**Homework**

**1 MUTUAL FUND PERFORMANCE**

Please attach your R script to your submission.

1. Load the data in mf\_data.rdata

2. Aggregate net assets, net returns, and gross returns at fund level.

3. Restrict the dataset to dates between January 1995 and December 2019.

4. Consider net returns.

(a) Further restrict the dataset to mutual funds with at least 12 non-missing net return observations during that period.

(b) Compute the net alpha of each mutual fund using a four-factor model. Store them in a data table.

(c) Provide a (nicely formatted) histogram showing the distribution of the four- factor alpha. What are the average and median alpha?

5. Consider gross returns and repeat the same steps as above, replacing net returns with gross returns.

**2. TRUE/FALSE/UNCERTAIN**

Justify your answer: Your grade depends only on the justification for your answer.

1. The past returns of a fund are an indication of the fund manager’s ability.

2. Because investors chase past performance even if performance is not persistent, the government should manage (a fraction of) investors’ savings through a public pen- sion system in order to increase the value generated by these savings.

**3. HEALTH INSURANCE PLANS**

In class, we studied how to offer contracts to screen good and bad managers. In this question, we apply the same logic to understand how health insurance companies can screen policyholders based on their preexisting conditions.

A person can be healthy (H) or have preexisting conditions (S). A person may incur medi- cal expenses M = $10, 000 with a certain probability. A H person incurs medical expenses with probability p^H=0.2, whereas a S person incurs medical expenses with probability p^S = 0.4.

A health insurance company offers two plans: plan 1 and plan 2.

• Plan 1 is a high-deductible plan. The plan covers medical expenses M after a de- ductible D (equal to an amount you will determine below). With this policy, if the policyholder incurs medical expenses, the policyholder will pay the deductible D, and the insurance company will pay the remaining M − D.

• Plan 2 is a full-coverage plan. The plan covers the entire amount of medical ex- penses M.

Let us assume that, if a person chooses plan 1, this person also experiences a personal cost (expressed in dollar terms) c = $1, 400. Think of this as the cost of being stressed because one is not fully insured. This cost is not too large, that is

1,400=c≤(p^S −p^H)M =2,000

Suppose the insurance company could offer different prices for the same plan based

on whether the person is H or S.

(a) What are the fair prices of plans 1 and 2 for an H person? What are the fair prices of plans 1 and 2 for a S person? [Note: The insurance company does not incur any cost of stress c.]

(b) What is the total expected cost of healthcare for the two persons under the two plans? Which plan would both persons choose?

[Hint: The total expected cost of healthcare includes the plan price, the (expected) de- ductible (if any), and the cost of stress (if any).]

(c) Based on your previous answers, what is the total expected cost of healthcare for H and S people after they choose the plan they prefer?

2. Legislation in the US forbids the insurance company to charge different prices for the same plan on the basis of preexisting conditions. However, the insurance com- pany can design the two plans so that H people selects plan 1, whereas S people select plan 2.

(a) The insurance company sets the price of plan 1 based on the assumption that only H people select plan 1. What is the fair price of plan 1? What is the total expected cost of healthcare for a H person that selects plan 1?

(b) The insurance company sets the price of plan 2 based on the assumption that only S people select plan 2. What is the fair price of plan 2? What is the total expected cost of healthcare for a S person that selects plan 2?

(c) What would be the total expected cost of healthcare for a S person that chooses plan 1? [Note: The insurance company cannot charge this person more because of preexisting conditions. Therefore, the insurance company keeps pricing plan 1 under the assumption in 2.a.]

(d) Compareyouranswersto2.band2.c.Underwhichconditiononthedeductible (D) does a S person prefer plan 2 over plan 1?

(e) Showthat,giventheconditioninequation(1),aHpersonprefersplan1toplan 2. [Note again: The insurance company cannot price plan 2 differently based on preexisting conditions (or lack thereof.) Therefore, the insurance company keeps pricing plan 2 under the assumption in 2.b.]

(f) Suppose the deductible in plan 1 satisfies the condition you derived in 2.d. What is the total expected cost of healthcare for H and S people after they choose the plan they prefer?

(g) Intuitively, why do H and S people select different plans?

3. Compare the results in part 1 and 2 of this question.

(a) Explainwhytheinsurancecompanyisstillable(inpractice)tochargedifferent prices based on preexisting conditions.

(b) Compare your answers in 1.c and 2.f. Does the legislation reduce total health- care costs for people with preexisting conditions? What happens to total health- care costs for healthy people? Provide an intuitive explanation for these changes (or lack thereof.)

**4. CAREER CONCERNS**

In class, we studied how investors can incentivize a portfolio manager to exert effort using performance- based contracts. Here, we study how career concerns may also motivate the manager to exert effort.

A manager is currently employed in a mutual fund at a fixed wage w = 100. The manager could exert effort (e = 1) or shirk (e = 0), but the manager suffers a cost of effort D = 10.

The mutual fund can generate positive or negative profits for investors, and the prob- ability of a positive profit depends on the manager’s effort:

R ̄ wp p(e)

R= −R ̄ wp1−p(e) R=1,800.

With effort, the probability of a positive profit is p(1) = 23 . Without effort, the probability of a negative profit is p(0)= 1/3,so that ∆≡p(1)−p(0)= 13.

The future career opportunities of the manager depend on the manager’s performance in the mutual fund. If the manager produced profits, the manager will be hired at a hedge fund with probability π. At the hedge fund, the manager will earn a much higher wage w ^H > w. Therefore, the expected future wage of a well-performing manager is w∗ =w+π(w^H −w).

If the manager produced losses, the manager will remain in the mutual fund industry at the same wage w.

1. What is the expected (lifetime) payoff of a manager that exerts effort?

2. What is the expected (lifetime) payoff of a manager that shirks?

3. Suppose (just hypothetically) that wH − w = 0. Would the manager exert effort?

4. Under what condition on π(wH − w) will the manager exert effort?

5. Explain why the expected difference in future wages π(wH − w) is analogous to the bonus we derived in class.

6. In what sense is the manager facing implicit incentives in this situation?

7. What could be the effect of a non-compete agreement on the incentives of the man- ager? Think of a non-compete agreement as a reduction in the probability of moving to a hedge fund, π.