# Homework 5

due Thursday, 11/15 in class

**Problem 1** Efficiency wages[1] are often suggested as one of the causes of long-term structural unemployment.

**a.** Explain how efficiency wages may arise as a consequence of worker moral hazard.

**b.** Larry works construction; he works alongside his supervisor, and checks in with him constantly. Creed works for Dunder Mifflin, doing an assortment of poorly-defined general office tasks; he sees his supervisor at coffee breaks, but rarely directly discusses work with him. Which of these workers is more likely to be paid an efficiency wage, and why?

**c.** Efficiency wage theory suggests that paying a worker more will make him more productive. Suppose you had data on the wages and productivity of all US workers. What difficulties would you face in testing whether or not the proposed relationship between wage and productivity actually shows up in the data?

**Problem 2** Suppose that workers value their time anywhere between \$0/hour and \$50/hour, with every value between 0 and 50 being equally likely. A worker will take a job only if the wage is above the value of his time. Suppose that if a worker takes a job, he will generate revenue equal to 1.5 times the amount he values his time (that is, a worker who values his time at \$20/hour will generate $\$20 * 1.5 = \$30$ revenue for a firm each hour). Firms cannot how productive workers are before hiring them; all workers look identical.

**a.** Is there an equilibrium in which all workers are hired? If so, describe it (what wages are paid, which workers work). If not, is there an equilibrium in which any workers are hired?

**b.** What is the name for this economic phenomenon studied in this question?

**c.** Suppose workers become more productive, so that now when a worker is hired, he increases a firm's revenue by $X$ times the amount he values his time (that is, a worker who values his time at \$20/hour will generate $\$20 * X$ dollars for a firm each hour). Would you get a different answer to part a if $X$ were much larger? Explain why.

**Problem 3** Suppose that normal workers increase a firm's revenue by \$6, while smart workers increase revenue by \$$A$, where $A > 6$. Firms cannot tell smart workers from normal workers *ex ante*, but can observe a worker's educational level.

Any worker can acquire as much education as she wishes, but getting $e$ years costs a normal worker $B * e$, where $B > 1$, while $e$ years cost a smart worker only $e$.

a. Solve for $e^*$, the minimum years of education that smart workers must get to differentiate themselves from normal workers. Your answer will be a function of the variables $A$ and $B$.

b. As $A$ increases, does $e^*$ increase or decrease? Explain intuitively why this is the case.

c. As $B$ increases, does $e^*$ increase or decrease? Explain intuitively why this is the case.

**Problem 4** A 2009 study by the White Group found that new cars lose, on average, 30% of their resale value in the first year after purchase, but only an additional 5% in their second year after purchase. Explain why this is, using concepts discussed in class.

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[1]Efficiency wage = any wage above the market clearing wage.

**Problem 5** ABC explosives has purchased fire insurance for its factory. It can institute a fire prevention program, which would cost $90, but which would lower the probability of a fire from .01 to .001. The insurance company cannot determine whether ABC has instituted the program. However, it charges a deductible in the event of a fire (i.e. ABC has to pay a certain amount to the insurance company if a fire occurs).

a. What problem discussed in class is the insurance company worried about in charging a deductible?

b. What is the smallest deductible that will incentivize ABC to institute the fire prevention program? (Hint: ABC's expected loss from a fire with no fire prevention program is $.01 * deductible$. Compare this to the expected loss from a fire with the fire prevention program.)

**Problem 6** A principal hires an agent to run a business for one year. The agent can exert high effort or low effort. High effort lowers the agent's utility by 10,000. Low effort is costless. If the agent exerts high effort, the business makes a profit of $150,000 with probability .5 and breaks even with probability .5. If the agent exerts low effort, the business makes a $150,000 profit with probability .25, and breaks even with probability .75. The principal cannot tell what effort level is exerted, although he is of course aware of the business's profit. The agent's utility function is his annual salary minus the cost of effort, and he can be guaranteed a utility of $50,000 if he quits and works for his borther's landscaping business (his outside option).

a. If the principal pays the agent a fixed salary $S$, what effort level does the agent choose?

b. Now suppose that the principal pays the agent a fixed salary $S$ and a bonus $B$, to incentivize the agent to exert high effort. Write down the participation constraint and the incentive constraint, and clearly label each.

c. Solve for the choices of $S$ and $B$ that maximize the owner's profit. Be sure to show that offering a contract with a bonus is more profitable to the owner than offering a contract with no bonus, and only a fixed salary.