ECO 10350 PRINCIPLES OF MACRO

LECTURE 3

DEMAND ELASTICITY

- As Price rises, quantity demanded falls – but how much?
- It depends
  - How vital is the good?
  - Are substitutes available? (different over time horizons, classifications)
  - How large are expenditures on that good already?
- Simple formula to express this:
  - Elasticity is percent change in quantity divided by percent change in price

- But the formulas look *ugly*
  - $\frac{percent\ change\ in\ Q}{percent\ change\ in\ P}$
  - $\frac{\%\Delta Q}{\%\Delta P}$
  - $\frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}}$

If change from (Q_0,P_0) to (Q_1, P_1) then

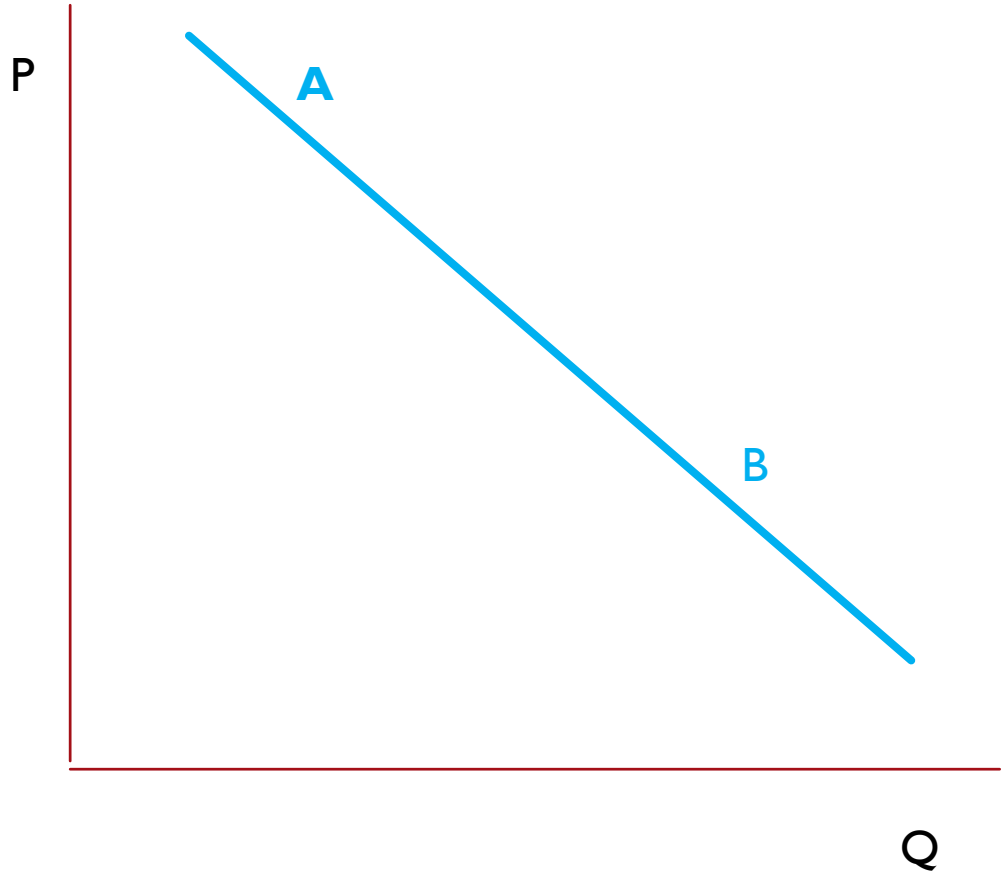
- $\frac{\frac{(Q_1-Q_0)}{Q}}{\frac{(P_1-P_0)}{P}}$ where the denominator Q and P are the average

DEMAND ELASTICITY

- Although we originally think of it as what change in quantity is caused by a change in price
- Works in reverse as well – if quantity changes by __%, what would be change in price?
  - Eg if Venezuela is about 2% of global oil production, then if their production goes to zero, what does that mean for oil prices? Elasticity in short run is something like ¼ or 1/6.
- Polar cases of infinite elasticity or zero elasticity if %ΔQ is infinite or zero
- Unit elastic is when %ΔQ= %ΔP

DEMAND ELASTICITY

- Elasticity is NOT constant on a linear demand curve so A & B have different elasticities
- Rearrange formula $\frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{\Delta Q}{\Delta P}\frac{P}{Q}$
- On a line, $\frac{\Delta Q}{\Delta P}$ is constant but ratio $\frac{P}{Q}$ changes – is higher at A than B



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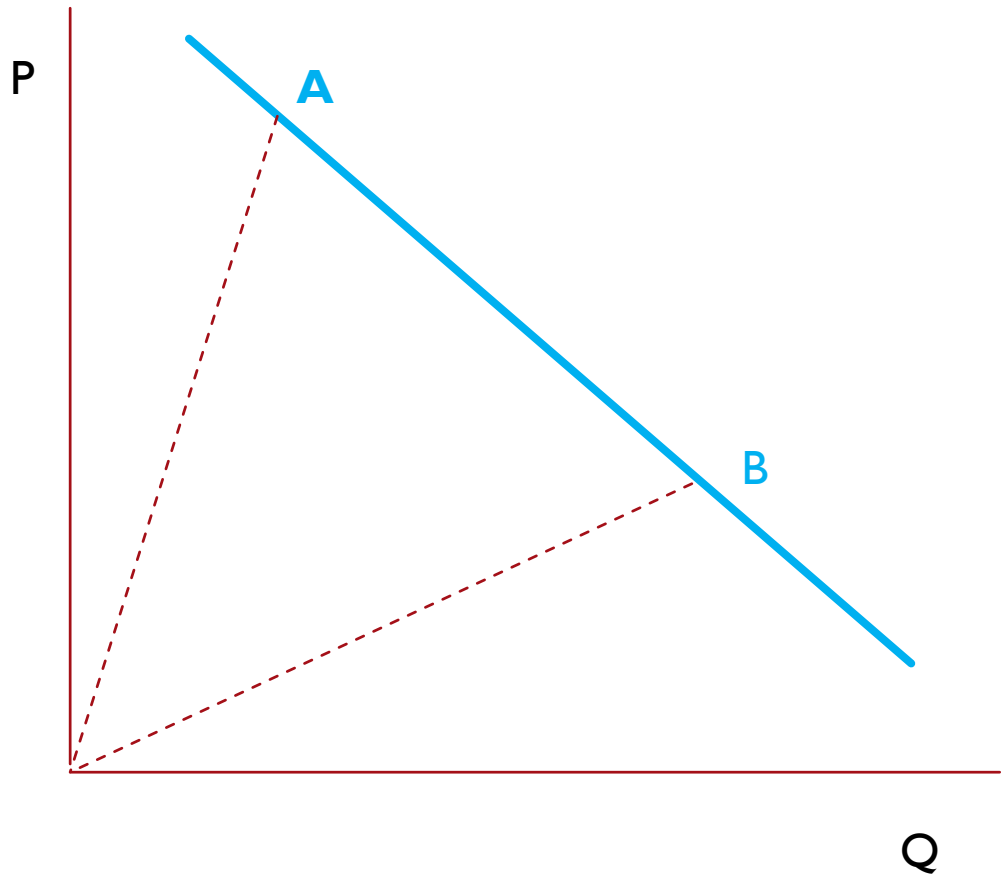
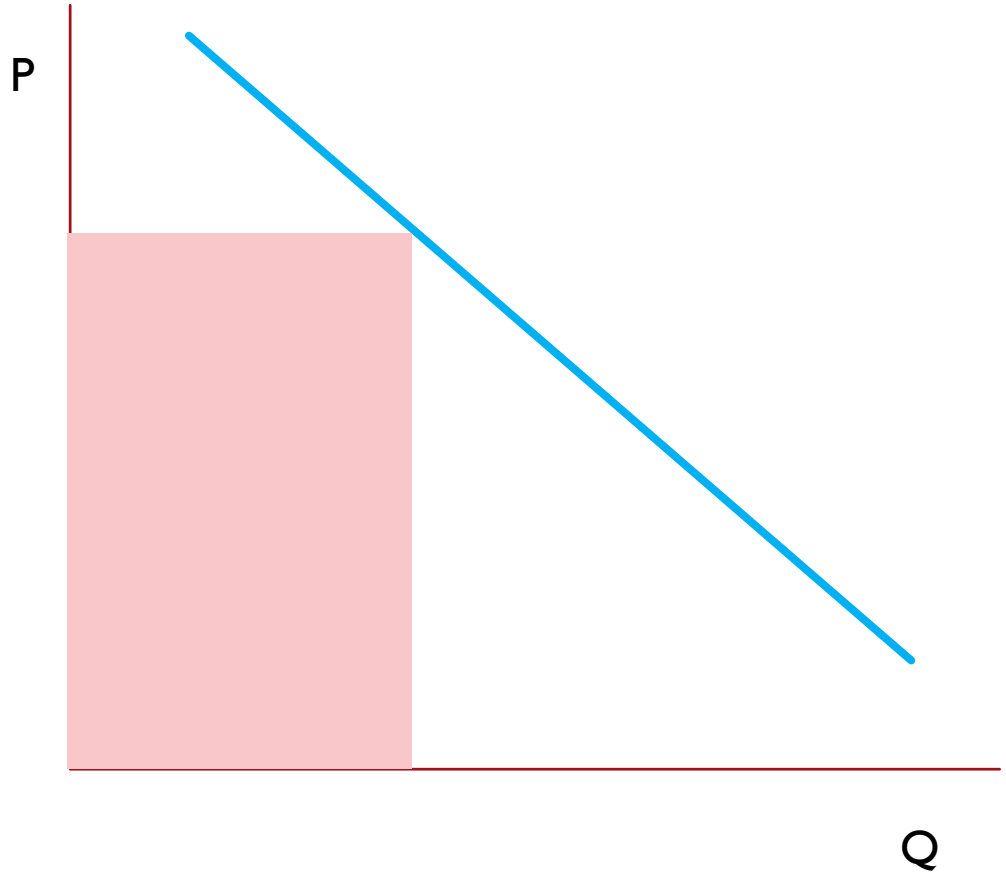
- Draw rays from A & B back to origin; angle is rise/run so $\frac{P_A}{Q_A} > \frac{P_B}{Q_B}$
- With a bit of calculus you can figure the equation for a curve with constant elasticity



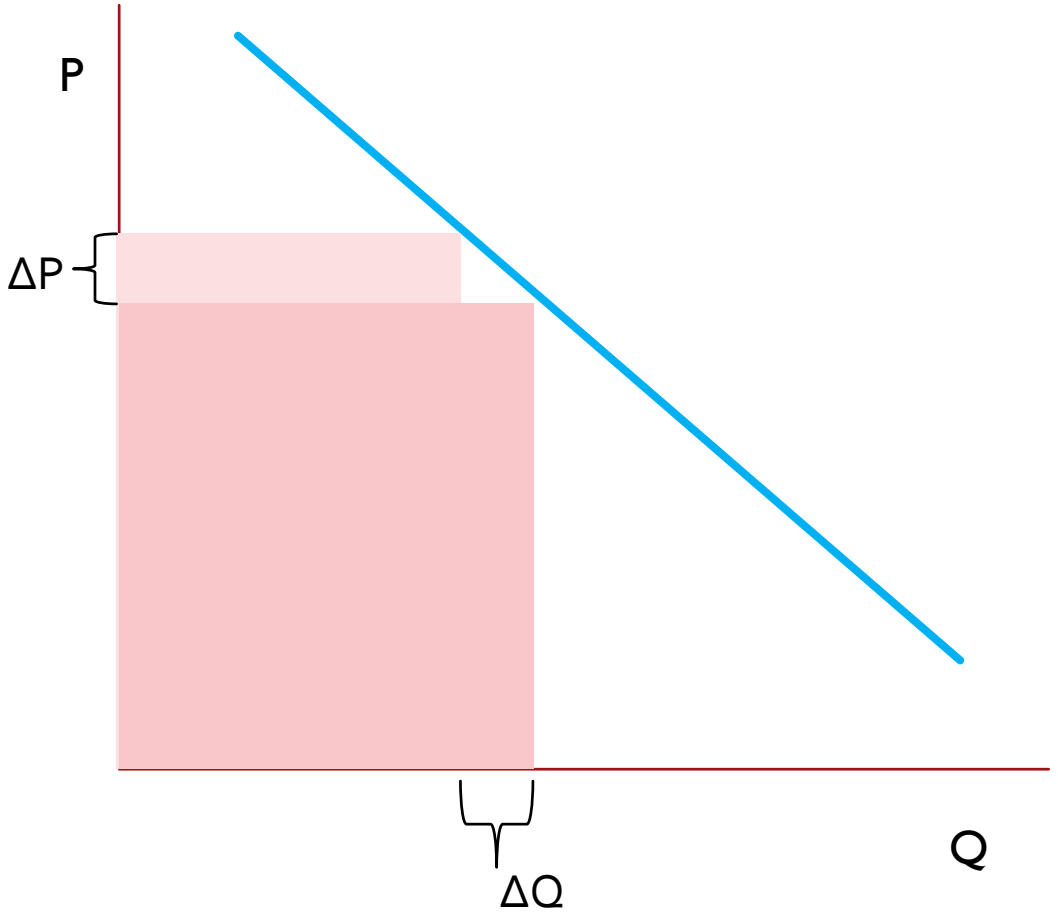
DEMAND ELASTICITY

- Elasticity links with Revenue
- Total Revenue = PQ
- This is the area of the box



DEMAND ELASTICITY

- So if lower price, what happens to revenue? (Is a sale good for a business?)
- Lower price means less revenue per unit sold (%ΔP), but more units sold (%ΔQ)
- $TR = P \cdot Q$
- $\%\Delta TR = \%\Delta P + \%\Delta Q$ (take ln then derivative)



ELASTICITY IN ACTION?

Note: next time I drove by, store was closed and signs said "For Rent"

OTHER ELASTICITY CALCS

- Can calculate elasticity of supply as well: what is change in quantity supplied as price changes? Same formula just looking at a different curve – as oil price rises, what is change in quantity supplied by US fracking?
- Cross-price elasticity also: what is change in quantity of cars sold, as price of oil increases?
- Income elasticity: as people get more income, how much more oil do they use? (Important in predictions of long-run climate change)

SUSTAINABILITY

- Sustainable Development
  - Principal definition from the 1987 Brundtland Commission, Sustainable Development is development that meets the needs of present generations without compromising the ability of future generations to meet their own needs.

SUSTAINABILITY

- AMNH has these words carved in the wall:
  - Nature
  - There is a delight in the hardy life of the open.
  - There are no words that can tell the hidden spirit of the wilderness, that can reveal its mystery, its melancholy and its charm.
  - The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased; and not impaired in value.
  - Conservation means development as much as it does protection.

SUSTAINABILITY

- "Conservation means development as much as it does protection. I recognize the right and duty of this generation to develop and use the natural resources of our land; but I do not recognize the right to waste them, or to rob, by wasteful use, the generations that come after us."
- "Defenders of the short-sighted men who in their greed and selfishness will, if permitted, rob our country of half its charm by their reckless extermination of all useful and beautiful wild things sometimes seek to champion them by saying the 'the game belongs to the people.' So it does; and not merely to the people now alive, but to the unborn people. The 'greatest good for the greatest number' applies to the number within the womb of time, compared to which those now alive form but an insignificant fraction. Our duty to the whole, including the unborn generations, bids us restrain an unprincipled present-day minority from wasting the heritage of these unborn generations. The movement for the conservation of wild life and the larger movement for the conservation of all our natural resources are essentially democratic in spirit, purpose, and method." (TR, A Book-Lover's Holidays in the Open, 1916.)
- Concern with generations is not new! Edmund Burke, Reflections on the French Revolution, 1790, "Society is indeed a contract. ... it is not a partnership in things subservient only to the gross animal existence of a temporary and perishable nature. It is a partnership in all science; a partnership in all art; a partnership in every virtue, and in all perfection. As the ends of such a partnership cannot be obtained in many generations, it becomes a partnership not only between those who are living, but between those who are living, those who are dead, and those who are to be born." (Earlier in the same, he noted, "the age of chivalry is gone. That of sophisters, economists, and calculators, has succeeded; and the glory of Europe is extinguished for ever." -- problem! Since future generations not part of current markets.

SUSTAINABLE GROWTH

- Back to Solow Growth Decomposition:
- Wrote $Y = A\,F(K, L) + \text{other stuff}$
- "other stuff" includes natural capital, whether oil/gas underground, biodiversity, natural beauty
- Can grow by depleting natural capital (eg pump oil out) but if this is spent on consumption then it's not sustainable in long run
- Sustainable in long run only if deplete natural capital to increase human or physical capital
- (although there might be some natural resources with threshold effects)

CIRCLE BACK TO SOME DEFINITIONS

- GDP: Gross Domestic Product
  - value of all goods & services produced in a country's borders in a year
    - final goods & services only counted (don't' double-count)
    - to avoid double-counting, subtract imports
    - new goods only not used items traded (so no stock market trades)
    - within borders not by citizens (that's GNP)
  - everything has buyer and a seller so we can count either side

GDP MEASURED BY DEMAND

- $Y = C + I + G + (X - M)$
- Consumption (C) is buying by households; biggest components are spending on non-durables and durables
- Investment (I) is NOT the stock market but real investment in factories, equipment, etc
  - Separated into Residential and Non-Residential also Change in Business Inventories
- Government spending (G) consolidates all levels (Fed, state, local) but only purchases of goods & services NOT transfer payments
- (X-M) are Exports and Imports, netted out

MACRO DATA

- These Macro Data can be presented as:
  - dollar amounts nominal or real
  - percent changes
  - logs
  - fractions of total
- Each version has its uses

- dollar amounts nominal
  - Simple and easiest to understand
- dollar amounts real
  - Takes out inflation rate
- percent changes
  - Concentrates on recent changes
- logs
  - Shows longer trends since slope is percent change
- fractions of total
  - Shows how compositions change

REAL/NOMINAL INTEREST RATES

- The nominal interest rate is what you usually see: bank offers to pay 2% interest so money grows by 2% over a year
- But inflation?
- If everything costs 2% more then you're net zero
- The real interest rate is nominal interest rate minus the inflation rate
  - $r = i - \pi$ where π is the inflation rate, i is nominal interest rate, and r is real interest rate
  - sometimes this is called the Fisher equation after Irving Fisher who popularized it

WHERE TO GET DATA?

- FRED
  - https://fred.stlouisfed.org/

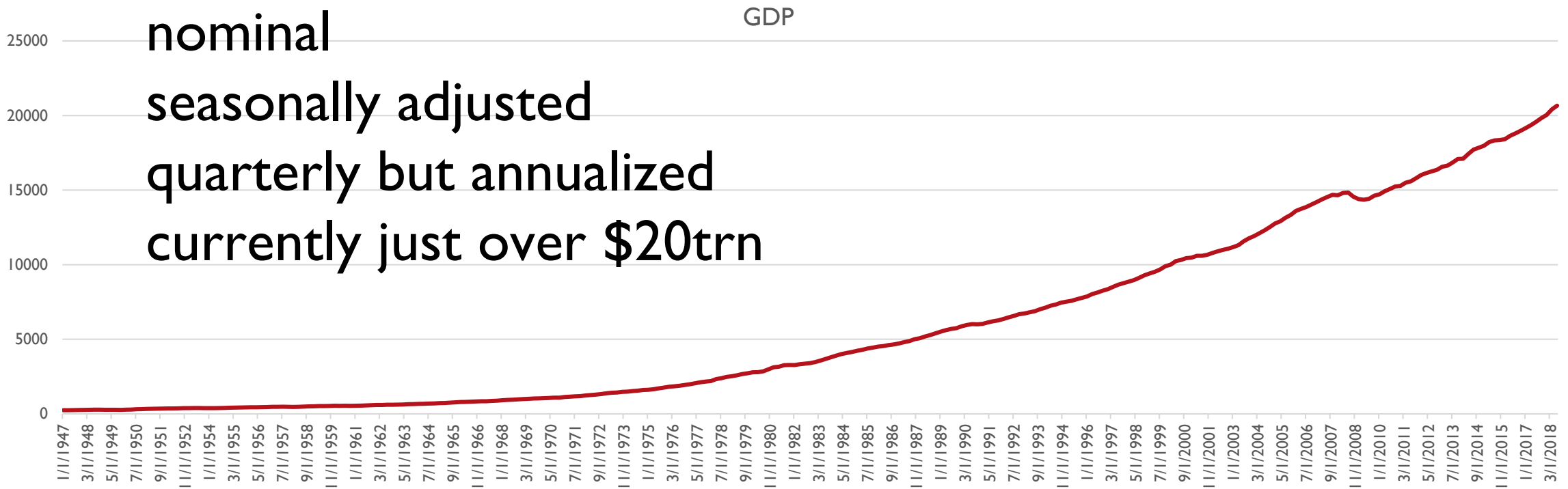
GDP

nominal

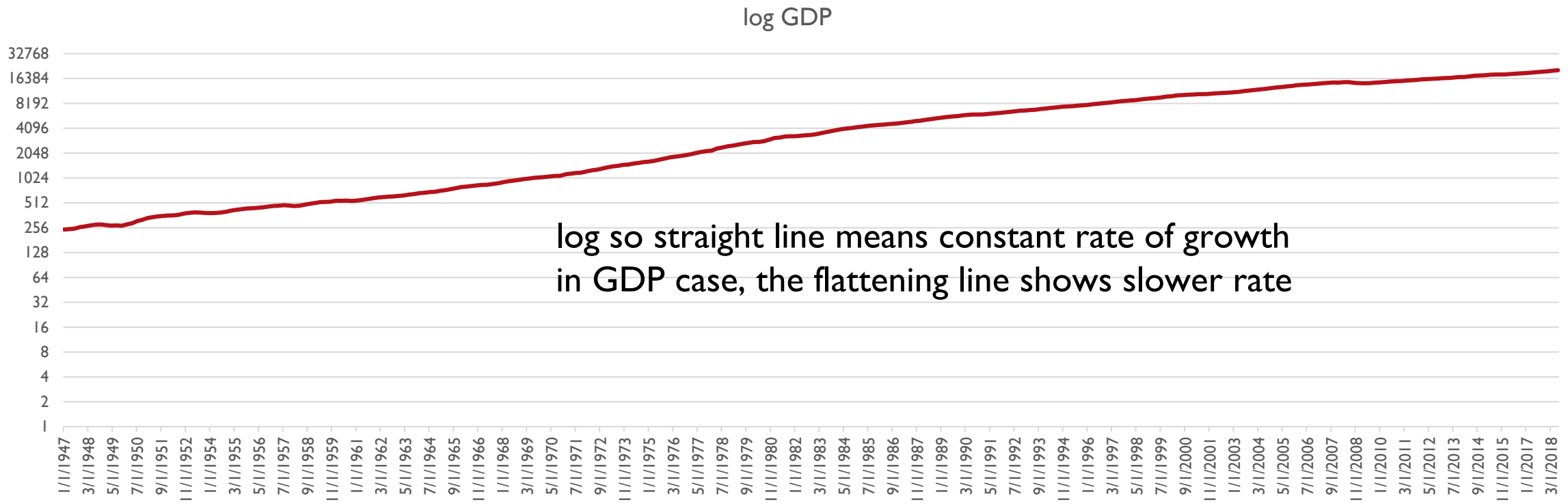
seasonally adjusted

quarterly but annualized

currently just over $20trn



GDP IN LOGS


log GDP
32768
16384
8192
4096
2048
1024
512
256
128
64
32
16
8
4
2
1
1/1/1947
3/1/1948
5/1/1949
7/1/1950
9/1/1951
11/1/1952
1/1/1954
3/1/1955
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11/1/2008
1/1/2010
3/1/2011
5/1/2012
7/1/2013
9/1/2014
11/1/2015
1/1/2017
3/1/2018
log so straight line means constant rate of growth
in GDP case, the flattening line shows slower rate

ANNUALIZED RATE

- For simple changes, annualizing is easy – if a business sells $1000 each quarter then multiply by 4 to get annualized
  - Although, hey!, does it seem reasonable that growth is that boring & easy? Nope, seasons are a thing…
- For rates of growth, a 1% growth rate in a quarter is approximately a 4% growth rate over a year (annualized)
  - Wait, "approximately"? Yes because compounding – technically if R_Q is the quarterly growth then find annual rate as $(1 + R_Q)^4 - 1$ so for 1% quarterly that's 4.06% annualized
- What about monthly data? So that's 12 months: if R_M is monthly growth rate then annualized is $(1 + R_M)^{12} - 1$
- Alt, take Q-on-Q change, so find growth of current quarter this year over same quarter last year