SIMON FRASER UNIVERSITY
Department of Economics

Econ 815 | Prof. Kasa
Financial Economics, I | Fall 2021

FINAL EXAM
Due December 15, 6pm

Answer the following True, False, or Uncertain. Explain Why. 10 points each.

1. Idiosyncratic labor income risk increases the equity premium.
2. The fact that trading volume responds to public information (eg, earnings announcements) is evidence of heterogeneous priors.
3. According to Grossman-Stiglitz (1980), when the variance of noise/liquidity trading increases, asset prices become less informative.
4. Asset market bubbles cannot exist if investors are 'rational'.

Short answer questions:

5. (35 points). **Rare Disasters and the Equity Premium**. A dataset (excel spreadsheet) named Shiller-Ch26-data is posted on the course webpage. It contains annual data from 1871-2016 on stock returns, interest rates, and per capita consumption for the US economy. The only 3 columns you need are column H (the 1-year real interest rate), column I (real per capita consumption), and column P (real return on the S& P500). Note, since the consumption data only run from 1889-2009, in what follows just use this shorter sample when plotting and computing moments.

   (a) Use the consumption data to compute a series of consumption growth rates, C_{t+1}/C_t. Also, since the stock return data is in percentage units, add 1.0 to it to express in units of gross returns. Now display time-series plots of the interest rate, stock return, and consumption growth series. Calculate their means. What is the equity premium?

   (b) Using the procedure outlined in Lecture Slide 14 (pages 15-16) compute and plot the Hansen-Jagannathan bound (put μ_m on the horizontal axis and σ_m on the vertical axis. Also, compute the mean and standard deviation of the implied stochastic discount factor when agents have time-additive, CRRA preferences, with $\beta = .99$ and $\gamma = 1, 2, \cdots 40$. (Hints: Use the data on consumption growth and let the computer do the work!) Plot the theoretical stochastic discount factors along with the Hansen-Jagannathan bound. Your plot should resemble the one reported on page 17 of Lecture 14. Explain intuitively why increases in γ first cause the mean SDF to decrease, and then eventually causes it to increase.

   (c) Consider an economy governed by a 2-state Markov chain. Let State 1 denote 'normal times' and let State 2 denote a 'recession'. Let G_i denote (gross) consumption growth in state-i and R_i denote stock returns in state-i. Using this notation, we can write the investor's Euler equation as

$$1 = \beta \sum_{j=1}^{2} \pi_{ij} (G_j)^{-\gamma} R_j \qquad i = 1, 2$$

where π_{ij} denotes the probability of going from state-i to state-j. Assume that $\beta = .99$ and $\gamma = 5$. Also, assume that in recessions, consumption declines by 3% (ie, $G_2 = .97$) and that the probability of switching from expansion to recession is 8% (ie, $\pi_{12} = .08$) Next, calibrate the value of the π_{21} so that recessions occur every 10 years on average (Hint: the long-run probability of being in state 1 is $\Pi_1 = \pi_{21}/(\pi_{12} + \pi_{21})$ and the long-run probability of being in state 2 is $\Pi_2 = 1 - \Pi_1$.) Finally, calibrate growth during normal times, G_1, so that the model's mean consumption growth matches the data. (Hint: mean consumption growth is $\Pi_1 G_1 + \Pi_2 G_2$).

Given all these parameter values, use the (state-dependent) Euler equations to calculate state-dependent values for the risk-free rate and stock return. (Hint: you need to solve 2 simultaneous linear equations for the stock return). What is the mean equity premium?

(d) Now consider a 3-state economy, featuring a small probability of a disaster. Assume that when disasters occur, consumption declines by 30%. Also, assume that disasters only last 1-period, after which you return to normal growth (ie, $\pi_{31} = 1$), and that disasters only occur while in the normal state (ie, $\pi_{23} = 0$). Finally, assume that the probability of switching to a disaster is $\pi_{13} = .02$ and subtract .01 from each of the previously calculated values of π_{11} and π_{12}, so that probabilities continue to sum to 1. Now repeat the analysis in part (c) to calculate the mean equity premium. (Hints: (1) the long-run stationary distribution of a Markov chain is given by the eigenvector associated with the unit eigenvalue of the transition matrix. (2) Now you need to solve 3 simultaneous linear equations to get the stock return in each state).

(Hint: This question is based on a 2006 paper by Barro entitled "Rare Disasters and Asset Markets in the Twentieth Century" in the *Quarterly Journal of Economics*).

6. (25 points). **The Concentration of Aggregate Risk and the Equity Premium**. Consider an economy with two possible states, good and bad. Each state occurs with probability 1/2. In the good state, each individual's consumption is 1. In the bad state, a fraction λ of the population consumes $1 - (\phi/\lambda)$ and the rest consumes 1, where $0 < \phi < 1$ and $\phi \leq \lambda \leq 1$. Note that ϕ represents the fall in *average* consumption in the bad state, while λ measures how broadly that reduction is shared. For example, if $\phi = \lambda = 1/2$, then in the bad state aggregate consumption falls by 50%, but half the population loses nothing, while the other half loses everything.

Consider two assets (Arrow securities), one that pays 1 unit in the good state, and one that pays 1 unit in the bad state. Let P denote the price of the bad state asset relative to the good state asset.

(a) As in the Lucas (1978) model, the equilibrium price must adjust so that everyone is willing to consume their endowment. Before uncertainty is realized, individuals can buy and sell the two assets so as to equate expected marginal utilities across states. Write down the Euler equation that makes individuals indifferent between holding the good state or bad state asset. (Hint: In equilibrium, an agent can't make himself better off by selling the bad state asset, and using the proceeds to buy the good state asset).

(b) Use the result in part (a) to derive an expression for the equilibrium value of P. (Hint: Your answer should be in terms of $U'(1)$, $U'(1 - (\phi/\lambda))$, and λ.)

(c) Prove that if $U''' > 0$, then $\partial P/\partial \lambda < 0$. Explain what this means in words, and interpret this result economically. Do you think this might help explain the equity premium puzzle?

(Hint: This question is based on a 1986 paper by Mankiw entitled "The Equity Premium and the Concentration of Aggregate Shocks" in the *Journal of Financial Economics*).