Entrepreneurial Risks

by

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Introduction

Taking risks is important, since it accelarates development. But there is always a tradeoff between exploration and exploitation.

"Life is Risk. Risk is Life."

Failures are important for growth (in the silicon valley founders are proud of failed startups).

What are risks?

- everyday risks ⟵ eating working driving
- business risks
- social risks
- political risks
  - economic risks
  - medical risks

Risk	Potential event with uncertain positive or negative consequence, that hasn't happened yet.

Hazards (e.g. tornados) are only a risk in combination with something to damage (Hazard / Safeguard).

We can (try) to quantifie risks (eg. chance of a plane crash). This differs a lot from the way a risk gets perceived by the avg. population.

Representation:

Loss x Chance Curve

This does not have to be a single curve. There are a lot of problems with this representation.

Formal Representation: $Risk \equiv [(p_1, c_1), ..., (p_n, c_n)]$

- p = probability
- c = consequence

Uncertainty:

Aleatoric uncertainty
- variability of factors

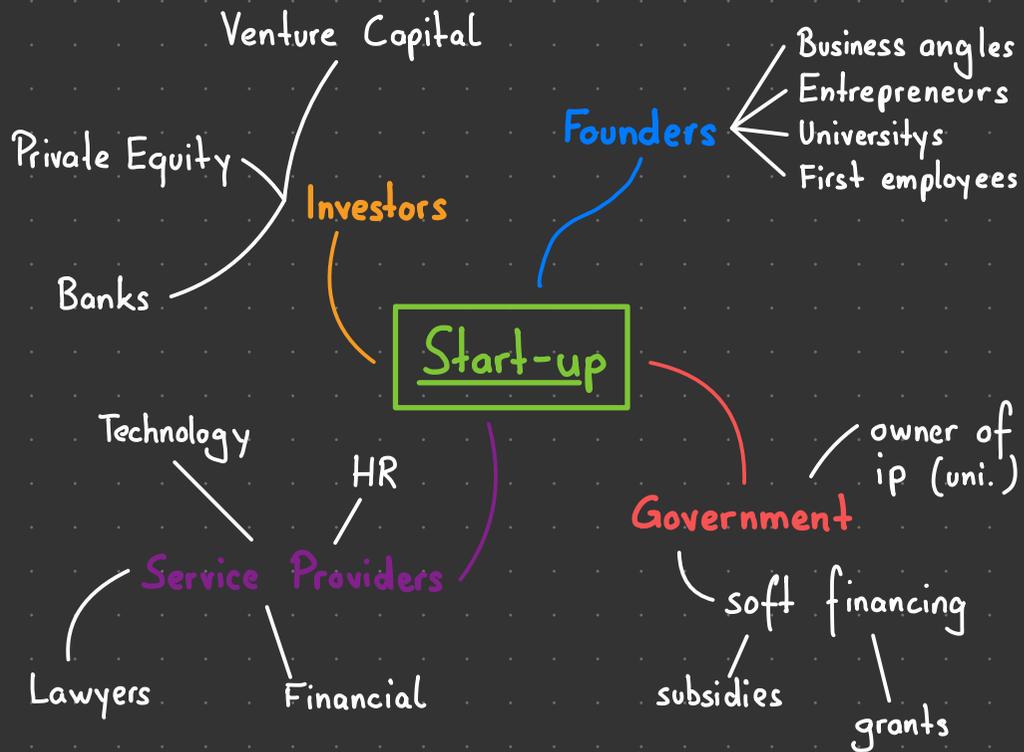Epistemic uncertainty
- lack of knowledge

Knightian uncertainty

Dragon King
- weakening of Black Swan
- Some extreme events would have been predictable to at least some degree with a sufficiently deep understanding of the structure

Start-ups and investments in Innovation

Investment landscape:

Venture Capital

Private Equity

Banks
→ Investors → Start-up

Founders ← Business angles, Entrepreneurs, Universitys, First employees

Technology, Lawyers, Financial, HR → Service Providers → Start-up

Government → owner of ip (uni.), soft financing → subsidies, grants

Start-up

Private Equity
- mature companies
- large sums
- value from cost reduction

$Asset = Debt + Equity$

$Leverage = \dfrac{Assets}{Equity}$

Venture Capital
- start-ups / small businesses
- smaller sums
- value from growth
- high risk

Venture Capital

Most start-ups (>5%) are gone within 5 years (not ETH why?). Therefore it is risky to invest in them, but while only few survive, the ones that do are likely to increase their value a lot.

Many loosers, few big winners

To decrees risk, VCs use „preference shares" to get prioritized in case of liquidation / selling of the company.
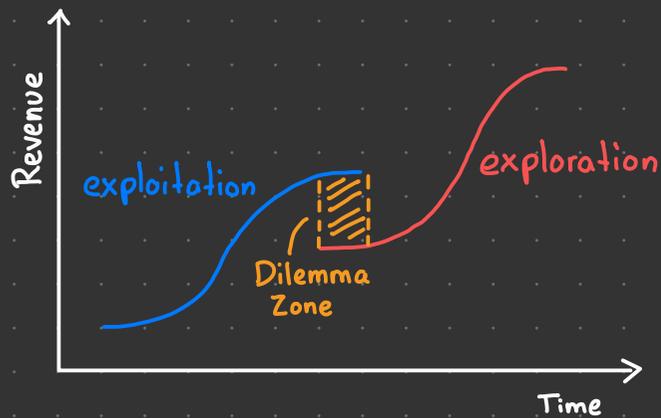
Risk and return is a duelism, higher risk => higher return

We have a tendency to overestimate small frequencies and underestimate large ones.

Similar we feel losses much more then gains (Prospect Theory).

Founder vs. Investor

	Founder	Investor
Motivation	Intrinsic	Extrinsic
Goal	Realize dream	Make money
Horizon		3-7 years
Risk	All-in	Part of portfolio
Viewpoint	Stakeholder	Shareholder
Skin in the game	Own money	Other peoples money
Role	Exploration	Exploitation
Involvement	Personal	Distanced

Revenue / Time axes — exploitation (blue), exploration (red), Dilemma Zone

Disruptive innovations initially have a too small ROI for large businesses. However after maturing they can capitalize from first-mover advantage. Exploration is a necessity, but it is also a risky endeavor. The payoff is hard to estimate.

<u>There are a lot of pitfalls:</u>

There is no causality, there is only regression to the mean.

- narrow framing (to focused on details instead of the broder picture)
- availability /survivor bias   • priming
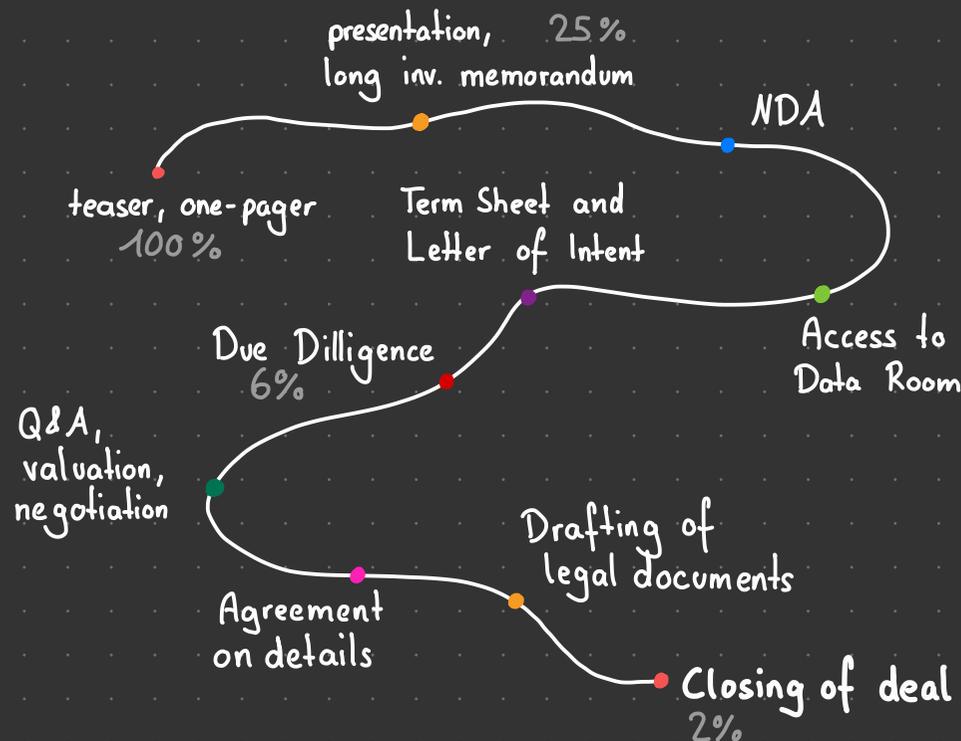- anchoring bias (reference point that influences decisions)

<u>How to deal with biases:</u>

- Heuristics — be consistent by using the same „rules"
- Consider an outside view — use a anchor not based on inside information

- Fermi questions — educated guessing
- Decorrelate error — ask people's opinions <u>individually</u>
- Sunk cost — awareness of difficulty to take a loss
- Validity of intuition — intuition can't be trusted without a stable environment and practice

It is important to balance creativity / exploration and rationalism / exploitation

From pitch to investment:

teaser, one-pager 100%
presentation, long inv. memorandum 25%
NDA
Access to Data Room
Term Sheet and Letter of Intent
Due Dilligence 6%
Q&A, valuation, negotiation
Agreement on details
Drafting of legal documents
Closing of deal 2%

A great pitch:

In a pitch it should not only be the investor asking questions. There are a lot of good questions that the entrepreneur can ask. The goal is to **get to know each other.**

BS wastes everyones time!

Demonstrate your knowledge of your business. Admit if you don't know something and seek for opposing views.

Introduction
Team
Problem
Advantages
Solution
Product
Traction
Market
Competition
Business Model
Investing
Contact

NDA — Non-Disclosure-Agreement

A legal contract that outlines the use of confidential material, knowledge and information that the parties wish to exchange.

Term - Sheet

Examples of topics:

- Valuation of the company
- Amount of investment
- Use of proceeds
- Share preferences

- Governance
- Investor commitment
- Management commitment
- Exit

Description of the Due Diligence process (time, topics, costs...)
Exclusivity

Exclusivity:

- Legally binding clause of the term sheet
- Transfers controll to the investor
- By giving exclusivity you cancel competition ⇒ will make investor dominant

Due dilligence:

This process starts after the term sheet is signed. **External advisors** enter the arena and will examine and study the different parts of the term sheet. The **investors** themeselves will also do certain checks and studies (e.g. forecast of future sales).

Based on the results of the due dilligence, the **investors will challenge the business plan**

- Create base - and worst-case scenarios
- Assess the risk of their investment
- Set goals and milestones for the management
- Make their own valuation of the company

Introduction to company valuation

Enterprise value = whole company
Equity value = only shares

Enterprise value = Equity + Debt - Cash

Assets	Liabilities
	Equity

Revenues
Expenses
Profit / Loss

Operating
Investing	CAPEX
Financing

Balance Sheet

ROE = Profit / Equity   higher = better

D/E = Debt / Equity   higher = more risk but also higher reward

Higher D/E - Ratio means more leverage, this increases the risk for insolvency.

The financiale bubble of 2007 was caused by banks having to large of a leverage, making them vulnerable to systemic shocks.

P/E - Ratio = Profit / Equity

Income Statement

Revenue = all income

COGS = cost of goods sold

Gross Margin = Revenue - COGS

OPEX = operating expenses

EBIT = Gross Margin - OPEX

EBITDA = EBIT + Depreciation & Amortization

EBT = EBIT - interest paid

Net Profit = EBIT - interest paid - taxes

A small change in one factor can change another value drastically

EV / EBITA - Ratio
EV / EBIT - Ratio

Cash Flow Statement   Change in Cash

ΔWC = Δ accounts receivable + change in inventory - Δ accounts payable

Accounts receivable = sum of all unpaid invoices sent out

Accounts payable = sum of all unpaid invoices received

Fast growth can lead to a large increase in working capital. This can lead to liquidity problems.

ΔWC = change in working capital

When valuing a company one should compare these ratios to the ones of companies from the same sector / background.

Theres a difference in using actual earnings and expected earnings.

Normaly public companies are more expensive than private companies, since publicly traded shares are easier to sell (liquity premium).

Discounted Cash Flow Valuation

Formula for future value:

$$FV = PV \cdot (1+r)^n$$

present value — PV
future value — FV
number of periods — n
rate of return / growth or discount / interest rate — r

DCFV of a mature business

number of periods — n
predicted cash flow — CF_i

$$PV = \sum_{i=1}^{n} \frac{CF_i}{(1+r)^i} \quad \text{or}$$

growth rate — g

$$PV = \sum_{i=1}^{n} \frac{CF_0 \cdot (1+g)^i}{(1+r)^i} \quad \text{if CF grows steadily}$$

or $PV = \dfrac{CF_1}{r-g}$

DCFV for start-ups

$$PV = \sum_{i=1}^{5} \frac{CF_i}{(1+r)^i} + \frac{TV}{(1+r)^5}$$

terminal value — TV

$$TV = \frac{CF_6}{r' - g}$$

targed rate of return of mature business — r'

We value a young company with a 5 year start-up phase. We discount the CF for each year individually (r decreases with maturity).

Summary

The balance sheet gives us the book value of a company, it does not take into account, that a company is a profit generating machine.

So it makes sense to use profit generation as a basis in the valuation. For companies in a steady state we can use different metrics P&L, EBITDA, EBIT, net profit ... . For growing companies we have to use the discounted cash flow approach.

Limits of markets, crashes and bubbles

not complicated!

Stock markets are highly complex systems. A stock is supposed to have a constant drift (return to normal) accompanied by random shocks.

(for calc. of volatility see lec. 3 slide 66.)

It is good to not only look at single numbers and take a look at the whole data.

The Geometric Brownian Motion implies that prices follow a exponential track, decorated with noise (or constant growth rates).

$$\frac{dP}{P} = \mu \, dt \quad \Rightarrow \quad \frac{d \log P}{dt} = \mu$$

In real markets this is not the case, we see hyperexponential increases in price, followed by drastic corrections.

A bubble happens when the growth rate increases with the price, there is positiv feedback. It goes like this:

- new opportunity or expectation
- smart money flows in
- less sophisticated investor follow
- a positive feedback loop is created, the market gets driven by sentiment

Then the crash happens, investors realize that the situation is not sustainable.

There are two types of crashes:

exogenous cause and effect are logically connected

endogenous cause and effect are not logically and
↑   linearly connected. The state of the
crash after   market is so bad any event can trigger
bubble   a crash.

Emergence: Coordination in absence of orchestration

Wrapping up the deal

Before we draft any legal documents, we need to agree on:

amount invested - how much and when it is made
                          available (tranches)
value of company - pre- / post-money valuation
cap table   - who owns how much
governance principles —

What : Outline the responsibility, composition
          and authority of the Managment Team,
          the Supervisory Board and the General
          Meeting of Shareholders of the company

Why : Efficient managment of the company
          based on objective criteria independent
          of existing persons and historical relationships

How : Changing articles of association or the
          shareholder agreement where needed

General Meeting of
Shareholders

Supervisory
Board
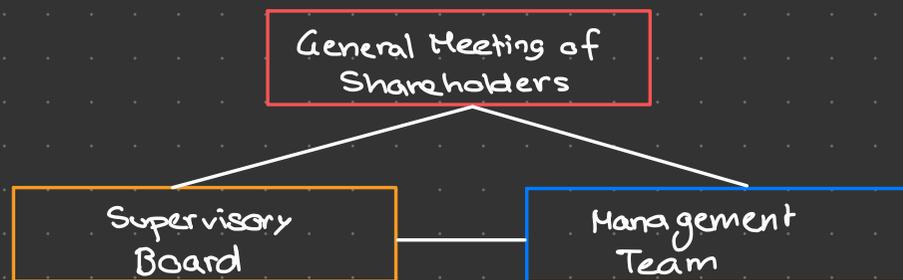
Management
Team

Management Team

- Day-to-day affairs
- Decide in line with the annual budget and business plan
- A matrix is drafted to show the decision authority of each or multiple MT members

Supervisory Board

- Composed of representatives of shareholders + independent board members + senior managment
- Voting rights defined in shareholders Agreement
- Must supervise and advice the managment and oversee the general affairs within the company

Decisions they can make:

- Hire/fire senior managment
- Adoption and/or changes of Businessplan/Budget
- Investments, loans, contracts
- Option plan for employees
- Targets and variable remuneration of senior managment

General Meeting of Shareholders

- Composed of shareholders (owners) of the company
- At least one annual meeting to approve the annual accounts, discharge the board and follow up and/or adapt the Value creation Plan
- Appoints members of Supervisory Board and sometimes also of the Management Team (e.g CEO)
- Normally decides by majority

Decisions they can make:

- issue of new Shares
- hire/fire new CEO
- distribution of dividends
- Reorganisation of the business
- ...

For some of these, majority voting may not be enough

Legal Documents

- Subscription Agreement (the transaction)
- Shareholders Agreement (governance and organisation)
- Management Agreement (day-to-day operations)

+ Prescribe how a "divorce" can be arranged

Logistics of growth

„Almost all social phenomena obey the logistic growth".

The logistic equation describes growth and saturation in on environment with competition for limited resources.

$$P(t) = \frac{K P_0 e^{rt}}{K + P_0 (e^{rt} - 1)}$$
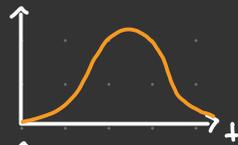
P, k, saturation, explosive growth, start, t
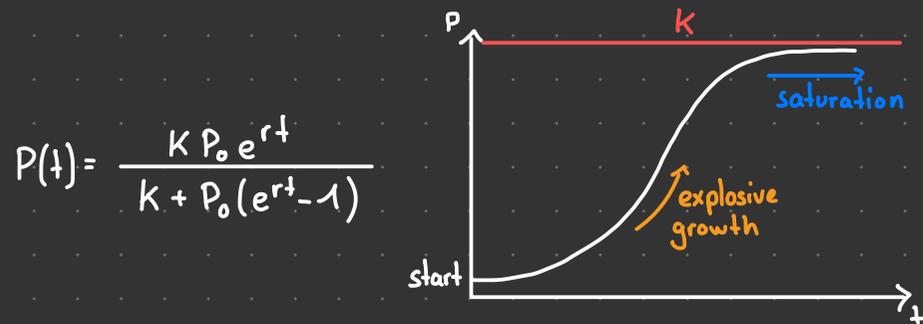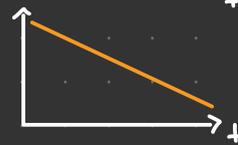
If K is infinite $P(t) = P_0 e^{rt}$.

One of the best examples of this modle in use, was when Hubert moddeled peak oil with a similar formula.

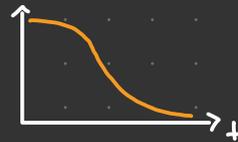## Different Representations

$$\frac{dP}{dt} = r P(t) \cdot \left(1 - \frac{P(t)}{K}\right)$$

$$\frac{1}{P} \frac{dP}{dt} = r \cdot \left(1 - \frac{P(t)}{K}\right)$$

$$\frac{1}{P} \frac{dP}{dt} = r \cdot \left(1 - \frac{P_0 e^{rt}}{K + P_0 (e^{rt} - 1)}\right)$$

Logistic growth and COVID

There are two types of models for epidemics:

Phenomenological models an empirical approach without a specific basis on physical laws or so.

Mechanistic models incorporate physical laws and mechanisms involved in the underlying problem.

Interestingly is the mechanical model often worse, since there are so many details that could be missed.

Extensions of logistic type model

Generalized-logistic growth model (GLM):

$$\frac{dC}{dt} = r C^p \left(1 - \frac{C}{K}\right)$$

$p \in [0,1]$ describes the „scaling of growth"

Richards model:

$$\frac{dC}{dt} = r C \left(1 - \left(\frac{C}{K}\right)^\alpha\right)$$

$\alpha \geqslant 0$ measures the deviation (controls asymmetry)

Generalized Richards model (GRM):

$$\frac{dC}{dt} = r C^p \left(1 - \left(\frac{C}{K}\right)^\alpha\right)$$

The GRM is the most flexible model with the four parameters (K, r, α, p).

These models become more accurate with more data. When only using data before the maximum, we get a large range of scenarios.

For Covid-19 we can see some interesting behaviour from the models:

- in early stages GRM is to flexible

- the classical logistic growth model and GLM underestimate the number of infections, while GRM tends to overestimate, giving us a upper and lower bound.

Logistic growth generalization

Many systems see succession of S-curves due to a increas in carrying capacity K.

We try to include this increase with a time delay τ.

$$\frac{dP}{dt} = r\,P(t) \cdot \left(1 - \frac{P(t)}{K(t)}\right) \quad \text{with} \quad K(t) = A + BP(t-\tau)$$

$$\Rightarrow \frac{dx}{dt} = \underbrace{x(t)}_{\substack{\text{individual}\\\text{growth}}} - \underbrace{\frac{x^2(t)}{a + bx(t-\tau)}}_{\text{competition}} \quad \text{with} \quad x \sim P$$

we can modify the signs:

gain & cooperation: + ■ + ■   gain & competition : + ■ - ■

loss & competition : - ■ - ■   loss & cooperation : - ■ + ■

we can further adapt the model to include:
- non-linear growth of K
- multiple species (symbiosis)

Chaos Theory   Logistic map = discretized logistic equation

Logistic map: $x(n+1) = \alpha\,x(n) \cdot \left(1 - x(n)\right)$

x is chaotic for $\forall \alpha \in [3.59..., 4]$

We can see the difference between chaos and randomness by plotting $x(n)$ vs $x(n+1)$. We call this the phase space.

Chaos satisfies the following properties:

- low dimensional – small amount of variables
- deterministic – predictable
- sensitive to initial values – drastic change in output
- trajectories are reinjected – different starting values lead to similar trajectories

Diffusion of innovation

We can apply LGM to model the adoption of new technology. This introduces a social trend into the equation, describing sort of a peer-pressure.

With this model we define penetration rate and penetration speed.
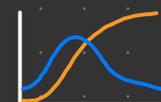
$\left(\begin{array}{l}\text{for more details}\\ \text{see slides 6.53}\end{array}\right)$

Company value before IPO

„Who values these actual validations"

Greenshoe option, by selling more shares then what is targeted, a short position is created. The purpose of this option is to artificially prop up the price of a not well received IPO.

See slides 6.54 for case study of FB & Zynga

Before an IPO we can use the previously developed models to create predictions that help to value these companies.

Conclusions

- we can use these models compute the intrinsic value of companies, enabling us to not only make long-term but also short-term predictions.

- bubbles are great for innovation and crossing capital and risk hurdles, but are bad for capital allocation

Important laws of valuation:

- prediction is not extrapolation, understand the process

- understand the technicalities of markets and investment banking

- always RTFM (Read the fucking manual)

150 year perspective

We can divide the past 150 years into five distinct periods:
- Gilded Age   1870-1910
- First shift   1911-1946
- Golden Age   1947-1968
- Second shift   1969-1979
- Fool's Gold Age   1980-2008-2019

Gilded Age   Gold standard ← hard to manage

Looks shiny but under the surface it's certainly not gold.

- rapid expansion (industry & infrastructure)
- innovation → interconnected growth
- globalization
- stock market was solid → strong economic growth
- geopolitical stability

- peak of colonialism
- monopolies
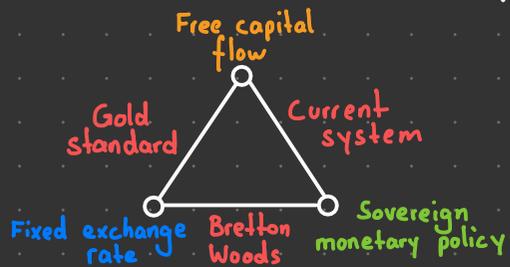- inequality at historical high

- urbanization

Lack of institutions and regulations lead to a cycle of boom → panic → depression.

First Transition

A shift from one system to another always comes with disruption and distress. During these shifts the seeds for the new system are planted (reforms).

- WW1 and WW2 → Stimulus / Capital Investments
- Great Depression
- Roosevelt's New Deal
    - Stabilizing banking system
    - Social Security
    - Public works   ⎫
    - National Labor Act   ⎬ Welfare system
    - Wealth Tax Act   ⎭
- Bretton Woods
- Institutions were reformed to fight the Great Depression

Trilemma of international finance

Free capital flow

Gold standard   Current system

Fixed exchange rate   Bretton Woods   Sovereign monetary policy

Economic policy makers want to achieve three goals. But only two of them can be achieved by each given system.

Golden Age

After the war two decades of extraordinary growth followed.

- Economic recovery
- Stimulus / infrastructure reconstruction
- Productivity increases
- Social Contract between workers and owners
    - Peak income from wages
- Collapse of inequality

Freetime and wealth accumulation create a consumer society.

Energy consumption skyrockets, fueled by coal and later oil.

Second Transition

From great optimism and great society to anarchy and counterculture.

- Murder of JFK and MLK
- Vietnam war

The war and rising public expenditure caused the world to loose trust in the dollar.

⇒ End of Bretton Woods!

Peak consumption was reached therefore growth decreased (S-curve).

Economic paradigm shift from falling unemployment with inflation, to stagflation.
Two large oil shocks, OPEC embargo and Iranian revolution.

Fool's Gold Age

Characterised by the illusion of the perpetual money machine.

- consumption funded by debt and not from savings

- economic growth driven by growth of financial sector and increase of productivity.

- climate of deregulations

- succession of bubbles and crashes, feeding upon each other

Reaganomics & Thatcherism

- decrease taxes for the rich
  ↳ should lead to trickle down effect
- gap between productivity and wages

During this time the stock market grows, but the productivity doesn't increase (only for the west).

Debt increases but the efficiency of it decreases to under 25%, it is not used to invest in tangible assets.

Consumption in general increases, but the mix shifts from goods to services.

The stock market opens up to everyone and ETF get popular. Out of 40 historical bubbles 38 happened during this area. Central bank lower interest rate to a point where they cant lower them anymore, so they loose this as a tool to influence the market. Fragile banks and fragile markets are a dry forest waiting for a spark.

Three waves of globalization:

1. increased connectivity, low transportation costs, global market place

2. international cooperation

3. information and communication systems, geographically dispersed supply chain.

⇒ Economic center of gravity is moving east

Conclusion

The past 150 years saw a super business cycle. It is important that we view this cycle as endogenous - boom and bust are two sides of the same coin and a fundamental property of capitalism.

Capitalism has evolved:

Commercial Capitalism:

- centered around commercial banks
- Banks financed working capital in the form of short-term loans
- Long-term investments were financed from retained profits or equity of owners

Finance Capitalism:

- finance becomes globalized
- demand for long-term financing of CAPEX
- investment banks
- bypassing rules
- ended in crash → Great Depression

CAPEX = capital expenditure

Managerial Welfare Capitalism

- reforms → regulations
- social contract → low inequality
- ended again in deregulation

Money Manager Capitalism

- large savings → shadow banking
- financial system only servs itself
- financialization, innovation focused on finance itself

Overview

	Economic driver	Stage of capitalism	Stock Market	International Financial System	Monetary Policy Regime	Reserve currency	Globalization and Colonialism	Inequality
Gilded Age (1870-1910)	Technological revolution	Finance Capitalism	Long term growth in line with earnings and the economy	Gold Standard	Gold convertibility of currency	Pound Sterling (backed by Gold)	First Wave: Falling transport costs, haute finance - cusp of Western European colonialism	Rising since last levelling event (black death in 14th century)
First Shift (1911-1946)	War and Depression		Losses and high volatility					Steep decline, levelling due to WWI and WWII
Golden Age (1947-1968)	Consumer society	Managerial Welfare State Capitalism	Very strong growth in line with earnings and the economy	Bretton Woods	Full employment	USD (backed by Gold)	Second Wave: Return to prewar state, vertical integration in Western countries - full decolonization	Great Compression
Second Shift (1968-1979)	Stagflation		Decoupling of stocks and earnings					
Fool's Gold Age (1980- ...)	Financialization	Money Manager Capitalism	Decoupling of stocks and earnings	Dollar Debt Standard	Price stability	USD (paper money)	Third Wave: Global supply chain, cost-of-labor arbitrage	General increase - Reagonomics

Third Transition

The fools gold age has been going on for 40 years, but in the past years we have seen many new challenges. In addition with Chinas return to power, we are in a new bipolar world.

- population aging
- increasing health costs
- unsustainable growth
- climate change
- Covid-19 (growing debt)

Knowledge and economic growth

GDP is only a crude measure:
     -only transactions that can be given a
     monetary value count
     - short term (ignores assets)

Better: real- GDP per capita

But still a lot of causes for growth get ignored.

In the long-run growth always follows an _boom/bust_
exponential curve. But growth occurs in cycles and
therefore growth doesn't look exponential in the short-run.