



Open Question 1. Human Capital Theory

The Human Capital Theory suggests that individuals invest in education when the present value of the investment is positive, therefore comparing the present value of the associated costs and benefits.

Let's suppose that Julia just finished High School. She must choose between three alternative career paths. There are only three periods of (working or studying) life after high school, for simplicity reasons. The three choices Julia faces are the following:

- Work as a cashier in a large supermarket chain with a salary of 12,000 euros for each of the three periods.
- Study Marine Biology at the University. She will have to study for one period with a tuition fee of 7,000 euro. After graduation, she will earn 30,000 euros for each of the remaining two periods.
- Study at Philosophy the University and receive a Doctoral Degree in Philosophy (DPhil). She will have to study for two periods with tuition fees of 5.000 euros per period. After graduation she will earn 60,000 euros for the remaining period.

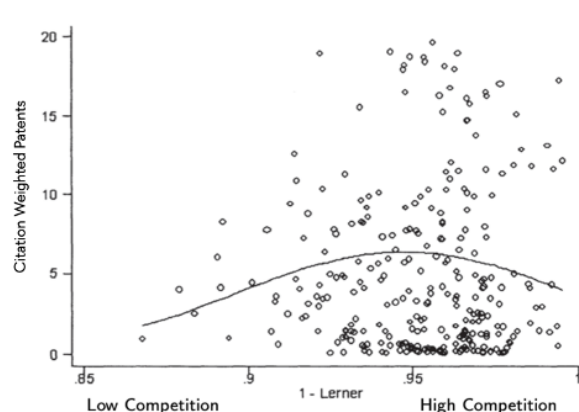
Suppose the interest rate per period is set at 10%. Answer the following questions:

- (10 rp) Which of the three choices is best in terms of economic benefits for Julia?
- (10 rp) If Julia has a passion for Philosophy and always wanted to get a DPhil in that subject, will she have to sacrifice consumption to follow this career path? If yes, what is the present value of consumption she will have to sacrifice?
- (10 rp) Should the State finance tuition for Philosophy studies? Justify your answer.

See questions 2–5 on the next pages

Open Question 2. Competition, Innovation, Inflation

(a) (10 rp) In their 2005 paper¹, Philippe Aghion, Nick Bloom, Richard Blundell, Rachel Griffith, and Peter Howitt found the inverted-U empirical relationship between the level of competition and the level of innovation in various industries. That is, not much innovation is seen in very competitive industries as well as in highly concentrated industries, most patents are acquired by firms in moderately competitive industries. Explain why this may be the case.



(b) (10 rp) One of the ways to regulate non-perfectly competitive markets and reduce their detrimental impact on social welfare is a price cap. In a standard model, the government sets the maximum price at the level where it would be in perfect competition ($P = MC$), so the firm(s) produce the socially efficient level of output. In some cases, however, this policy is not feasible, because it forces the firm(s) to leave the market, harming the society even worse. Provide an example of such a market where forcing $P = MC$ is clearly not the best idea and explain why. Suggest another way of regulation, that can help achieve the goal instead (or in addition to) the price cap.

(c) (10 rp) In macroeconomics textbooks, the authors often distinguish between two types of inflation: cost-push and demand-pull. Assume that two equivalent countries are in the long run macroeconomic equilibrium, and they simultaneously experience inflation — cost-push in country A and demand-pull in country B. Using the AD-AS model, explain for which country's government (the central bank) it will be relatively harder to fight this inflation.

Open Question 3. Public Debt Policy

The sovereign debt crisis in Europe and the fiscal deficit crisis in the United States have triggered global attention on government debt. Why is it necessary to control the government budget deficit reasonably and effectively? Please explain in detail some **positive** and **negative** effects of budget deficit on a country's economic development.

Open Question 4. Automation and the labour market

Automation is a term used to describe new technologies that allow machines to do the work that people used to do. Technological innovations that replace labour have been an essential part of the capitalist economy since the introduction of the spinning jenny in the eighteenth century. Explain five effects of the process of automation to the labour market, naming five historical examples from economic life.

¹ Aghion, Philippe, et al. "Competition and innovation: An inverted-U relationship." *The Quarterly Journal of Economics* 120.2 (2005): 701-728.

Open Question 5. Internal Rate of return

In case you forgot the formula:

$$w^n + w^{n-1} + w^{n-2} + \dots + w = \frac{w^{n+1} - w}{w - 1}$$

Let $P_0, P_1, P_2, \dots, P_k$ be a future payment flow. This means that at the time instant 0 we pay P_0 , at the time instant 1, we pay P_1 and so on. If a payment is negative, usually P_0 , this means that we receive money instead of paying.

The **Net Present Value** of this flow, denoted by **NPV(r)**, is defined as the sum of all present values of the above payments, for a given interest rate r . The rate r is the rate which is applied at each time instant. To find the **Internal Rate of Return (IRR)** of this flow, we follow the next steps:

1. We define a set of interest rates $r_0, r_1, r_2, \dots, r_n$.
2. We calculate the quantities: $NPV(r_0), NPV(r_1), NPV(r_2), \dots, NPV(r_n)$.
3. We find successive r_a, r_b such that $NPV(r_a) > 0$ and $NPV(r_b) < 0$.
4. We find a straight line joining the points: $(r_a, NPV(r_a)), (r_b, NPV(r_b))$.
5. We find the value r^* where this straight line meets the horizontal r -axis.
6. $IRR = r^*$

A company takes, at the "zero" time instant, a loan equal to 71 money units and plans to pay the first month 15 money units, the second 28 and the third 30, that is $P_1 = 15, P_2 = 28, P_3 = 30$

(a) (10 rp) Using the above procedure calculate the IRR for this payment flow. Use $r_0 = 0.14$, applied annually, and increase it with step $h = 0.01$ up to the value $r = 0.16$.

(b) (10 rp) If the company, instead of following this payment policy, decides to give 25 money units on the third month and some amount of money the fifth month, what should this amount be, in order the whole loan to be repaid? As an annual interest rate, use the IRR we found before.

(c) (10 rp) The company has started to repay the loan by 5 equal monthly payments, covering both principal and interest and with an interest rate equal to the IRR, found before. Suddenly after the second payment, the interest rate is increased by 3%. The government, in order to help, decides to cover the 25% of the loan which has not been paid yet and to extend the number of total payments from 5 to 8. Find the amount of each equal monthly payment, the company must pay from now on, to repay the loan.