UNIVERSITY OF TORONTO
Faculty of Arts and Science
JUNE 2014 EXAMINATIONS
ECO381H1S – Personnel Economics
Duration 2 hours
(Instructor: J. Kantarevic)

Instructions

The test consists of seven questions, each worth five points. Please show all your work. Non-programmable calculators are allowed. Good luck!

1. Discuss each of the following statements:

    a. (1 point) New firms with uncertain prospects may have more difficulty motivating their employees than well-established firms.
    b. (1 point) Rather than promote within the firm, firms sometimes hire outsiders, even though the firm is uncertain about the productivity of these outsiders.
    c. (1 point) Fixed bonus pools are rarely used by companies.
    d. (1 point) Some employment relationships are inefficient, even when the employer can perfectly observe and verify the actions of her employees.
    e. (1 point) It is important that the legal system functions properly whenever employees' actions cannot be verified.

    a. (1 point) Uncertain prospects and the short history may affect firms' reputation and impact their ability to offer self-enforcing contracts based on non-verifiable performance measures. This could be problematic if the available objective performance measures are highly dysfunctional.
    b. (1 point) Promotion within the firm may induce sabotage and collusion activities and may discourage co-operation. When these possibilities are significant, the firm may be better off hiring an outsider.
    c. (1 point) Fixed bonus pools are rarely used by firms because they introduce uncertainty in pay and because they may encourage workers to sabotage each other or collude with each other. In addition, fixed bonus pools do not address other problems with the subjective evaluation, such as favouritism.
    d. (1 point) This case may arise if the outside options for both parties are sufficiently high and the gain from the relationship is sufficiently small.
    e. (1 point) No, since contracts based on non-verifiable measures must be self-enforcing and cannot be enforced in courts even if the legal system functions perfectly.

2. Consider a promotion tournament between two vice presidents. Assume that the output of vice presidents is given by $q_1=e_1+0.5u$ and $q_2=e_2 - 0.5u$, respectively, where e_1 and e_2 are vice presidents' efforts that cannot be observed and u is a random variable that is distributed uniformly on [-1,1]. Both vice presidents are risk neutral, but the disutility of effort is $c(e_1)=0.5e_1^2$ for the first vice president and $c(e_2)=e_2^2$ for the second vice president. The vice president with the higher output gets promoted and earns a pay increase.

(a) (1 point) What is the optimal level of effort for each vice president?
(b) (3 points) What is the required increase in salary (W-w) that will induce both vice presidents to provide the optimal level of effort?
(c) (1 point) If the tournament is designed so that both vice presidents provide the optimal level of effort, what is the probability that the first vice president get promoted?

(a) (1 point)The optimal level of effort for each vice president equates the expected marginal benefit of effort with its marginal cost. For the first vice president, the expected benefit is $E[q_1]=e_1$ and therefore the expected marginal benefit is 1. The marginal cost is e_1. Therefore, the optimal level of effort for the first vice president is 1. For the second vice president, the expected benefit is $E[q_2]=e_2$ and therefore the expected marginal benefit is 1. The marginal cost is $2e_2$. Therefore, the optimal level of effort for the second vice president is 0.5.
(b) (3 points) The expected payoff is $E[U_1]=w+Pr(q_1>q_2)(W-w)- 0.5e_1^2$ for the first vice president and $E[U_2]=w+Pr(q_2>q_1)(W-w)-e_2^2$ for the second vice president. Now, $Pr(q_1>q_2)=Pr(u>e_2-e_1) = 0.5(1-e_2+e_1)$. Therefore, $E[U_1]=w+0.5(1-e_2+e_1)(W-w)- 0.5e_1^2$ and $E[U_2]=w+0.5(1-e_1+e_2)(W-w)-e_2^2$. The incentive compatibility constraints are then $0.5(W-w)=e_1$ and $0.5(W-w)=2e_2$. To induce $e_1=1$ and $e_2=0.5$, we therefore need $W-w=2$.
(c) (1 point) $Pr(q_1>q_2)= 0.5(1-e_2+e_1)=0.5(1-0.5+1)=0.75$.

3. Prior to 2000, all Canadian firms used a salary contract. In 2000, firms in Ontario switched to a piece rate contract, while firms in the rest of Canada (ROC) did not. To estimate the impact of this change, a researcher has estimated the following model:

$$\text{Productivity} = a + b\times\text{Ontario}+c\times\text{Post2000}+d\times\text{Ontario}\times\text{Post2000}$$

where Ontario is 1 if the firm is in Ontario and 0 otherwise and Post 2000 is 1 for the period after 2000 and 0 otherwise. The results were as follows.

Variable	Coefficient	Standard Error
Ontario	-1.05	0.90
Post2000	1.50	0.30
Ontario × Post2000	2.15	1.45

a. (1 point) Was there a significant productivity difference between ROC and Ontario prior to 2000?
b. (1 point) Did the productivity significantly increase in ROC after 2000?
c. (1 point) Do these results indicate that the piece rate contract improves productivity relative to the salary contract?
d. (1 point) What is the main assumption required in this study to interpret the impact of the type of contract on productivity as a cause and effect relationship?
e. (1 point) Could these results be explained by the multi-tasking problem?

a. (1 point) There was no significant productivity difference between ROC and Ontario prior to 2000 (b=-1.05, but t>-2).
b. (1 point) Productivity increased significantly in ROC after 2000 (b=1.5, with t>2).
c. (1 point) No, the change in productivity between Ontario and ROC before and after 2000 was not significantly different (d=2.15, but t<2).
d. (1 point) This empirical strategy is known as the difference-in-difference strategy. The main assumption behind this strategy is the common trend assumption: in the absence of treatment (that is, if all provinces remained on the salary contract), outcomes (i.e. productivity) in the treatment and control groups would evolve similarly.
e. (1 point) The results indicate no significant impact of the piece rate on productivity. This could be explained by the multi-tasking problem as follows. This problem is likely to reduce the ability of firms to provide high-power incentives. As a result, low-power incentives can improve results by a small amount, which due to sample variation may not be picked in the data.

4. Three physicians are about to form a partnership. The revenues of the partnership Q depend on the effort of each physician according to $Q=e_1+e_2+e_3+u$, where u is a random variable with a mean of zero. Each physician is risk neutral and has an outside option of 0.

The cost of effort is e^2 for each physician

a. (1 point) What are the expected revenues if each physician provides the efficient level of effort?
b. (2 points) What are the expected revenues if each physician chooses his effort and the physicians agree to split the revenues equally?
c. (2 points) Suppose that the physicians can impose a penalty on each other, given by $0.5(G-e_i)^2$, where G is the group norm. What group norm will induce all three physicians to provide the efficient level of effort?

a. (1 point) The efficient level of effort for each physician solves max $E[Q]-c(e_1)-c(e_2)-c(e_3)=e_1+e_2+e_3-e_1^2-e_2^2-e_3^2$. The first order conditions for the three efforts then yield $1/2=e_1=e_2=e_3$. Therefore, the expected revenues are 3*(1/2)=3/2.
b. (2 points) Each physician *i* solves max $(1/3)E[Q]-c(e_i)=(1/3)(e_1+e_2+e_3)-e_i^2$. The first-order condition then yields $1/3-2e_i=0$, or $1/6=e_1=e_2=e_3$. Therefore, the expected revenues are 3*(1/6)=1/2.
c. (2 points) With the group norm, each physician *i* solves max $(1/3)E[Q]-c(e_i)-0.5(G-e_i)^2=(1/3)(e_1+e_2+e_3)-e_i^2-0.5(G-e_i)^2$. The first-order condition is then $1/3-2e+(G-e)=0$. To induce the efficient level of effort of 1/2, we have that G=7/6.

5. Define each of the following concepts (without using any mathematical symbols):

a. (1 point) Self-enforcing contract
b. (1 point) Intrinsic motivation
c. (1 point) Equal compensation principle
d. (1 point) Informativeness principle
e. (1 point) Incentive compatibility constraint

a. (1 point) Contracts that cannot be enforced by a third party but rely on the parties for enforcement. This usually occurs when objective performance measures (i.e. the measures that can be observed and verified) are not available.
b. (1 point) The possibility that the agent (or the principal) may care about the other party's objectives, even in the absence of any monetary compensation.
c. (1 point) The principle that if two competing tasks involve equal costs to the agent, then the compensation structure must reward the two tasks equally on the margin. This principle typically occurs in the multitasking problems.
d. (1 point) The principle that the optimal compensation contract should include any performance measures that is informative about the agent's performance. This approach will reduce the risk and improve incentives when the agent is risk averse.
e. (1 point) The constraint that the agent will respond to any given contract by choosing actions that maximize his or her own payoffs. This is a constraint that must be taken into the account when the agent's actions cannot be observed and verified.

6. Employee's contribution to the firm is given by q=e+u, where e is employee's effort that cannot be observed and u is a random variable with a mean of zero. The cost of effort function is $e^2/6$. Both the employee and employer are risk neutral and have an outside option of zero. In addition to the contribution to the firm, the employer also observes y that is

related to q. Specifically, y=kq, where k is a parameter that the employee can manipulate. The employee knows that the actual value of k is one, while the employer only knows that k has a mean of one and a variance of one.

a. (2 points) What is the expected profit if the employer uses q as a performance measure (that is, the employee pay is given by w=a+bq)?
b. (3 points) What is the expected profit if the employer uses y as a performance measure (that is, the employee pay is given by w=a+by)?

a. (2 points) When the employer uses q as a performance measure, he can induce the efficient level of effort by using a piece rate contract with b=1. This level of effort is given by equating the expected marginal benefit and marginal cost of effort. In this question, this implies that $1=e^*/3$, so $e^*=3$. The value of social surplus is then $E[q(e^*)-c(e^*)]=3-3^2/6=1.5$.
b. (3 points) When the employer uses y as a performance measure, the employee maximizes $a+bE[y]-c(e)=a+bke-e^2/6$. The IC condition is then $bk-e/3=0$ or $e=3bk$. The employer maximizes his expected payoff subject to IC and PC. The employer's expected payoff is $E[e-c(e)] = 3bE[k]-E[(3bk)^2]/6 = 3b-1.5b^2E[k^2] = 3b-1.5b^2(1+\theta) = 3b-3b^2$. The optimal value of b is then 0.5. Given b=0.5, the employee will choose $e=3bk=1.5$. The social surplus when the employer uses y is then $1.5-1.5^2/6=1.125$.

7. The Ministry of Health and Long-Term Care wishes to provide incentives to the Toronto General Hospital and the Princess Margaret Hospital to reduce waiting time for the cardiac surgeries. One option is to pay a bonus to both hospitals if the two hospitals together achieve a targeted number of surgeries. The other option is to pay a large bonus to the hospital that performs more surgeries than the other hospital. Both hospitals have the same number of physicians and other resources to perform the surgeries.

   a. (5 points) Discuss factors that the Ministry should consider in choosing between the two options.

   a. Factors to consider: the free rider problem – ability of two hospitals to influence each other (e.g. establishing social norms), need to rank hospitals, measurement cost, risks common to both hospitals, frequency of technological change, possibility of sabotage, possibility of collusion, willingness of hospitals to participate, need for co-operation between the two hospitals.

THE END