

Written Exam Economics Summer School 2019

Financial Frictions, Liquidity and the Business Cycle

From 17 August 2019 10 AM to 19 August 10 AM

This exam question consists of 3 pages in total.

Answers only in English.

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

The paper must be uploaded as one PDF document. The PDF document must be named with exam number only (e.g. ‘1234.pdf’) and uploaded to Digital Exam.

Be careful not to cheat at exams!

Exam cheating is for example if you:

- Copy other people’s texts without making use of quotation marks and source referencing, so that it may appear to be your own text
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Reuse parts of a written paper that you have previously submitted and for which you have received a pass grade without making use of quotation marks or source references (self-plagiarism)
- Receive help from others in contrary to the rules laid down in part 4.12 of the Faculty of Social Science’s common part of the curriculum on cooperation/sparring
You can read more about the rules on exam cheating on your Study Site and in part 4.12 of the Faculty of Social Science’s common part of the curriculum.

Exam cheating is always sanctioned by a written warning and expulsion from the exam in question. In most cases, the student will also be expelled from the University for one semester.

1) (40 points) Consider the following variant of the Diamond and Dybvig (1983) model. The economy lasts for three periods, $t = 0, 1, 2$. There are two consumption goods that give utility in periods 1 and 2. One good is called tradable and the other, non-tradable. There is no endowment of any of the goods in this economy at any date. In period 0 there can only be tradables, which the economy can get from the rest of the world.

There is a continuum of ex-ante identical consumers, with unit mass. As it is standard in this literature, at the beginning of date 1 there exists a preference shock that determines the ex-post type of each consumer. With probability $0 < p < 1$ (the probability is known at date 0) the consumer becomes impatient and with the remaining probability she becomes patient. An impatient agent has preferences represented by the utility function $u(c_{1T}) + v(c_{1N})$, where c_{1l} is the consumption by an impatient consumer (in period 1) of good $l = T, N$, where T stands for tradables and N for non-tradables. A patient consumer has utility function $u(c_{2T}) + v(c_{2N})$, where c_{2l} stands for the consumption at date 2 by the patient agent of good l . Both $u(\cdot)$ and $v(\cdot)$ are increasing and concave. Hence, the ex-ante utility function is:

$$p[u(c_{1T}) + v(c_{1N})] + (1 - p)[u(c_{2T}) + v(c_{2N})] \quad (1)$$

Non-tradables are produced with a constant-returns-to-scale technology. Each unit of tradable invested at date 0 gives either $A > 1$ units of non tradables at date 1, or A^2 units of non-tradables at date 2. It is not possible to invest at date 1 new tradables to produce non tradables. (Thus this linear technology can be seen as allowing reinvestment at date 1 but only of date 0 investments) It is not possible to transform non-tradables back into tradables.

There exist two other investment technologies, standard in the literature. There is a long term investment project that gives $R > 1$ units of tradable goods at date 2 per unit of the T good invested in period 0. As in the literature, assume that if liquidated at date 1 the gross return in terms of tradables is $r < 1$. The other investment corresponds to the fact that the tradable good is assumed to be storable with net return equal to 0.

First, we want to characterize the planner's problem, assuming the existence of credit from the rest of the world that allows the planner to borrow tradable goods directly in period 0, at a net interest rate equal to 0 (assume it is not possible to borrow from the rest of the world at date 1). The planner allocates this amount in the different available technologies. Let d be the amount of tradables borrowed by the planner at date 0, let x be the amount of tradables invested in the long term project, and y the amount of tradables stored between dates 0 and 1. Let z be the amount of tradables invested in 0 to produce non-tradables, and let α be the proportion of z withdrawn at period 1 ($0 \leq \alpha \leq 1$). Assume that debt borrowed by the planner at date 0 is repaid in full at date 2.

a) Write the constraints of the planner's maximization. Hint: there are 5, one budget constraint for the planner at date 0, and each one of the remaining four account for the expected consumption of each type of good for every kind of consumer (of T and N, by patient and impatient). Write the planner's objective function (1) replacing c_{it} by the expressions found from the budget constraints.

b) Let z be fixed. Now rewrite the problem in terms of how much of z must be liquidated early (α). Show that the optimal amount of investment liquidated at date 1 in

the non-tradables technology is such that $v'(c_{1N}) = Av'(c_{2N})$. Interpret.

c) Write down the other first order conditions for an interior solution (besides the constraints), and show that $c_{1T} < c_{2T}$ and $c_{1N} < c_{2N}$. Explain.

Now we want to study the decentralized outcome without a planner. Assume that debt must be repaid, such that if there is a situation of distress, debt is repaid before consumption is determined.

d) Can these optimal assignments be reached by a bank offering deposit contracts? If you can't find a formal proof, give intuition.

e) Find conditions for a bank run to be a Nash equilibrium. Mention (and briefly describe) three ways of resolving that.

2) (60 points) Write an essay of no more than 2000 words. You can use up to four short references outside the syllabus reading list (think of these as news posted online more than academic works). Please provide links to these references such that I can read them.

Consider as given the following summary stylized facts of developments in the last two years in the Danish and Australian real estate markets (I provide a simplification, highlighting some facts over others; you can base your response on a more accurate description but you have to refer to the facts I mention).

In January 2018 Danish regulators decided, presumably as a response to signs of an overheated housing market in Copenhagen, that lenders should restrict the set of contracts offered to mortgage borrowers seeking to purchase real estate in Copenhagen (but not for the rest of the country). In mid 2017, real estate prices started to decline in major cities in Australia after a prolonged and steep boom (with prices falling by as much as around 15% in Sydney after two years). The decline in prices increased the number of households with negative equity in their houses and recently led to the bankruptcy of a major developer, as it became evident that there would not be sufficient demand for the large increase in supply in recent years. The Australian central bank responded by reducing interest rates twice to 1% in mid 2019.

a) Explain why would (or should) the Danish and Australian central banks be worried by a large drop in residential property prices. Think about likely development in these countries financial systems, and on causal effects on economic activity.

b) What do you think are the direct and indirect effects of the restrictions in credit availability for new mortgages in Copenhagen.

c) Analyze the effects of investors perceiving these restrictions as "scary news". Explain how thus they can backfire. For this keep in mind that the mortgage market in Denmark works with mortgage-backed securities issued such that they are standardized (each type of bond reflecting a type of underlying loans provided by mortgage issuers). This makes mortgage bonds to be very liquid, and thus attractive to investors.

d) Do you think that the reduction in interest rates in Australia is sufficient to mitigate any causal effect of the decrease in residential real estate prices on economic activity? Would you complement that with other policy measures? Explain.

e) Give reasons why banks have to meet liquidity requirements. Explain how bank liquidity might affect the real economy.