219B – Final Exam – Spring 2017

Question 1. (Augenblick, Niederle, and Sprenger QJE)

Consider the setting of Augenblick, Niederle, and Sprenger, QJE who aim to estimate time preferences from a real effort choice. Subjects make choice on allocating required effortful work between period t and period $t+1$. Think of each period as one week. The choices are made either in advance, say in period $t-1$, or exactly at period t. Assume that individuals have a cost of effort function $c(e_t)$ for doing e_t units of work in period t. By design, the person can make a trade off between working in period t or period $t+1$ at interest rate R, where the interest rate is varied experimentally:

$$e_t + R * e_{t+1} = m. \tag{1}$$

When choosing at time $t-1$ (in advance), the individuals minimize the sum of the discounted cost of efforts in the two periods subject to achieving objective (1):

$$\min_{e_t, e_{t+1}} \beta\delta \left[c(e_t) + \delta c(e_{t+1})\right]. \tag{2}$$

Assume a cost of effort function

$$c(e) = k\frac{1}{1+\gamma}e^{1+\gamma}. \tag{3}$$

(a) First, before we step into the problem at hand, a side derivation on this cost of effort function. Denoting the value of effort with ve such that the first order condition of effort would be $c'(e) = v$, show that the cost function (3) has a constant elasticity of effort with respect to the value of effort v. What is the elasticity? Interpret.

(b) Solve for e_{t+1} from (1) and substitute into (2) so as to solve for the optimal choice of effort e_t^* and e_{t+1}^*. Rewriting the expression using e_{t+1}, you should obtain

$$\frac{(e_t^*)^\gamma}{\left(e_{t+1}^*\right)^\gamma} = \frac{\delta}{R}. \tag{4}$$

(c) Assume now that individuals are now making a choice at time t between effort at t and effort at $t+1$. That is, now the costly effort at t is in the present. Rewrite the expression in (2) to apply to this choice and derive a solution parallel to the one in (4). Denote the solutions $\hat{e}_t$ and $\hat{e}_{t+1}$. what is the different between the new expression and (4)?

(d) Suppose now that you run the specification

$$\log(e_t) - \log(e_{t+1}) = A + B\log(R). \tag{5}$$

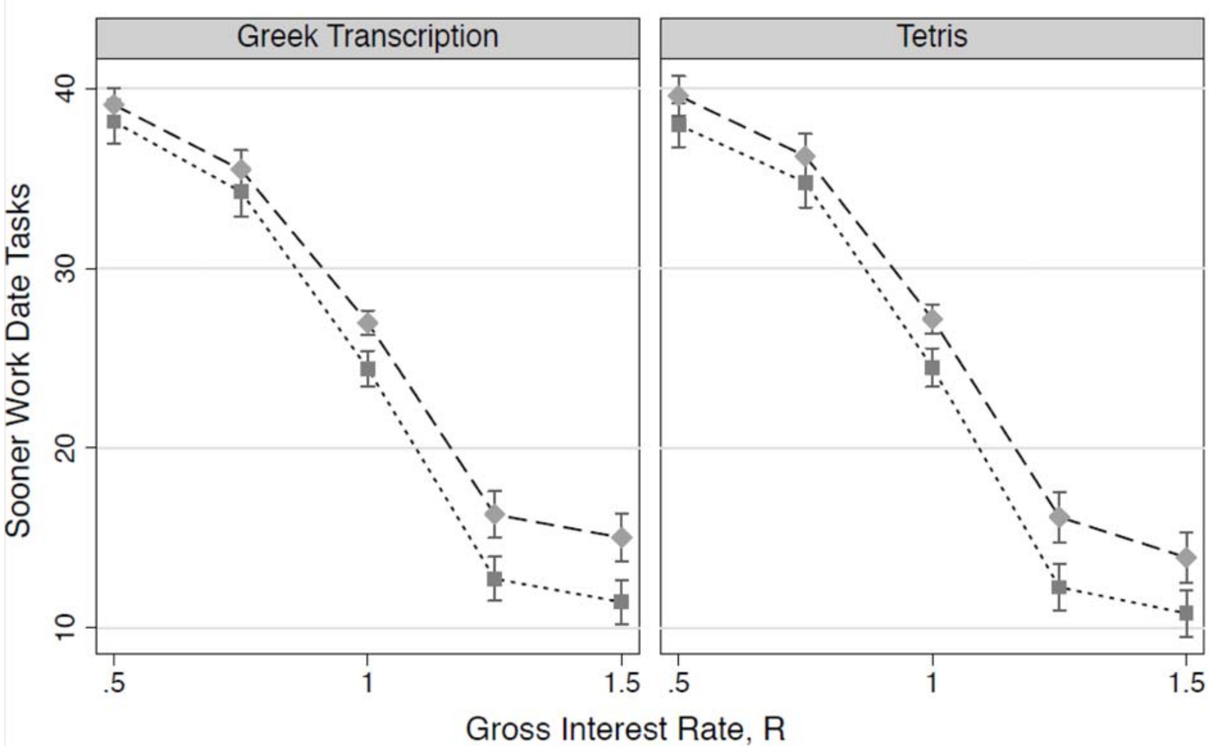
Under the model above, what is the estimate for $\hat{A}$ and $\hat{B}$? Solve both for the case in which the choice is made at t (that is, the choices of $\hat{e}_t$ and $\hat{e}_{t+1}$) and the cases in which the choice is made at $t-1$ (that is, the choices of e_t^* and e_{t+1}^*)

(e) Using your response to point (d), explain how you can estimate structurally (or not) γ, β, and δ using equation (5).

(f) Continuing on point (e), comment on the statement "Estimation of structural parameters can be sometimes done with simple OLS regressions." Are there other examples of this type which we discussed in the class?

(g) The attached figure displays the result of the experiment for two tasks, Greek transcription and Tetris (the results are similar for the two). The Figure plots how much (out of 50 units) in the first period, that is, e_t in our notation. The Figure shows that as a function of R (the gross interest rate, as per our equations), for both the choice made at $t-1$ (labeled 'initial allocation mean') and for the choice made at t (labeled 'subsequent allocation mean'). Describe clearly and in detail what the experimental results reveal.

Figure 5: Real Effort Discounting Behavior



(h) Using the results in the Figure, can you approximately calibrate what the estimates for $\hat{\gamma}$, $\hat{\delta}$, and $\hat{\beta}$ are likely to be? Notice that the units in the figure do not exactly correspond to the ones in equation (5), but you should be able to derive an order of magnitude calibration based on the findings. Again, I am not looking for a exact estimate, and certainly not for confidence intervals, but am looking at the ability extrapolate approximate magnitudes from the parameters from the aggregate results, which is a useful skill. Show your work.

(i) In particular, if the cost of effort had had a higher γ, would the lines in the Figure be steeper or flatter? Discuss in light of the discussion in point (a).

(j) Are there advantages of estimating the discounting parameters with an effort task, compared to the standard choice of monetary amounts, that is, what is the amount \$X delivered today that is equivalent to 10\$ next week? Discuss.

Question 2. (Charitable Giving)

a) **Charitable Giving.** Summarize qualitative features of charitable giving in the US, such as amount given annually, number of charities given to, crowding out.

b) **Charitable Giving, Altruism.** Does a pure-altruism model of charitable giving fit well with observed patterns of giving? For pure altruism, consider a model like

$$\max_{g_i \geq 0} u\left(W - g_i\right) + \alpha f\left(g_i + G_{-i}\right) \tag{6}$$

where W is the pre-giving wealth, g_i is giving by person i, $u\left(\right)$ is the utility of private consumption, $f\left(\right)$ is the production function of the public good, and G_{-i} is the giving by others. What does α capture? Explain the predictions of this model qualitatively with equation (6).

c) **Charitable Giving, Warm Glow.** Does a warm glow model of charitable giving fit well with observed patterns of giving? For warm glow, consider a model like

$$\max_{g_i \geq 0} u\left(W - g_i\right) + a\phi\left(g_i\right) \tag{7}$$

where $\phi\left(\right)$ is the warm glow function which we assume increasing and concave in g_i, with $\phi\left(0\right) = 0$. What is $\phi\left(\right)$ supposed to capture? Explain discussing qualitatively with equation (7). Stress at least one key different prediction between the warm glow model and the pure altruism model.

d) **Charitable Giving, Social Pressure.** Does a social pressure model of charitable giving fit well with observed patterns of giving? For social pressure, consider a model like

$$\max_{g_i \geq 0} u\left(W - g_i\right) - S\mathbf{1}_{\{g_i < \bar{g}\}} \tag{8}$$

where $\bar{g}$ is a minimum acceptable level of donation. What does S capture? Discuss the qualitative solution of (8) Explain discussing qualitatively the solution of this social-pressure problem. What is a key difference relative to the two models above?

Question #3 (Reference Dependence and Job Search)

Two researchers, Johannes and Stefano, make the following conjecture: '*Consider two unemployment benefit systems. State A has a constant unemployment benefits equal to a 60% replacement rate [That is, benefits equal 60% of the previous wage] for the whole duration of the benefits [6 months]. State B has a step system, with unemployment benefits set at 70% for two months, and then 60% for the remaining duration of four months. Hence, State B has a more generous system the first two months, and equally generous in the next four months. According to the standard model, State B will experience a slower exit from unemployment because it is more generous. If, however, unemployed workers use past earnings as a reference point and if loss aversion is high enough, then the reverse can be true: The step system in State B induces a* ***faster*** *exit, despite being more generous.*'

Motivated by this scenario, this question considers the impact on job search of loss aversion in a reference-dependent model where the reference point is past consumption. (Hence, in this model the reference point is the status quo, not expectations) We consider the following simplified model of job search with two periods of unemployment, $t = 1$ and $t = 2$. At time $t = 1$ the person becomes unemployed and at time $t = 1, 2$ the person decides how much search effort s_t to put into finding a job. If the person finds a job at time $t = 1$, which occurs with probability s_1, she receives wage w in periods $t = 1$ and $t = 2$. If she does not find a job, she gets benefits b_1 at $t = 1$ and then decides again in period 2 how much search effort s_2 to exert. If she finds a job in period 2, which occurs with probability s_2, the job pays w at $t = 2$; otherwise, she receives benefits $b_2 \leq b_1$ at $t = 2$. The benefit level can be constant or decreasing over time, but in any case unemployment benefits are lower than the wage obtained by finding a job, that is $w \geq b_1 \geq b_2$.

The utility function is as follows. The utility of consumption equals

$$u(c_t|c_{t-1}) = \begin{array}{ll} c_t + \eta\,[c_t - c_{t-1}] & \text{if} \quad c_t \geq c_{t-1} \\ c_t + \eta\lambda\,[c_t - c_{t-1}] & \text{if} \quad c_t < c_{t-1} \end{array}$$

The agent has consumption utility c_t (we are assuming linear utility) and gain-loss utility relative to consumption in the previous period c_{t-1}, which acts as the reference point.

a) Interpret the parameters η and λ, and discuss briefly the psychological interpretation.

We are going to assume that the agent consumes all that she earns. In addition to the utility of consumption, there is a cost of effort from searching for a job. The cost of effort is $c(s) = \gamma/2 * s^2$. (Assume that $s \in [0, 1]$ not worrying about possible corner solutions). Finally, the discount function is $\delta = 1$, so do not worry about discounting.

b) Let's start from the last period, $t = 2$. Explain why the maximization problem of the unemployed agent, conditional on still being unemployed at $t = 2$ (otherwise she just receives wage w) is

$$\max_{s_2} = s_2 u(w|c_1) + (1 - s_2)\, u(b_2|c_1) - c(s_2) \tag{9}$$

[We assume no probability weighting]

c) Take first-order conditions and solve for the optimal s_2^*. To do so, substitute the expressions for $u(|c_1)$ and $c(s)$. Keep in mind that c_1, which is the reference point, equals b_1 given that this agent consumes all that she earns. You should find

$$s_2^* = [w - b_2 + \eta (w + (\lambda - 1)\, b_1 - \lambda b_2)] / \gamma. \tag{10}$$

[Use this expression in the next questions if you are stuck in the derivation]

d) Consider first the special case with no gain-loss utility, hence $\eta = 0$. Rewrite the expression for s_2^*. Discuss the comparative statics of optimal search s_2^* with respect to (i) the wage w, (ii) the benefit level in period 2 b_2; (iii) the benefit level in period 1 b_1; (iv) the cost of effort γ. Here and below, provide intuition on the results.

e) Now consider the general case for gain-loss utility ($\eta > 0$) as well as loss-aversion ($\lambda > 1$). Discuss the same comparative statics as above, highlighting the differences. What is the main implication of reference dependence in this model?

f) Denote by V_2 the continuation payoff in period 2 for an unemployed worker, which is expression (9) evaluated at s_2^*. Consider now the maximization problem in period 1. Briefly explain why the maximization problem is

$$\max_{s_1} = s_1 [u(w|c_0) + u(w|w)] + (1 - s_1) [u(b_1|c_0) + V_2] - c(s_1). \tag{11}$$

Assume that $c_0 = w$, that is, before losing the job, the agent had earnings w equal to the re-employment earnings if she finds a job. (Remember that if the agent finds a job in period 1, the earnings are w in both periods).

g) Similarly to what you did in point (b), obtain the first order conditions and solve for s_1^*.

h) For the no-reference dependence case ($\eta = 0$), derive how search effort in the first period s_1^* responds to an increase in benefits b_1, holding constant the benefits b_2 in period 2. (Note: V_2 in this case will not depend on b_1. Why?) Discuss the intuition for this effect of more generous benefits in period 1.

i) Consider now the case with loss aversion ($\eta > 0$ and $\lambda > 1$) and discuss now how search effort in the first period s_1^* responds to an increase in benefits b_1, again holding constant benefits in period 2 b_2. Note: Solving formally for this is extra credit, as it requires using the envelope theorem to solve for $\partial V/\partial b_1$. Try instead to discuss *intuitively* the various channels through which more generous benefits in period 1 affect search effort. In particular, is there a channel by which a higher benefit b_1 can *increase* the search effort in period 1 s_1^*?

j) In light of this, how would you evaluate the assertion of the two economists above?