



## Topic 7. The labor market

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# Introduction

- In **Topic 4**, we already described the basic structure of the labor market as well as its main indicator: the unemployment rate → **Please, review this!!**
- In this topic, we are getting deeper at how the market for labor works:
  - In many dimensions, the market for labor is *similar* to any other market: **supply vs. demand**.
  - **In the labor market** the traditional roles are reversed:
    - Households are no longer consumers but producers/suppliers of labor.
    - Firms are no longer producers/sellers, but consumers of labor.
  - One key difference is that we care very much about the supply of labor that is not demanded in equilibrium: **unemployment**.

# Outline

1. Labor supply: from individual to market supply
2. Labor demand: from individual to market supply
3. Market equilibrium and labor regulations
4. Labor and technology

# Outline

## 1. Labor supply: from individual to market supply

1.1 Individual labor supply

1.2 Aggregate labor supply

## 2. Labor demand: from individual to market supply

## 3. Market equilibrium and labor regulations

## 4. Labor and technology

# Individual labor supply

- Let's imagine an individual, called Pablo, who needs to decide how many hours to work.
- Pablo's utility/satisfaction depends on two conflicting sources: consumption and leisure.

To enjoy higher consumption one needs to work more which implies less leisure time.

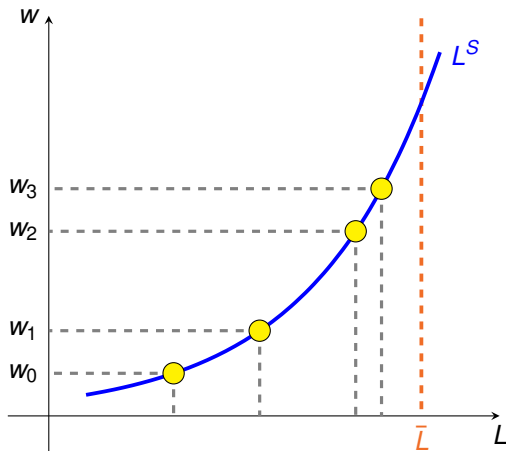
→ Pablo needs to decide how much of each to “consume”: consumption vs. leisure

- As the wage Pablo can obtain increases, two effects happen:
  - Working one more hour increase his/her income so that Pablo can consume more.
    - **Substitution effect**: Pablo gives up more leisure to enjoy more consumption
  - Working one more hour decreases in one hour the amount of leisure Pablo enjoys.
    - **Income effect**: Pablo demands more leisure time (normal “good”).

# Individual labor supply

- The substitution effect is larger than the income effect: **labor supply is increasing in wages.**  
*Assuming we do not consider an insane amount of hours ( $L \leq \bar{L}$ ).*
- How much does labor supply increase when wages go up? That depends on the relative magnitude of the two effects, which depend on the level of labor supply itself:
  - When labor supply is low, the extra consumption I can enjoy generates a lot of utility through increased consumption because leisure is already high (not scarce, lower “value”).  
→ **A small increase in wages generates a large increase in labor supply**
  - When labor supply is high, the extra consumption I could enjoy does not generate enough utility to compensate the loss in leisure time, which is already small (scarce).  
→ **A large increase in wages generates a small increase in labor supply**

# Individual labor supply



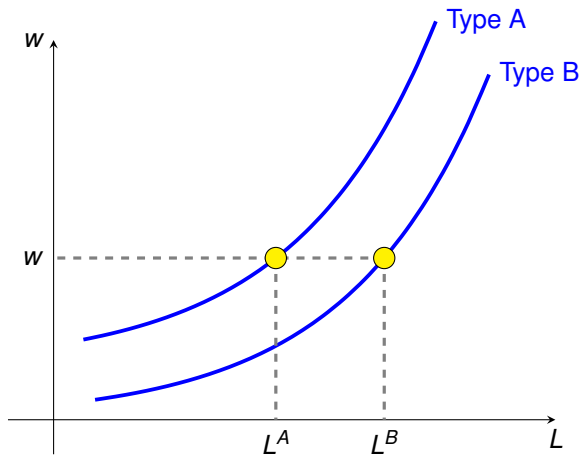
- Labor supply is increasing in wages  
 $\bar{L}$ : max hours of work
- When labor supply is low, income is low and the substitution effect is stronger:  
When  $L$  is low, a small increase in wages generates a large increase in labor supply.
- When labor supply is high, income is already high and the income effect is stronger:  
When  $L$  is high, the individual “needs” a large increase in wages to work a bit more.

# Individual labor supply

- Wages are not the only thing that matters to determine how much Pablo should work.
  - **Other sources of income**: if Pablo gets a high income from real estate, for instance, the income effect is stronger and he'll supply less labor for a given wage.
  - **Preferences for leisure**: if Pablo is a “workaholic”, he'll supply more labor for a given wage.
  - **Skills**: if Pablo is highly skilled, he'll supply more labor for a given wage
    - Think of  $w$  as the wage per task completed.
    - If I'm high skill and will be able to complete more tasks in one hour, so my hourly wage is higher and I supply more labor.



# Individual labor supply



- Type A:
  - low skilled
  - high assets
  - high preference
- Type B:
  - high skilled
  - low assets
  - low preference

# Individual labor supply

- Would you work, even if very little, if the wage is very low?

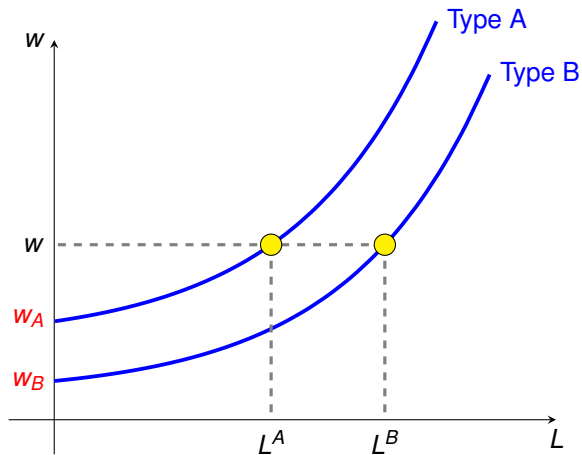
Answer: **NO!**

- Working is costly: time to go the office, cost of waking up early, etc.
- In other words: not working at all also gives some satisfaction.
- This level of satisfaction is called **outside option**: the utility from not working at all
- **Implication**: Pablo will only work (even if very little) if the wage is above certain value that compensates him for his outside option.

$$L_P^S = 0 \quad \text{if } w < \underline{w}$$

- Graphically...

# Individual labor supply



- If Pablo is of **Type A**, he'll decide not to work at all if the wage is below  $w_A$ .
- If Pablo is of **Type B**, he'll decide not to work at all if the wage is below  $w_B$ .

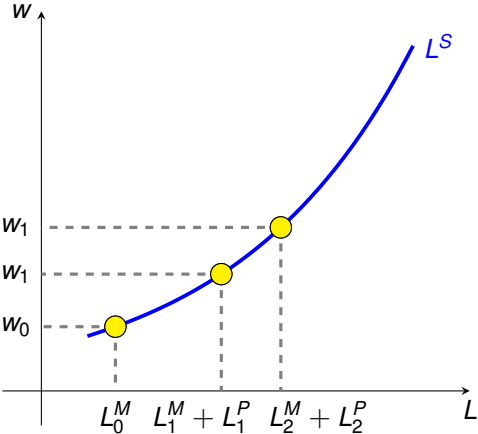
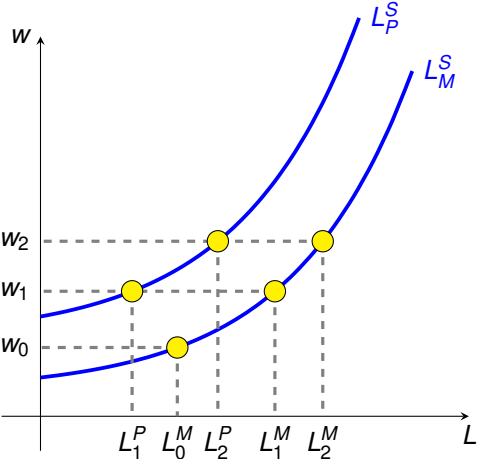
## Aggregate labor supply

- Overall, given a wage  $w$ , Pablo wants to work  $L_P^S(w)$ .
- Let's now assume there is a **second individual**, Macarena, who would like to work  $L_M^S(w)$  which can be higher or lower than  $L_P^S(w)$  depending on Macarena's skills, assets, etc.
- In this (small) labor market, the total (aggregate)= labor supply given  $w$  is:

$$L^S(w) = L_P^S(w) + L_M^S(w)$$

- Let's imagine Macarena is highly skilled while Pablo is not.

# Aggregate labor supply



# Outline

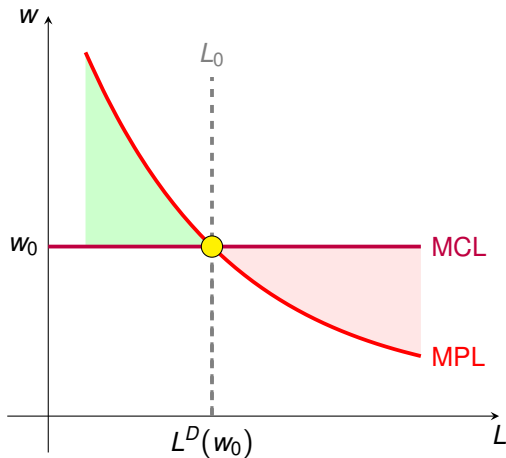
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## Individual labor demand

- Imagine CUNEF needs to decide whether to hire Pablo as a new professor.
- Hiring Pablo would imply. . .
  - A. A rise in revenues, from the extra output Pablo produces: **Marginal product of labor (MPL)**
    - Always positive: adding one extra worker never decreases output.
    - Decreasing as labor grows (law of decreasing return): output grows more from hiring the 10th worker than from hiring the 100th.
  - B. An increase in production costs, from Pablo's wage: **Marginal cost of labor (MCL)**
    - If I hire one extra worker, my labor costs increases by his/her wage.
- Clearly, CUNEF will hire Pablo if and only if  $MPL \geq MCL$ . . .

. . . and will keep hiring professors until  $MPL = MCL$ .

# Individual labor demand



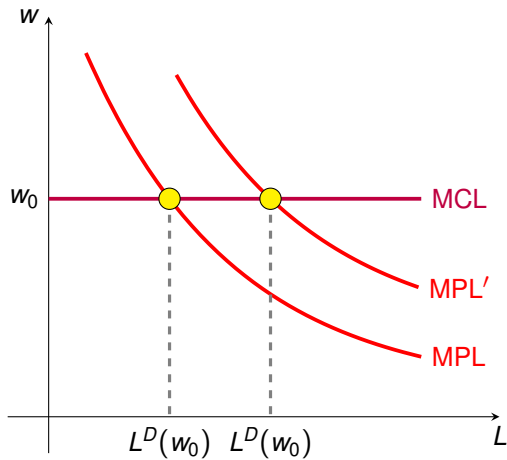
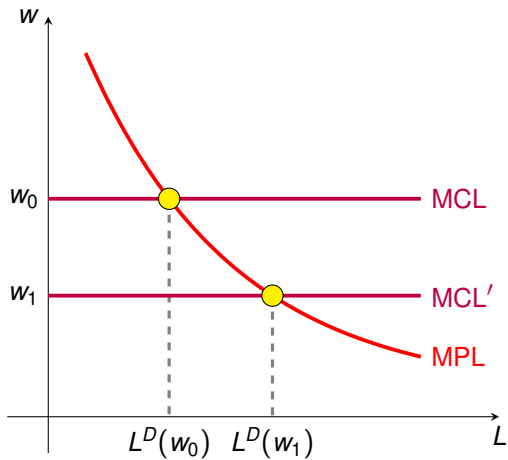
- The **marginal cost of labor** is given by  $q$ , and is independent from the number of workers.
- The **marginal product of labor** is decreasing with the level of labor.
- For any level of labor below  $L_0^D$ , hiring an additional worker generates higher extra revenues (MPL) than extra labor costs (MCL)
- By contrast, for any level of labor above  $L_0^D$ , hiring an additional worker generates more costs than revenues.
- If  $w = w_0$ , the firm should hire  $L_0^S$  workers.



## Individual labor demand

- CUNEF should hire as many professor as required in order to make the marginal product of labor equal to the wage (marginal cost of labor).
- The number of professors CUNEF hires will increase when:
  - The **wage** decreases the level of  $L$  at which  $MPL = MCL$  increases.  
*And vice-versa: if  $w$  increases, the level of  $L$  at which  $MPL = MCL$  decreases*
  - The **MPL increases**, so that the level of  $L$  at which  $MPL = MCL$  increases too.
    - This may happen when the firm increases its capital or improve its technology.
    - Both changes allows each worker to produce more, increasing the extra revenue each of them generates (marginal product of labor).

## Individual labor demand



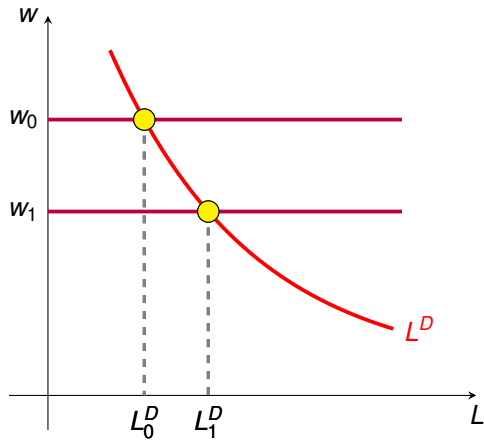
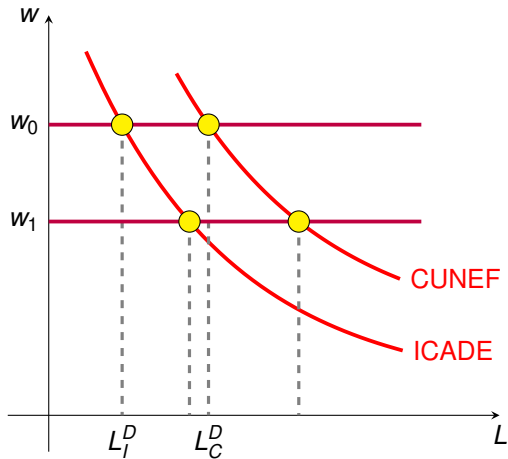
## Aggregate labor demand

- Overall, given a wage  $w$ , CUNEF wants to hire  $L_{CUNEF}^D(w)$  professors.
- Let's now assume there is a **second university**, ICADE, whose labor demand is  $L_{ICADE}^D(w)$
- In this (small) labor market, the total (aggregate) labor demand given  $w$  is:

$$L^D(w) = L_{CUNEF}^D(w) + L_{ICADE}^D(w)$$

- Let's imagine ICADE is less productive than CUNEF so that its MPL is lower

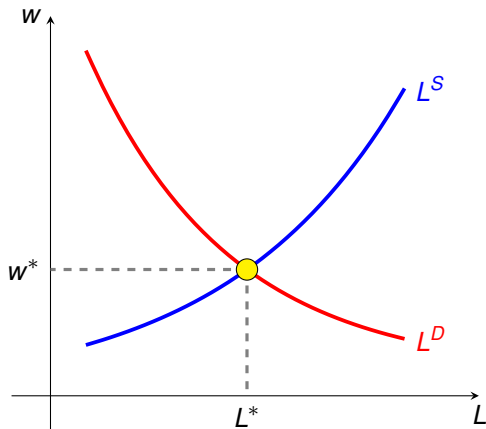
# Aggregate labor demand



# Outline

1. Labor supply: from individual to market supply
2. Labor demand: from individual to market supply
3. Market equilibrium and labor regulations
  - 3.1 Efficient equilibrium
  - 3.2 Search frictions
  - 3.3 Wage rigidities
  - 3.4 Labor regulations
4. Labor and technology

# Efficient equilibrium



- The **aggregate supply of labor** is increasing in wages.
- The **aggregate demand of labor** is decreasing in wages.
- There exists only one level of wages,  $w^*$ , such that demand and supply are equal: **the equilibrium wage**. When  $w = w^*$ :
  - All those who want to work, do so.
  - No unemployment in the economy.

# Efficient equilibrium

- In this economy, there is no unemployment:
  - The labor market is efficient.
  - The equilibrium wage “clears the market”: all those who want to work, do so.
- But we do observe unemployment in reality. . . Where does it come from? Inefficiencies:
  - A. Search frictions
  - B. Wage rigidities
  - C. Labor regulations

# Search frictions

- The **process of finding a job/employee** is complex: firms post vacancies (i.e. Infojobs), workers search for them and then decide whether to accept it or not.
- A worker that is willing to work at the offered wage may still **not accept the offer**:
  - Maybe the vacancy is in a different city.
  - Maybe the worker thinks she/he may get a better offer soon, and prefers to wait.

so that effective labor supply is smaller:

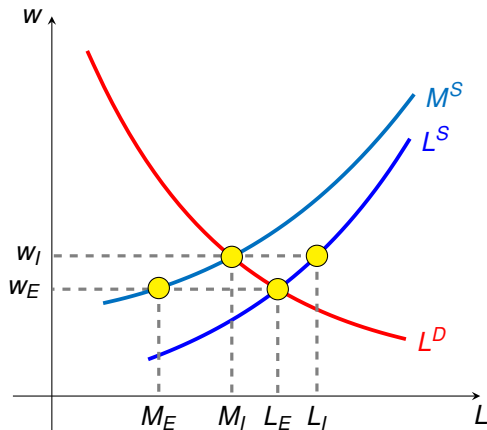
$$M^S(w) = L^S(w) - X(w)$$

where  $X(w)$  is the number of workers that agree on  $w$  but still do not accept the offer.

→  $X(w)$  is decreasing in the wage: higher  $w$  induces workers to accept more offers.



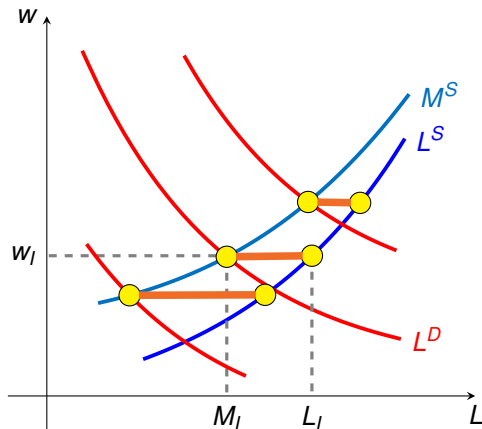
# Search frictions



- The efficient equilibrium is  $(w_E, L_E)$ .
- For a given supply of labor and a wage rate, there is a fraction of people that prefer not to accept the offer.
- However, at this wage, only  $M_E$  workers accept offers so firms run short of labor: they need to increase the offered wage.
- The wage increases up to  $w_I$  where the demand of labor equals the *effective* supply:

$$L^D(w_I) = M(w_I)$$

# Search frictions



- There is unemployment!  $u(w_I) = L_I - M_I$

- If the demand of labor increases...

The equilibrium wage increases and the amount of workers that reject offers is smaller: lower unemployment

- If the demand of labor decreases...

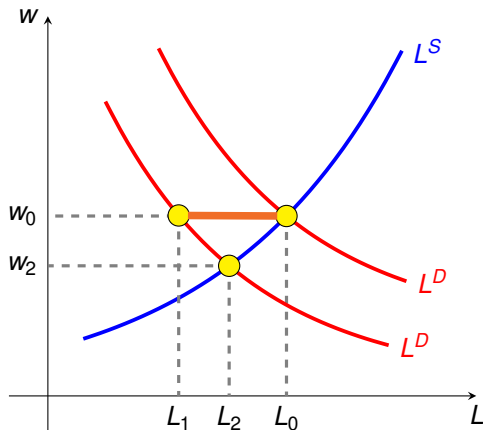
The equilibrium wage decreases and the amount of workers that reject offers is higher: higher unemployment

# Wage rigidities

- Another source of unemployment is the existence of downwards wage rigidities: wages do not adjust intermediately when the demand of labor falls.
- This implies that, for some time, the wage is above the equilibrium wage:
  - The supply of labor remains the same (the wage has not changed)
  - The demand of labor has fallen

Demand and supply are not equalized: **unemployment!**

# Wage rigidities



- Initial (efficient) equilibrium:  $(w_0, L_0)$
- There is a negative shock in the economy that depresses labor demand (e.g. an increase in energy prices)
- The new (efficient) equilibrium is:  $(w_2, L_2)$
- But if wages do not adjust and stay (for some time) at  $w_0$ :  $L^D(w_0) < L^S(w_0)$
- Until the wage adjusts to its new equilibrium level, the demand of labor is smaller than the supply: **unemployment**.

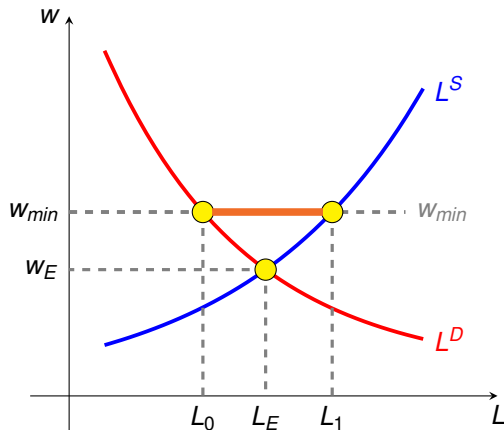
# Labor regulations

- An additional source of unemployment may be **labor regulation**.

In the pursue of some social goal, the government may want to introduce regulations in the labor market that makes it inefficient.

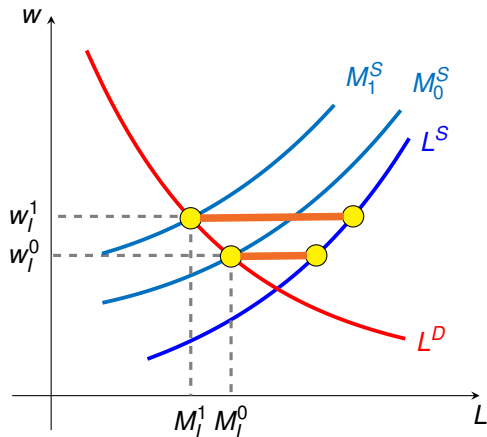
- **Two typical examples:**
  - The establishment of a **minimum wage** above which firms cannot hire.
  - The establishment of some **unemployment benefits** that allowed unemployed individuals to cover their basic needs.
- These two regulations, which may be desirable in other dimensions, **distort the efficiency of the labor market** potentially generating unemployment.

## Labor regulations: minimum wage



- Initial (efficient) equilibrium:  $(w_E, L_E)$
- The government decides to set a minimum wage at  $w_{min}$  which is greater than  $w_E$ .
- For a wage of  $w_{min}$ , firms demand  $L_0$  and workers supply  $L_1$
- The demand of labor is smaller than the supply: **unemployment**.
- **Question:** What if  $w_{min} < w_E$ ?

## Labor regulations: unemployment benefits



- Imagine there are search frictions and we start at the (inefficient) equilibrium  $(w_l^0, M_l^0)$ .
- The government decides to establish some unemployment benefits: people get income from the gov. while unemployed.
- This benefits make rejecting an offer less costly, so more people do so.
- The new equilibrium is  $(w_l^1, M_l^1)$ .

Higher unemployment!

## Summing up on unemployment

- Overall, unemployment comes from:
  - A. **Search frictions**: some people who find it optimal to work at a wage  $w$  do not work either because it involves other costs (moving to a different city) or because they expect to receive a better offer soon.
  - B. **Wage rigidities**: the wage does not fall immediately after a negative shock to labor demand, so that, for some time, it is above the equilibrium wage: demand  $<$  supply.
  - C. **Labor regulations**:
    - **Minimum wage**: if the government sets a minimum wage above the equilibrium wage, demand  $<$  supply.
    - **Unemployment subsidies**: if being unemployed yields higher income, not accepting an offer is less costly, exacerbating search frictions.



# Outline

1. Labor supply: from individual to market supply
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4. Labor and technology

# Labor and technology

- “Robots are going to take away our jobs”... Have you ever heard this? The debate on whether technology will substitute workers is much older than what people typically think. . .
  - During the 1910s, English artisans (“Luddites”) destroyed 1,000 looms out of a total of 25,000.
  - In the 1930s, JM Keynes warned of the dangers of technological unemployment.
  - In a 2017 European Commission survey, 72% of respondents said they agreed with the statement “Robots are stealing our jobs.”
- Where does this fear come from? The belief that the number of tasks in the economy is fixed.
  - “Luddite fallacy”

# Labor and technology

- What effects has technological development had on employment over the last 200 years?

Three key results:

1. Technological progress has not generated net job losses.
2. Technological progress has led to a redistribution of employment among sectors and occupations.
3. Technological progress has allowed for a systematic reduction in working hours.

# Labor and technology

## 1. Technological progress has not generated net job losses.

- No doubt that technological progress has led to the disappearance of many jobs/occupations:
  - The first Industrial Revolution brought the mechanization of textiles. . .  
... forcing many artisan to lose their jobs
  - The second Industrial Revolution brought the internal combustion engine. . .  
... leading to horse dealers with very little business.
  - The third Industrial Revolution brought computing and the internet. . .  
... causing big troubles to typist.
- But it has also created many new jobs/occupations.

# Labor and technology

## 1. Technological progress has not generated net job losses.

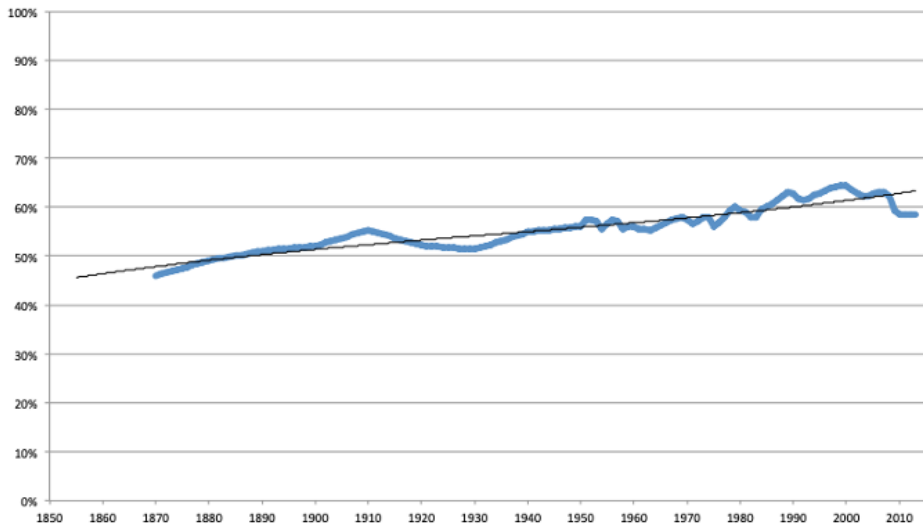
- Technological progress creates **new jobs that did not previously exist**: industrial machines replaced artisans, but created jobs needed to build, repair, and distribute the machines.
- Sectors affected by technology may experience an **increase in employment**: technological improvement allows for a reduction in the cost of goods, generating an increase in demand which, if large enough, creates employment.

*For example, ATMs reduced the number of employees per bank office from 20 to 13 between 1988 and 2014, but the number of offices increased by 43%.*

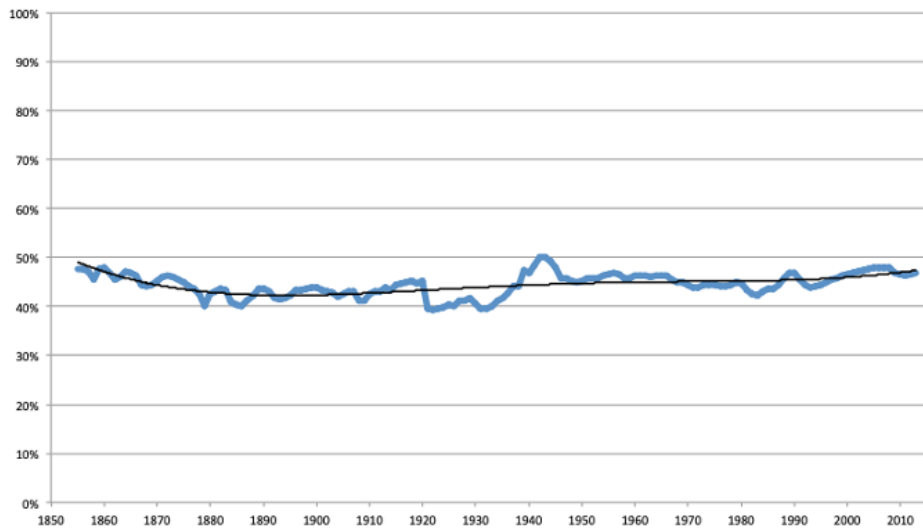
- New technologies “**free**” **workers from sectors with high productivity growth** to sectors with less technological growth (Baumol Effect).

*Agricultural technology allowed a large portion of the population to be employed in industry.*

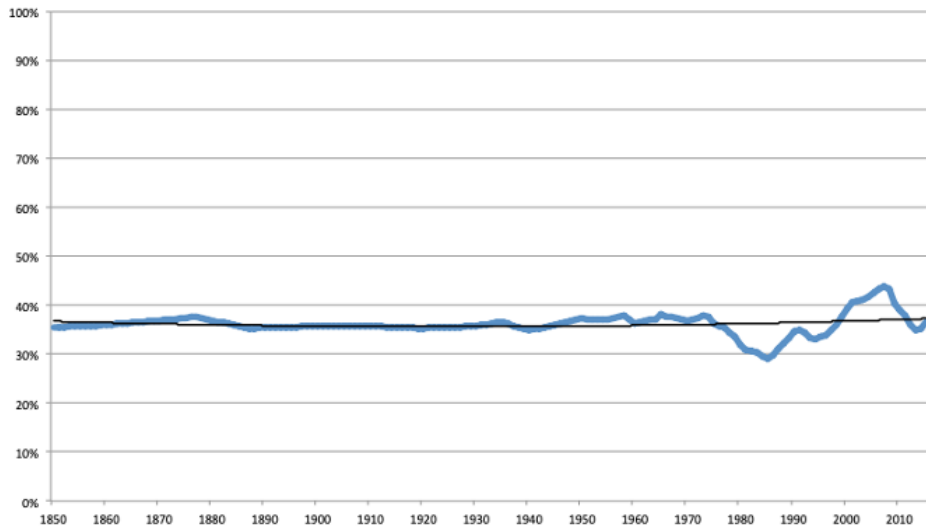
## Employment share in the US



## Employment share in the UK



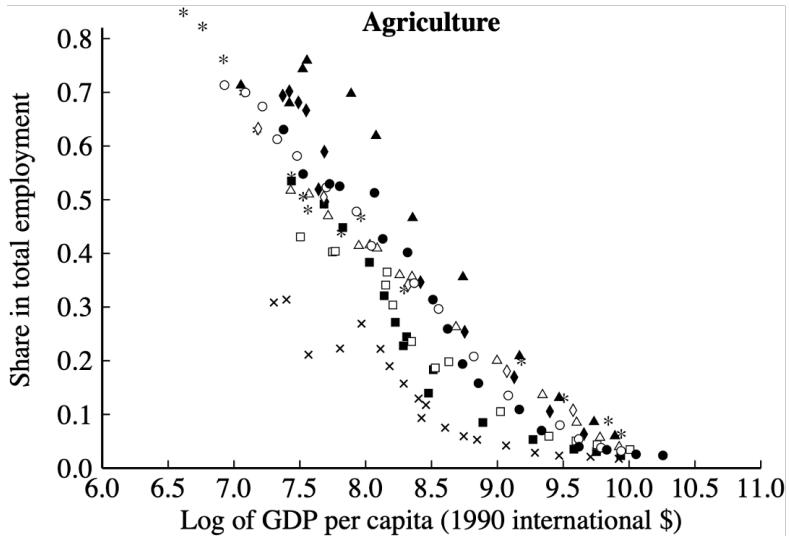
## Employment share in Spain

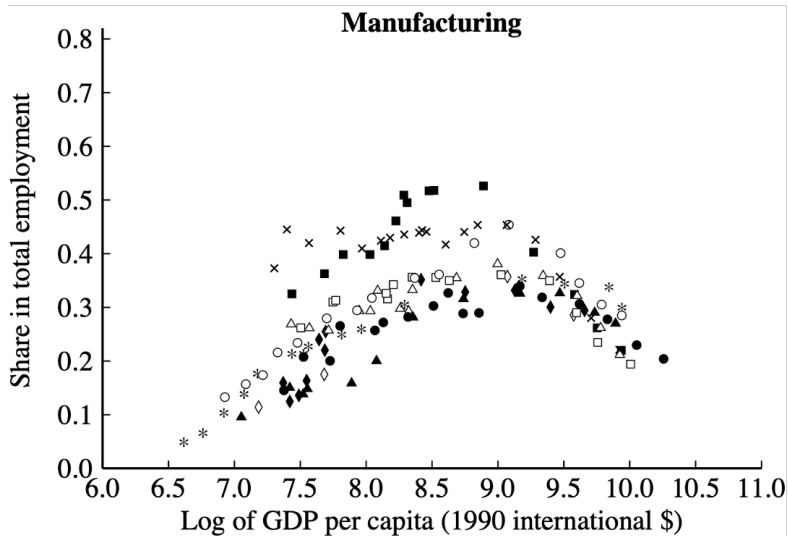


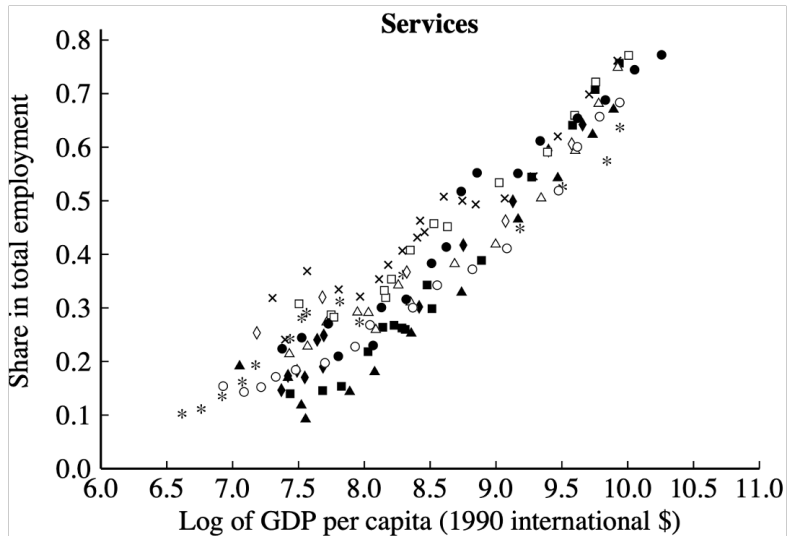


## 2. Technological progress has led to a redistribution of employment among sectors and occupations.

- If technology has destroyed jobs, but total employment has not changed, where have the destroyed jobs gone?
- The Baumol effect, which we have already mentioned, tells us that technology allows workers to be freed up in some sectors and employed in others.
- This is exactly what we observe: as a country develops, employment. . .
  - It falls in the agricultural sector.
  - First it rises and then it falls in the industrial sector.
  - It increases in the services sector.

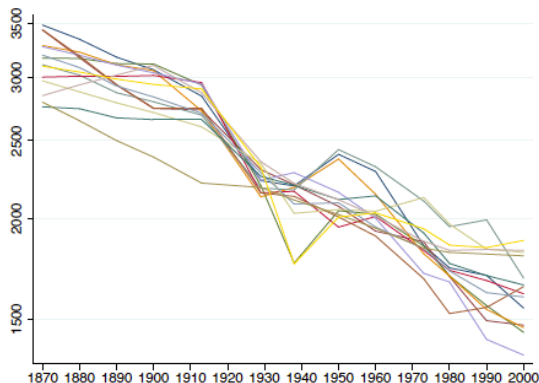






# Labor and technology

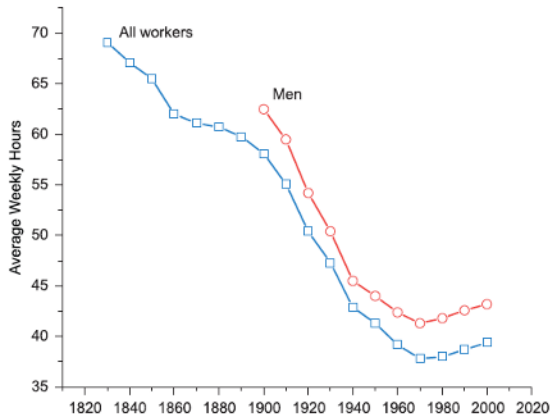
## 3. Technological progress has allowed for a systematic reduction in working hours.



- Hours per worker have been steadily decreasing in (almost) all developed economies.
- Technological progress increases income, and leisure is a “normal good”: higher income increases its demand.
- At the core of this trend is the fact that with better technology we can produce more in less time.

# Labor and technology

## 3. Technological progress has allowed for a systematic reduction in working hours.



- Exceptionally, working hours have increased in the US in recent years. Why?
- Increasing income inequality:
  - High pay jobs are paying much more.
  - Higher incentives to work longer to promote and get one of those jobs.
  - “Fighting for your career”.

Questions?