UNIVERSITY OF TORONTO

DEPARTMENT OF ECONOMICS

ECONOMICS 381H1F – SUMMER 2015

MANAGERIAL ECONOMICS II: PERSONNEL ECONOMICS

Midterm

Version A

SOLUTIONS

Instructions

The test is 50 minutes long. Non-programmable calculators are allowed. The test consists of four questions, each worth 5 points. Show all your work in the space provided below the question. If you need additional space, you may write on the back of the page.

LAST NAME _____

FIRST NAME _____

STUDENT NUMBER _____

Good luck!

Question 1	Question 2	Question 3	Question 4	Total
/5	/5	/5	/5	/20

1. Consider a relationship between an actor and her manager. The manager obtained a deal for the actor for a TV commercial in which the actor can either dance or sing. If the actor dances, the expected revenues are $5M and if she sings the expected revenues are $9M. The actor dislikes dancing at $3M and singing at $4M. The outside options are 0 for both parties and both parties are risk neutral.

   (a) (2 points) What is the optimal contract that the manager can offer to the actor if the manager can observe the actor's action?
   (b) (2 points) What is the optimal contract that the manager can offer to the actor if the manager cannot observe the actor's action (for example, the manager cannot attend the shooting of the commercial because he has to attend another meeting)?
   (c) (1 point) If the manager can expect revenues of $1M from the other meeting, is it better for the manager to attend this meeting or attend the shooting of the commercial?

   (a) (2 points) If the manager can observe the actor's action, he will offer a contract that consists of two elements: the payment and the required action. The choice of action will be determined by maximizing the difference between the expected revenues and the actor's cost of action. In this case, we only have to compare two actions. For dancing, the net benefit is $5M-$3M, or $2M. Similarly, the net benefit for singing is $9M-$4M=$5M. Therefore, the manager will stipulate that the actor sings. Now, the manager has to pay the actor an amount that covers her cost of effort ($4M) and her outside option ($0), so the payment will be $4M.

   (b) (2 points) If the manager cannot observe the actor's action, and given that the actor is risk neutral, the manager can charge the actor an amount of $5M. He can do so because the actor will choose the optimal level of action given this contract (sing) and the expected revenues ($9M) will cover both her cost of effort ($4M) and the payment she has to make to the manager ($5M), so the contract will be acceptable to her given that her outside option is $0.

   (c) (1 point) In both cases, when he can and when he cannot observe the actor's action, the manager's expected profit is $5M. Therefore, his attending the shooting of the commercial is not critical if he charges the agent $5M, and it is better for him to attend the other meeting.

2. Define each of the following terms:

(a) (1 point) Social surplus in the principal-agent relationship
(b) (1 point) Risk premium (as it applies to the agent)
(c) (1 point) Incentive compatibility constraint
(d) (1 point) Statistical significance of a regression coefficient
(e) (1 point) Informativeness principle

(a) (1 point) The difference between the value of relationship between the principal and the agent and the sum of their outside options. The value of the relationship includes the expected benefit net of the cost of effort and risk premiums, where the benefit depends in part on the agent's action.
(b) (1 point) The perceived disutility by the agent from entering a relationship where her compensation depends on an outcome that she cannot perfectly control. It includes the agent's risk aversion coefficient and the riskiness of the outcome (the extent to which the agent cannot control the outcome).
(c) (1 point) The condition that describes how the agent chooses her action for any given contract when her action cannot be observed by the principal. The choice of this action maximizes the agent's expected utility.
(d) (1 point) Denotes whether the coefficient estimated from a sample is likely to be different from zero if we were to obtain additional samples. It is usually evaluated by comparing the t-statistic (the coefficient divided by the standard error) to the critical values given a specified confidence level. For example, if the confidence level is 0.05, we can reject the hypothesis that the coefficient is zero if the t-statistic is larger that |2|. Our interest in the statistical significance is mainly because we want to know whether there is a relationship between the dependent variable and the independent variable for which the coefficient is estimated.
(e) (1 point) The principle according to which the optimal compensation should include any signal related to the performance in an attempt to reduce the risk to the agent and therefore improve their performance by strengthening the link between the pay and outcome. This principle applies to the principal-agent relationships in which the agent's action cannot be observed, the agent cannot perfectly control the outcome, and the agent is risk averse.

(3) The board of directors of Blackberry Inc. wishes to hire a new CEO. The board considers a payment method of the form w=a+bq+cy, where w is the CEO's pay, q is the revenues for Blackberry Inc. and y is the revenues of Samsung Inc. Specifically, the Board knows that that E[q]=2e, Var[q]=1, E[y]=0, Var[y]=1, and cov(q,y)=0, where e is the CEO's effort. The CEO's cost of effort is $0.5e^2$ and his coefficient of risk aversion is 2. On the other hand, the board of Blackberry Inc. is risk neutral. Assume that both parties have outside options of zero.

a. (1 point) Write down the expected payoff (i.e. certainty equivalent) for the board of Blackberry Inc. and the CEO using the information given in the question.
b. (1 points) What is the maximum expected profit for Blackberry Inc. if the board can observe and verify the CEO's effort?
c. (3 points) What is the maximum expected profit for Blackberry Inc. if the board cannot observe and verify the CEO's effort?

a. (1 point) The expected payoff for the board is E[V]=E[q]-E[w] since the board is risk neutral. Further, E[q]-E[w]=2e-a-b2e. The CEO's expected payoff is $E[U]=E[w]-c(e)-RP^A=a+b2e-0.5e^2-RP^A$.Now,$RP^A=0.5rVar[w]=0.5(2)Var[a+bq+cy]=b^2(1)+c^2(1)+2bc(0)=b^2+c^2$. Therefore, $E[U]=a+b2e-0.5e^2-b^2-c^2$.

b. (1 point) The expected profit for the board is E[q]-E[w]=2e-a-b2e. If the effort can be observed, the board can choose e such that the expected marginal benefit of effort (2) is equal to its marginal cost (e), or set e*=2. Further, given that the board is risk neutral while the CEO is risk averse, it is optimal that the board fully insures the CEO, i.e. b*=0. Lastly, the board has no need for additional signal of performance since e can be observed. Therefore, c*=0 and w=a+bq+cy=a. Now, a must satisfy the CEO's participation constraint, $E[w]-c(e)-RP^A=R=0$. Since b*=0=c*, $RP^A=0$, and $E[U]=a-0.5(2)^2=0$, or a*=2. The expected profit is then 2e*-a*=4-2=2.

c. (3 points) The board maximizes E[V] subject to the CEO's participation and incentive compatibility constraints. The ICC is $\partial E[U]/\partial e=0$, or $\partial(a+b2e-0.5e^2-b^2-c^2)/\partial e=0$, from which it follows that 2b-e=0, or e=2b. The PC is E[U]=R=0, or $E[w]=c(e)+RP^A=0.5e^2+b^2+c^2$. Now, E[V]= E[q]-E[w]. Substituting for E[w] from the PC, we have $E[V]= 2e-0.5e^2-b^2-c^2$. Substituting for e from the ICC, this becomes $4b-0.5(4b^2)-b^2-c^2$. Further, since the signal is uncorrelated with the performance, it is optimal not to use the signal and set c=0. The first-order condition for b is then 4-4b-2b=0, or b=2/3. From the ICC, this then yields e*=2b*=4/3 and E[q]=2e=8/3. Also, from the PC, we have that $E[w^*]= 0.5e^{*2}+b^{*2}=0.5(16/9)+4/9=12/9$. Therefore, the expected profit is E[q*]-E[w*]=8/3-12/9=24/9-12/9=12/9=4/3, which is smaller than in the case when the CEO's action could be observed.

4. In their research, Gibbons and Murphy (1990) used data on about 2,000 Chief Executive Officers from about 1,300 firms between 1974 and 1986. Their main result can be expressed using the following regression model: E[w] = 0.068 + 0.1805q-0.1490y, where w represents the CEO's pay (in logarithm), q is the firm's rate of return, and y is the market rate of return. The t-statistics were 21.0 and -7.6 for the coefficients on q and y, respectively.

   d. (2 points) What is the main hypothesis that Gibbons and Murphy test in their study? How does this hypothesis relate to the theory of using multiple signals in principal-agent relationships?
   e. (1 point) What is the assumption required to allow us to interpret this regression model as a causal impact of q and y on w?
   f. (2 points) Interpret the coefficient estimates on q and y in terms of their sign and statistical significance.

a. (2 points) Gibbons and Murphy test the hypothesis that using additional performance signals (the market rate of return in their study) may impact the agent's productivity, as reflected in their pay. The principal-agent theory suggests that the principal should use any signal informative about the agent's performance (the informativeness principle) and that the signal should be used in the opposite way of the correlation between this signal and the agent's actual performance. In this study, the market return and the firm's rate of return are expected to be positively correlated; therefore, we expect that the sign on the market return coefficient will be negative.

b. (1 point) The assumption is that the only relevant differences between CEOs in different firms are the differences in the firm's rate of return and the market's rate of return. If this is the case, then these differences across firms can be interpreted as having a causal impact on the CEO's performance.

c. (2 points) The coefficient on q, the firm's own rate of return, is positive and statistically significant (t-statistic > 2). This is as expected, as we would expect that the pay should be positively related to the firm's own performance. The coefficient on y, the additional signal of the market rate of return, is negative and statistically significant (t-statistic < -2). This is consistent with the principal-agent theory given that we expect the firm's and market rate of return to be positively correlated and that the optimal use of additional signals is opposite of the correlation between the signal and the agents' outcome.