Economic growth and market power

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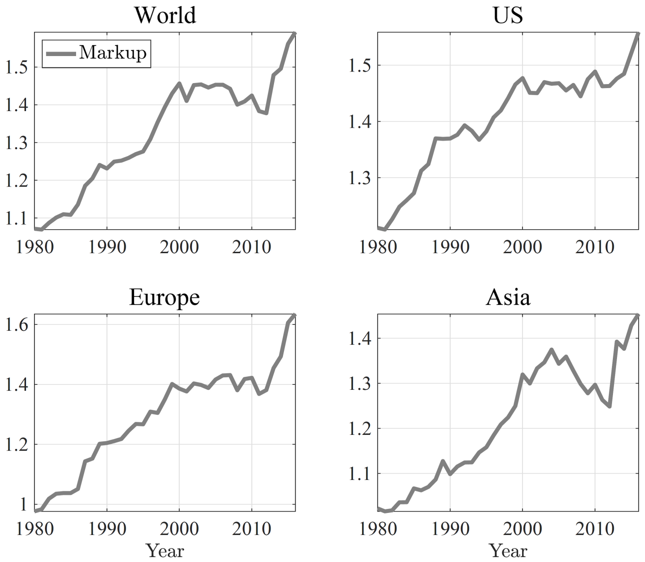
Introduction



Introduction

- Firms have market power if an incremental price increase above marginal costs does not lead to a loss of all (or most) of the demand
- Sources of market power:
  - Product differentiation with firm entry costs
  - Lock-in effects with consumer entry costs
  - Government sponsored-monopolies/oligopolies
- What is driving the observed rise in market power across the world?
  - Relaxation of antitrust policy
  - Technological change
  - Globalization
- Here I present a simple model to think about these issues:
  - What are the interactions between economic growth and market power?
  - What is the effect of globalization?
  - What is the effect of anti-trust policy?

Some literature

- On the evidence: De Loecker and Eeckhout (2020, 2021), Rossi-Hansberg et al (2021), Philippon (2019), Eeckhout (2021)
- On the theory: Aghion et al. (2014), Krugman and Helpman (1989), Epifani and Gancia (2011), Edmond et al (2015), Arkolakis et al (2019),

Model 1. Savings

- OLG setup, two-period lifetimes and constant population equal to L
- There is a final good used for consumption and production
- Generation t maximizes:

$$U_t = \ln C_{1t} + \beta \ln C_{2t+1} \tag{1}$$

subject to:

$$C_{1t} \leq (1-\eta)\, W_t - S_t \tag{2}$$

$$C_{2t+1} \leq \eta W_{t+1} + R_{t+1} S_t \tag{3}$$

- Optimal savings:

$$S_t = \frac{\beta}{1+\beta}(1-\eta)\, W_t - \frac{1}{1+\beta}\frac{\eta W_{t+1}}{R_{t+1}} \tag{4}$$

  - increase with present wage
  - decrease with discounted future wage

Model 2. Technologies and products

- There is a discrete number of technologies available, $n = 1, ..., N$
- Each technology consists of a continuum of products, $z \in [0, M_{nt}]$
- The final good is a bundle of products:

$$Q_t = \left(\sum_n Q_{nt}^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}}, \quad \text{with } Q_{nt} = \left[\int_0^{M_{nt}} Q_{nt}(z)^{\frac{\sigma_n-1}{\sigma_n}} dz \right]^{\frac{\sigma_n}{\sigma_n-1}} \qquad (5)$$

Order technologies such that $\sigma_1 < \sigma_2 < ... < \sigma_N$

- The final good is the numeraire:

$$1 = \left(\sum_n P_{nt}^{1-\varepsilon} \right)^{\frac{1}{1-\varepsilon}}, \quad \text{with } P_{nt} = \left[\int_0^{M_{nt}} P_{nt}(z)^{1-\sigma_n} dz \right]^{\frac{1}{1-\sigma_n}} \qquad (6)$$

Model 3. Production

- Monopolistic competition with free entry
- The revenue of a monopolist is:

$$P_{nt}(z)\,Q_{nt}(z) = P_{nt}(z)^{1-\sigma_n}\,P_{nt}^{\sigma_n-\varepsilon}Q_t \tag{7}$$

  - increases with the size of the economy
  - decreases with the price of the product
  - decreases with the price of competitors if $\varepsilon < \sigma_n$, but increases if $\sigma_n < \varepsilon$

- The monopolist maximizes profits:

$$\Pi_{nt}(z) = \left[P_{nt}(z) - W_t\right] Q_{nt}(z) \tag{8}$$

  subject to the demand in Equation (7) and taking the wage as given

- Pricing policy:

$$P_n(z) = \frac{\sigma_n}{\sigma_n - 1} W_t \tag{9}$$

  - Reminder: the markup is the inverse of the labor share

Model 4. Wages and output

- The equilibrium wage:

$$W_t = \left[\sum_n \left(\frac{\sigma_n - 1}{\sigma_n} M_{nt}^{\frac{1}{\sigma_n - 1}} \right)^{\varepsilon - 1} \right]^{\frac{1}{\varepsilon - 1}} \tag{10}$$

  - increasing on the measure of products
  - decreasing on product differentiation/market power

- Equilibrium output:

$$Q_t = \left[\sum_n \left(M_{nt}^{\frac{1}{\sigma_n - 1}} L_{nt} \right)^{\frac{\varepsilon - 1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon - 1}} \tag{11}$$

with this employment allocation:

$$L_{nt} = \frac{\left(\frac{\sigma_n - 1}{\sigma_n} \right)^{\varepsilon} M_{nt}^{\frac{\varepsilon - 1}{\sigma_n - 1}}}{\sum_k \left(\frac{\sigma_k - 1}{\sigma_k} \right)^{\varepsilon} M_{kt}^{\frac{\varepsilon - 1}{\sigma_k - 1}}} L \tag{12}$$

  - decreasing on markups
  - increasing on the measure of products

Model 5. Investment

- To produce a product in period $t+1$, one unit of the final good must be invested in period t:
  - If technology n is active in period $t+1$: $R_{t+1} = \Pi_{nt+1}$
  - if technology n is inactive in period $t+1$: $R_{t+1} \geq \Pi_{nt+1}$
- Since our country is a closed economy:

$$\sum_n M_{nt+1} = \frac{\beta}{1+\beta}(1-\eta) W_t L - \frac{1}{1+\beta} \frac{\eta W_{t+1} L}{R_{t+1}} \tag{13}$$

  - Note: investment affects the discounted future wage
- This completes the description of the model

Summarizing the model

- The wage equation:

$$W_{t+1} = \left[\sum_n \left(\frac{\sigma_n - 1}{\sigma_n} M_{nt+1}^{\frac{1}{\sigma_n - 1}} \right)^{\varepsilon - 1} \right]^{\frac{1}{\varepsilon - 1}} \tag{14}$$

- The investment possibility frontier:

$$\sum_n \left[1 + \frac{\eta \left(\sigma_n - 1 \right)}{1 + \beta} \right] M_{nt+1} = \frac{\beta}{1 + \beta} \left(1 - \eta \right) L W_t \tag{15}$$

- The free-entry conditions:

$$\frac{\Pi_{nt+1}}{\Pi_{mt+1}} = \frac{\sigma_k^{\varepsilon} \left(\sigma_n - 1 \right)^{\varepsilon - 1} M_{nt+1}^{\frac{\varepsilon - \sigma_n}{\sigma_n - 1}}}{\sigma_n^{\varepsilon} \left(\sigma_k - 1 \right)^{\varepsilon - 1} M_{kt+1}^{\frac{\varepsilon - \sigma_k}{\sigma_k - 1}}} \begin{cases} = 1 & \text{if } n \text{ is active} \\ \leq 1 & \text{if } n \text{ is inactive} \end{cases} \tag{16}$$

where k is any active technology (there is always one at least)

Three observations

- At least one technology must be active in every period
  - Assume not, then savings would exceed investment. An implication of this result is that $M_{nt} > 0$ for some n in all t, which is implicitly used in the proof of the next two observations

- All technologies such that $\varepsilon < \sigma_n$ must be active in all periods
  - Assume not. Then, a small measure of entrants would make arbitrarily large profits and all producers would like to invest in this technology

- There is always an equilibrium in which a technology such that $\sigma_n < \varepsilon$ is inactive in any period t
  - Assume this technology is inactive in period t. Then a small measure of entrants would make zero profits. Since there is always an active technology that offers positive profits, there are no producers that want to invest in the technology

The case of one technology

- Consider first the case in which there is a single technology:

$$W_{t+1} = \frac{\sigma - 1}{\sigma} M_{t+1}^{\frac{1}{\sigma-1}} \tag{17}$$

$$\left[1 + \frac{\eta(\sigma - 1)}{1 + \beta}\right] M_{t+1} = \frac{\beta}{1 + \beta}(1 - \eta) LW_t \tag{18}$$

- Product differentiation/market power affects the growth process in two ways:
  - Through income distribution and its effect on savings:
    - ⋆ Savings has an inverse U-shaped relationship with σ reaching a peak at $\sigma = 1 + \sqrt{\frac{1+\beta}{\eta}}$ (increase in σ raises both the present and discounted future wage, with opposing effects on savings)
  - Through its effect on aggregate returns to scale:
    - ⋆ Aggregate returns to scale are $\frac{1}{\sigma - 1}$ (increase in σ lowers aggregate returns to scale which are increasing if $\sigma < 2$ but decreasing if $\sigma > 2$)

Figure 1. Growth with low market power

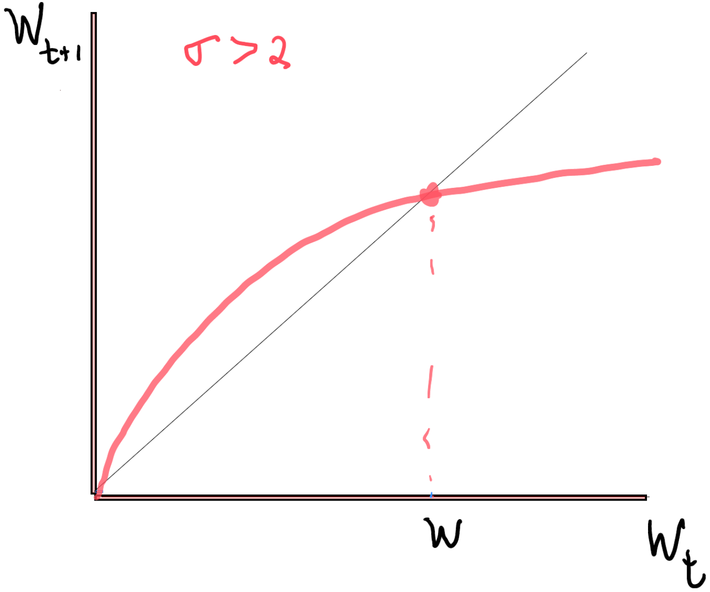
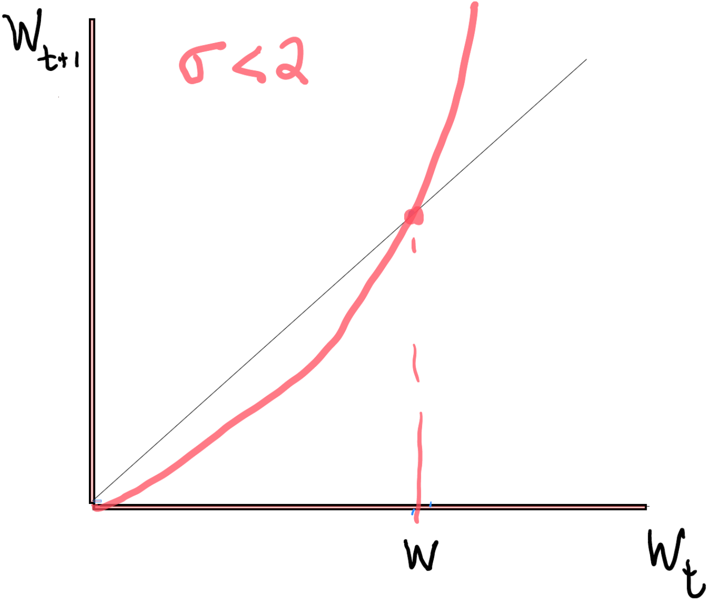


Figure 2. Growth with high market power



Comment

- According to the estimates of De Loecker and Eeckhout (2021) average markups around the world increased from an average 1.15 in 1980 to an average 1.6 in 2016

- This means that σ declined from $\sigma_{1980} = 7.7$ to $\sigma_{2016} = 2.7$. This should have a major impact on the growth process:
  - A large change in income distribution and (perhaps) savings
  - A large change in aggregate returns to scale

- How did this change happen? Is there any reason to think that economic growth brings about a change in market power?

The case of two technologies

- Consider now the case of two technologies:

$$W_{t+1} = \left[\left(\frac{\sigma_1 - 1}{\sigma_1} M_{1t+1}^{\frac{1}{\sigma_1 - 1}} \right)^{\varepsilon - 1} + \left(\frac{\sigma_2 - 1}{\sigma_2} M_{2t+1}^{\frac{1}{\sigma_2 - 1}} \right)^{\varepsilon - 1} \right]^{\frac{1}{\varepsilon - 1}} \quad (19)$$

$$\left[1 + \frac{\eta (\sigma_1 - 1)}{1 + \beta} \right] M_{1t+1} + \left[1 + \frac{\eta (\sigma_2 - 1)}{1 + \beta} \right] M_{2t+1} = \frac{\beta}{1 + \beta} (1 - \eta) L W_t \quad (20)$$

- The economy is some sort of weighted average of the corresponding single-technology economies:
  - The weights depend on the the relative size of the two technologies
  - The relative size of the two technologies changes as the economy grows

- We say that there are no network effects if $\varepsilon < \sigma_1 < \sigma_2$. We say that there are network effects in technology 1 if $\sigma_1 < \varepsilon < \sigma_2$

Figure 3. Technology choice without network effects

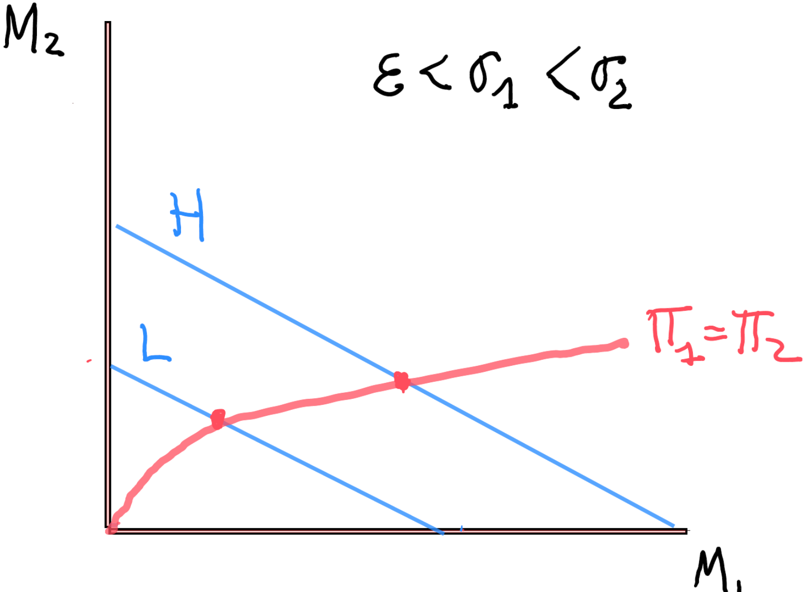
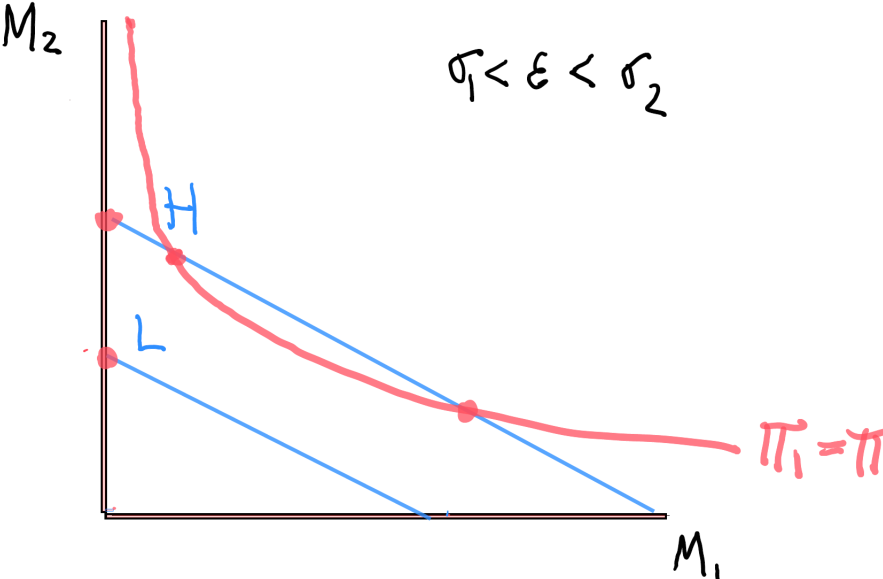


Figure 4. Technology choice with network effects



Key takeaways

- Economic growth has an anti-competitive bias
  - Intuition: the value of creating new products declines quickly if these are similar to the old ones
- Market power has a pro-growth bias
  - Intuition: product differentiation raises aggregate returns to scale
- With network effects, there are multiple equilibria and threshold effects. Thus, random and large discrete changes in product differentiation/market power are possible
- Asymmetric effects of shocks to savings and the wage profile
  - Positive shocks raise market power and are slow and long-lived
  - Negative shocks lower market power and are sharp and short-lived
- Scale effects such as globalization or population growth have an anti-competitive bias

Antitrust regulation

- Assume a binding markup $\mu < \frac{\sigma_1}{\sigma_1 - 1}$.
- The new dynamical system is now:

$$W_{t+1} = \frac{1}{\mu}\left[M_{1t+1}^{\frac{\varepsilon-1}{\sigma_1-1}} + M_{2t+1}^{\frac{\varepsilon-1}{\sigma_2-1}}\right]^{\frac{1}{\varepsilon-1}} \tag{21}$$

$$\left[1 + \frac{\eta}{(1+\beta)(\mu-1)}\right](M_{1t+1} + M_{2t+1}) = \frac{\beta}{1+\beta}(1-\eta)LW_t \tag{22}$$

$$\frac{\Pi_{1t+1}}{\Pi_{2t+1}} = \frac{M_{1t+1}^{\frac{\varepsilon-\sigma_n}{\sigma_n-1}}}{M_{2t+1}^{\frac{\varepsilon-\sigma_m}{\sigma_m-1}}}\begin{cases} = 1 & \text{if 1 is active} \\ \leq 1 & \text{if 1 is inactive}\end{cases} \tag{23}$$

- Antitrust regulation affects income distribution and therefore savings:
  - The effect is positive if product differentiation is high, but negative if product differentiation is low
- Antitrust legislation does not affect aggregate returns to scale, so it does not fundamentally affect the nature of the growth process

Concluding remarks

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  - Intuition: the value of creating new products declines quickly if these are similar to the old ones
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  - The effect is positive if product differentiation is high, but negative if product differentiation is low
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