The competitive model.

Labour Economics - set 1

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April 2013

Course description and organization

This course will organized in a theoretical and an applied part
A) The theoretical part

- The benchmark case: Perfect markets: General equilibrium model - The effect of some labour on the general equilibrium - The labor market in an open economy
- The labour market produces involuntary unemployment. The labour market is imperfect.
    - Labour market with frictions: Search models
    - Unions and bargaining
    - Insider-outsider models
    - Asymmetric information and incentives: efficiency wage model, labour turnover model

B) Applied part

- Indicators of the labor market (Labor force, employment rate, unemployment rate, activity rate)
- Employment protection
- Labour Policy
- The "Riforma Fornero"
- The labour market in Veneto - evidence from Veneto Lavoro

Readings and Assessment

Readings

- Brucchi Luchino, "Manuale di Economia del Lavoro", il Mulino 2001
- Tito Boeri and Jan Van Ours, "Economia dei Mercati del Lavoro Imperfetti", EGEA 2009

Assessment

- written exam
- project + presentation

Few facts in Italy

Let's look to a few pictures:

- GDP
- employment
- unemployment rate
- inflation rate
- wages

The competitive model

- The competitive model is a benchmark - not the reality
- It is a benchmark because its equilibrium 1) exists (almost always) and 2) it is Pareto efficient
- We use the competitive model to compare the outcomes of other, more realistic, ways of representing the economic system

- The competitive model is not realistic, but we might think of it as the representation of the latent behavior of an economy, at least if each actor can be considered small enough. In that case, if left alone, the economy will converge towards the general equilibrium outcome
- Of course this implication does not hold if contracts can be broken, prices can be manipulated, predation is possible... i.e. if an effective legal system is missing.

Basics

- short run model. Capital is fixed.
- N individuals with identical preferences $U(x, y, l)$. All individuals are price takers. Utility is increasing and quasi-concave.
- All have the same time endowment T
- There are M_x firms producing good x and M_y firms producing good y. All firms are price takers.
- Firms are public companies and belong to individuals. Each individual owns the same share of stocks.
- x-firms are endowed with K_x units of capital and y-firms are endowed with K_y units of capital.
- Technology $F_x(L_x, K_x)$ and $F_y(L_y, K_y)$. Production functions are increasing and quasi-concave.
- Labour market is integrated and perfect.
- Full information, no uncertainty.

Equilibrium

A general equilibrium in this economy is a price vector (p_x, p_y, w) and a corresponding allocation $(\mathbf{x}, \mathbf{y}, \mathbf{L})$ such that:

- all individual maximize their utility given market prices
- all firms maximize their profits given market prices
- in all markets aggregate demand equals aggregate supply

Households' side - Demand of goods and supply of labour

- Households maximize their utility subject to their budget constraint
- The outcomes of the maximization problem are demand functions for x and y and labour supply
- Households budget constraint is

$$p_x x + p_y y = wL + \frac{1}{N}(M_x \pi_x + M_y \pi_y) = wL + \Pi$$

i.e.

$$p_x x + p_y y + wl = wT + \Pi$$

- Demand and supply are functions of the parameters $[px, px, w, T, \Pi]$

Example

$$U(x, y, l) = x^{1/3} y^{1/3} l^{1/3}$$

demand / supply functions are:

$$x^D = \frac{wT + \Pi}{3px}$$

$$y^D = \frac{wT + \Pi}{3py}$$

$$l^D = \frac{wT + \Pi}{3w} \rightarrow$$

$$L^S = T - l^D = T - \frac{wT + \Pi}{3w} = \frac{2wT - \Pi}{3w} = \frac{2}{3}T - \frac{\Pi}{3w}$$

(suppose $\Pi < 2wT$).

Note: if $\Pi = 0$ labour supply will not depend on wages: this is a particular case, due to the Cobb-Douglas preferences. This occurs because the substitution effect is totally offset by the income effect.

Close look: substitution and income effect

An increase of the wage rate implies

- leisure is less convenient compared to consumption –> less leisure is bought –> more labour is supplied: SUBSTITUTION effect
- more bundles are affordable because labour income is larger –> more leisure is bought (since leisure is a normal good) –> less labour is supplied: INCOME EFFECT

In the labour market the two effects tend to offset each other –> labour supply is relatively rigid, i.e. elasticities w.r.t. wage is small.

Think about:

- What is the effect of an income transfer on labour supply?
- What is the effect of labour income taxes on labour supply?
- What is the effect on taxation of consumption goods on labour supply?
- What is the effect of a rigid work schedule (e.g. 8 hours per day)?

Firms side - Supply of goods and demand of labour.

- Firms maximize profits by choosing L

$$\pi_x = p_x F_x(L_x, K_x) - wL_x$$

$$\pi_y = p_y F_y(L_y, K_y) - wL_y$$

- Profit maximization conditions yield

$$F_x^{'}(L_x, K_x) = \frac{w}{p_x}$$

$$F_y^{'}(L_y, K_y) = \frac{w}{p_y}$$

Marginal productivity of labour equals real wage, or, the value of the marginal productivity of labour equals the nominal wage.

Comparative statics

- suppose $F_x(.) \equiv F_y(.)$ and inputs are complements
  1. if $K_x > K_y$ then the marginal productivity of labor in the x-sector is larger than in the y-sector (at the same level of labour).
  2. if $p_x > p_y$ then the value of the marginal productivity of labour in the x-sector is larger than in the y-sector (at the same level of labour and capital)
- suppose $F'_x(.) > F'_y(.)$ at a given level of inputs.
  1. if $p_x = p_y$ x-sector will hire more labour than y-sector

Example

$$F_x(L_x, K_x) = A_x L_x^{1/2} K_x^{1/2} \qquad F_y(L_y, K_y) = A_y L_y^{1/2} K_y^{1/2}$$

Labour demands are

$$L_x^D = A_x^2 \frac{p_x^2}{4w^2} K_x \qquad L_y^D = A_y^2 \frac{p_y^2}{4w^2} K_y$$

good supplies are

$$x^S = A_x^2 \frac{p_x}{2w} K_x \qquad y^S = A_y^2 \frac{p_y}{2w} K_y$$

profits are

$$\pi_x = A_x^2 \frac{p_x^2}{4w} K_x \qquad \pi_y = A_y^2 \frac{p_y^2}{4w} K_y$$

Note

- When firms are allowed to modify their capital (in the long run) they can substitute labour for capital.
- Profit maximizing firms are always seeking to minimize their costs (for any production level). Firms always operate on the technology frontier (also when they have market power)
- When capital is fixed, costs cannot be lower than when capital is free, at any production level –> the long run cost function is a lower envelope of the short run cost function.

Equilibrium

Demand = Supply in all markets

$$Nx^D = M_x x^S$$

$$Ny^D = M_y y^S$$

$$M_x L_x^D + M_y L_y^D = NL^S$$

Note: given the optimization conditions above one condition will be redundant. If two markets clear, the third must clear. This implies that one price can be set arbitrarily and the other prices will be multiples of the reference price. Suppose then $p_y = 1$.

Example I

Demand = Supply in the

- x-market:

$$N\frac{wT+\frac{1}{N}[M_xA_x^2\frac{p_x^2}{4w}K_x+M_yA_y^2\frac{p_y^2}{4w}K_y]}{3p_x}=M_xA_x^2\frac{p_x}{2w}K_x$$

- y-market:

$$N\frac{wT+\frac{1}{N}[M_xA_x^2\frac{p_x^2}{4w}K_x+M_yA_y^2\frac{p_y^2}{4w}K_y]}{3p_y}=M_yA_y^2\frac{p_y}{2w}K_y$$

- labour market:

$$M_xA_x^2\frac{p_x^2}{4w^2}K_x+M_yA_y^2\frac{p_y^2}{4w^2}K_y=N\frac{2wT-\frac{1}{N}[M_xA_x^2\frac{p_x^2}{4w}K_x+M_yA_y^2\frac{p_y^2}{4w}K_y]}{3w}$$

Example II

The last equation can be resolved for Π and gives

$$\Pi = \frac{1}{2} w T$$

Substitution in the first two equation yields:

$$p_x = \left(\frac{M_y}{M_x} \frac{K_y}{K_x} \right)^{1/2} \frac{A_y}{A_x}$$

$$p_y = 1$$

$$w = \left(\frac{M_y}{N} \frac{K_y}{T} \right)^{1/2} A_y$$

Example III

Substituting solutions into labour demand and supply we obtain

$$L^S = \frac{T}{2}$$

$$L_x^D = \frac{T}{4}\frac{N}{M_x} \qquad L_y^D = \frac{T}{4}\frac{N}{M_y}$$

Aggregate demand $=$ aggregate supply $\rightarrow$ no unemployment by construction.

Example IV - taking stock

- only fundamentals matter to determine price and wages and the corresponding allocation
- in this case (very specific, admittedly):
  1. labour supply and labour demand is unresponsive to productivity shocks and capital intensity.
  2. this means that partial equilibrium effects corresponding to productivity shocks are entirely offset by the general equilibrium interactions
  3. note that we have normalized $p_y = 1$. This implies that p_x and w are relative to p_y. This explains why productivity shocks in the x-sector does not affect wages (though, they affect p_x and affect the purchasing power of the salary)
  4. productivity shocks in the y-sector "reduce the real price of y" and increase the relative-to-p_y wage rate
  5. capital intensities ($M_y K_y / NT$ = capital in the y-sector per potential work hour) determine wages and prices

Example IV

Let's focus on the labour market (PARTIAL EQUILIBRIUM ANALYSIS)
Take the market clearing equation and rewrite demand = supply as

$$\frac{\Pi}{w} = \frac{2}{3}T - \frac{1}{3}\frac{\Pi}{w}$$

The first term is per-capita labour demand and the second is the per-capita labour supply. Recall that Π is individual non labour income and in this example coincides with individual share of firms profits.

$$\Pi = \frac{1}{N}[M_x A_x^2 \frac{p_x^2}{4w} K_x + M_y A_y^2 \frac{p_y^2}{4w} K_y]$$

Moreover, recall that Π is a decreasing function of w when p_x and p_y are fixed (PARTIAL EQUILIBRIUM ANALYSIS).
Thus:

- decreasing demand (in w)
- increasing supply (in w)

Extensions (?)

- long run
- time dimension - dynamic model
- government interventions
- open economy

Long run

- in the long run K is variable
- firms enter into the market until profits are zero. The number of firms operating into the market is determined ex-post.
- In the long run prices need to be equal to the minimum average cost to guarantee zero profits

Time dimension - dynamic model

- Where K comes from? from households savings.
- Savings derive from households' plans of consumption over time
- At each time some households save and offer capital that firms hire
- Typically a general equilibrium model like this is modelled by means of a OLG model

Government interventions

- VAT: p_x and p_y are multiplied by $(1+t)$. Supply prices are (p_x, p_y). Demand prices are $(p_x(1+t), p_y(1+t))$
  1. leisure is more convenient, but agents labour supply does not respond to VAT because of C-D preferences. Labour supply is constant.
  2. consumers' prices are $(1+t)$ higher $->$ lower aggregate demand
  3. $->$ lover demand for labor $->$ no general equilibrium exists
- Taxation on non-labour income $->$ no general equilibrium exists
- Taxation on labour income $->$ no general equilibrium exists

Remark

- general equilibrium exists because it is possible to make demand and supply compatible in a very decentralized way, only by means of prices
- in particular "compatibility" means that
  - MRS_{yx} is the same for all consumers
  - $MRTS_{KL}$ is the same for all firms, regardless of their sector
  - $MRS_{yx} = MRT_{yx}$ (MRT is the marginal rate of transformation that indicates how factors can be reallocated across sectors to "transform" one unit of x-good in units of y-good). This equality indicates that if I want to exchange one unit of x for MRSyx units of y, I free up the exact amount of inputs to allow the production of the y units. This condition links demand side and supply side.

$$MRS_{yx} = \frac{p_x}{p_y} = \frac{MC_x}{MC_y} = MRT_{yx}$$

  - we have equilibrium when consumers' prices transmit the right signal to the supply side.
- Any intervention that alters relative prices, distorts the signal

Open Economy

- What is the effect of free international trade on domestic labour markets?
- Often unions demand protectionism, why?
- Let's consider a simple 2-sector 2-countries model, with constant returns to scale
- International trade of consumption goods is free
- International trade of inputs is restricted (in reality labour mobility is rather low, but capital mobility is high)

Basics

- Two sectors: C = computers, T = fabric
- Two inputs (factors): H = high skilled labour, L = low skilled labour
- Each sector employs both factors - internal markets are integrated
- All markets are competitive.
- Technology is described by the so-called technical coefficients

$$a_{is} = \frac{\text{employed units of input } i}{\text{output of good } s}$$

(units of input per unit of output).

Factor intensitivity

Definitions

Sector s is intensive in the factor i (compared to sector $s\prime$) if

$$\frac{a_{is}}{a_{js}} > \frac{a_{is'}}{a_{js'}}$$

- Computer sector is intensive in high skilled labour
- Fabric sector is intensive in low skilled labour

Factor endowments

Benchmark case - identical endowments in both countries, identical technology and identical preferences over C and T: no incentive to trade or to factor mobility

Suppose country 1 has relatively more H than country 2: $H^1/L^1 > H^2/L^2$ country 1 is relatively more abundant in H and country 2 relatively more abundant in L

- Two preliminary results:
    - RESULT 1
    - competition implies zero profits –> price = average cost

$$P_C = W_L a_{LC} + W_H a_{HC}$$

$$P_T = W_L a_{LT} + W_H a_{HT}$$

- wages that verify zero profit conditions belong to the factor prices frontier - the slope of the factor prices frontier is the ratio between the technical coefficients: a_{LC}/a_{HC} and a_{LT}/a_{HT}

(Cont.)

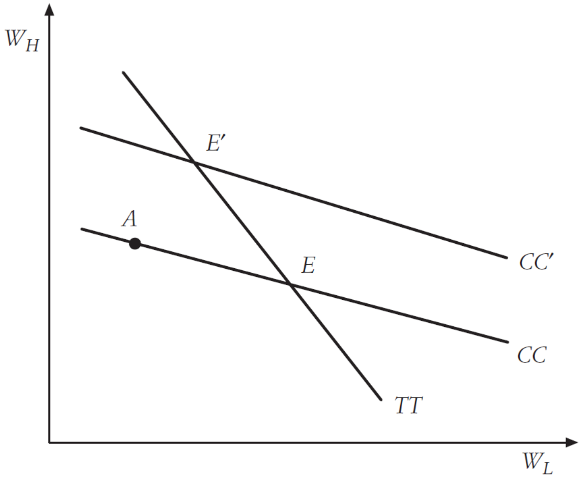
-
    - equilibrium in both factor markets is obtained at the intersection of the two frontiers (outside, job mobility and positive/negative profits)
    - if one price increases, we can guess the effect on domestic input prices (recall: no international factor mobility)

Theorem

Stopler-Samuleson Theorem: *If the price of the good produced by sector s increases, the wage of the factor employed more intensively by s will increase and the wage of the factor employed less intensively will decrease.*

- intuition: sector s becomes more profitable and firms flow to it.

Factor Prices Frontier



Specialization I

RESULT 2

Consider the equilibrium conditions on the factor markets

$$L = a_{LC} Q_C + a_{LT} Q_T$$

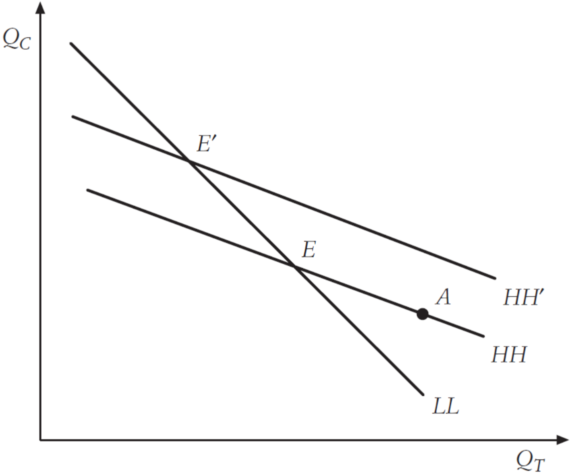
$$H = a_{HC} Q_C + a_{HT} Q_T$$

where Q is for quantity of good and L, H are factor endowments.

Theorem

Rybczinski Theorem: *the country relatively more endowed in factor i will specialize (relatively) in the sector more intensive in i*

Specialization II



Autharchy.

- The two countries cannot trade.
- In country 1, more abundant in H, we must observe $W_H^1 / W_L^1 < W_H^2 / W_L^2$ (wages are higher for the scarcest factor)

Lemma

Since technologies are alike, it must be $P_C^1 / P_T^1 < P_C^2 / P_T^2$.

Proof.

$$\frac{P_C^1}{P_T^1} = \frac{a_{LC} + W_H^1 / W_L^1 a_{HC}}{a_{LT} + W_H^1 / W_L^1 a_{HT}}$$

$$\frac{P_C^2}{P_T^2} = \frac{a_{LC} + W_H^2 / W_L^2 a_{HC}}{a_{LT} + W_H^2 / W_L^2 a_{HT}}$$

$$\frac{P_C^1}{P_T^1} < \frac{P_C^2}{P_T^2} \iff \left(\frac{W_H^2}{W_L^2} - \frac{W_H^1}{W_L^1} \right) (a_{LC} a_{HT} - a_{HC} a_{LT}) < 0 \iff \frac{W_H^2}{W_L^2} > \frac{W_H^1}{W_L^1}$$

$\square$

International Trade

- International trade creates a unique market for computers and fabric where a unique international price is determined.
- At the international price, country 1, more endowed of H, will export computers and, country 2, will export fabric.

Theorem

Heckscher-Ohlin-Samuelson Theorem: The country relatively more endowed of a given factor i, will export the good whose technology is more intensive in i and import the good whose technology is less intensive in i.

(cont.)

- in country 1, "domestic" price of computers will increase −> higher wages for high skilled jobs in country 1 and lower wages for low skilled jobs
- symmetrically in Country 2.

Theorem

International trade implies that wages of the factor relatively more abundant will rise while those of the factor relatively more scarce will decrease.

Note: what really matters are relative prices: even if both "domestic" prices are lower in country 1 than in country 2 before the opening to international trade, country 1 will export computers and import fabric, because it might exchange computers with fabric at a better rate on the international market than on the domestic market.

Remark

- Trading goods is like trading the corresponding factors: the country more relatively abundant of factor i will be a net exporter of factor i and will import the factor relatively more scarce

- Wages will equalize across countries because of the zero profit condition ($P = AC_{\text{min}}$) because of international trade
  - But some will benefit and some will lose
  - Although total production will be larger

Factor Mobility

Suppose technology is the same across countries

Result: Factor mobility and international trade are substitutes.

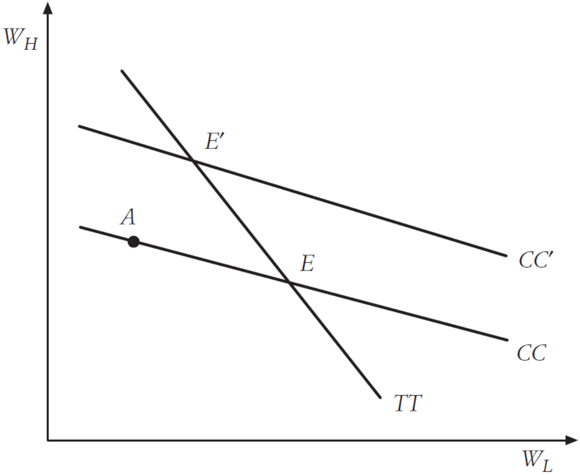
If international trade were restricted, H would migrate from country 1 and L will migrate in country 1 up to the point of equalizing wages.
$-\!>$Therefore factor mobility tend to reduce international trade

Factor Mobility

What if technology is different across countries?

- Suppose that initially the two countries have the same technology and the same relative factor endowment.
- Next, suppose that country 1 can produce C by employing less H and less L (both coefficients are reduced by the same proportion).
- This implies that country 1 firms can increase wages to meet the zero profit condition (if the domestic price remains constant)
- Result: At the new equilibrium, the wage of the factor more intense in the sector that has experienced the technology progress will increase, while that of the factor less intense will decrease.

Factor Mobility



Factor Mobility

- Thus H will migrate in country 1 and L will migrate out.
- In general: influx of the factor intensive in the sector with a technological advantage
- Country 1 relative endowment of H will increase compared to country 2 $->$ this opens opportunity of international trade

Therefore, in this case, factor mobility and international trade are complements.

Intuition: although international trade will tend to equate international prices, H-wages in the C sector remain higher in country 1 than in country 2.
Note: Wage differentials increase for two reasons, difficult to tell apart: 1) technology 2) international trade

Summing up

- In the competitive model all markets clear: −> no involuntary unemployment
- At the general equilibrium only the fundamentals of the economy determine price and wages
- At the general equilibrium some results of the partial equilibrium might change / disappear / reverse
- International trade influence domestic wage rates. Wages will be equalized across countries.
- International trade determines country specialization. The wage rate of the factor more intensive in the sector where the country specializes benefit from international trade and viceversa for the factor less intensive.
- If technologies are alike across countries, international trade is a substitute of factor mobility.
- If technologies differ, factor mobility could reinforce international trade.