Big Push

(chapter 6 Ray, and Murphy & Shleifer)

The idea

- Increasing returns to scale (unit costs falls in volume) or/and positive spillovers (increased activity at unit i makes it more profitable to increase activity at unit j) can lead to several equilibria, equilibria can be Pareto ranked.

- Increasing returns $\Rightarrow$ unit costs decrease in volume. Old product with inferior production technology may keep the new superior out of the market since the new technology needs a high volume in order to outperform the old (draw graphs)

- Spillover: Consider a simple $2 \bullet 2$ game:

	low	high
low	2,2	3,1
high	1, 3	5,5

- two equilibria, and (h, h) Pareto Dominates (l, l).
- What will happen
  - History matters (two societies that are ex ante similar may end up in two different situations)
  - Expectations matters - self fulfilling: if everyone expects the others to play h the $h-$equilibria will be realised
- $(l, l) \rightarrow (h, h)$ requires a big push from the government (coordinated action). Individual initiatives are futile.
- Only a temporary push is needed, not a permanent pull (since (h, h) is an equilibrium)

- Contrast complementarities with the more standard situation where there are negative externalities: the profitability of doing more of an activity decreases in the level of activity at other units (two routs to the city, draw graph).

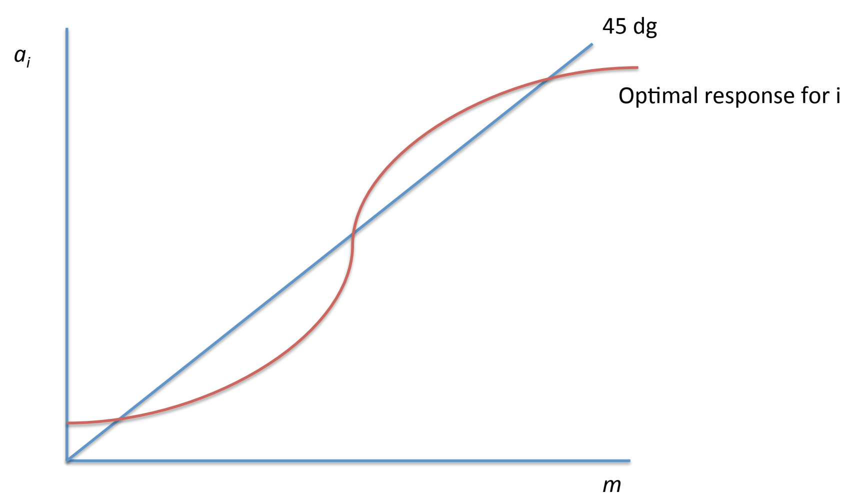
Formalism

- Consider a population of agents that each choose an action $a \in A \subseteq \mathbb{R}$. Let m be the average action chosen by the other agents ($a_{-i} = m$). Actions are complements if for $a_i > a_i^{'}$,

$$\pi_i(a_i, m) - \pi_i(a_i^{'}, m)$$

increases in m.

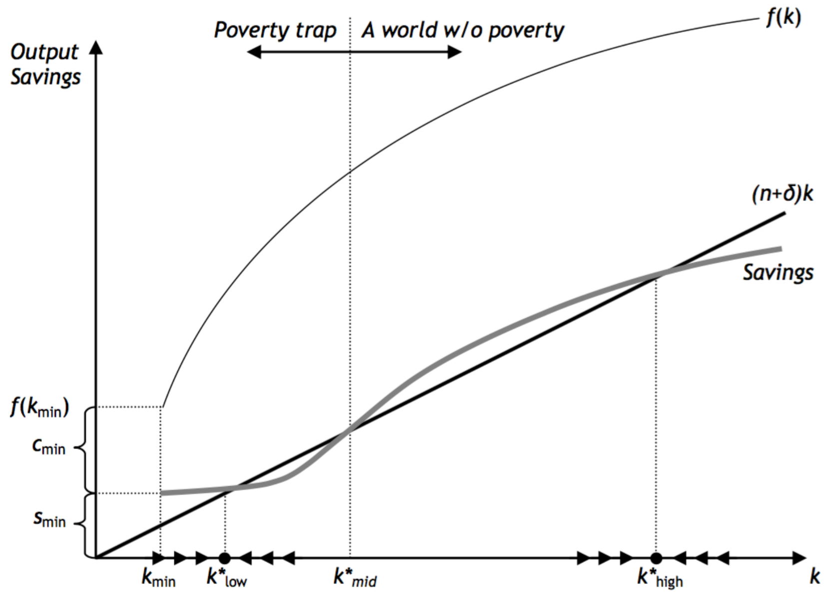
- If the payoff function can be differentiated, complementarities implies $\frac{\partial \frac{\partial \pi_i}{a_i}}{\partial m} > 0$.
- When there are complementarities like this situations with several equilibrium; for example a low and a high

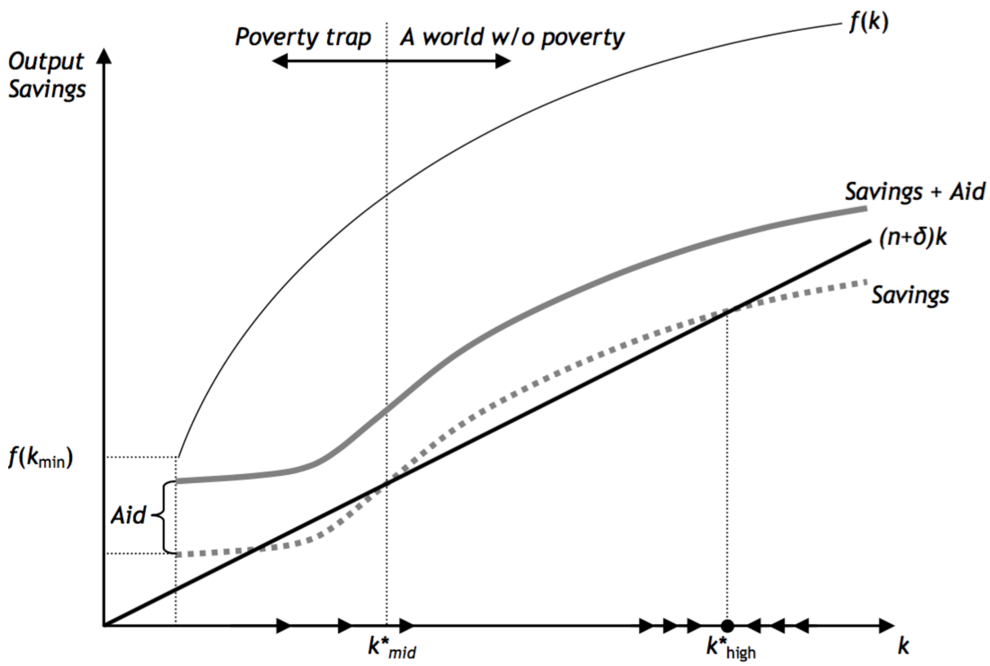


Examples

- Networks and platforms: the more individuals that use a “platform” the higher is the returns from joining; telephone, social media,.. QWERTY
- Social Norms: “How corruption may corrupt”
- Bank runs
- Endogenous growth: Economy wide investment may raise return to individual investments.
  - Could be technological spillovers
  - Another mechanism is Pecuniary Externalities: Industrialization in one sector may increase demand and prices for other goods and the profitability of industrializing other sectors. This was the idea that Rosenstein-Rodan and Hirschman brought to development economics. Lack of development (industrialization) could be a poverty trap that needs government policy to get out of. They took up an idea by Allyn Young (1928) that there may be complementarities and increasing returns in economic production
  - This idea was long ignored in mainstream economics because it was difficult to formalize in a general equilibirum framework (a model that assumes constant returns to scale). Murphy and Schleifer (the big push paper) and Krugman (in trade) did important work to formalize and analyze models with increasing returns and complementarities.

A Macro Picture





Micro foundation (the big push model by Murphy and Scheleifer)

- The economy produces a continuum of goods over the unit interval. Each good is produced by a firm. The only factor of production is labor, with L being the representative worker's endowment.
- Any good can be produced either with a traditional or a modern technology, with n being the fraction of firms using modern technology. Firms using traditional technology transform one unit of labor into one unit of output (CRS).
- Normalize the wage (price of a unit of labor) to 1, we obtain that the price of any good is also 1. The income
- Consumers derive utility from consumption $U = \int_0^1 x(q)dq$. Maximizing U subject to prices and wages being equal to 1 $\Longrightarrow$ Income is given by wages and profits $y = L + \pi$ and is spent by the worker/consumer equally among all the goods.
- The output of each good in a purely traditional economy ($n = 0$) is: $y(0) = L$. No profit in the traditional industry.
- If a sector chooses to modernize it has hire F workers to set up the factory (fixed cost), in return with a modern technology each unit of labour will be more productive and produce $\alpha > 1$ units of good.

Same wage $= 1$

- The profits earned by modernization is $\pi = y - \frac{y}{\alpha} - F = \frac{\alpha-1}{\alpha} y - F \equiv ay - F$.
- It is a function of n(the fraction of sectors that has modernized; the reason is that income is a function n and F implies that unit costs decreases in quantity sold:

$$\pi(n) = ay(n) - F$$

$$y(n) = n\pi(n) + L$$

- We can write

$$\pi(n) = \frac{aL - F}{1 - an} \tag{1}$$

- Complementarity, a multiplier effect $\pi \uparrow \Longrightarrow y \uparrow \Longrightarrow \pi \uparrow \Longrightarrow y \uparrow ...$
- Even though there are complementarities in this model, there is only one equilibrium. The reason is that the externality comes via profits only. So there must be profitable for a sector to industrialize to get a positive multiplier: Hence if $F < aL$ there is positive profits and the whole economy will industrialize. Or if $F > aL$ there is not profitable to industrialize (not even if $n = 1$, check equation 1). So no room for a big push policy here. To get such a situation there must be a pecuniary externality that comes through wages.
- This is one of the presumptions in Rosenstein-Rodan example of the shoe factory: In order to hire workers away from home in a factory one must offer a wage premium.

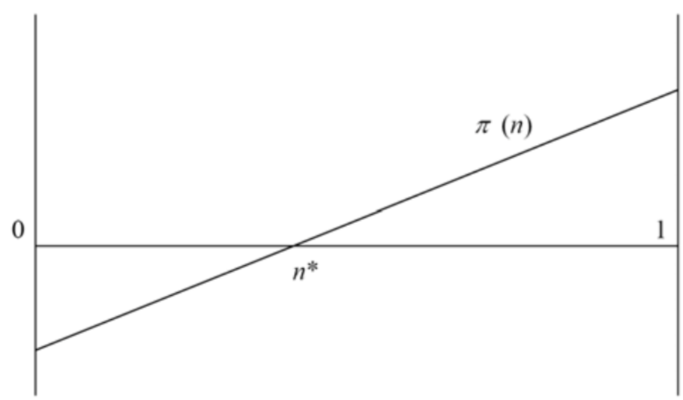
- The profits for an industrialized sector is $\pi = y(1 - \frac{(1+v)}{\alpha}) - F(1+v)$. To get an interesting situation it must be the case that $\alpha - 1 > v$.

- With that condition we can have two equilibria; one with no industrialization and one with complete industrialization. To prove this we need to show that it is not profitable for for one sector to modernize if no other sector is industrialized, while it will be profitable to industrialize if all other sectors are.

- $\mathbf{n = 0}$: If no other sector is modernized income and demand is L, so there is an equilibrium with no modernization if $\pi(0) = L(1 - \frac{1+v}{\alpha}) - F(1+v) < 0$.

- $\mathbf{n = 1}$: There is an equilibrium with full modernization if and only if profits is positive in each sector at this level modernization. The point here is that demand is high when all workers are in the modern sector since they earn a wage premium. With full modernization the income that will be used to buy goods from each sector is $L(1+v)$ so demand for each good is $y(1) = L(1+v) + \pi(1) = L(1+v) + y(1)\left(1 - \frac{(1+v)}{\alpha}\right) - F(1+v)$. Solving this we find $y(1) = \alpha(L - F)$. The condition for earning profits is then $\alpha(L-F)\left(1 - \frac{1+v}{\alpha}\right) - (1+v)F \geq 0$.

- If we compare the conditions for $n = 0$ and $n = 1$, there is a range of parameter values for which both equilibria exists. In that case there must be a watershed $0 < n^* < 1$ that makes it profitable for an additional sector to modernize. If the government can industrialize up to n^* the economy will "by itself" go towards full industrialization.



Infrastructure

- Suppose building a railroad costs a fixed cost R (takes R workers to build the railroad). A railroad must be financed by at tax (rate γ) on profits. Only profits in industrialized sectors, hence a rail raod will only be built if a sufficient fraction of the economy is industrialized. Here we can have two equilibria one in which there is full industrialization and a railroad, and one in which there is no railroad and the old technology.

- It is social optimal to have the industrialized railroad equilibrium if $\alpha(L - R - F) > L$ (explain why). If there is no industrialization there is no profit and the railroad company has a loss of R. If there is industrialization the railroad company runs with a profit $\pi^R = \gamma((1 - \frac{1}{\alpha})\alpha(L - R - F) - F))$, with sufficiently high profits or tax rate.