

What could “sustainability” mean?

*A personal and probably highly prejudiced, inaccurate view from
a non-expert*

*Julian Wilson,
Currently Climate Change & Air Quality Unit...*

*With quite some assistance from
“Prosperity without growth – Economics for a Finite Planet”
by
Tim Jackson*



- *“Annual income twenty pounds
annual expenditure nineteen pounds
nineteen and six, result happiness.
Annual income twenty pounds
annual expenditure twenty pounds
ought and six, result misery.”*

**Wilkins Micawber, an early and
successful advocate of personal
economic sustainability &
wellbeing
(as told to Charles Dickens, 1850)**

“the capacity to endure”

Endure: as in “to continue in the same state” rather than “to suffer” ...

Sustainability therefore has:

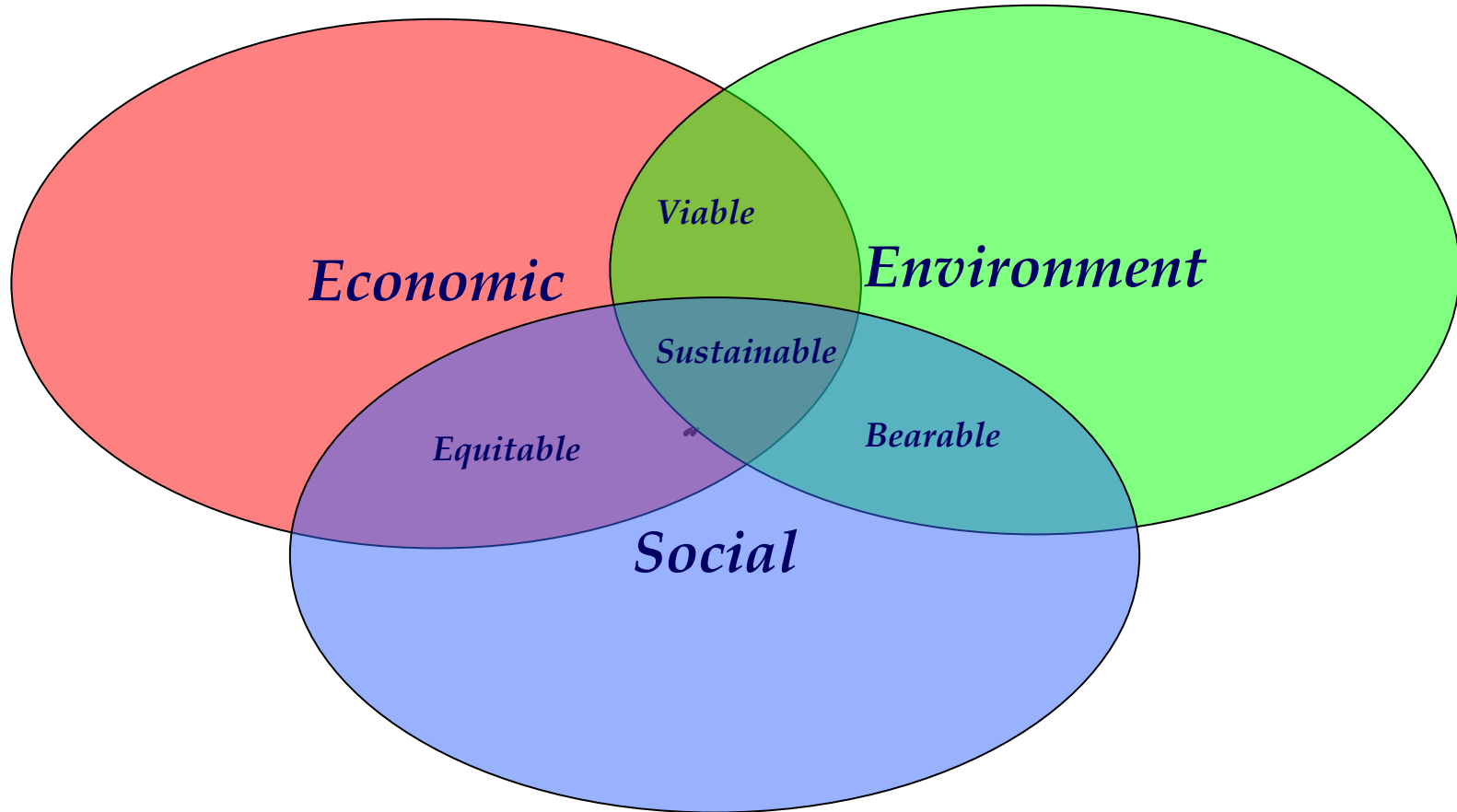
⇒ Temporal component

⇒ Equilibrium/steady state component

Sustainable in the context of environment, growth, economy, population, society, wellbeing etc implies:

⇒ lasting, long term

⇒ does not diverge overly from the equilibrium/steady state.





- Published 6 editions of An essay on the principle of population:
Population growth generally expands in times and in regions of plenty until the size of the population relative to the primary resources causes distress:
“The power of population is so superior to the power of the earth to produce subsistence for man, that premature death must in some shape or other visit the human race”
At the time Malthus wrote this the population of the world was c1billion...so the power of the earth must have increased...

Malthusian Growth model - exponential growth with no limit ($r =$ intrinsic rate of increase):

$$\frac{dP}{dt} = rP$$

Logistic model: growth limited by carrying capacity (K)

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



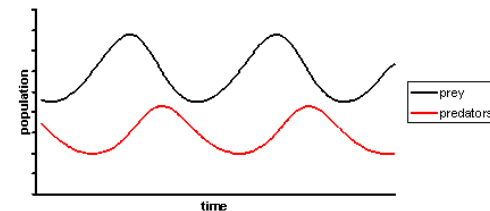
Lotka-Volterra equations: Prey & Predator population growth

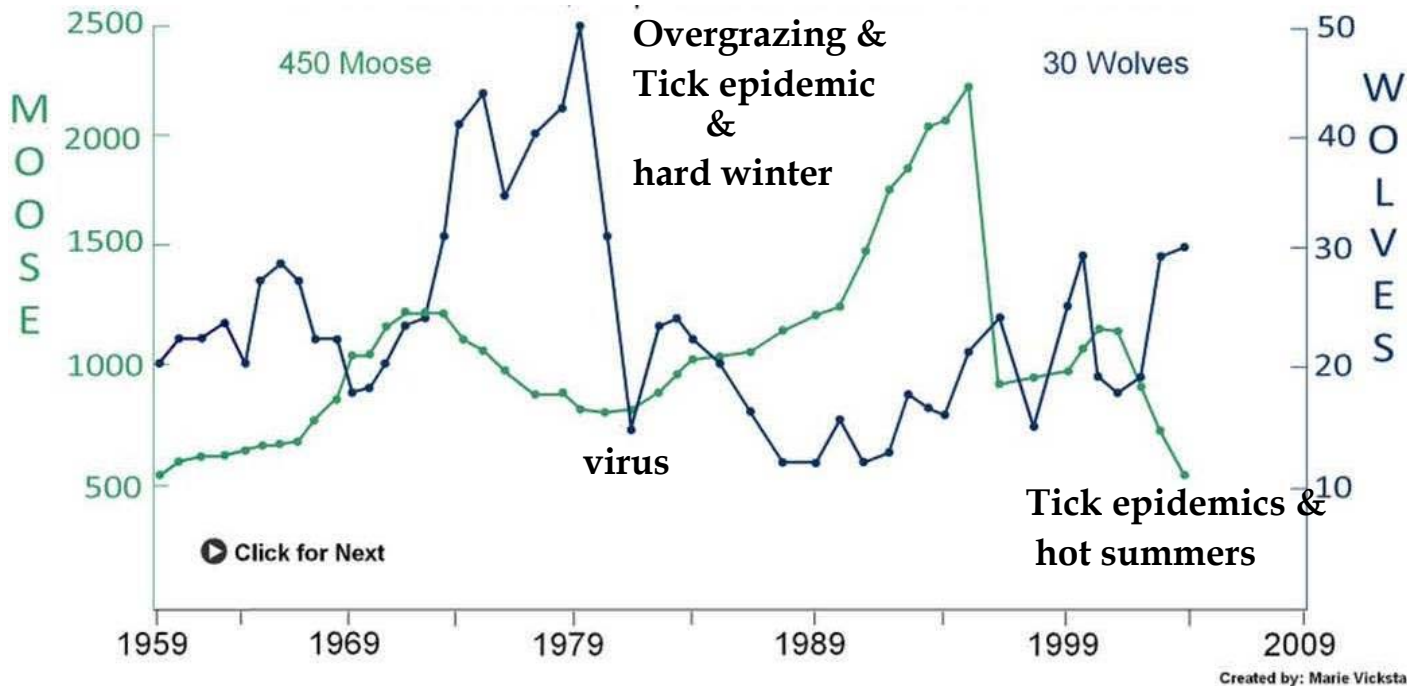
$$\frac{dP_y}{dt} = r_{P_y} P_y \left(1 - \frac{P_y}{K}\right) - H_r P_r P_y$$

Prey P_y , hunting efficiency H_r

$$\frac{dP_r}{dt} = F_r P_y P_r - M_r P_r$$

Predator P_r , Fecundity F_r and Mor





Wolf & Moose population dynamics on Isle Royale

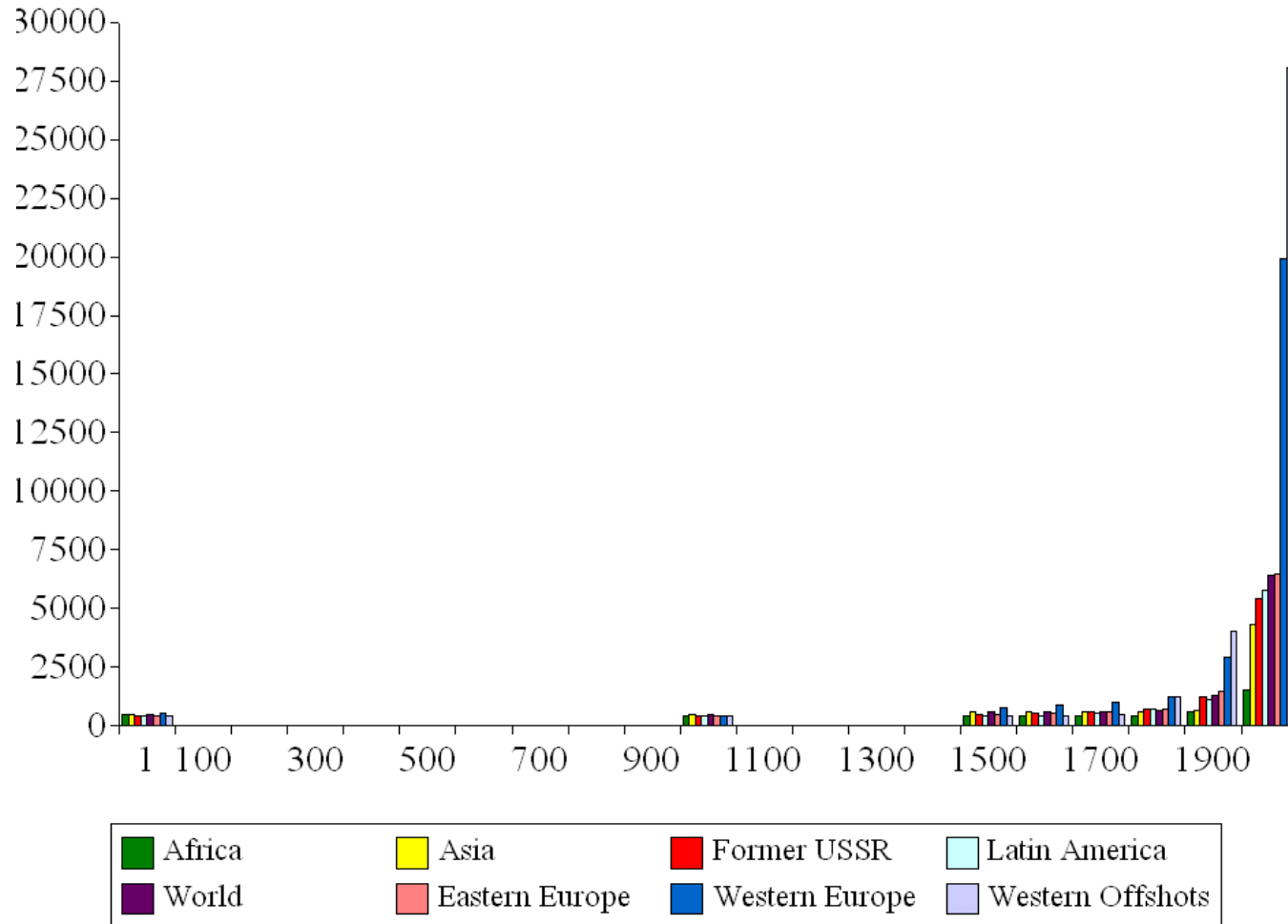
- Moose arrived 1900 & grazed out indigenous Birch & Aspen, now survive on less nutritious Balsam Fir (understory growth rates c5% of pre-Moose era - population unable to maintain K carrying capacity = **not self-regulating**,
- 1949 winter a pair of wolves arrived over the ice one winter
- Single species carrying capacities - prey - predator, theoretical equilibrium c 25 wolves & 1500 moose, but have never achieved this - env. factors, weakness of wolf population - in-bred all share a single ancestor
- Similar behaviour to Lotka-Volterra **but at lower numbers than predicted**
- is mankind any better at regulating itself?

YEARS WHEN WORLD POPULATION REACHED INCREMENTS OF 1 BILLION



Until now world population is still growing Malthusianly/logistically
Although individual population groups variously exhibit Malthusian growth, stability or crashes, either due to disease etc as predicted by Malthus, or predators (including other populations) as predicted by L-V

World GDP/capita 1-2003 A.D.



Not sustainable – indefinite exponential growth not possible with a finite global resource limit
Not equitable

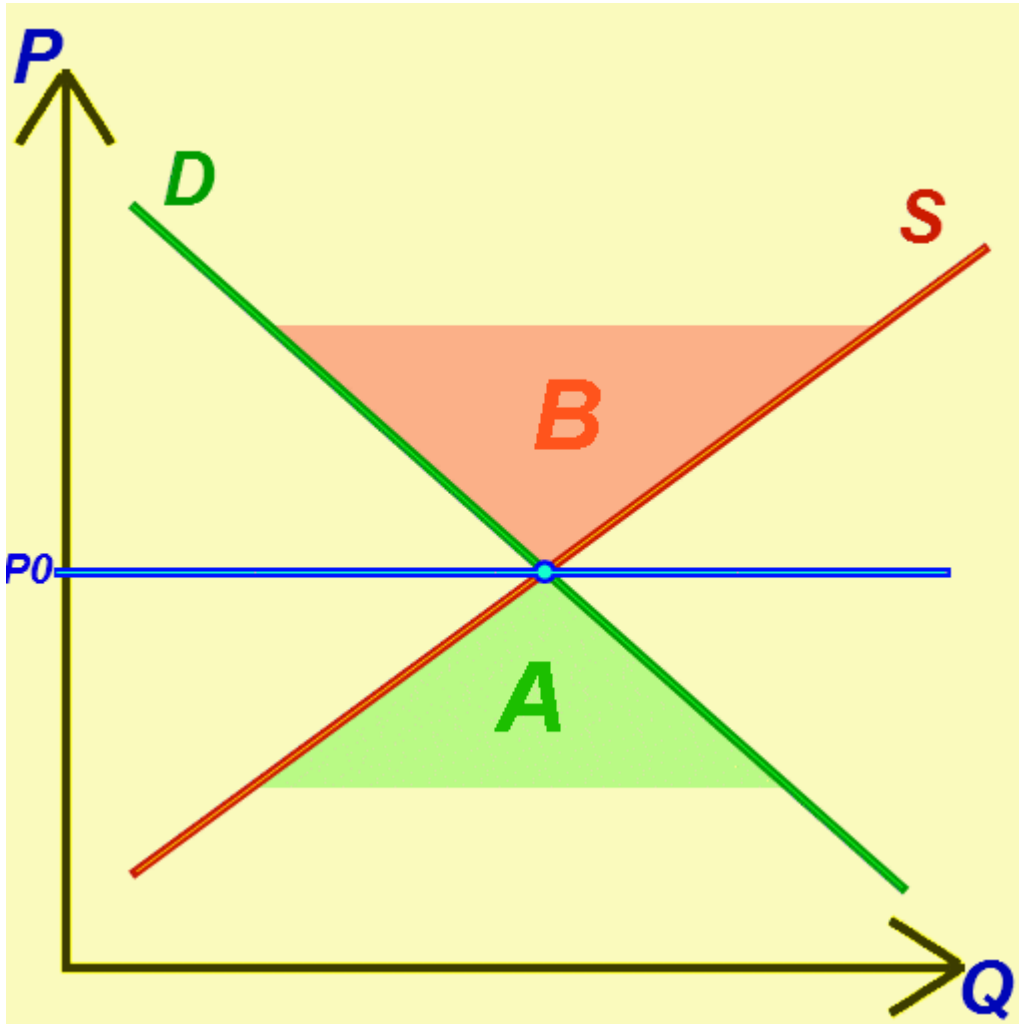
- 1.1 billion people survive on less than \$1 per day. 70 percent live in rural areas where they are highly dependent on ecosystem services
- Inequality has increased over the past decades. During the 1990s, 21 countries experienced declines in their rankings in the Human Development Index
- Over 850 million people were undernourished in 2000–02, up 37 million from the period 1997–99
- Per capita food production has declined in sub-Saharan Africa
- Some 1.1 billion people still lack access to improved water supply, and more than 2.6 billion lack access to improved sanitation
- Water scarcity affects roughly 1–2 billion people worldwide.
- Global improvements in levels of poverty are skewed by rapid economic growth in India and China; poverty elsewhere (especially in sub-Saharan Africa) is profound and persistent (IUCN)
- The poorest 20 % by income of the world's population earns 2% of GWP, the richest 20%, 74%
- & within that top 20% in-equality has increased steadily since the 1980s, market liberalisation has delivered income increases across the board, but in both absolute and percentage terms incomes have increased more at the top.

- Essentially the message of Malthus – however he misjudged the size of finite global resource s
- Repeated at various times since, most critically by the Club of Rome in the book Limits to Growth (1972) – looked at then current exponential growth rates in primary commodity consumption and projected forward against best estimates of the finite global reserves to predict increasing resource shortages from the first years of the new millenia.
- 2005 reanalysis of their projected consumption rates compared with what happened showed good agreement, but LtG made the same mistake as Malthus in underestimating the discovery of additional global resources.
- Now we are being told about peak oil, 60% of worlds ecosystem services (?) degraded post 1950, but is it another chapter in the same story?
- How close to finite global resource limits are we?
- *Post-war the worlds economy has grown c5x since 1950, continuing at the same rate it will be 80x larger than 1950 by 2100 (=16x today)*
- *However to give everyone in the world to the OECD average would need 75x growth by 2050 and 200x 1950 by 2100, ie a speed-up in growth compared with post war! (T. Jackson, Prosperity without growth).*

- Is this level of growth possible without hitting resource limitations? Is it bearable by the environment?
- What is the EU future scenario view of resource limitation & inequality? Specifically:
 - ⇒ What are the projected global & European growth rates for 2020 & 2050 compared to the growth as usual & equitable growth paths and where does this growth come from?
 - ⇒ What is the inherent continuing global inequality in growth (countering a fundamental sustainability target) assumed in Europe 2020 & the 2050 roadmap?
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- Given the scale of the increases needed, especially if we are going to combat inequality, and not damage global sustainability potential (c.f. birch & aspen on Isle Royale) *all measures to remedy the current economic problems need to be very carefully formulated to maximise their positive impact on sustainability to avoid having to do more work tomorrow to remedy problems caused by today's short term solutions.*

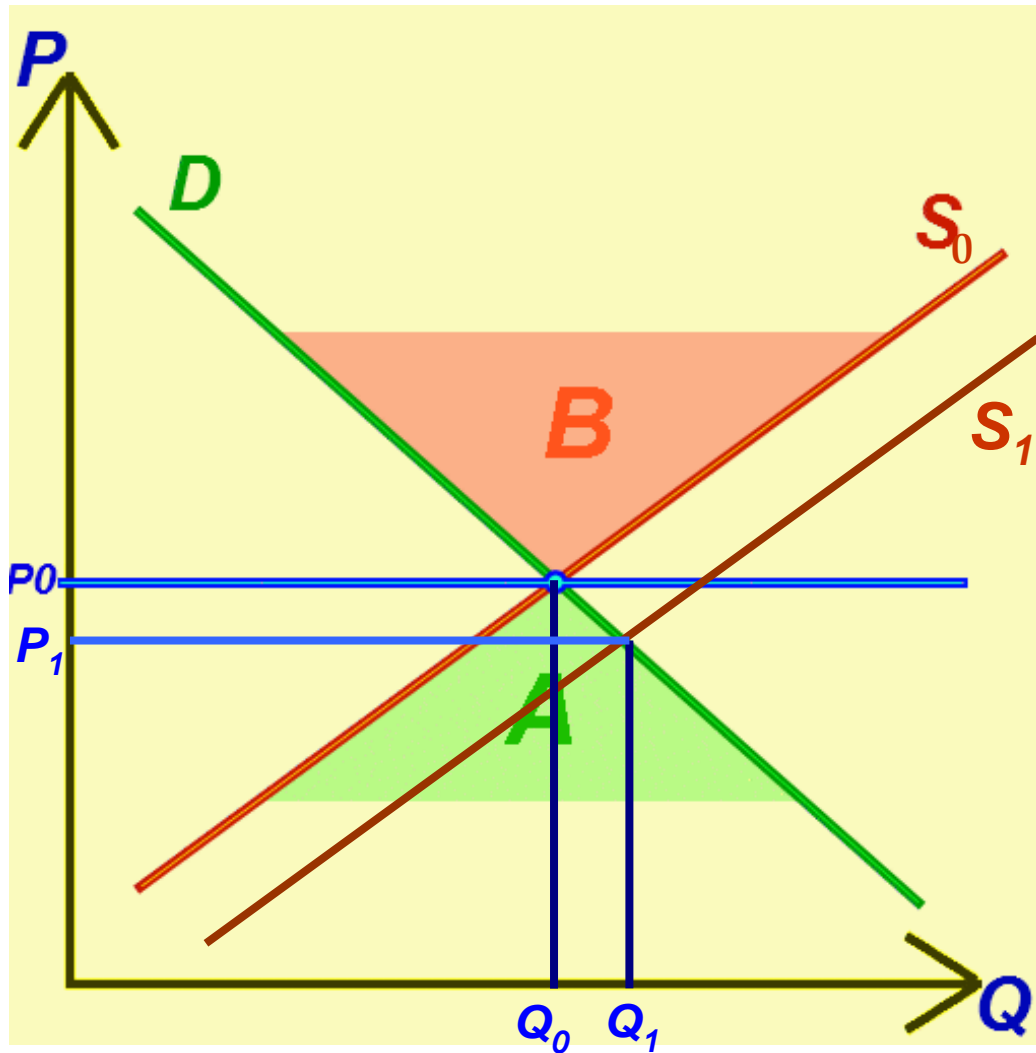
Consumption of renewable resources	State of environment	Sustainability
More than nature's ability to replenish	Environmental degradation	Not sustainable
Equal to nature's ability to replenish	Environmental equilibrium	Steady State economy
Less than nature's ability to replenish	Environmental renewal	Environmentally sustainable

Once non-renewable resources are gone, they are gone – here sustainability is a matter of slowing the consumption rate down



- P - price
- Q - quantity of good
- S - supply
- D - demand
- P_0 - price of market balance
- A - surplus of demand - when $P < P_0$
- B - surplus of supply - when $P > P_0$

Simplest Economic Growth model



Supply costs = labour cost + capital cost

Capital investment => lower labour cost per unit & we move Supply curve to the right;

$Q_1 > Q_0 = \text{growth}$

In a perfect market all competitors do the same & all $P_1 - P_0$ goes to the consumer.

In an imperfect market, not all $P_1 - P_0$ passes to consumers, Q_1 is smaller & less labour is needed.

Historically in europe growth of c1% pa is needed to maintain employment

- *A general equilibrium economic growth model attempt to solve the supply & demand equilibrium simultaneously across a wide number of interconnected markets*
- *Partial equilibrium models (e.g Poles) have interconnections across markets, but calculate equilibrium market conditions for individual goods/markets.*
- *Keynsian economics based on markets not being in equilibrium (both producers and consumers continually try to cheat the market by):*
 - *Monopopoly behaviour e.g price fixing,*
 - *Externalising costs to gain a competitive advantage,*
 - *Destabilising the market to set up arbitrage positions (short selling, capital etc)*
 - *Monopsony behaviour, extracting reduced prices from producers,*
 - *Disobeying regulations – avoiding purchase taxes etc.*

- *Nominally exist to provide capital, foreign currency, commodities etc. to the manufactured sector*
- *Now larger than manufacturing. EU-27 2010 % contributions to 2010 Gross Value Added :*
 - *Business & financial services 30%*
 - *Other services 23%*
 - *Trade transport & communication services 21%*
 - *Agriculture, hunting and fishing 2%*
 - *Construction 6%*
 - *Industry including energy 19%* (Eurostat)
- *Trading financial instruments to make money c50x+ trade in support of manufacturing, main growth post 1980 market liberalisation / deregulation (esp US repeal of Glass-Steagall in 1999)*
- *In a rising market (until 2008!) buying, holding and selling is profitable bull trading – additional profit from creating more deregulated things to sell – new derivative in particular & CDS, asset based securities - result inflated asset prices & consumption lead growth*
- *In a falling market (post 2008) different strategies:*
 - Bear & Short selling, Arbitrage – e.g. capital structure arbitrage – exploit mismatches in the market price of a companies or countries debt & equity using CDS – result depressed asset prices and consumption and massive increases in debt.*
- *In both cases the financial markets generate positive feedbacks, with the boom & bust results we see today once more.*

- *Re-regulation of financial markets to reduce the positive feedbacks on the economy*
- *Start paying off the debts...*
- *Increase saving rates to pay off the debts & start paying for restructuring the economy between now & 2050 (c19th Europe & modern China both 20-25%, India 35% - paradox that the less one has the more one saves).*
- *Any spending in Europe should*
 - ⇒ *meet sustainability goals (otherwise even more problems in the future)*
 - ⇒ *leverage as much economic activity as possible, i.e. no repeat consumer boom,*
 - ⇒ *increase long-term employment rates particularly for young people.*
 - ⇒ *not target classical GDP growth.*
- *Most grand projects do not fit the above criteria, small may be more beautiful.*
- *An obvious candidate and one that would meet all the above criteria & enable Europe to make progress towards the one 20-20-20 energy efficiency goal is to put in place a meaningful large-scale program to cut energy consumption, initially in the domestic housing stock. There are others.*

**Enjoy the Cake, there
should not be any
metal in it...**

