Economics 70, Personal Finance:
Making Better Decisions and Building a Better Financial System

Practice questions for final exam

Instructions for the exam:

- **The exam will be in class on Thursday, December 2.**

- **There will be 5 questions. You should attempt all of them and should not spend too much time on any one question.**

- **The last part of the course will be emphasized in the exam, but the exam will also test your knowledge of material that was presented earlier in the course and was already tested in the two midterm exams. The practice questions are drawn primarily from the last part of the course because you have not had so much opportunity to practice this material.**

- **You may use a smartphone or other calculator but should not use any other tools or materials. You will need a scientific calculator that can raise numbers to large powers and can give you the logs of numbers (remember that we use natural logs, sometimes written ln, in this course).**

Tips about the exam:

- **You are not expected to memorize formulas, but you will be asked to apply some formulas as stated in questions, and to explain some of their properties.**

- **You are responsible for the following readings, and questions may be asked about their content:**

    - **Mullainathan, Noeth, and Schoar, "The Market for Financial Advice: An Audit Study".**
    - **Sunstein, "Nudges that Fail".**
    - **Sydnor, "(Over) Insuring Modest Risks".**

1. Quick warm-up calculation

Calculate the real interest rate for a nontaxable investor when (i) the nominal interest rate is 0% and the inflation rate is 6%, and (ii) the nominal interest rate is 6% and the inflation rate is 6%. Calculate the after-tax real interest rate for a taxable investor who pays tax at rate 1/3 on nominal interest, in the same two scenarios. In which scenario does taxation lower the real interest rate that an investor receives? Explain.

2. Rolling over a traditional IRA to a Roth IRA

You have a traditional IRA with $30,000 from past contributions and capital income that you have earned in the account. This year you have unusually low income because you are between jobs, so you estimate that your tax rate is 20%. You expect that in retirement, your tax rate will be 30%. You plan to retire in 10 years, and at that time you plan to withdraw the money in the IRA and consume the proceeds. Over the next 10 years you expect to earn 5% per year on the assets in the IRA. You do not plan to make further contributions to the IRA during this 10-year period.

You learn that you have the right to convert your traditional IRA to a Roth IRA. If you do this, you pay tax on the total value of the traditional IRA today, but then invest your remaining funds free of taxation on future capital income and any future withdrawals.

a) If you keep your traditional IRA, how much can you consume in 10 years when you withdraw the funds?

b) If you convert your traditional IRA to a Roth IRA, how much tax do you have to pay this year, and how much can you invest in the Roth IRA?

c) If you convert your traditional IRA to a Roth IRA, how much can you consume in 10 years when you withdraw the funds?

d) Comment on any difference between your answers in parts a) and c). Be sure to explain which features of this example are responsible for any difference.

e) Are there any other reasons besides a difference in income that might lead you to expect a different tax rate in 10 years than now?

3. Retirement saving with a deferred payout annuity

In this question you will use the annuity formula,

$$PV = \frac{X\left(1 - \left(\frac{1}{1+i}\right)^n\right)}{i}.$$

After many years of saving in a traditional 401(k) account, you have reached age 70 and are planning your retirement. Since you know you should take account of inflation, all numbers given in this question are in real (inflation-adjusted) terms. You want to be able to spend $80,000 per year in retirement. You expect your tax rate to be 28%, and you expect to receive Social Security benefits of $2,000 per month after tax for the rest of your life.

a) To handle the risk of living past age 85, you withdraw funds now from your 401(k) to buy a deferred payout annuity which pays an inflation-adjusted $2,400 per month for each $100,000 invested, starting in 15 years. How much money do you need to withdraw from your 401(k) to buy an annuity that meets your spending goals after age 85?

b) You plan to fund your spending needs for the next 15 years by withdrawing money each year from your 401(k) account. You expect to earn a real return of 3% per year on your 401(k) investments. Use the annuity formula to calculate the value you need to keep in your 401(k) to fund your 15 years of spending.

c) Putting parts a) and b) together, how much do you need in your 401(k) to implement your retirement plan? (Hint: remember that you have a traditional 401(k) account.)

4. Adjusting asset allocation to your age

You are saving for retirement in a 401(k), starting with a $15,000 contribution at age 25. You expect the balance of the 401(k) to grow at 10% per year, because of both contributions and investment returns, until you retire at age 65.

a) What do you expect the balance of your 401(k) to be when you retire?

b) You are planning your asset allocation and you decide to have 1/3 of the account in equities and the rest in safe fixed-income securities when you retire. What do you expect to have invested in equities when you retire?

c) You decide that you want to come as close as you can to a constant dollar allocation (not proportional allocation) to equities during your working life. However, you know that you cannot use leverage in your 401(k) so the largest possible proportional allocation to equities is 100%. Show that you hold 100% in equities for the first part of your working life, and then decrease the equity share for the second part of your working life until it reaches 1/3 at age 65.

d) How old will you be when you stop holding 100% in equities?

e) What is the argument for keeping a constant dollar allocation to equities over your working life?

f) Use your answers to earlier parts of this question to explain the popularity of target date funds in retirement savings.

5. Adverse selection and insurance demand

In sections we showed that in the standard economists' model of marginal utility we have already used to discuss consumption smoothing and financial risktaking, each person will demand enough insurance to set $w_0 - w_{Loss} = m/\gamma$, where w_0 is log wealth at the time insurance is purchased, w_{Loss} is log wealth in the event of a loss including the value of any insurance payout, m is the proportional excess of the insurance premium over the actuarially fair value for this person, and γ is the person's coefficient of risk aversion. Since the change in log wealth is approximately equal to the proportional change in wealth, this formula can be restated as saying that each person sets the fraction of wealth lost in the event of a loss, after accounting for insurance, equal to the ratio m/γ.

Note two limitations on the application of this formula. First, it applies only if m is positive. If m is negative, then the person will buy full insurance and set $w_0 - w_{Loss} = 0$, but is not allowed to overinsure to make $w_0 - w_{Loss}$ negative as the formula would suggest. Second, the formula does not apply if the fraction of wealth lost in the event of a loss, before accounting for insurance, is smaller than the ratio m/γ. In this case the formula would suggest buying a negative amount of insurance but this is also not possible.

a) Suppose there is a health condition that will cost you 10% of your wealth if left uninsured. The probability that any individual has the condition is 1.5%. For simplicity, assume the real interest rate is zero. What is the actuarially fair premium for a dollar of insurance against this condition?

b) Now suppose there are three groups in the population, of equal size. The first group has a 1% probability of having the condition, the second group has a 1.5% probability, and the third group has a 2% probability. Members of each group know which group they are in, but an insurance company cannot tell. The insurance company sets the insurance premium equal to the actuarially fair level under the assumption that their customers are randomly drawn from the whole population. What is the premium?

c) With this premium, what value of m do people in each of the three groups perceive? (The answer is different for each group.)

d) Assume that people in all three groups have a risk aversion coefficient of 5. How much insurance do people in each group buy?

e) Now suppose the insurance company recalculates the insurance premium. In order to break even the insurance company sets the premium to the actuarially fair level for its pool of customers, given the insurance demands of the three groups you calculated in part d). What is the premium now?

f) Without doing the calculation, discuss how each of the three groups will alter their behavior if the insurance premium changes to the level in part e). Does the insurance company break even with that insurance premium? Where do you think the process of insurance premium adjustments ends up?

6. Financial advice

Mullainathan, Noeth, and Schoar show this table:

Table 4: Advisers' initial reaction and (non-) supportive recommendations in different treatments

	Overall Sample	Chasing Returns	Company Stock	Index Funds
Is the adviser *supportive* of the current strategy?	13.11	19.41 (39.74) 0.007	9.68 (29.81) 0.0341	2.44 (15.62) 0.024
Is the adviser *against* the current strategy?	67.48	59.22 (49.38) 0.011	69.35 (46.48) 0.707	85.37 (35.78) 0.006
Inital reaction positive	16.99	16.50 (37.30) 0.854	12.90 (33.79) 0.308	24.39 (43.48) 0.160
Inital reaction negative	39.81	23.30 (42.48) 0.001	56.45 (49.98) 0.001	56.09 (50.24) 0.017
#observations	214	103	62	49

a) Briefly explain the design of the research study, including what the three column headings "Chasing Returns", "Company Stock", and "Index Funds" refer to.

b) Mullainathan, Noeth, and Schoar argue that the first two rows of this table are inconsistent with the view that financial advisers help people make good decisions (judging good decisions from a similar perspective to this course). Explain their argument.

c) Is there any puzzle about the relationship between the second two rows of the table and the first two rows? If so, how do Mullainathan, Noeth, and Schoar explain the puzzle?

d) Mullainathan, Noeth, and Schoar suggest that financial advisers are pursuing their own financial interest rather than their clients' financial interest. Explain the argument they make.

e) What is the fiduciary standard? Does it help resolve the problem in part d)?

7. Short questions

Briefly define each of the following terms, and then answer the specific additional question about each one.

a) *Present bias*. What type of present biased consumers demand commitment devices?

b) *The winner's curse*. How is this phenomenon related to overconfidence?

c) *Base rate neglect*. How does it relate to Bayes' Law?

d) *The breakeven inflation rate.* What type of bonds should you buy if you believe inflation will exceed the breakeven inflation rate?

e) *The LTV ratio.* Is this the only limit on the amount you can borrow for a mortgage?

f) *Stablecoins.* How do these differ from other types of cryptocurrencies, and how confident can you be that they will live up to their name?

g) *CARD Act disclosure.* What disclosure is mandated by the CARD Act, and what has it achieved?