Econ 131
Fall 2016
Danny Yagan

Midterm

October 19

Student Name:

Student ID:

GSI Name:

Exam Instructions

- **Closed book/notes exam.** No computer, calculator, or any electronic device allowed.
- **No phones.** Turn them off and put them in your bag.
- **Explanation should be written using pens.** No pencils, except for graphs.
- **You must submit your solutions using the exam packet provided.** If you need more room to write your answers or need to re-draw a graph use the extra pages at the end. Make sure to note it clearly and accurately if your solutions continue on a different page.
- **Do not write your solutions on pages that say "Do not write on this page"**. Answers written on these pages will not be graded.
- **When time is called, STOP** writing, immediately **CLOSE** your exam packet and hold it up until it is collected by one of the GSIs.

Do NOT open this test until instructed to do so.

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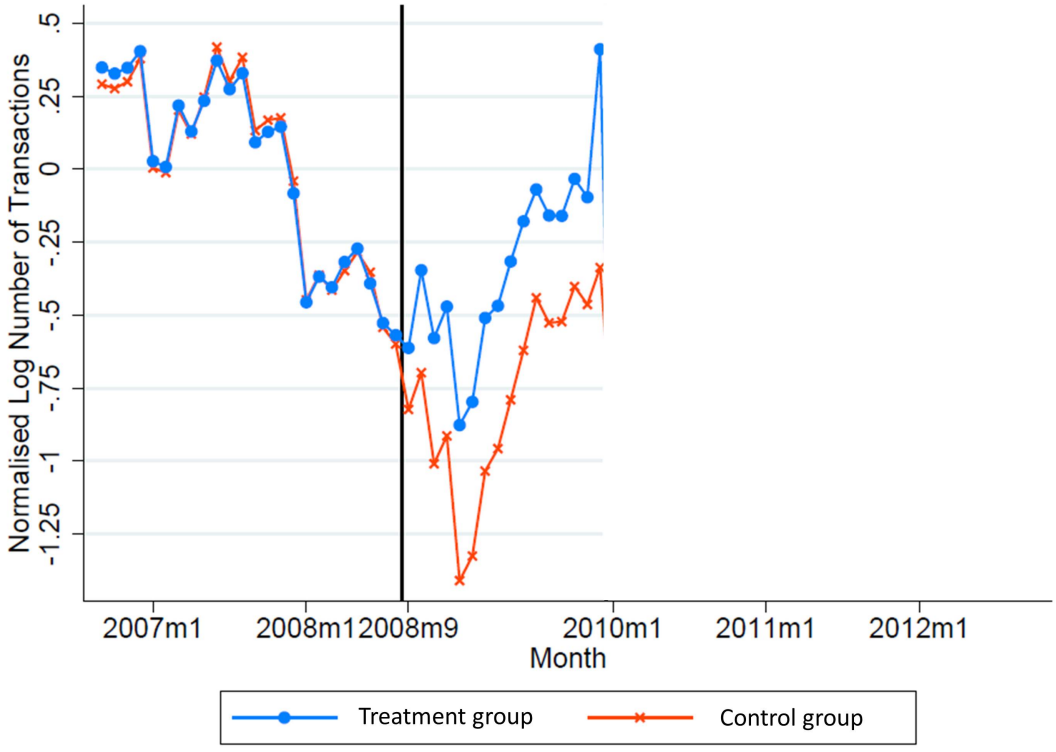
1. True/False/Uncertain (questions 1a-e) and Short Answer (question 1f) (15 points, 2.5 points per question.)

Explain your answer fully based on what was discussed in class, since all the credit is based on the explanation. Your grade depends entirely on the substance of your justification, not on whether you are correct in writing "True" or "False". Note that it is possible to answer each question for full credit with three sentences or fewer, and answers longer than ten lines long will not be graded.

(a) The graph below plots an outcome of interest (the number of house sales) before and after a treatment (a reduction in Britain's tax on house sales) for a treatment group (affected houses) and a control group (unaffected houses). The vertical black line indicates the timing of the treatment. The authors want to compute a difference-in-differneces (DD) estimate of the effect of the tax change on the outcome of interest, using data points from before and after the tax change and across the two groups. The graph suggests that the DD identifying assumption is valid (i.e. a DD estimate can be trusted in this case). [Completely ignore the fact that the right half of the graph didn't get printed.]

Figure 11: Effects of the Stamp Duty Holiday Stimulus



PLEASE ANSWER THIS QUESTION ON THE NEXT PAGE OF YOUR EXAM BOOKLET

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(a) Please write your answer to problem (a) (See question on previous page)

(b) If Ricardian equivalence holds, then increased government debt will not crowd out investment.

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(c) Consider a tax system in which each person has to pay a tax equal to \$100 plus 30% of her income z. There are no transfers. Thus each person's tax liability T(z) can be written as: $T(z) = 100 + .3z$. This is a progressive tax system as defined in lecture.

(d) It is true that the United States has higher levels of income inequality than other countries like Canada, but at least the United States has higher rates of intergenerational income mobility than Canada. (In your answer, make sure to spend one sentence defining intergenerational income mobility.)

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(e) There is no theoretical explanation for why the 2003 dividend tax cut was found to have not increased investment.

(f) SHORT ANSWER: A real news article reported last week: "The IRS (the U.S. tax collection authority) is investigating how the Facebook Corporation valued assets that it sold to its Irish subsidiary. The IRS is arguing that Facebook sold those assets for billions of dollars less than they were actually worth, allowing Facebook to save billions of dollars in taxes." Briefly explain how Facebook could have reduced its taxes by selling assets at an undervalued price to its Irish subsidiary. To be concrete, assume that the asset that Facebook Corporation sold to its Irish subsidiary was the right to sell Facebook ads in Europe.

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2. Exercise - Taxation and Labor Supply (15 points)

Andorra is comprised of a population of 1000 individuals with identical preferences and wages. Each individual has 720 hours per month to allocate to labor and leisure. Let l denote leisure and let w denote the hourly wage. The price of consumption c is \$1. In all graphs for the remainder of the exam, carefully label the intercept points and any kinks or discontinuities. Everyone in Andorra has the same utility function:

$$U = c - \frac{1}{2}(720 - l)^2$$

Suppose that the Andorran government decides to impose a linear tax rate t on all labor income earnings.

(a) Draw the budget constraint in consumption-leisure space for a single person living in Andorra, both before and after the tax rate is implemented. **For the purposes of graphing the budget constraints only**, assume that $w = 20$ and $t = 0.4$. Draw both budget constraints on the graph provided below. (2 points)

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(b) Write the budget constraint of an individual with wage w facing tax rate t. (1 point)

(c) Solve for the optimal choices of c and l for a person facing the budget constraint calculated in (b). (2 points)

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(d) What is the total tax revenue generated by this tax, as a function of t and w? (1 point)

(e) What is the revenue-maximizing tax rate t, as a function of w? (1 point)

(f) Now, think about the actual country of Andorra (that is, ignore the previous statements about utility and wages). Suppose that the government of Andorra decided to implement a linear tax, and suppose that everybody in Andorra works. Given your knowledge of the empirical literature, would you expect bunching at any point in the income distribution for self-employed workers? (1 point)

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Now, suppose the government of Andorra wants to encourage work, and so instead of a linear tax, it creates a subsidy program similar to the EITC but with no plateau: They give a 50% subsidy for every dollar of earnings up to \$500 (giving a maximum subsidy of \$250). Then, this subsidy is phased out at 25% rate, that is, for every dollar earned beyond \$500 the subsidy check is reduced by \$0.20. Once the subsidy is fully phased out, there is no additional tax or subsidy.

(g) Draw the budget constraint for a single worker when the government implements the subsidy program. As before, assume that $w = 20$. (1 point)

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(h) Consider the effect of the proposed subsidy program on labor supply for a worker initially earning \$500 (before the subsidy program came into effect). What direction (positive/negative) is the substitution effect on labor supply? What direction (positive/negative) is the income effect on labor supply? What is the net effect of the subsidy program on labor supply for this worker? (2 points)

(i) Suppose that an Andorran worker has a wage of \$20/hour. Write out their budget constraint after the subsidy program comes into effect. (1 point)

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(j) Suppose individuals have the same utility function described before, ($U = c - \frac{1}{2}(720 - l)^2$) and earn a wage rate of \$20 per hour. Solve for a single individual's optimal labor supply and consumption. (2 points)

(k) Now, think about the actual country of Andorra (that is, ignore the previous statements about utility and wages). Suppose that the government of Andorra decided to implement a subsidy program like the one defined in (g), and suppose that everybody in Andorra works. Given your knowledge of the empirical literature, would you expect bunching at any point in the income distribution for self-employed workers? (1 point)

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Solutions to Problem 1:

(a) TRUE. The DD identifying assumption is that in the absence of the treatment, the outcome would have evolved similarly for both the treatment and control groups. In other words, the control group needs to be a good counterfactual for the treatment group: in the absence of the treatment, we need to believe that the treatment group's outcomes would have evolved similar to how the countrol group's outcomes actually evolved. The main way to validate this assumption is to look for parallel (common) trends between the treatment and control groups, before the treatment. This graph (from Best and Kleven "Housing Market Responses to Transaction Taxes") shows extremely parallel trends before the treatment.

(b) TRUE. If Ricardian equivalence holds (i.e. each person acts like a dynasty on behalf of their descendants), then people will realize that an increase in government debt will have to be paid by their descendants in the future in the form of higher taxes. People will therefore increase their savings by exactly the amount that government debt (borrowing) increased. Since savings = investment + government borrowing, investment will not fall (i.e. investment will not be crowded out). [However, the evidence suggests that Ricardian equivalence often does not hold in reality as mentioned in lecture.]

(c) FALSE. This is a regressive tax system. A progressive tax system is defined as one in which the average tax rate T(z)/z rises with income. Here, the average tax rate falls with income.

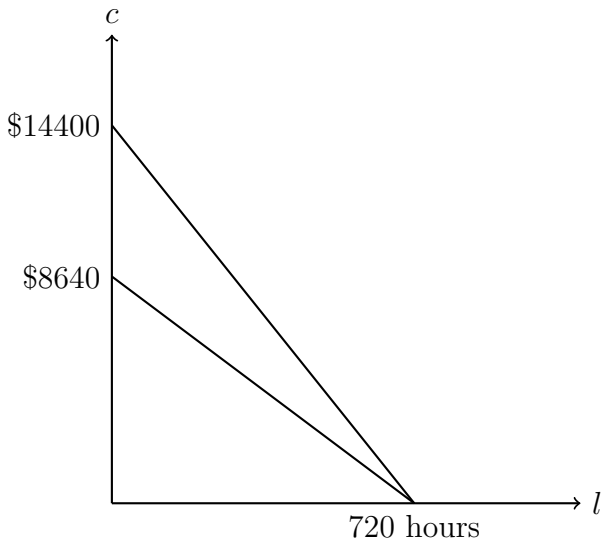
(d) FALSE. The evidence from Chetty-Hendren-Kline-Saez (2014) and Corak and Heisz (1999) cited in lecture shows that Canada has higher rates of intergenerational mobility than the United States. Intergenerational mobility was defined in lecture (to be comparable across countries) as the share of children whose parents' incomes were in the bottom quintile of the income distribution grow up to have income in the top quintile of the income distribution. The figure is 7.5% in the United States and 13.5% in Canada. [You didn't need to have cited the authors or to have remembered the exact numbers. It's acceptable to have defined the measure of intergenerational mobility without the specifying quintiles, e.g. the share of poor kids who grow up to be high-earners.]

(e) FALSE. In the new view of dividend taxation, a dividend tax cut increases the post-tax return on investment by the exact same factor $(1 - t_{div})$ that it reduces the opportunity cost of investment (the return on savings outside the firm). Thus the firm does not change its optimal choice for investment when the dividend tax is cut. [You could have also said that that traditional view can explain the zero effect of the 2003 dividend tax cut, since the government perhaps could not commit to future low dividend tax rates, or because the cost-of-capital elasiticity of investment is in fact so small (i.e. firms' gross profit function F(K) is so concave) that the effect on investment was basically zero.]

(f) By selling assets at an undervalued price to its Irish subsidiary, Facebook Corporation will report lower income to the IRS and higher income to the Irish tax authority. The Irish corporate tax rate is lower than the U.S. corporate tax rate, so Facebook will save on taxes—at least if it can repatriate (bring back) its Irish profits to the California headquarters at a low rate such as during a repatriation tax holiday. [Note: The article's wording was amended here in order to make it clearer for the exam. The original article is at: `https://www.ft.com/content/1aa579fa-9012-11e6-a72e-b428cb934b78`. Here's a related article that you don't need a subscription in order to view: `https://bol.bna.com/facebook-continues-fight-over-u-s-taxes-after-ireland-move/`.]

Solutions to Problem 2:

(a) Solution graph:



(b) The budget constraint is given by $c = (1-t)w(720-l)$.

(c) The utility function is given by $U = c - \frac{1}{2}(720-l)^2$. Plugging in for c from the budget constraint and differentiating with respect to l yields

$$0 = -(1-t)w + (720-l)$$

This implies that the optimal choices of l and c are given by

$$l^* = 720 - (1-t)w$$
$$c^* = (1-t)^2w^2$$

(d) The total tax revenue generated is given by $T = 1000[tw(720-l)]$, since $720-l$ is the total labor hours of an individual, and there are 1,000 individuals. Substituting in the optimal leisure decision from part (c), we get: $T = 1000(t(1-t)w^2)$.

(e) Differentiating, we get

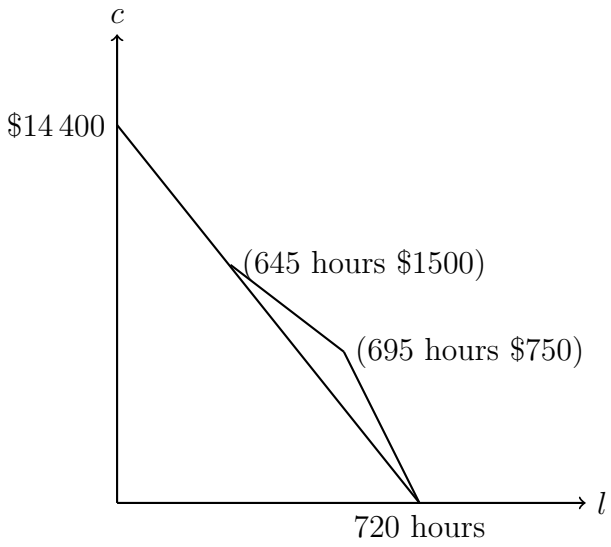
$$\frac{\partial T}{\partial t} = 1000\big[(1-t)w^2 - tw^2\big]$$

Setting this expression equal to 0 yields:

$$0 = (1-t)w^2 - tw^2$$
$$t^* = \frac{1}{2}$$

(f) There are no kinks or notches, so we do not expect bunching at any point in the income distribution. It would also be acceptable to say that self-employed workers earnings may bunch at zero reported income because it is hard for the IRS to observe workers' true earnings (since their earnings are not also reported by their employers), which means they are able to cheat and report zero income without fear of repercussions.

(g) Solutions Graph



(h) Note: Some astute test-takers noticed that working 500 hours would put someone at the kink in the budget set, where wages are "undefined". This was not the intention, and was the results of a typo. In grading this question, we gave one point for correctly identifying the income effect, which is negative (because the $250 subsidy makes people "richer", which induces them to work fewer hours). However, since the substitution effect is technically "undefined" at the kink, we instead decided to take a lenient stance and accept any combination of substitution effect/total effect which was internally consistent. Some examples:

- If you said you used the "phase-in" part of the figure, then wages are higher, substitution effect is positive, and thus total effect is ambiguous (or positive if you cited

empirical research from Chetty-Friedman-Saez (2013) documenting that the substitution effect is greater than the income effect for the US EITC)

- If you said you used the "phase-out" part of the figure, then the substitution effect and total effects are negative.
- Some students said the substitution effect was zero because they are at the kink. We accepted this if you also said the total effect was negative.

(i) The budget constaint is:

$$\begin{aligned} c &= 30 * (720 - l) && if \quad 695 \leq l \leq 720 \\ c &= 15 * (695 - l) + 750 && if \quad 645 \leq l \leq 695 \\ c &= 20 * (720 - l) && if \quad l \leq 640 \end{aligned}$$

(j) From before, we know that $l^* = 720 - (1 - t)w$. Thus, if $t = -.5$ (segment 1), then $l^* = 690$. This is lower than 695, and so is not feasible in the first segment. If $t = .25$ (segment 2), then $l^* = 705$. This is higher than 695, and so is not feasible for the second segment. If $t = 0$ (segment 3), then $l^* = 700$ which is too high for segment 3.

Since optimal leisure is "too high" for segment 1 and "too low" for segment 2, then consumers will bunch at the kink. Optimal leisure is 695 hours, optimal consumption is \$750, and optimal labor supply is 25 hours.

(k) Yes, we would expect people to bunch at the point where leisure is 695 and consumption is \$750. This is based on evidence from Chetty-Friedman-Saez (2013) cited in lecture which showed that people tended to bunch at the lower kink point of the US EITC, where the total subsidy from the EITC went from positive to zero (and the overall tax rate went from a net subsidy to a net tax after factoring in other taxes on self employment earnings).