Development ECON 2273 Problem Set 6

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Spring 2017

Answer Key

1. **Some simple BMI calculations.** Calculate the BMI, and (approximately) the relative mortality risk based on comparing the iso-mortality risk curves from Fogel figure 4 for each of the following people. Keep in mind that the curves are actually being calculated based on data for older males and so the results are not particularly reliable. If the person is off the charts, try to figure an approximate mortality.

   (a) Kate Moss kicked off the "heroin chic" trend with a Calvin Klein campaign in 1993. She was 5'7" and approximately 100 lbs (170 cm and 45.4 kg) give or take a piece of celery.

   Answer: Kate Moss is off the charts unhealthy. My guess puts her someplace around 3.4 relative mortality risk (but wide uncertainty).

   (b) Mike Huckabee, the former governor of Arkansas, famously discovered he had type 2 diabetes and started a weight loss campaign, eventually running a marathon. He says he has continued to struggle with his weight. At his heaviest he weighed approximately 300 lbs (135 kg) and is 5'11" (180 cm) tall.

   Answer: Huckabee is also off the chart unhealthy. Seems be someplace around 2.4 or so relative mortality risk.

   (c) The average Indian man is about 165 cm (5'5"). What weight should the average Indian be to have the smallest mortality risk?

   Answer: Around 72 kg or around 160 pounds.

2. **Enforcement of ROSCAs** Rotating Savings and Credit Associations are a common way for the poor to save and get big lump sums. But ROSCAs have many of the same problems that plague credit in general. Suppose 10 women come together, each of them put in $20 a month, and they pick the first person to get the $200. All of them can invest in a goat whose milk they will sell. The goat provides an income of $30 a month. Income from other sources is $60 a month. They consume all income that they are not saving, or putting into the ROSCA.

   (a) Suppose all of the women in the group must save separately. They each save $20 a month for 10 months, and then each buys a goat which adds to her income (buying the

goat does not count as consumption), and then they consume all of income from then on. What is the average consumption of the group over the 10 months that they are saving, and after each owns a goat?

Answer: First 10 months \$40. Afterwards \$30 + \$60 =\$90 (since no longer saving and have goat). \$70 in consumption (they keep on saving) is a fine answer as well.

(b) Now suppose that they form a ROSCA and give the \$200 the first month to one member, and so on until they have all received \$200 and each bought a goat. Calculate average consumption of the group for each month. Remember that the person who gets the money first must keep on contributing afterwards, but has a higher income. Did the ROSCA help the group on average?

Answer: Month 1: (9*40+1*70)/10= 43, Month 2: (8*40+2*70)/10=46, . . . , Month 9: 67, Month 10: 70. (It is fine to be shifted by one month, it depends on how you chose to define the timing of the model). The ROSCA definitely helped the group on average. They had higher average consumption for 10 months.

(c) The last member of the group only gets the \$200 after 10 periods. Once she learns that she is last, does she prefer saving or being in the group, or is she indifferent? Before they hold the lottery and find out who goes first and last, are any of the women indifferent about joining?

Answer: The last member of the group is indifferent. She consumes \$40 dollars for 10 months, and then 70 whether she saves or joins the group. But before they are randomly assigned an order she could be in any place in the order. The average consumption for everyone over the 10 months is \$56.5 which is much higher than \$40. And the first person is much better off.

(d) Now consider the incentives of the first person to get the payout. She has to show up for the next nine months and pay \$20, otherwise the scheme falls apart. Suppose the only threat the group has is that they will kick her out if she does not pay into the group, and she will not be eligible for the next round of the ROSCA. If she is kicked out of the group, she can still save \$20 dollars for the next 10 months. Given her outside option, is being kicked out bad for her? Will she take the \$200 and run? Can the group form under such incentives?

Answer: Assuming the scheme continues, the first person will not get a payout for 10 months (after her payout, the first person becomes the last person—the order *rotates*). So she is indifferent between saving and being in the ROSCA. So being kicked out is not bad for her. Alternatively, if the ROSCA finishes after 10 months, then she has to pay \$180, but gets no benefit at all. A group cannot form under these circumstances.

(e) Now suppose these women are all neighbors. Someone who reneges on her commitment to the group will be socially ostracized. What is the smallest dollar value of the social cost that convinces the first person to get the payout to show up the next month? Does your answer explain why ROSCAs are common in poor villages or communities where everyone knows each other and the savings are small, but virtually unknown in rich anonymous cities where the savings are large?

Answer: If the group does not continue, to keep the first member from absconding with the payout and never contributing, the social cost of must be at least \$180. So to

work the social cost has to be as large as the loan from the group (since she put in $20 upfront, the amount the first person gets from the group is $180). The social cost then limits the loan size. If the ROSCA continues, then she might have some value from staying in, and so the social cost would be less (we could calculate that value, it is the net present value just as we calculated the benefit of education). But if the group ever stops, the person who gets the payout 10 months before the ROSCA will end still has to be pressured into staying in the group—at a cost of $180. (You don't need to know all of that, but it shows how interesting these arrangements can become.)

Small, tightly knit, communities may have large social cohesion, and the cost of stealing from your neighbors may be high, at least compared to the savings ($180 may be a good fraction of a yearly income, but it is reasonable to believe that not having your neighbors hate you is valuable as well). In anonymous rich cities, where the residents may want to save much more compared to their incomes, it seems less likely that such a scheme would work.

(f) A ROSCA is a group coming together to make a loan to one member. Why does a ROSCA work when a formal banking institution would not be able to make the same loan? What mechanism do microcredit institutions use that is similar?

Answer: Banks cannot impose the "social cost" of default, and so are not able to create the same contract to force repayment. Microcredit typically uses group lending. With group lending the costs of default are imposed on the group (either through joint liability or through denial of future credit). In both cases the group acts as a form of social capital—it makes default more costly, which makes repayment more likely, which makes lending possible.

3. **Aid around the world** Go back to www.gapminder.org. Plot income per person on the x-axis, and aid received per person on the y-axis (aid variables are under the economy section when you click on the y-axis variable) .

(a) One might suppose that aid should go to the most needy. Is there any support for this supposition? Ignoring the many countries who get zero and so are not plotted, does there seem to be much of a relationship between income and aid?

Answer: There does not appear to be any strong relationship that poorer countries get more aid.

(b) Follow Zambia and South Korea over time. From these two paths, is it possible to conclude whether aid has any effect on growth? Explain how the path of Zambia makes it difficult to conclude that aid is always good for growth.

Answer: Zambia appears to stay in the same place over time, it just gets more aid, whereas South Korea received the same amount of aid but grew (it stopped receiving aid, and kept growing, but that path is not shown).

(c) Now plot aid given as % of GNI on the y-axis. Which country gives the least aid (as % of GNI) of those listed? Approximately how many countries have higher Income per person than this country (note income per person is not in terms of PPP)?

Answer: The US gives the least aid as % of GNI, but only three countries appear to be richer.

(d) Now plot "Aid Given" on the y-axis, which shows the total dollar amount of aid. Which country gives the most aid of those listed? Approximately how many times larger is the amount of aid this country gives compared to the next most generous country?

Answer: But the US gives the most aid in total, twice as much as the next most generous country.

4. **Calculating the risk premium.** Suppose the cost of funds to a money lender is 20% and a lender is considering making a loan of \$100. For each situation calculate the minimum interest rate at which the lender is willing to make the loan.

(a) The borrower will repay the loan with interest with probability 1/2 and nothing with probability 1/2.

Answer: For each part write out the expected return for the lender. The minimum interest rate the lender will accept is an interest rate that makes the expected return zero. Then plug in the numbers and solve for i.

$$E[\pi] = p[(1+i)L - (1+r)L] + (1-p)[0 - (1+r)L] = 0$$

Plugging in $L = 100$, $r = .2$, $p = 1/2$ and solving for i gives $i = 1.4$ or 140%.

(b) The borrower will repay the loan with interest with probability 1/2 and only the principal (no interest) with probability 1/2.

Answer: Now the borrower pays back something in the bad state.

$$E[\pi] = p[(1+i)L - (1+r)L] + (1-p)[L - (1+r)L] = 0$$

The loan size cancels. Plugging in $L = 100$, $r = .2$, $p = 1/2$ and solving for i gives $i = .4$ or 40%.

(c) With probability 1/3 the loan and interest is repaid, probability 1/3 only the principal is repaid, and with probability 1/3 nothing is repaid.

Answer:

$$E[\pi] = (1/3)[(1+i)L] + (1/3)[L] + (1/3)[0] - (1+r)L = 0$$

The loans cancel. Solving for i gives $i = 1.6$ or 160%. That is higher than in (a) since although now you get paid something more often, you get paid in full less frequently.