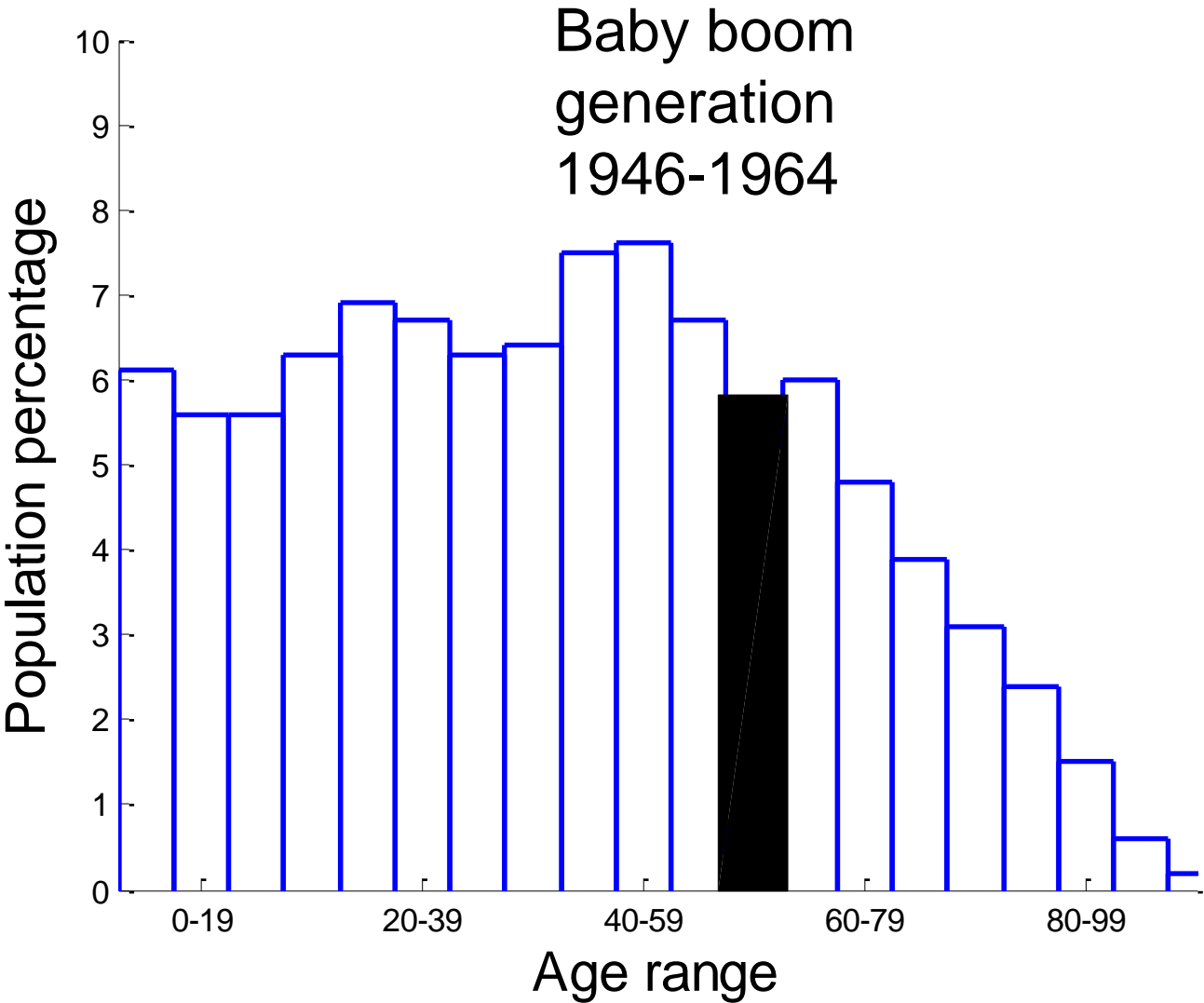
Forever doubling?

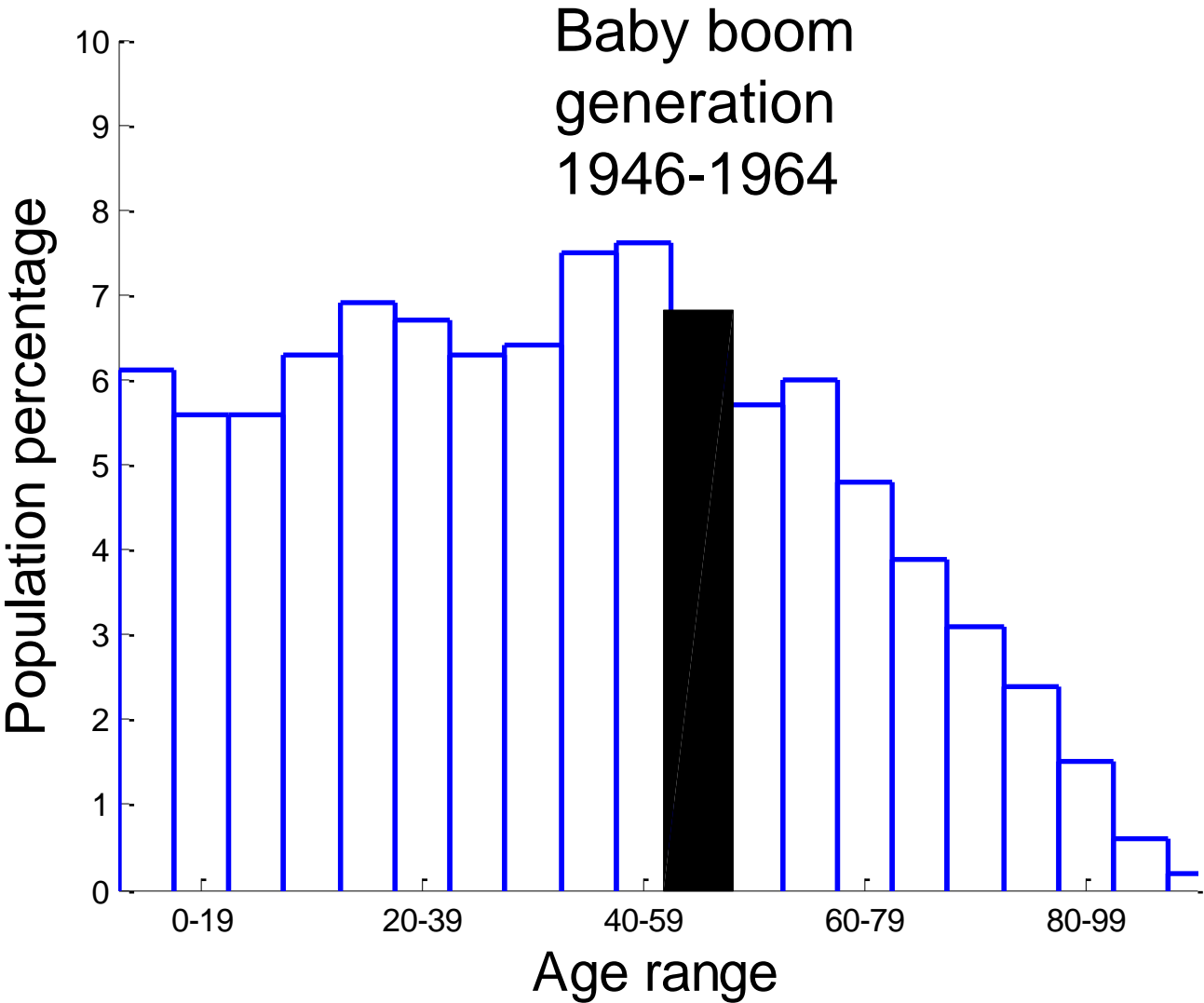
Looming debt/pension crisis

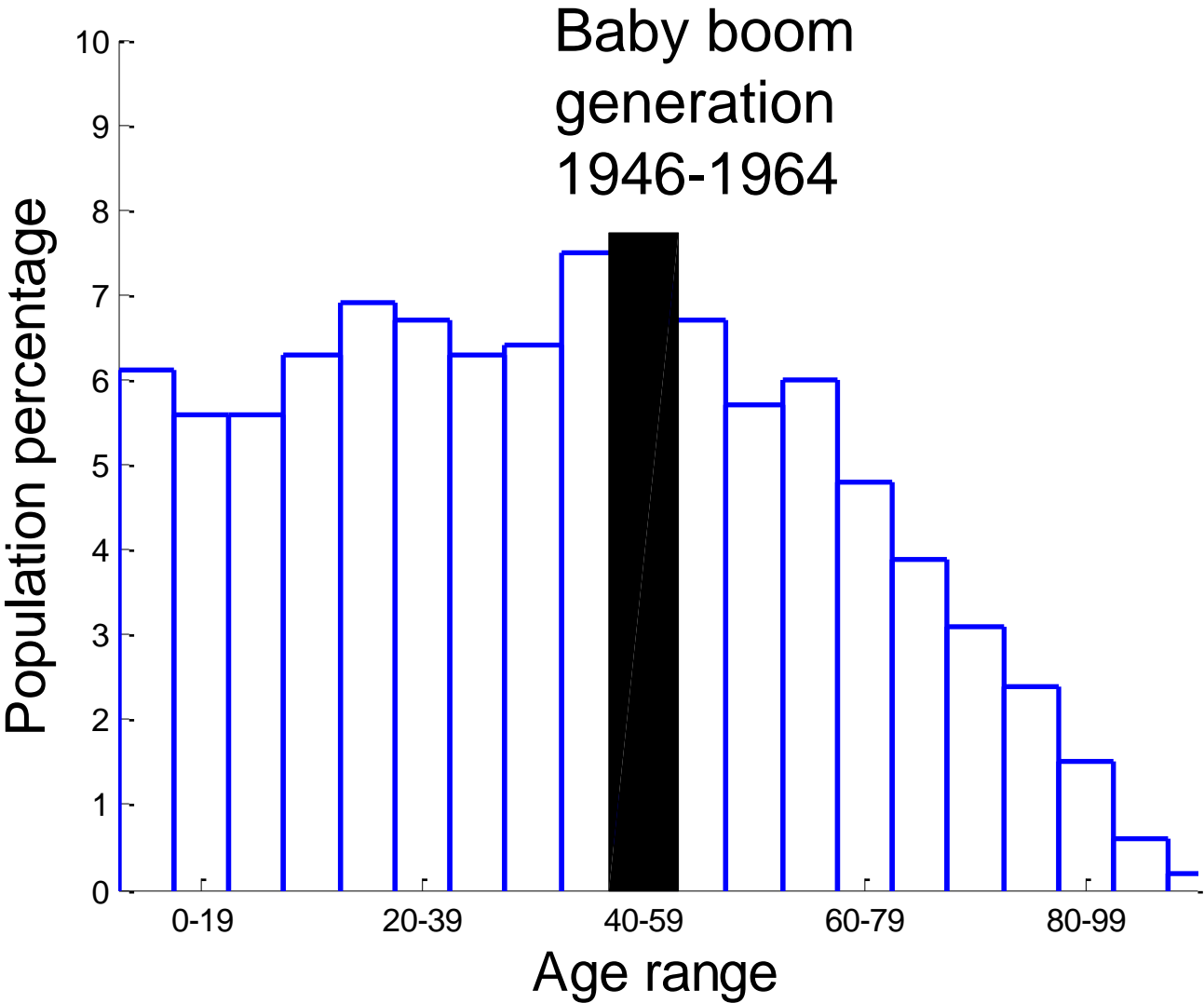


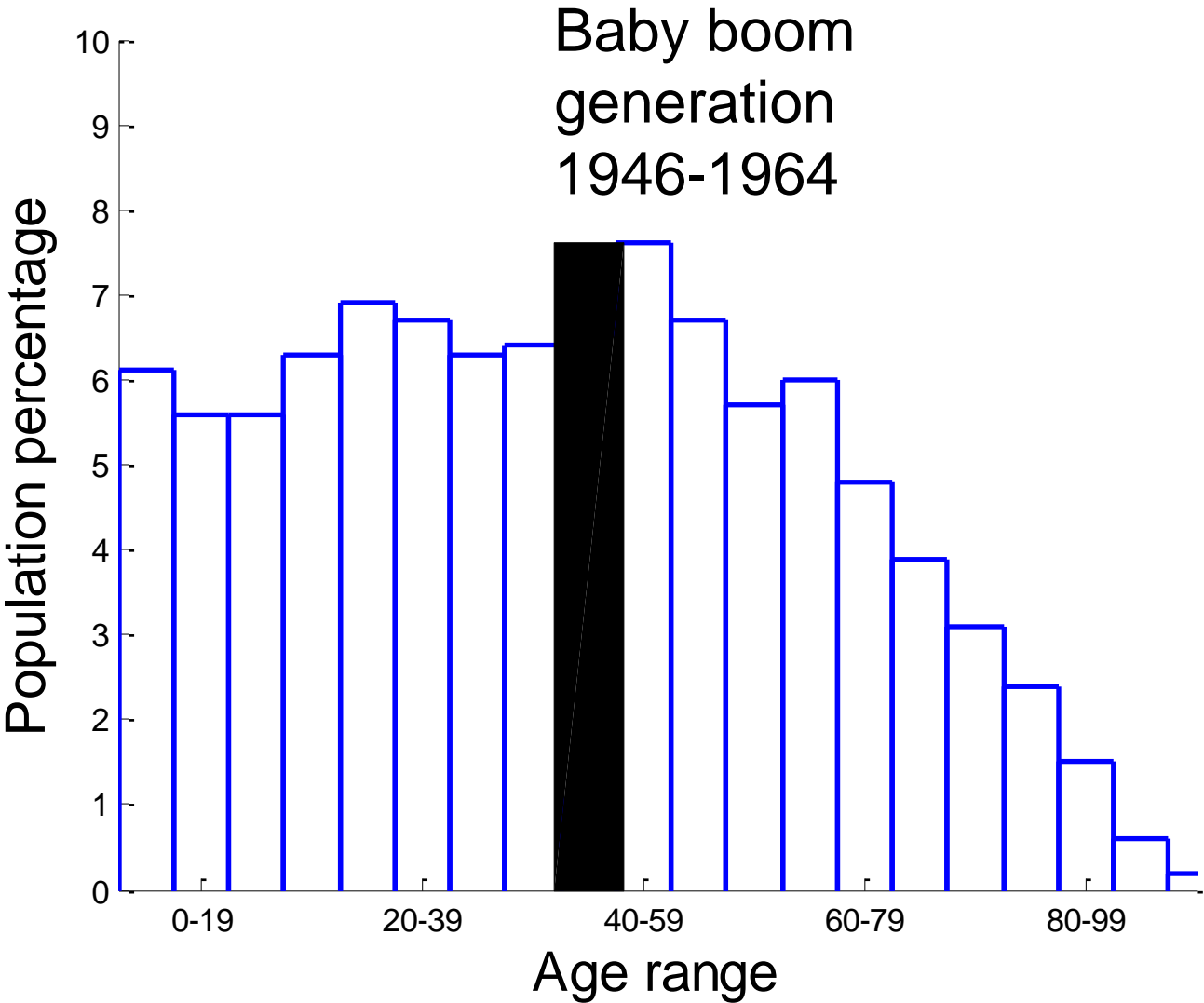
2012: \$15.8 trillion











Forever doubling?

The courtier and the Indian king

Square 1 Day 1 1	Square 2 Day 2 2	4	8	16	32	Square 7 End week 1 64	128
256	512	1024	2048	4096	Square 14 End week 2 8,192	16,384	32,768
65,536	131,072	262,144	524,288	1,048,576	2,097,152	4,194,304	8,388,608
16,777,216	33,554,432	67,108,864	134,217,728	268,435,456	536,870,912	1,073,741,824	2,147,483,648
55,934,592	111,869,184	223,738,368	447,476,736	894,953,472	1,789,906,944	3,579,813,888	7,159,627,776
1,099,511,627,776	2,199,023,255,552	4,398,046,511,104	8,796,023,022,208	17,592,046,044,416	35,184,092,088,832	70,368,184,177,664	140,737,368,355,328
281,474,976,710,656	562,949,953,421,312	1,125,899,906,842,624	2,251,799,813,685,248	4,503,599,627,370,496	9,007,199,254,740,992	18,014,398,509,481,984	36,028,797,018,963,968
72,057,594,037,927,936	144,115,188,075,855,872	288,230,376,151,711,744	576,460,752,303,423,488	1,152,921,504,606,846,976	2,305,843,009,213,693,952	4,611,686,018,427,387,904	9,223,372,036,854,775,808

Star Trek tribbles
(10^{6.2484} = 1,771,561)

Transistors/chip = 4 billion
(2³² = 4,294,967,296)

U. S. national debt = \$16 trillion
(2⁴⁴ = 17,592,186,044,416)

100 million galaxies x 100 million stars
10 million billion (10¹⁶)

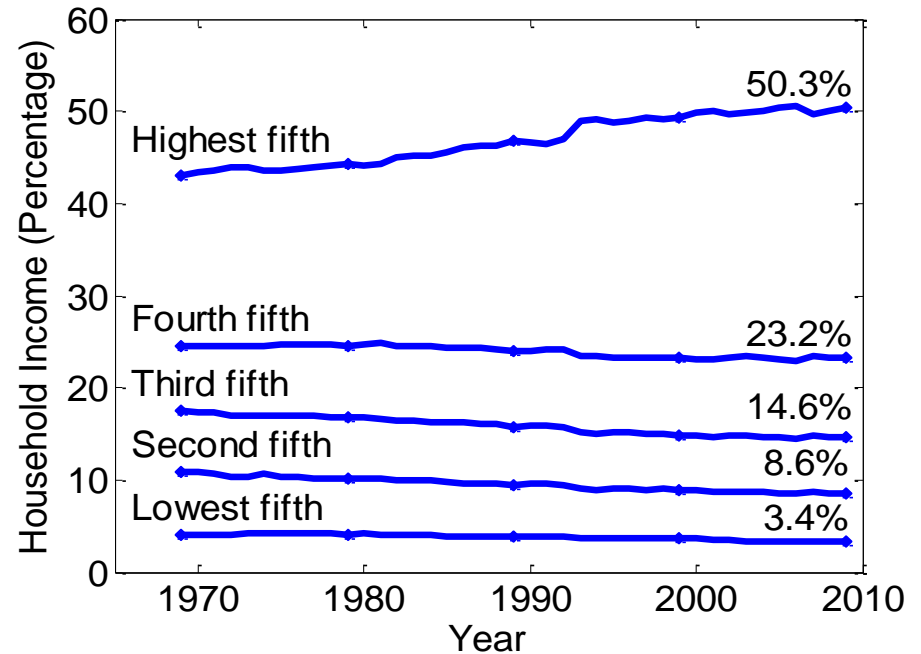
Power laws recognize the exponential relationship between two variables and are straight lines when plotted.

Pareto expressed this in his “80:20 rule”
80% of wealth is held by 20% of people.

OR

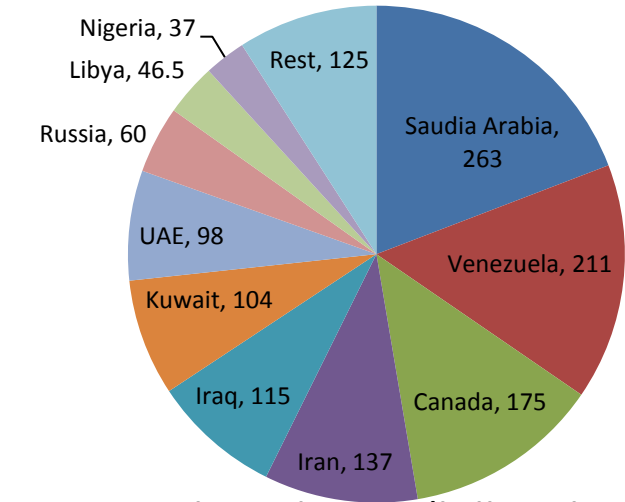
80% of employees do 20% of the work
80% of time spent on 20% of solution
80% of awards go to 20% of actors

...



The probability of an outcome decreases as its size increases, in such diverse systems as earthquakes, word count in books, size of human settlements, ...

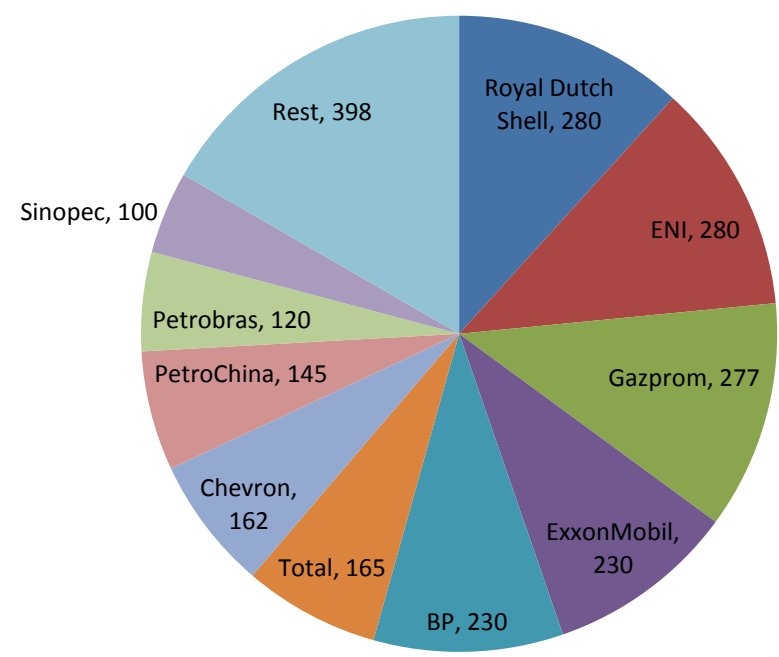
Oil Stats: Top 10 countries



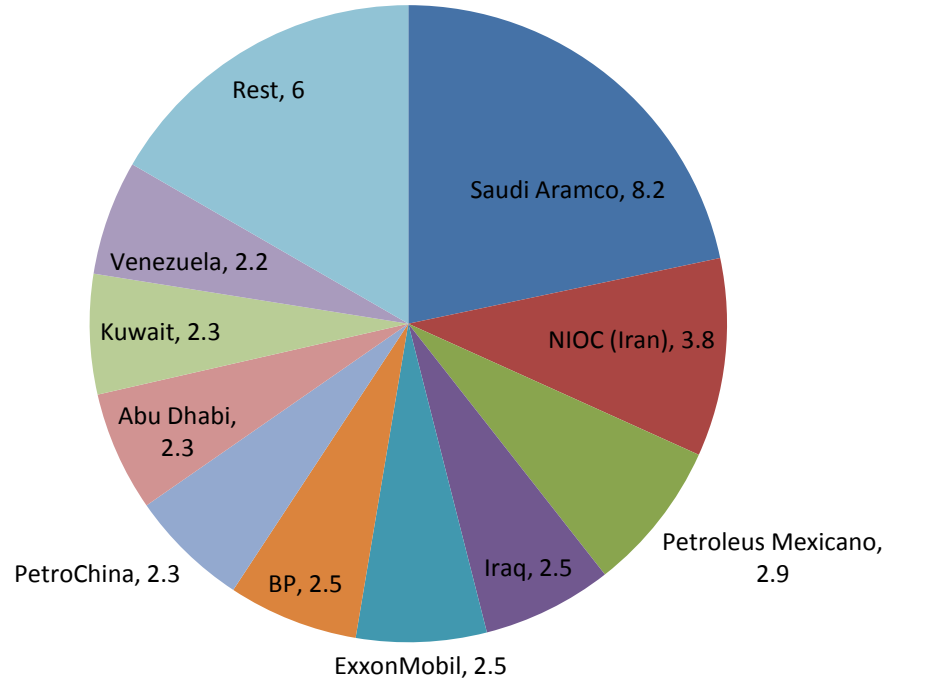
Top 10 Oil Producers (billion barrels)

Oil Stats: Top 10 companies (assets and barrels)

Public Oil Company Assets (billion \$US)



Oil Company Reserves (mbd)



Oil Stats: Top 10 oil fields

Ghawar, Saudi Arabia: 30 bb



Forbes.com

Oil Stats: Top 10 oil fields

West Qurna, Iraq: 21 bb



Oil Stats: Top 10 oil fields

Majnoon, Iraq: 13 bb



Oil Stats: Top 10 oil fields

Rumaila, Iraq: 17 bb



Oil Stats: Top 10 oil fields

Ahwaz, Iran: 100? bb



Oil Stats: Top 10 oil fields

Kashagan, Kazakhstan: 9 bb



Oil Stats: Top 10 oil fields

Khurais, Saudi Arabia: 27 bb



Oil Stats: Top 10 oil fields

Tupi, Brazil: 8 bb



Oil Stats: Top 10 oil fields

North Slope, USA: 40? bb



Oil Stats: Top 10 oil fields

Carabobo, Venezuela: 15 bb



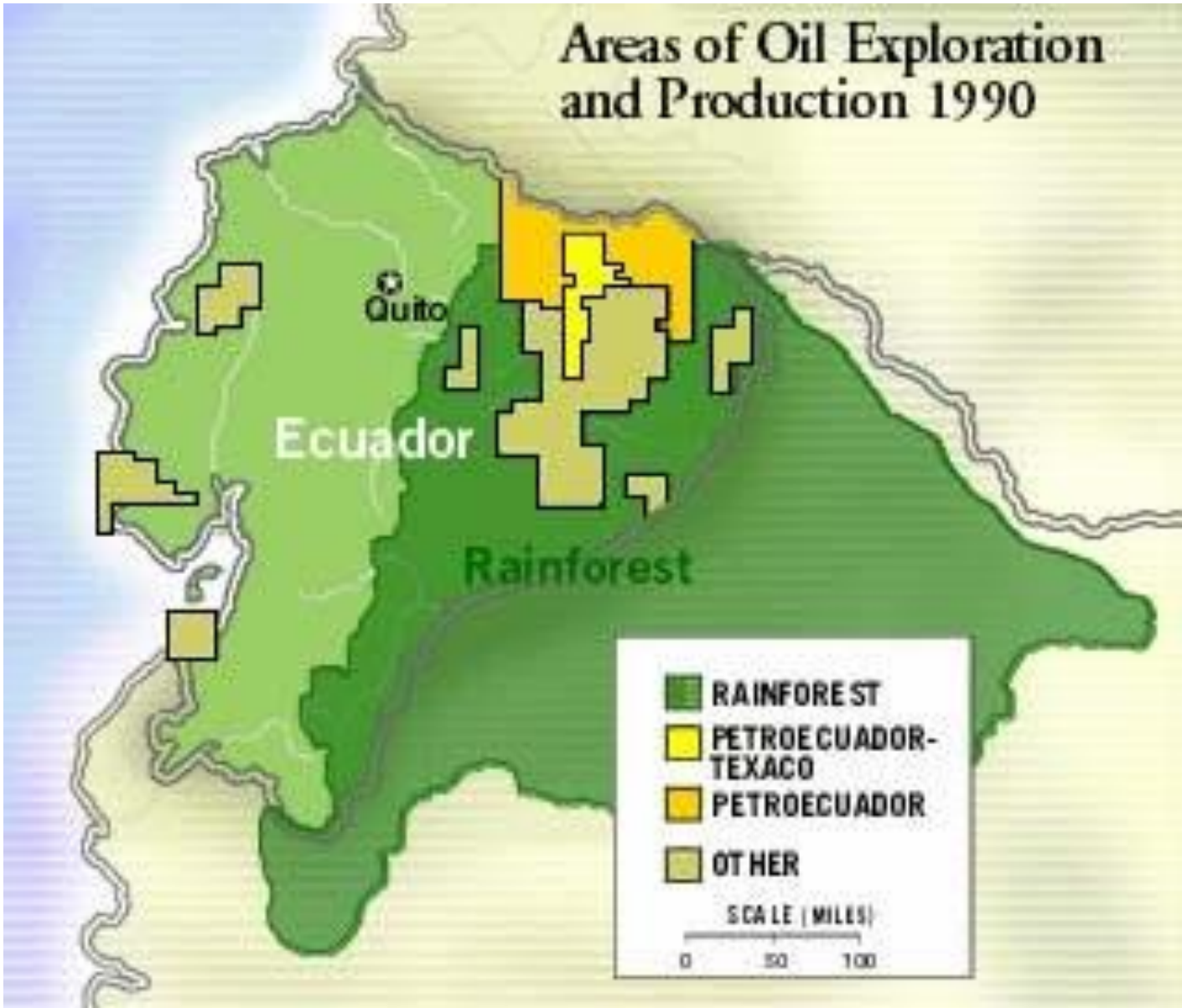
Oil Stats: Ecuador, the rainforest, and the Cofán indigenous people



Oil Stats: Ecuador, the rainforest, and the Cofán indigenous people

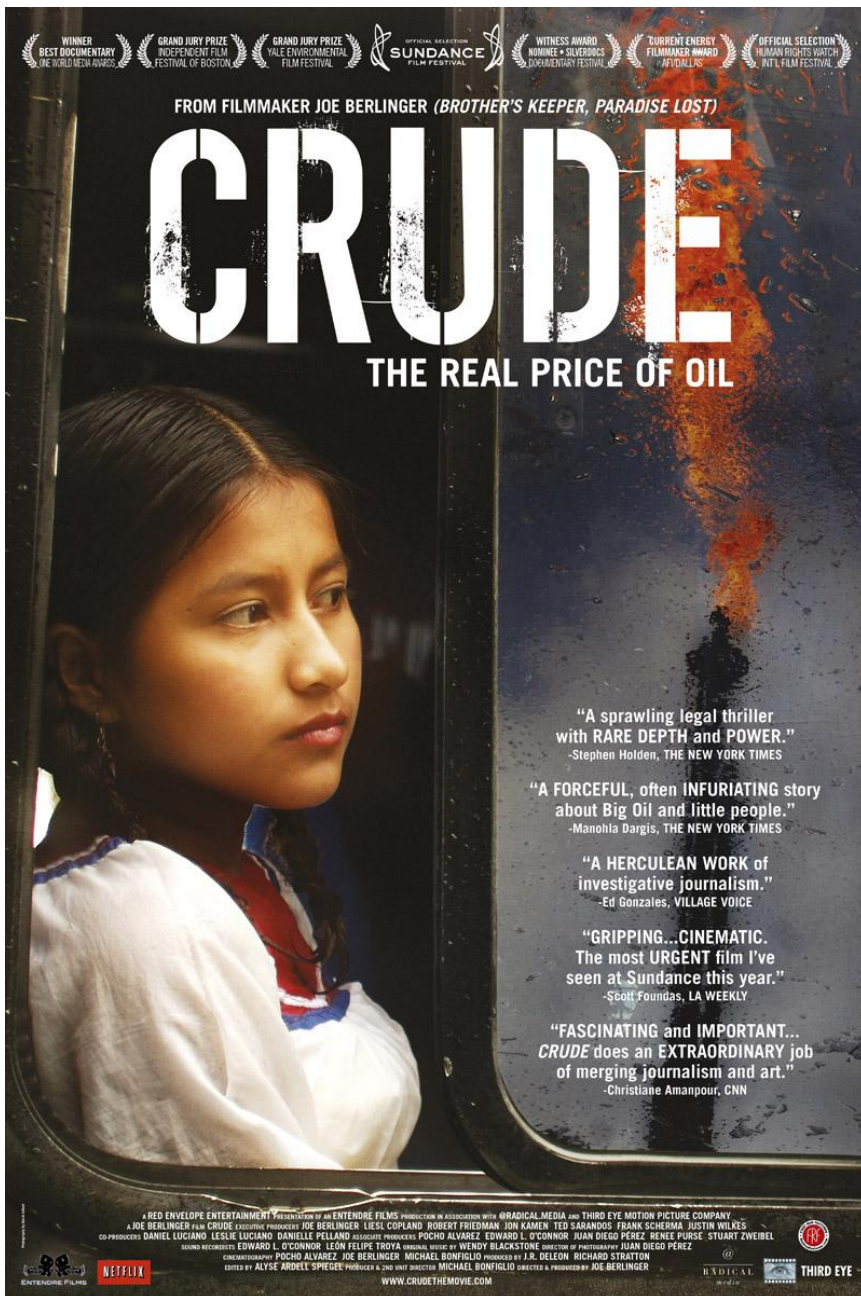


Oil Stats: Ecuador, the rainforest, and the Cofán indigenous people



Oil Stats: Ecuador, the rainforest, and the Cofán indigenous people





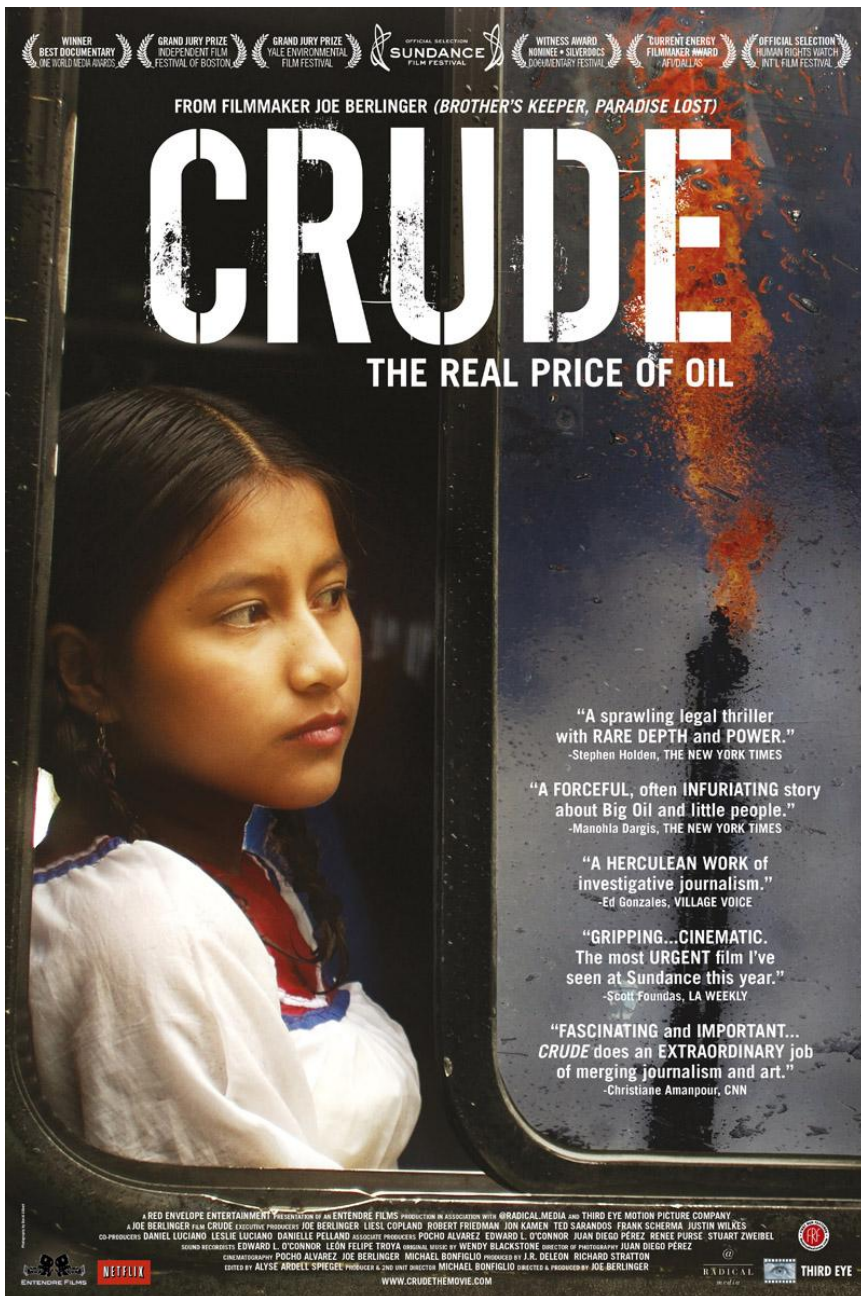
Crude: The Real Price of Oil, by Joe Berlinger

Ecuadorian Amazon rain forest,
Cofán indigenous people

Texaco/Chevron (1964-1992) & PetroEcuador,
18 billion gallons of post-drilling waste water
Saved \$1-\$3 / barrel, made \$30 billion profits

Crude oil/petroleum are hydrocarbons C_xH_y
Refined by boiling
E.g., petrol/gas (methane, ethane, propane,
octane), kerosene, asphalt, chemical reagents
(plastics)

Creating CO_2 when burned.



Crude: The Real Price of Oil, by Joe Berlinger

1,700 square miles of
contamination

17-year struggle, 3-years of filmed
documentation

A real-life thriller
(environmentalists, politicians,
multinationals, celebrity activists,
human rights advocates, and
disappearing indigenous culture

DO THE MATH!

ON GROWTH, GREED,
AND STRATEGIC THINKING

How do pyramid scams work?

When did the real downturn in the economy occur?

Which state was really responsible for George W. Bush's 2000 win?

Why are North American sports leagues better than those in Europe?

How do stock pickers win at the market?

Why is the average person not the most likely person?

How does Arnold Schwarzenegger send secret messages?

Can No. 1 chart toppers explain increasing world poverty?



JOHN K. WHITE



www.johnkwhite.ie/DoTheMath.html

Exponential Growth: Pyramids, Bubbles, and Crashes

JOHN K. WHITE

She told two friends and they told two friends, and they told ... Pyramids, bubbles, and crashes are all linked to exponential growth and the mathematics of doubling, from tulip selling in 17th century Holland to sub-prime mortgages in 2009 America. With the doubling game, we see how a pyramid scam works and why it ultimately can't sustain itself (and from that, the essential causes of the 1929 stock market failure and 2009 credit crisis, among other examples of such greed-fueled growth). All prey on those who dream of future fortunes, seemingly made with only a modest investment and a few friends. How many friends? Well, let's see.

(Excellent bubble photos courtesy of [Richard Heeks](#).)



Debt and Demographics

JOHN K. WHITE

Limited tax slashing from 77% to 70% began to stimulate employment after World War II with the Employment Act of 1946, but Ronald Reagan pushed the measures to the limits. Reagan slashed the top tax rate from 70% to 28%, which increased the federal deficit more than 3 times from \$900 billion to \$3,000 billion. When demographics are factored in, countries with ageing populations are especially vulnerable, and as the working population shrinks, the debt burden will grow even more. In the US, the percentage of new retirees will increase from 4.1% in 2011 to as high as 7.1% in the following 10 years. When the weight of the debt pyramid becomes too great, wholesale relief will be required. As noted with personal debt, however, the system is a closed one, and so one must ask, to whom is all this debt owed? Certainly not to the regular citizen.



DO THE MATH!

ON GROWTH, GREED,
AND STRATEGIC THINKING



JOHN K. WHITE



www.johnkwhite.ie/DoTheMath.html