Written Exam for the M.Sc. in Economics - Fall 2015

Financial Frictions, Liquidity, and the Business Cycle
Final Exam

February 17, 2016

3-hour closed book exam

Please note that the language for this exam is English.

The points for each question should guide you in allocating time to answering them (they add up to 180, thus proportional to the total time you have for the exam).

1 (20 points) Answer true, false, or uncertain. Justify your answer.

For the bank lending channel to be active we need that bank loans and market finance are imperfect substitutes for borrowers.

2 (20 points) Answer true, false, or uncertain. Justify your answer.

Mian and Sufi (2011) find that between 1997 and 2006 new homeowners increased home equity based borrowing for consumption reasons.

3 (20 points) Answer true, false, or uncertain. Justify your answer.

The Kiyotaki and Moore (1997) model features a procyclical leverage ratio, as entrepreneurs respond to a negative productivity shock by decreasing their leverage.

4 (60 points) Consider the following version of the Bernanke and Gertler (1990) model covered in class. There is a continuum of risk neutral agents that live for two periods. A fraction μ of these are entrepreneurs, and the rest, fraction $1 - \mu$, are consultants. There is a risk free storage technology that has gross return $1 + r$. Each entrepreneur has access to a risky technology that transforms a unit of the consumption good in $t = 1$ into X units of the consumption good in $t = 2$ with probability p, or into 0 units of the consumption good in $t = 2$ with probability $1 - p$. Entrepreneurs are heterogeneous in their initial wealth, w, which is assumed to be observable, and $H(w)$ is the cumulative distribution of wealth among entrepreneurs. But p is not observable to outside investors,

and initially even unknown to entrepreneurs themselves. Each entrepreneur gets to know the probability p of her project if she pays the pecuniary cost C to a consultant. We assume consultants can provide this service at no cost to them, and that $C < \min(w)$ (such that every entrepreneur could in principle pay for this service). Let $F(p)$ be the cumulative distribution function for p (and $f(p)$ its density), known to financiers.

a) Characterize investment and output in the first best for this economy (i.e. under the assumption that for every entrepreneur $w > 1 + C$). Assume that the option value of knowing the probability p of one's project, V, is larger than the consultancy fee C, and that it does not pay to invest without knowing the quality of one's project (i.e. $E[p] < 1 + r$).

Assume now that some entrepreneurs cannot finance their risky projects with own funds (i.e. for some of them $w < 1 + C$). If they want to undertake their projects they need outside finance. This funding is done with a debt contract that prescribes a repayment $R(w)$ in case of success. Funding is only available once the probability of success p has been observed by entrepreneurs.

b) Characterize the indifference condition between borrowing to invest in one's project and saving one's wealth at the risk free rate for an entrepreneur with wealth w.

c) Characterize the zero profit condition for financiers that lend funds to entrepreneurs with wealth w.

d) Characterize the option value, $V(w)$, of investing in consulting services to know the probability of success p of one's project for entrepreneurs with wealth w. Show that it is increasing in w.

e) Characterize the investment and output in this economy. For this assume there exists a w_C such that entrepreneurs with wealth lower than w_C would not invest in consulting services (obviously assume $0 < H(w_C) < 1$).

Now assume this economy suffers an information shock. This makes consultants to report the true value p with probability $\pi < 1$. With probability $1 - \pi$ the value reported comes from the distribution $F(p)$, and is thus uninformative. Assume π is high enough that investing in consulting services is optimal in the first best.

f) How does this shock affect investment and output when there are information asymmetries? Explain your answer.

5 (60 points) Consider the following version of the interbank market model seen in class. There is an economy that lasts for three periods, $t = 0, 1, 2$, and has one consumption good. To transfer wealth from $t = 0$ to later periods there are two technologies. One is a storage technology with unitary gross return, such that a unit of the good invested in t gives a unit of the good in $t + 1$. The other technology is a long term investment project that gives $R > 1$ units of the good in date 2 per unit of the good invested in date 0. If liquidated at date 1, the return is $L = 0$.

There is a continuum of consumers endowed with a unit of the good at date 0. Con-

sumers' preferences are given given by

$$\ln c_1 \qquad \text{for impatient consumers,}$$
$$\ln c_2 \qquad \text{for patient consumers.}$$

Where c_i represents consumption in date i. Assume first that consumers do not have access to either of the savings technologies. Given this assumption, all consumers will deposit their endowments in a bank in period $t = 0$. Also, assume that consumers initially do not know their type and is only revealed to them in period $t = 1$.

The financial system is composed of a continuum of banks. These cannot distinguish at date $t = 0$ the fraction of their depositors that are patient or impatient. Banks invest a fraction I of deposits in the illiquid technology, and the remaining fraction $1 - I$ is invested in the storage technology.

In period $t = 1$ banks discover how many impatient consumers they have, i.e. they suffer a liquidity shock. Assume that there are two possible outcomes. With probability p_H, there are $0 < \pi_H < 1$ impatient consumers (and thus $1 - \pi_H$ patient consumers). And with probability $p_L = 1 - p_H$, there are $\pi_L = 0$ impatient consumers.

a) Find consumption and investment in the illiquid technology in the first best (i.e. the optimal allocation).

b) Characterize consumption and investment when each bank is in autarky, i.e. when each bank must offer consumers deposit contracts that make withdrawals contingent on the liquidity shock. HINT: Be careful, if banks know they are in autarky they might not necessarily invest the same amount of resources in the illiquid technology as in the first best.

c) Now assume that there is an interbank market and that the liquidity shocks that banks suffer are observable. Show that an interbank market can decentralize the first best allocation. What are the amounts of funds transacted in this market and what is the equilibrium interbank interest rate?

d) Now assume that banks' liquidity shocks are unobservable. This implies that banks could lie about their liquidity shock and not be punished for this. What condition must the interbank interest rate satisfy to make all banks reveal truthfully their type? Explain.

Assume now that there are no banks, consumers can invest in both savings technologies, and that a bond market opens in period $t = 1$ for them to trade.

e) Find the market allocation (consumption and investment). What is the equilibrium interest rate on the bond?

f) Compare social welfare in a), b), c), d), and e) (you do not need to use explicitly outcomes for allocations and expected utility for this). Explain.