

ECON 133 Global Inequality and Growth

Section #8: Tinbergen model, minimum wage

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Tinbergen model of labor returns to human capital/skill¹

How do we explain the divergence of high- and low-skilled earnings?

The compensation of high-skilled labor relative to low-skilled labor² depends on:

- Productivity of labor
- Relative scarcity of labor types

Definition: the skill premium is the relative wage of skilled to unskilled workers: $\frac{w_s}{w_u}$

Cobb-Douglas Let's study an environment with perfect competition, abstracting away from the role of capital.

Assume production can be characterized by a Cobb-Douglas function:

$$F(L_s, L_u) = L_s^\alpha L_u^{1-\alpha}$$

- Does this look familiar?
- What does each parameter and variable stand for?

L_s : supply for skilled labor

L_u : supply for unskilled labor

α : relative importance of skilled labor in the production function (skilled-labor share of output)

What is the skill premium under this production function?

*These notes borrow from past notes by José Díaz, Margie Lauter, Cristóbal Otero, All mistakes are my own.

¹There's been considerable development in thought in how we employ the terms "low-" and "high-skilled" as pertaining to labor. In economics, we use these terms to refer to accumulation of human capital, but the terms clearly have tons of normative loading. We might say "low/high wage" or education, but these terms inadvertently bake unintended results into our language. Imho, our terminology is imperfect, but the key is trying to separate heuristics around the relationship between human capital + wages from our normative judgements surrounding the social worth of labor.

²See [this](#) David Autor paper for a more in-depth discussion.

- Let's derive a formula for the skill premium based on L_u , L_s and α
- Taking the FOC of the profit maximisation problem (what is the implicit assumption here?):

$$w_s = \alpha L_s^{\alpha-1} L_u^{1-\alpha}$$

and

$$w_u = (1 - \alpha) L_s^\alpha L_u^{-\alpha},$$

so that the skill premium can be written as:

$$\frac{w_s}{w_u} = \left(\frac{\alpha}{1 - \alpha} \right) \left(\frac{L_u}{L_s} \right).$$

Understanding the skill premium:

$$\frac{w_s}{w_u} = \left(\frac{\alpha}{1 - \alpha} \right) \left(\frac{L_u}{L_s} \right)$$

- The skill premium depends **positively** on α (demand for skills):
 - \Rightarrow A higher α implies a higher skill premium
- The skill premium depends **negatively** on $\frac{L_u}{L_s}$ (relative supply for skills):
 - \Rightarrow Expanding education decreases skill premium

What is the **elasticity of substitution** between skilled and unskilled labor here? In plain words?

Recall that in the Cobb-Douglas function, the elasticity of substitution between factors (σ) is 1. Thus, a 1% increase in $\frac{L_u}{L_s}$ raises $\frac{w_s}{w_u}$ by 1%. But is $\sigma = 1$ the right parameter value? Let's generalize the model a bit. Maybe we could make a similar critique as to studying macroeconomic inequality with Cobb-Douglas (constant α).

Let's generalize the model.

CES production

- In a CES production function:³

$$Y = \left(A_s L_s^{\frac{\sigma-1}{\sigma}} + \underbrace{A_u}_{1-A_s} L_u^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

- A_s and A_l are two separate “technology” terms (productivity shifters)
- σ is the elasticity of substitution between skilled and unskilled labor
- What is the skill premium in this case?

- Taking the FOC of the profit maximisation problem:

$$\begin{aligned} w_u &= \frac{\sigma}{\sigma-1} \left(A_u L_u^{\frac{\sigma-1}{\sigma}} + A_s L_s^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}-1} \times A_u \frac{\sigma-1}{\sigma} L_u^{\frac{\sigma-1}{\sigma}-1} \\ &= \left(A_u L_u^{\frac{\sigma-1}{\sigma}} + A_s L_s^{\frac{\sigma-1}{\sigma}} \right)^{\frac{1}{\sigma-1}} \times A_u L_u^{-\frac{1}{\sigma}} \\ &= \left(A_u L_u^{\frac{\sigma-1}{\sigma}} + A_s L_s^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1} \times \frac{1}{\sigma}} \times A_u L_u^{-\frac{1}{\sigma}} \\ &= A_u Y^{\frac{1}{\sigma}} L_u^{-\frac{1}{\sigma}} \end{aligned}$$

Using a similar reasoning you get:

$$w_s = A_s Y^{\frac{1}{\sigma}} L_s^{-\frac{1}{\sigma}}$$

- Therefore, we can write the skill premium as:

$$\frac{w_s}{w_u} = \left(\frac{A_s}{A_u} \right) \left(\frac{L_u}{L_s} \right)^{\frac{1}{\sigma}}$$

- Interpretation: The wage premium rises when:

- technology becomes relatively more skilled-labor augmenting i.e. when $\left(\frac{A_s}{A_u} \right)$ rises (“skill-biased technological change”)
- the relative supply of skilled labor decreases i.e. $\left(\frac{L_u}{L_s} \right)$ rises
- the elasticity of substitution between skilled and unskilled labor decreases (i.e. $\frac{1}{\sigma}$ rises)—intuition?

³Sometimes you may find $\frac{\sigma-1}{\sigma}$ written as ρ . Therefore, $Y = \left(A_s L_s^{\frac{\sigma-1}{\sigma}} + A_u L_u^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \equiv (A_s L_s^\rho + A_u L_u^\rho)^{\frac{1}{\rho}}$

Limits of these frameworks

- The “race between education and technology” story cannot explain key facts:
 1. Sharper inequality increase in the US than elsewhere
 2. Rise in inequality concentrated at the top
- Where does “skill” come from?
- What is the role of imperfect competition?
- What are other institutional forces at play?

Perspectives on the minimum wage

The minimum wage is a transfer to “low-skilled” workers at the expense of:

- Consumers
- Firm owners

But may also express costs to:

- Low-skilled workers due to disemployment effects
- All households through inflation

There is **so** much work trying to estimate every aspect of this question.

The empirical research has some current suggestions:

- Extensive-margin disemployment effects are probably not large, less sure about intensive-margin disemployment.
- Minimum wage increases spillover to non-minimum wage workers
- Minimum wages result in lower firm profits and slightly higher prices to consumers.
- Relatively little work (to my knowledge) demonstrating the impact of MW on poverty outcomes (sort of: e.g. Derenoncourt and Montialoux (2021))

We tend to focus a lot on the disemployment effects of the minimum wage.

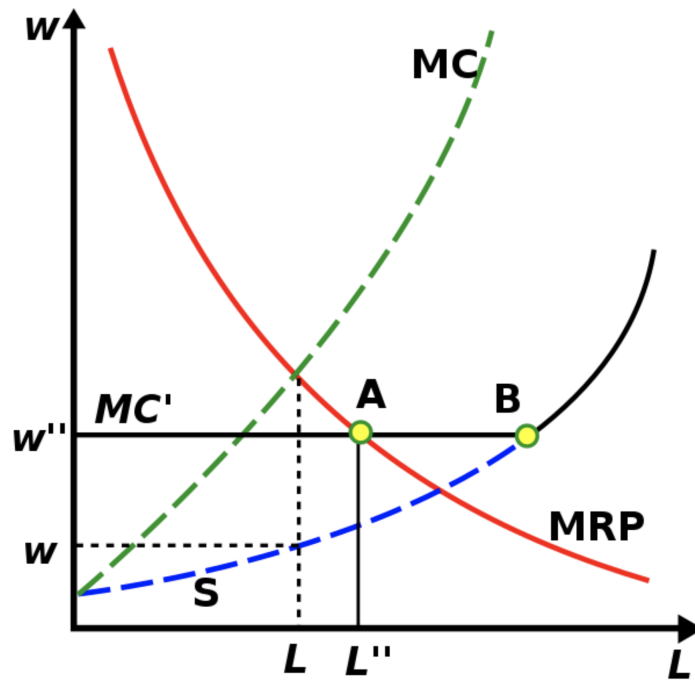
In a classical framework with perfect competition, a minimum wage just results in disemployment—workers are paid their marginal products, and firms cannot pay workers above their marginal products.

However, there are theoretical justifications for negligible (or net positive) employment effects of the minimum wage:

1. General equilibrium effects: giving low-earners more money (or more time) will increase demand.

2. Monopsony

3. Improvements upon misallocation (e.g. forcing lower productivity firms to close)



Binding minimum wage under monopsony