General Equilibrium, Welfare and Policy when Firms have Market Power

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Introduction

Consider a simple market economy in which

- Firms produce consumption goods using labor as input
- *Consumers* own the firms and use their shares of the firms' returns to buy consumption goods
- *Workers* supply labor and use their labor income plus their shares from the firms to buy consumption goods
- There are neither public goods nor production or consumption externalities. (Hence perfect competition generates Pareto optimal allocations.)

Introduction

Market power

The common wisdom is that

- it reduces the real output, the employment, the real wage and the labor share
- and leads to dead-weight losses.

Introduction

Contrary to common wisdom, market power has non-monotonic effects: if the number of firms is below a threshold the monopolistic equilibrium allocation Pareto dominates the oligopolistic equilibrium allocation.

The monopoly:

- uses more labor
- pays a higher real wage
- generates larger real returns

... the monopolist's and society's interests are better aligned than those of the Cournot competitors.

Introduction

The price distortions and significant deadweight loses caused by market power call for *policy intervention.*

- Policies fostering competition are effective, with the caveat on the number of firms
- Taxes or policies regarding trade unions have distributional effects but are unlikely to reduce inefficiencies.
- We study the effectiveness of minimum real wages.

A Market Economy

- There $m \geq 2$ number of consumption goods, and $n \geq 1$ firms producing in each sector.
- All firms produce their good using labor (l) as input according to the production function $F(l) = l^{\alpha}$, where $\alpha \in (0, 1]$.
- Firms' owners buy goods using their share of the firms' returns as their exclusive source of income.
- There is a continuum of *workers* (whose measure is normalized to 1) who supply labor and use their labor income (and their share of the firms' returns) to buy consumption goods.

A Market Economy

- Both consumers and workers care about their consumption of a composite good c, given by

$$c = v(c_1 ..., c_m) := \left(\frac{1}{m}\right)^{\frac{1}{\theta-1}} \left(\sum_{i=1}^{m} c_i^{\frac{\theta-1}{\theta}}\right)^{\frac{\theta}{\theta-1}}.$$

with a higher $\theta \in (1, \infty)$ indicating a higher value of variety of the society.

- Workers care as well about their leisure (or its counterpart, labor l), and their preferences are represented by the utility function

$$u(l, c) = c - \frac{\varepsilon}{1+\varepsilon} l^{\frac{1+\varepsilon}{\varepsilon}},$$

where $\varepsilon > 0$ is the elasticity of labor suppply.

A Market Economy

- Given the good prices $p = (p_1, ..., p_m) \in \mathbb{R}^m_+$, we may calculate the minimum expenditure required to consume $c \in \mathbb{R}_+$ units of the composite good, and the effective price of c,

$$P = \left(\frac{1}{m} \sum_{i=1}^{m} p_i^{1-\theta} \right)^{\frac{1}{1-\theta}},$$

  best known as the Dixit-Stiglitz price index.

- Write $\rho_i := p_i / P$ for the real price of good $i \in \{1, ..., m\}$, and $\rho = (\rho_1, ..., \rho_m)$ for the profile of real prices. Also denote by ω the real wage.

A Market Economy

- Given a profile $(\rho, \omega) \in \mathbb{R}_+^{m+1}$, we may calculate the workers demands of goods, their supply of labor and their utility: $l^S(\omega) = L^S(\omega) = \omega^\varepsilon$, $c(\omega, R) = R + \omega^{1+\varepsilon}$, and $U(R, \omega) = R + \frac{\omega^{1+\varepsilon}}{1+\varepsilon}$
- Note L^S is increasing and convex in ε iff $\varepsilon > 1$: A small increase in ω has a large impact on the supply of labor.
- Note also that workers' consumption of composite good and their utility increase with ω (and R).
- Given the profile of firms' labor $\ell \in \mathbb{R}_+^{mn}$ we may calculate the market supply of each good and the labor demand.
- Also, given the profile (ℓ, ρ, ω) we may calculate the firms real returns, which consumers (and workers) use to buy goods in order to maximize their consumption of the composite good.

A Competitive Economy

In a competitive economy firms choose their labor to maximize *real returns* taking as given the profile of real prices and the real wage, (ρ, ω), and supply their output, that is, firm ij chooses l_{ij} solving the problem

$$\max_{l_{ij} \in \mathbb{R}_+} \rho_i l_{ij}^{\alpha} - \omega l_{ij}.$$

A *competitive equilibrium (CE)* is thus a market equilibrium (ℓ, ρ, ω) such that the labor of each firm $ij \in \{1, ..., m\} \times \{1, ..., n\}$ is a solution to its profit maximization problem.

A Competitive Economy

In the unique CE of the economy, which is *symmetric*:

$$
\begin{aligned}
\omega_{CE} &= mn^{(1-\alpha)\beta}\alpha^{\beta}, \\
L_{CE} &= mn\left(\frac{\alpha^{\varepsilon}}{mn}\right)^{\beta} \\
Y_{CE} &= mn^{1-\alpha\beta}\alpha^{\varepsilon\alpha\beta} \\
\omega_{CE}L_{CE} &= \alpha Y_{CE} \\
\Pi_{CE} &= (1-\alpha)\,Y_{CE} \\
W_{CE} &= \frac{\omega_{CE}L_{CE}}{Y_{CE}} = \alpha.
\end{aligned}
$$

where $\beta := \frac{1}{1+(1-\alpha)\varepsilon}$.

A Monopolisitc Economy

Consider a market economy in which a single agent controls all the firms (i.e., *plants*), acting as monopoly in the goods' markets and as a monopsony in the labor market.

A *monopolistic equilibrium (ME)* is a market equilibrium such that the labor profile maximizes monopoly's real returns.

A Monopolisitc Economy

In the unique ME of the economy, which is *symmetric*:

$$
\begin{aligned}
\omega_{ME} &= \left(\frac{\varepsilon}{1+\varepsilon}\right)^{\beta} \omega_{CE} < \omega_{CE}, \\
L_{ME} &= \left(\frac{\varepsilon}{1+\varepsilon}\right)^{\beta\varepsilon} L_{CE} < L_{CE} \\
Y_{ME} &= \left(\frac{\varepsilon}{1+\varepsilon}\right)^{\alpha\beta\varepsilon} Y_{CE} < Y_{CE} \\
\omega_{ME} L_{ME} &= \left(\frac{\varepsilon}{1+\varepsilon}\right) \alpha Y_{ME} \\
\Pi_{ME} &= \left(1 - \frac{\varepsilon\alpha}{1+\varepsilon}\right) Y_{ME} > \Pi_{CE} \\
W_{ME} &= \frac{\omega_{ME} L_{ME}}{Y_{ME}} = \frac{\varepsilon}{1+\varepsilon} W_{CE} < W_{CE}
\end{aligned}
$$

An Oligopolisitc Economy

Consider an economy in which firms compete *à la* Cournot by choosing the amount of labor they use (and hence the output they produce), exercising market power in the goods' and labor markets.

An *oligopolistic equilibrium (OE)* is a market equilibrium (ℓ, ρ, ω) such that the labor of each firm maximizes its real returns taking as given the labor used by the other firms.

An Oligopolisitc Economy

In the unique OE of the economy, which is *symmetric*:

$$
\begin{aligned}
\omega_{OE} &= (\varepsilon\gamma)^{\beta}\omega_{CE} < \omega_{CE}, \\
L_{OE} &= (\varepsilon\gamma)^{\beta\varepsilon} L_{CE} < L_{CE} \\
Y_{OE} &= (\varepsilon\gamma)^{\alpha\beta\varepsilon} Y_{CE} < Y_{CE} \\
\omega_{OE} L_{OE} &= \varepsilon\gamma\alpha Y_{OE} \\
W_{OE} &= \frac{\omega_{OE} L_{OE}}{Y_{OE}} = \varepsilon\gamma W_{CE} < W_{CE} \\
\Pi_{OE} &\gtreqless \Pi_{CE} \Leftrightarrow (\varepsilon\gamma)^{\alpha\beta\varepsilon} \gtreqless \frac{1-\alpha}{1-\varepsilon\alpha\gamma}.
\end{aligned}
$$

where

$$
\gamma := \frac{(1+mn\theta - m)\,\varepsilon}{(1+mn\varepsilon)\,\theta} \in (0,1).
$$

Welfare

If all firms of an oligopolistic economy become under the control of a monopoly (i.e., monopolistic economy), then the employment, the real wage, and the labor share increase provided

$$n < \bar{n}(\varepsilon, \theta, m) := \frac{(1+\varepsilon)(m-1)}{m\theta} + \frac{1}{m}.$$

Moreover, the resulting allocation is Pareto superior. Thus, market power may have non-monotonic effects on employment, real wage, labor share and welfare.

Intuition

- The owners' of a Cournot competitor care only about the firm's real profits, as their consumption of the composite good is equal to the firm's real returns. In contrast, the monopolist's owners care about the sum of all firms' real returns.

- Hence, the monopolist will coordinate all its actions in the goods markets and the labor marker to achieve the highest real industry returns.

Intuition

- Consider first a simple economy with one firm per sector ($n = 1$)
- Comparing to the oligopolistic equilibrium, a monopolist should take into account also how a small increase in l_1 will influence its real returns in plant 2 that produces a substitute good
- The monopolist should balance out two effects: The effects of a small increase in l_1 on the real price of good 2 ($\frac{\partial \rho_2}{\partial l_1}$) and on the real wage ($\frac{\partial \omega}{\partial l_1} = \frac{\partial \omega}{\partial l}$)
- The first effect is positive and decreasing in θ, while the second effect is negative and decreasing in η
- When θ is small $\frac{\partial \rho_2}{\partial l_1}$ is large and when η is large $\frac{\partial \omega}{\partial l_1}$ is small. Then the first effect dominates the second as long as $\eta + 1 > \theta$ and the monopolist has incentives to increase l_1 above the level chosen by a Cournot competitor

Intuition

- As the number of firms per sector n increases, there is a third negative effect that the monopolist should take into account
- An increase in l_{11} decreases the real price in sector 1 ($\frac{\partial \rho_1}{\partial l_{11}}$), which makes the monopolist more reluctant to choose a higher l_{11}
- The higher is n, the stronger is the latter effect and the more difficult is that the positive effect $\frac{\partial \rho_2}{\partial l_{11}}$ dominates the two negative effects $\frac{\partial \omega}{\partial l} = \frac{\partial \omega}{\partial l_{11}}$ and $\frac{\partial \rho_1}{\partial l_{11}}$
- Hence, the condition for the monopolist to choose a higher level of employment per plant compared to a Cournot competitor becomes more stringent: $\eta + 1 > (2n - 1)\theta$

Policy

In a monopolistic economy a binding minimum real wage leads to an increase of:

- the real wage,
- employment,
- and the labor share,
- and hence to a increase of workers' consumption and welfare.

As the minimum real wage approaches the competitive real wage, the allocation approaches the competitive equilibrium allocation.

Policy

In oligopolistic economies, the effects of minimum real wages are uncertain:

- While in equilibrium the employment equals the labor supply at the minimum real wage, and hence the workers' welfare is the same,
- for minimum real wages not to far from the oligopolistic wage a symmetric equilibrium and a continuum of asymmetric equilibria arise that differ in the economy's real output and real returns (maximum at the symmetric equilibrium and minimum at the most asymmetric equilibria).
- For minimum real wages near the competitive equilibrium real wage no pure strategy equilibrium exists.

Discussion

Why does monopoly perform well?

- The monopoly has an incentive to *create value*. Cournot competitors ignore the impact of their decisions on the output composition.
- Monopsony power is *not* the element driving our results.

Why are minimum real wages an effective policy (particularly in monopolistic economies)?

- Labor is the only input. If there were more inputs, a minimum real wage will lead to a process of inputs substitution which make weaken the effectiveness of the policy.