General Equilibrium, Welfare and Policy Analysis when Firms Have Market Power

Diego Moreno and Emmanuel Petrakis

Universidad Carlos III de Madrid

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Introduction

Market power pervades modern economies, and is increasingly viewed as a source of *inefficiencies* and *inequalities*

- Shapiro (2018) on the *decline of competition* in the US over the last 20 years
- Eeckhout (2021) on the rise of the *superstar firms*.

Research in needed to identify policy interventions

- fostering efficiency
- reducing inequality.

Introduction

Our understanding of the effects of market power across the economy, and its impact on performance and distribution, is somewhat lacking.

- Earlier attempts to model oligopolistic economies, e.g., Gabszewicz and Vial (1972), were inconclusive as equilibrium depends on the choice of the numeraire.
- Representative agent models focus mainly on economic efficiency.
- Trade models of oligopoly or monopolistic competition typically assume the existence of a continuum of firms, deluding the effects of firms' market power across the economy.

Introduction

We study a simple market economy amenable to equilibrium analysis and show that *market power* leads to

- dead-weight losses
- low real income and employment
- real wage mark-downs shifting the distribution of income in favor of firms' owners.

Introduction

There are *policy interventions* that help reducing the inefficiency and distribution biases caused by market power, e.g.,

- minimum wages
- subsidies on consumption goods or employment financed via corporate taxes.

Also, *public spending* financed with corporate taxes may foster efficiency and/or improve distribution, e.g.,

- The provision of public education aimed to increase the fraction of high-skilled workers in the labor force
- Programs to incentivize technological innovation.

A Market Economy

- There are $m \geq 2$ consumption goods that are produced using high-skilled labor (h) and low-skilled labor (l) as inputs, according to the production function $Ah^{\alpha} l^{\beta}$, where $A, \alpha, \beta \in (0, \infty)$, and $\beta < \alpha \leq 1 - \beta$. There are n firms per sector.
- There is a continuum of consumers who care about their consumption of the composite good

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

where c_i is the consumption of good $i \in \{1, ..., m\}$. The parameter $\theta \in (1, \infty)$ is a proxy for consumers' preference for variety.

A Market Economy

- Among the consumers there is a unit measure of *workers* who care about their leisure (or its counterpart, labor ℓ) as well their consumption of the composite good, and their preferences are represented by the utility function

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

  where $\varepsilon \in (0, \infty)$ is the elasticity of labor supply.
- A fraction $\lambda \in (0, 1)$ of workers can supply high- and/or low-skilled labor, while the remaining fraction can only supply low-skilled labor. High-skilled labor is scarce $(\lambda\beta < (1 - \lambda)\,\alpha)$.

A Market Economy

In an economy $(m, n, A, \alpha, \beta, \theta, \varepsilon, \lambda)$:

- The (*real*) aggregate income resulting from an economic activity is the output of composite good.
- The *surplus* (i.e., aggregate utility) resulting from an economic activity is the aggregate income minus the workers' aggregate disutility of labor.
- The *maximum surplus* is *uniquely* defined: all firms use the inputs (h^*, l^*), each high-skilled worker supplies mnh^*/λ units of high-skilled labor, and each low-skilled worker supplies $mnh^*/(1-\lambda)$ units of low-skilled labor.

Let us denote by W^* and Y^* the surplus and aggregate income generated by this economic activity.

A Market Economy

- Given the prices of consumption goods $(P_1, ..., P_m) \in \mathbb{R}^m_+$, we calculate the (Dixit-Stiglitz) price (index) of the composite good P.
- Dividing the nominal prices and wages by P we calculate the goods' real prices, $p = (p_1, ..., p_m) \in \mathbb{R}^m_+$, and the real wages of high- and low-skilled labor, (v, w).

A *market-clearing profile* is a collection $[(\mathbf{h}, \mathbf{l}), (p, v, w)] \in \mathbb{R}^{2mn}_+ \times \mathbb{R}^{m+2}_+$ such that all markets clear.

A *market equilibrium* is a market-clearing profile such that the inputs of each firm solve its maximization problem.

We assume throughout that firms' objective is to maximize real profits.

Competitive Equilibrium

A *competitive equilibrium (CE)* is a market-clearing profile $(\mathbf{h}, \mathbf{l}, p, v, w)$ such for the inputs of each firm maximizes its real profit given the price system.

In the unique CE:

- The maximum surplus is realized, i.e., $(h_{ij}, l_{ij}) = (h^*, l^*)$, $W_{CE} = W^*$ and $Y_{CE} = Y^*$
- wages equal the value of marginal productivity
- the labor share is $LS_{CE} = \alpha + \beta$, and
- the aggregate profits are $\Pi_{CE} = (1 - \alpha - \beta)Y_{CE}$.

Monopolisitc Equilibrium

A *monopolistic equilibrium (ME)* is a market-clearing profile for which aggregate profits are maximal on the set of market-clearing profiles.

Relative to the CE, in the unique ME:

- the surplus, income and employment are smaller
- the wages are lower and are below the value of marginal productivity $\left(MD_{ME} = 1/\left(1+\varepsilon\right)\right)$
- the labor share is smaller $\left(LS_{ME} = \left(\varepsilon/\left(1+\varepsilon\right)\right) LS_{CE}\right)$
- the aggregate profits are larger.

Oligopolisitc Equilibrium

An *oligopolistic equilibrium (OE)* is a *market-clearing profile* $(\mathbf{h}, \mathbf{l}, p, v, w)$ such that $(\mathbf{h}, \mathbf{l})$ is a Cournot equilibrium, i.e., each (h_{ij}, l_{ij}) solves

$$\max_{(h,l)\in\mathbb{R}^2_+} p_i(h, \mathbf{h}_{-ij}, l, \mathbf{l}_{-ij})Ah^\alpha l^\beta - v(h, \mathbf{h}_{-ij})h - w(l, \mathbf{l}_{-ij})l.$$

Relative to the CE, in the unique OE:

- the surplus, income and employment are smaller
- wages are lower and are below the value marginal productivity $(MD_{OE} = 1 - \gamma)$
- the labor share is smaller $(LS_{OE} = \gamma LS_{CE})$
- the aggregate profits are larger.

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

Welfare

If the number of firms per sector n is below the threshold

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

the employment, aggregate income, surplus, real wages and labor share are larger in the ME than in the OE, and the ME equilibrium allocation is Pareto superior to the OE allocation.

Intuition: oligopolists do not care about goods' complementarities, while the monopoly does.

Policy: Minimum Wage

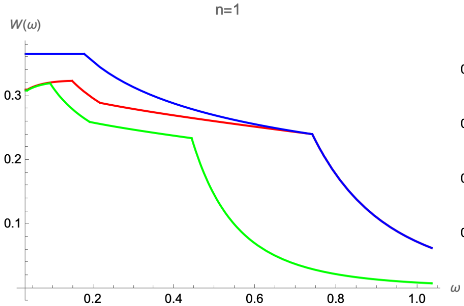
Monopoly: Effects vary in intervals of *low*, $\omega < \omega_1$, *intermediate*, $\omega_1 < \omega < \omega_2$, *high*, $\omega_2 < \omega < \omega_3$, and *extreme*, $\omega > \omega_3$, minimum wages.

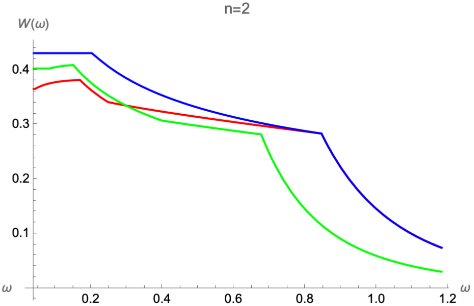
Oligopoly: multiple equilibria arise. Focus on the symmetric equilibrium (best case scenario) on which the qualitative effects of a minimum wage are the same as in ME.

Conclusion: *a low binding minimum wage mitigates the inefficiency and distribution bias caused by market power.*

Policy: Minimum Wage

Minimum real wages: $(m, A, \alpha, \beta, \theta, \varepsilon, \lambda) = (2, 1, 3/5, 1/5, 6/5, 1/4, 1/4)$.





Surplus (CE: blue; ME: red; OE: green)

Policy: Minimum Wage

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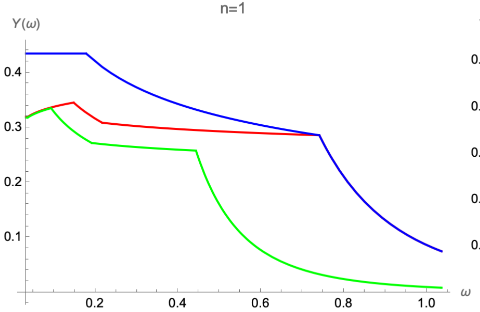

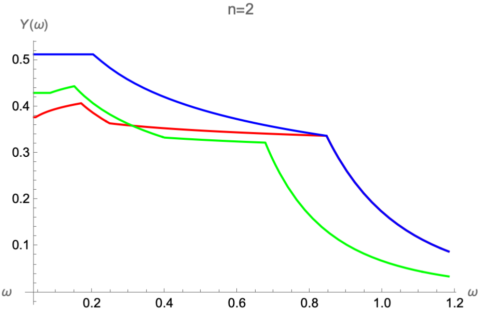

Aggregate Income (CE: blue; ME: red; OE: green)

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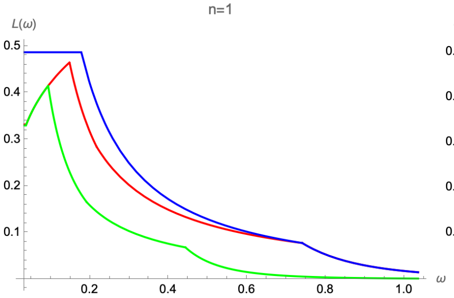
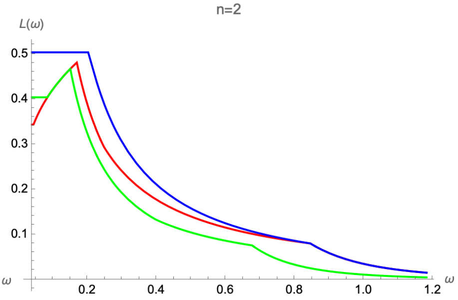
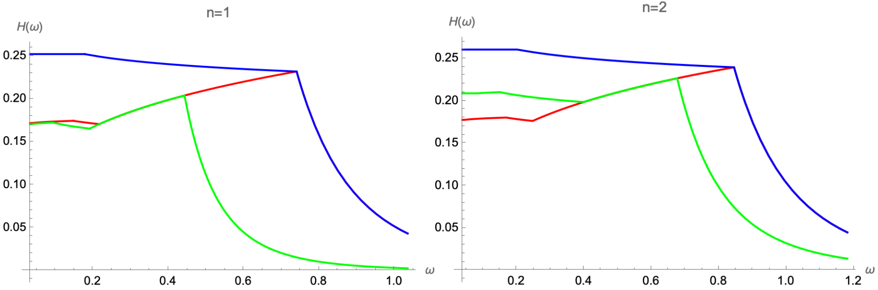




Employment of Low-Skilled Labor (CE: blue; ME: red; OE: green)

Policy: Minimum Wage

Minimum real wages: $(m, A, \alpha, \beta, \theta, \varepsilon, \lambda) = (2, 1, 3/5, 1/5, 6/5, 1/4, 1/4)$.



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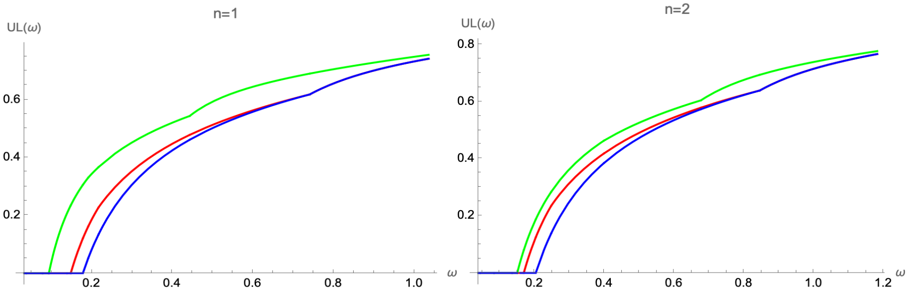
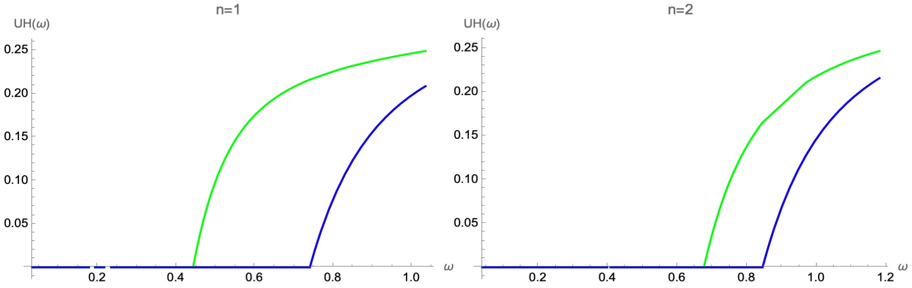


Unemployment of Low-Skilled Labor (CE: blue; ME: red; OE: green)

Policy: Minimum Wage

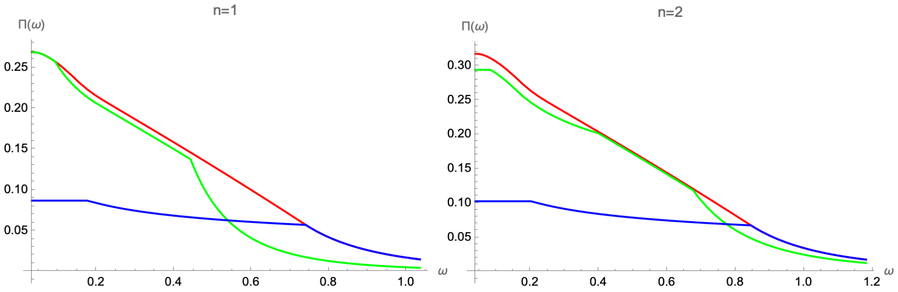
Minimum real wages: $(m, A, \alpha, \beta, \theta, \varepsilon, \lambda) = (2, 1, 3/5, 1/5, 6/5, 1/4, 1/4)$.



Unemployment of High-Skilled Labor (CE: blue; ME: red; OE: green)

Policy: Minimum Wage

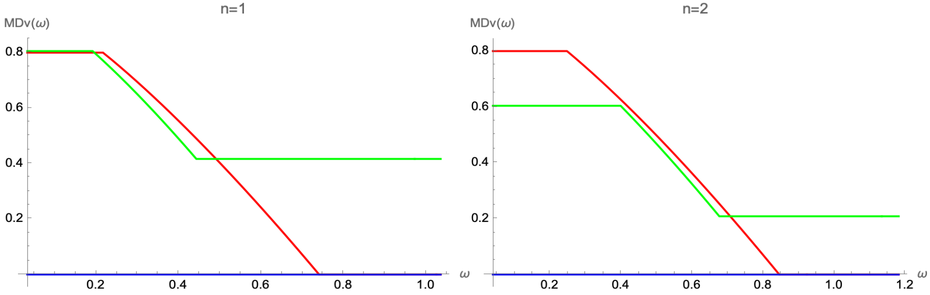
Minimum real wages: $(m, A, \alpha, \beta, \theta, \varepsilon, \lambda) = (2, 1, 3/5, 1/5, 6/5, 1/4, 1/4)$.



Profits (CE: blue; ME: red; OE: green)

Policy: Minimum Wage

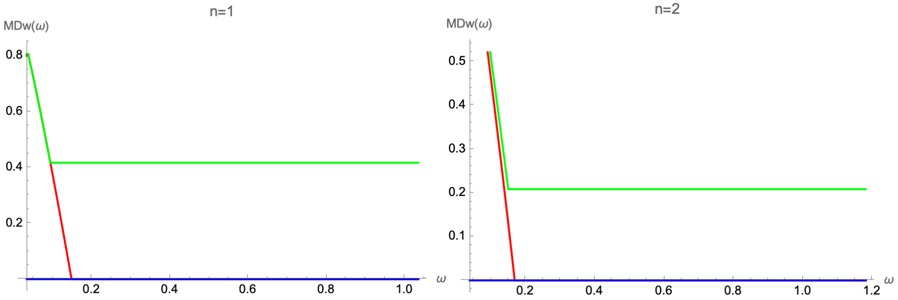
Minimum real wages: $(m, A, \alpha, \beta, \theta, \varepsilon, \lambda) = (2, 1, 3/5, 1/5, 6/5, 1/4, 1/4)$.



Wage Markdown of High-Skilled Workers (CE: blue; ME: red; OE: green)

Policy: Minimum Wage

Minimum real wages: $(m, A, \alpha, \beta, \theta, \varepsilon, \lambda) = (2, 1, 3/5, 1/5, 6/5, 1/4, 1/4)$.



Wage Markdown of Low-Skilled Workers

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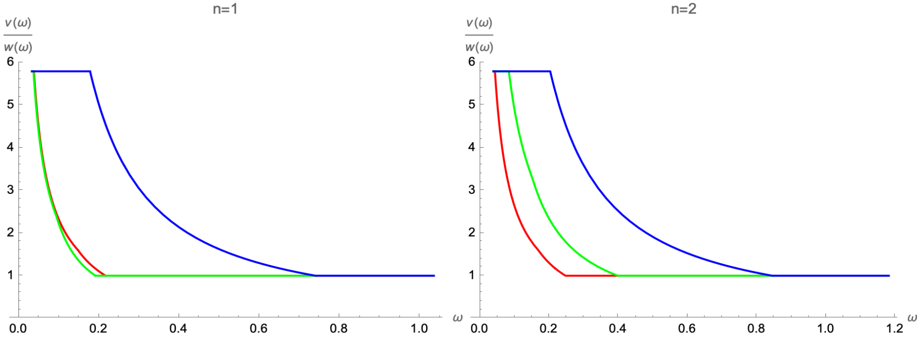
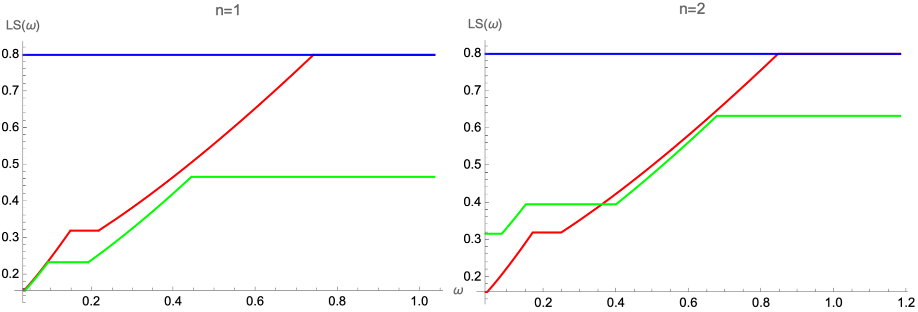


Skill Premium (CE: blue; ME: red; OE: green)

Policy: Minimum Wage

Minimum real wages: $(m, A, \alpha, \beta, \theta, \varepsilon, \lambda) = (2, 1, 3/5, 1/5, 6/5, 1/4, 1/4)$.



Labor Share (CE: blue; ME: red; OE: green)

Policy: Taxes and Subsidies

A policy intervention involving a symmetric subsidy $s \in (0, 1)$ *on consumption goods (or employment) financed via a (non-distortionary) corporate tax mitigates the inefficiency and distribution bias caused by market power.*

The optimal subsidy restores efficiency and leads to the CE allocation.

The simplicity and effectiveness of these policies hinge on the symmetry and lack of large economies of scale in our setting.

Heterogeneity of firms' technologies/consumers' preferences and imprecise information about the economy's fundamentals, would pose significantly challenges.

Policy: Public Spending

The impact of *public education* aimed at increasing the fraction of high-skilled workers in the labor force, financed via non-distortionary (e.g., corporate) taxes, on employment, income, and the surplus and its distribution are evaluated as changes on the fraction of high-skilled workers λ.

Likewise, the effects of the economy's equilibrium of policy interventions providing incentives to technological innovation may be assessed as changes on the technology parameters (A, α, β).

Of course, such policies must trade-off benefits and costs.

Policy: Entry

Do firms' extraordinary rents persist of disappear in the long run?

(i) With decreasing (constant) returns to scale, perfect competition leads to optimal (insufficient) entry.

(ii) Monopolistic market power leads to insufficient entry

(iii) Insufficient (excessive) entry arises under oligopolistic competition when the elasticity of labor supply and the cost of entry are large (small) and the consumers preference for variety is small (large).

(iv) The free entry monopolistic equilibrium allocation may be Pareto superior to the free entry oligopolistic equilibrium allocation.

Policy: Concluding Remarks

In the absent of public goods, externalities ...

- *Perfect Competition* leads to a Pareto optimal allocation ... policy interventions (e.g., motivated by distributional objectives) erode efficiency (reduce the surplus, distort entry decisions ...).

- However, *imperfect competition* leads to inefficiencies and distributional biases ... policy intervention may improve efficiency (increase real income and surplus) and reduce distributional biases.