

Exam HECON4210. Spring 2023.

Exercise 1: Childhood investments in health (25%)

The article “Childhood Circumstances and Adult Outcomes: Act II” by Almond, Currie and Duque (2018) presents a model of childhood investments in health. The following three equations are part of the model.

$$h = A \left[\gamma(\bar{I}_1 + \mu_{1g})^\phi + (1 - \gamma)(I_2 + \mu_{2g}^\phi) \right]^{(1/\phi)}$$

$$U = (1 - \alpha) \log C + \alpha \log h$$

$$Y = p_c C + p_I I_1 + p_I I_2 / (1 + r)$$

a) Explain the main aspects of their model by referring to the given equations.

A good answer should include the following points:

- In this model, parents are utility maximizers who make costly investments in their children’s health subject to a budget constraint.
- Child health is produced according to a CES household production function, with inputs in two periods, corresponding to the fetal period and early childhood.
- Investments in the two periods can be substitutes or complements; this is represented by the parameter ϕ .
- In this version of the model, investments during pregnancy are taken as given.

b) Use their framework to discuss whether adverse conditions during pregnancy can be compensated by health investments in early childhood. How does the investment response differ in the case of perfectly complementary investments compared to perfect substitutability?

Answers should include the following points:

- The answer to this question depends on the elasticity of substitution between inputs in the two periods
 - Consider the optimal solution for two special cases

1. Perfect substitutes.
 - Prenatal shocks can be fully compensated in early childhood.
2. Perfect complements.
 - Prenatal shocks cannot be compensated in early childhood at all.
- A good answer should discuss how the magnitude of the investment response depends on the parameters of the model (parental preferences over non-health consumption, relative importance of the prenatal period).
- A good answer should discuss the possibility of liquidity constraints.

Exercise 2: Adverse selection (25%)

In their article “Selection in Insurance Markets: Theory and Empirics in Pictures”, Einav and Finkelstein present a model for an insurance market with adverse selection.

a) Assume risk averse individuals with identical preferences, who differ in their probability to incur a loss, perfectly competitive insurance markets and no loading factors. Describe equilibrium. Explain why there may be an efficiency loss in such a market.

Answers should include the following points:

- The marginal cost (MC) curve is the expected cost increase of marginally increasing the quantity of insurance
- Since the individuals who have the highest WTP are those who have the highest expected loss the MC curve is downward sloping
- The WTP is equal to the sum of expected loss and the risk premium as a result the demand curve is always above the MC curve
- The individual specific loss probability is private information to the individual, and therefore firms offer a single price contract
- The equilibrium price will be equal to where the demand curve intersects the average cost because:
- The firm with the lowest price will attract the whole market
- Since there always will be an incentive to cut the price if it is above the average cost of the contract
- There will be only one equilibrium in which the price is pushed down to average cost of providing the contract
- In this model, the efficient outcome is that everyone buys insurance
- Whether this efficiency loss occurs will depend on the degree of risk aversion

- A private market will result in the efficient outcome if the demand curve is always higher than the average cost curve, ie if risk aversion is sufficiently high
- Adverse selection could lead to complete unraveling of the health insurance market
- The reason is that for any given price the average cost of insuring the people who are willing to buy the contract are higher than the price
- The competitive equilibrium is that no individual is insured
- While the efficient outcome is that everybody should be insured

b) Explain what could be different if the selection was advantageous instead of adverse.

A good answer should cover the following points:

- Advantageous selection happens if low-risk individuals are more risk averse, and heterogeneity in risk aversion is sufficiently large
- This is modelled by an increasing MC and AC curve.
- The AC curve lies always below the MC curve because the marginal individual is always cheaper to insure
- Equilibrium is at the intersection of the AC curve and the demand curve
- Equilibrium insurance level higher than optimal
- A verbal explanations of the upward sloping MC/AC curves should be included even if students include a graphical representation (the figure without explanation is not sufficient)

Exercise 3: Moral hazard (25%)

The textbook by Zweifel, Breyer & Kifmann discusses ex post moral hazard in a market for health insurance. The model includes the following equations:

$$y_s = f(\theta_s + M_s) - M_s - P + I_s \quad (1)$$

$$EU = \sum_{s=1}^S \pi_s u\left(f(\theta_s + M_s) - M_s - P + I_s\right) \quad (2)$$

$$P = \sum_{s=1}^S \pi_s I_s \quad (3)$$

a) Explain the main aspects of the model by referring to the given equations.

A good answer should include the following points:

- One-period model, individuals decide how much to spend on medical care M and other consumption y

- Health status and consequently need for health care is uncertain
- The health level in state s is θ_s ; the individual can experience S different states, $s = 1, \dots, S$
- The probability that state s occurs is π_s , and

$$\sum_{s=1}^S \pi_s = 1$$

- To get better health in state s the individual can buy medical treatment, M_s , which increases health linearly
- The overall health level in state s is therefore $H_s = \theta_s + M_s$
- Gross income, Y_s , in state s depends on the health level H_s ; individuals allocate income between M and y (with reference to equation 1).
- Individuals maximize expected utility (with reference to equation 2). Assuming risk averse preferences, individuals will therefore demand health insurance to reduce the financial risk of needing medical care
- Actuarially fair insurance is available (with reference to equation 3)

b) Assume the health state prior to treatment is not observable to the insurers, and payments are made contingent on realized expenses.

$$I_s = (1 - c)M_s$$

Will the market solution be socially optimal?

Answers should include the following points:

- Characterize the socially optimal solution, either with an equation

$$f'(\theta_s + M_s) = 1$$

or verbally. In optimum, use medical care until the marginal return on medical care is equal to the cost (normalized to 1)

- A good answer should include that in the socially optimal solution, all uncertainty in disposable income is absorbed by insurer y_s^o is identical for all s
- Characterize the market solution, using either mathematical notation or a verbal description

$$f'(\theta_s + M_s^*) = c$$

- In the market solution, individuals solve the ex post maximization problem of allocating resources taking the copayment c as given; will consume medical services until the

marginal return is equal to the copayment. Will only be the socially optimal level of medical consumption when the copayment is 1.

- Recognize that when the health state is not observable, the first best solution (full insurance and efficiency) is not feasible
- Good answers should discuss how asymmetric information means consumers now carry more risk relative to the socially optimal solution, describe the associated utility loss
- Good answers should include a discussion of optimal copayments in the second-best case.

Question 4 Health insurance (25%)

The textbook by Zweifel, Breyer & Kifmann (2012, chapter 5) models the insurance market under varying assumptions.

a) Consider a model where the demand side consists of two risk types. Assume that the insurance companies cannot identify risk type, explain why a pooled equilibrium will not exist.

Answers should include the following

- When there is adverse selection a pooling contract is not an equilibrium, because:
- It is possible to offer a different contract that is only preferred by low risk types, and therefore makes positive profits
- Therefore, the low risk types pull out of the pooling contract causing the pooling contract to make negative profits

b) Assume a separating equilibrium exists. Will everyone have full insurance?

Answers should include the following:

- The following points define the separating equilibrium:
 1. For the two contracts to yield zero expected profits we know that both contracts must be on the zero profit lines:
 - C_H must be a point on the line with slope $-\frac{1-\pi_H}{\pi_H}$
 - C_L must be a point on the line with slope $-\frac{1-\pi_L}{\pi_L}$
 2. C_H must be on the certainty line, or else it would have been possible to offer a different contract that yields nonnegative profits
 3. The π_H -type must not prefer the contract intended for the π_L type, which is where the indifference curve of the π_H -type intersects the budget line of the π_L type
- The result is that the low risk type must bear more risk

- This is necessary in equilibrium or else the high risk type would prefer C_L and the contract would yield negative profits
- This means that low risk types will not receive their preferred insurance contract of full compensation