Written Exam at the Department of Economics Summer 2020

Macroeconomic Risk Management
Final Exam

From July 22 10 AM to July 24 10 AM, 2020

Answers only in English.

A take-home exam paper cannot exceed 10 pages – and one page is defined as 2400 keystrokes

This exam question consists of 4 pages in total

The paper must be uploaded as one PDF document. The PDF document must be named with exam number only (e.g. '127.pdf') and uploaded to Digital Exam.

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- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text
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1 (20 points, not more than 150 words) Answer true, false, or uncertain. Justify your answer.

In financial markets with heterogenous investors, sudden bad news (like the outburst of a pandemic) would lead to a market collapse as most levered investors' net worth is wiped out, and to an inflow of new investors that lever to purchase the asset even if they face higher margins.

2 (20 points, not more than 150 words) Answer true, false, or uncertain. Justify your answer.

Politically chosen social security generates persistence as higher taxes today increase future expected taxes (by reducing after tax income, and thus increasing the marginal utility of future transfers). Since persistence is essential for intergenerational risk sharing, as this spreads current shocks onto future generations, this is evidence that social security increases welfare.

3 (20 points, not more than 150 words) Answer true, false, or uncertain. Justify your answer.

The introduction of risk sharing contracts in economies where individuals are exposed to transitory income shocks will reduce precautionary savings and increase the real risk free rate.

4 (20 points, not more than 150 words) Answer true, false, or uncertain. Justify your answer.

Because of their higher funding costs, banks that have a larger share of interest bearing deposits create more systemic risk than banks that have a larger share of non-interest bearing deposits.

5 (20 points, not more than 150 words) Answer true, false, or uncertain. Justify your answer.

When the entrepreneurs that are most productive in the use of a particular type of capital face incomplete markets due to imperfect commitment issues, a coordinated decision among them (say taken through a union or a cooperative) to increase initial investment increases social welfare.

6 (100 points) Consider an economy with two dates, $t \in \{0, 1\}$. There is a consumption good and a fixed supply of capital, $\bar{K}$. The economy is populated by a continuum of entrepreneurs and households, both of measure one. Both are risk neutral, value consumption in both periods and do not discount the future (i.e. $\beta = 1$).

Entrepreneurs have an endowment of capital in period 0 equal to K_0, are presumed to start with debt at level b_0 (this is legacy debt that we take as given), and must decide how much to invest in capital for the next period, K_1. Entrepreneurs have access to a productive technology that will enable them to produce aK_1 in period 1. After production

capital can be scrapped and yields ξ consumption goods, i.e. $q_1 = \xi$, where q_t is the price of capital in period t.

At date 0 entrepreneurs have to decide whether to repay their debts or not. In case of default they are only liable up to the market value of their assets. If the face value of their debt is higher than this, they may renegotiate their debts and it is assumed that entrepreneurs have all the bargaining power such that in this case there will be no default and they only repay $q_0 K_0$ when $b_0 > q_0 K_0$.

After debt repayment (or renegotiation), entrepreneurs may borrow b_1 subject to a collateral constraint,

$$b_1 \leq \xi K_1.$$

Households have a large endowment of consumption goods in both periods, such that they will never be constrained and thus in equilibrium the gross interest rate always satisfies $R = 1$. They have access to a production technology with decreasing returns characterized by

$$G(\tilde{K}_t) = \tilde{K}_t - \frac{1}{2}(\tilde{K}_t)^2$$

a) State the optimization problem of entrepreneurs. What is the demand of capital when $q_0 \leq \xi$? When $q_0 \geq \xi + a$? And when $\xi < q_0 < \xi + a$? Explain.

For b) and c) consider entrepreneurs' demand when q_0 satisfies $\max(\xi, b_0/K_0) < q_0 < \xi + a$ (i.e. $\xi < q_0 < \xi + a$ and $b_0 < q_0 K_0$)

b) Show that entrepreneurs' collateral constraint binds, and that they choose $c_0 = 0$ and do not default on their debts. Derive an expression for the entrepreneurs' capital demand, K_1, as a function of q_0.

c) Show that if $b_0 < \xi K_0$, the entrepreneurs' demand for capital is decreasing in q_0 while if if $b_0 > \xi K_0$ the entrepreneurs' capital demand is increasing in q_0. Show that whether demand is increasing or decreasing depends on the sign of $K_1 - K_0$, i.e. on whether entrepreneurs are net buyers or sellers of capital. Explain.

d) State the households' optimization problem and derive the first order condition for $\tilde{K}_1$. Write the market clearing condition for capital in period 0.

e) Assume that $b_0 < \xi K_0$. Provide a graphical characterization of the equilibrium in the capital market and show this is unique.

f) Assume that $b_0 > \xi K_0$. Provide a graphical characterization of the equilibrium in the capital market and show that there can be multiple equilibria. Discuss the intution behind the multiplicity.

g) Consider the following example, $K_0 = \bar{K} = 0.9$, $b_0 = 0.6$, $\xi = 0.5$, and $a = 1$. Show that there is a stable equilibrium with a high price q_0, and unstable one with lower, but positive price, and an equilibrium with $K_1 = 0$, $q_0 = 0$ in which entrepreneurs have zero net worth and therefore cannot borrow. Explain why we might have this last equilibrium.

h) Consider the following policy which consists of transfering resources to distressed entrepreneurs. Show that an appropriate reduction in b_0 (which is how we can interpret this policy to work) will eliminate the worst equilibrium in g). Explain why this happens.

i) Suppose there are multiple equilibria. Can the government eliminate the bad equilibrium if it announces that it will purchase capital at the high equilibrium price? How much capital it would have to purchase to implement this policy?

j) Compare the fiscal costs of policies in h) and i). Which one does our exercise recommend adopting? Discuss briefly a change in the underlying environment (i.e. to the assumptions on which we setup the problem) that might lead to a revearsal of the convenience between policies h) and i).

7 (100 points, not more than 1200 words) Consider the following two global risks. First, due to a rise in populism and the growing fear of a Cold War between the United States and China there is a risk of "deglobalization", i.e. a reversal of globalization with the rupture of supply chains. Second, technological progress that leads to more general and cheaper robots that displace workers.

Imagine that across the world individuals are differentially exposed to these risks based on their occupations and the country in which they live. For simplicity think that we can only consider just four occupations, low-skill non-tradable sector, high-skill non-tradable, low-skill tradable, and high-skill tradable.

Which occupations would be more exposed to the first risk and which to the second? Which are the riskiest and safest ones? Which countries would be more exposed to the first risk and which to the second? (Hint: think of differences between Denmark, the U.S., and Japan)

You are now asked to design financial contracts to allow individuals to hedge these risks. Which indicators (could be prices, could be something else) would you use to form indexes on which these contracts can be written? Who would take short and long positions on them? Would firms find it useful to use these markets? If so, what would they use them for, and which firms have the most to gain?

Explain how you would set these markets if you want these to take the form of perpetual futures. Which of these two markets would you expect to be more successful (i.e. attract more traders)? Explain why?

If these markets were not created, can individual countries' governments resort to policy choices to "manage" these risks? What would these be? (you can use a particular country to frame your thoughts).

Relatedly, what policies could countries take to foster the creation of the above mentioned markets? What challenges do you think they will face?