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ECON 2202 Supplementary notes for Chapter 10

"A Monetary Intertemporal Model"

The goal of these notes is to simplify the introduction of money in the intertemporal model. The resulting money demand is to a large extend identical to the one used in the textbook, but the procedure to determine it is different. They replace the following pages in the textbook:

1. First edition, Chapter 9, pages 323–335;

2. Second edition, Chapter 10, pages 355–360;

3. Third edition, Chapter 10, pages 369–376.

1 Representative Consumer

As we want to add a market for money in the model, we want to derive a demand for money and a supply of money. Demand emerges from the behavior of households and firms, supply is determined by the government. Here, we want to focus on demand for money for transaction purposes, but keeping in mind that money can also serve as a store of value.

There are banks in the model that have a very passive role. They provide the following services: they provide a safe place for money and (Treasury) bonds, and they provide transaction services. At the start of every period, households first interact with the government, then the bank and finally with the firm, in this this specific order.

At the start of the period, the households wakes up with the following holdings at the bank: M_C^-, which is money carried over from the previous period, and $B_C^-(1 + R^-)$, which is the reimbursement with interest of the one-period bond

bought the previous period. The household first pays off the taxes and then decides how much of the remainder to keep in cash and how much to invest in bonds B_C. Clearly, the amount of cash is then

$$M_C = M_C^- + B_C^-(1 + R^-) - PT - B_C,$$

where PT are taxes in nominal terms, as all elements of the equation are in nominal terms. The cash is to be used during the period to buy consumption goods, which have to be bought with money. Thus we have the so-called cash-in-advance (CIA) constraint

$$PC \leq M_C,$$

where, again, consumption is represented in nominal terms. The inequality means that the household may choose to buy less consumption than what its money holdings warrant, but clearly the household does not want to do so. By choosing to hold money, it forfeited interest income it could have obtained from an investment in bonds, and the household would always want to have just enough money to cover the transaction needs for acquiring consumption goods. Thus, we treat the CIA constraint as an equality from now on.

During the period the household works and consumes. At the end of the period, the wage income as well as divivdends are paid in cash to the household, who then deposits it at the bank. The sequence of events for the household is very crude and stylized, and one could have laid out things differently. But in almost any case, all that matters is that there is something like a CIA constraint that generates a demand for money.

2 Representative Firm

We do not need to change much to the setup of the representative firm. It works much like before, in particular it does not face a CIA constraint for its investment. During the period, it sells the consumption good for cash, which is then used to pay wages and dividends. The real side of the firm is therefore identical to the model without money, and one obtains the nominal side by multiplying all aggregates with the same price level P.

3 Government

This section is not modified from the textbook and only summarized here.

The government has now one additional policy tool: monetary policy through money creation. Note that here we lump together the government and the central bank even though in most institutional arrangements, they are fiercely maintaining their independence from each other. Thus, current period expenses (government expenses and bond reimbursements) can be financed by taxes, new bonds and money creation. In equation form, the first period budget constraint is thus

$$PG + B^-(1 + R^-) = PT + B + M - M^-,$$

where $M - M^-$ is money creation.

4 Competitive Equilibrium: The Complete Monetary Intertemporal Model

We are now ready to put all agents together in the market. From the above presentation of the representative household, it faces a trade-off in its decision to hold cash. It wants more cash if it expects to consume more, but that costs lost interest on bond holding. Thus, a household wants to hold less cash if the nominal interest rate is high and if it expects to spend little on consumption. The latter spending can also be decomposed into real consumption and the price level, i. e., PC into C and P.

We like in general to separate the real and nominal parts of macroeconomic aggregates. In this case, we separate this demand for money, which we will label M^d, into the price level P and a so-called liquidity function $L(Y, R)$:

$$M^d = PL(Y, R).$$

Note that this liquidity function depends on Y, not C. We know higher incomes increase consumption demand. While it would be more appropriate here to write L as a function of C, we adopt Y, which is not wrong, to be closer to other, more complex ways to introduce money into the model.

We represent the money market in a (M, P) space. $L(Y, R)$ being a positive constant in that space, it is obvious that money demand must be upward sloping. It may seem surprising that a demand curve is upward sloping, but remember that

P does not represent the price of money, but rather the price of the consumption good in terms of money.

In this space, the money supply M^s from the government is just a vertical curve, as it is set by policy. Thus we have now a money market equilibrium that specifies an equilibrium price level P^*. Refer to the textbook for the figures.

5 How the Textbook Handles this Material Differently

All editions have a different, more complex introduction of money into the intertemporal model with investment. But all leads to the same money demand and money supply curves. Here are the sketches on how they differ.

5.1 First Edition

Households care about two different kinds of consumption goods: cash goods, as in this note, and credit goods, for which cash is not needed before the end of the period. Firms can freely substitute between the production of both goods. Thus, the trade-off of the households is slightly different, as the household can substitute between cash and credit goods. For example, if the nominal interest rate increases, the household want less cash goods (and thus less money) and more credit goods and bonds.

5.2 Second Edition

The treatment is similar to the first edition, except for a change in the timing: taxes are paid after the cash-bond decision is taken. Thus the CIA constraint contains consumption and taxes.

5.3 Third Edition

Here, there is a more explicit treatment of the banking sector. Households are still subject to a CIA restriction, like in this note there is no credit good, but they can withdraw at a cost some cash from the bank. This cost helps then determine the money demands function. Firms also face a CIA constraint for their investment purchases and have the same costly access to cash at the bank.