

Session 4 – Payments, Credit and Asset Prices

Part 2: Discussant (Oleg Itskhoki)

This is an extremely meaty paper. It took me quite a while to work through it, and it was absolutely worthwhile. There were a lot of dimensions to the paper, and I'm going to discuss just a few of them, but the paper definitely contains a lot more.

The idea of the paper is to build a detailed micro model of how the monetary transmission works through the banking system, and then study the macroeconomic implications of this transmission mechanism. One can then use it to ask the question of the optimal aggregate liquidity management by the government. The model combines quite a few ingredients, and each of them appears simple and intuitive in partial equilibrium, yet the paper's main contribution is in having all these individual ingredients work nicely together in general equilibrium. And it is very impressive how Monika and Martin can characterize the equilibrium outcomes in a tractable way.

The model is an endowment economy. The macro variables to be determined in equilibrium are consumption, inflation, and asset prices. The reason why consumption is not equal to output is because there are real collateral costs, and so consumption can differ across equilibria depending on how large are the aggregate collateral costs in the economy.

There are three types of agents: the households (consumers), the banks, and the government. There are multiple assets in the economy (deposits, reserves, short-term debt, bank equity, stock markets, etc), and the paper characterizes equilibrium prices of all assets. Typically, one can characterize the prices of all assets when either they are all equivalent, or when the markets are complete. Neither is the case in the present paper, and it is very impressive how all asset prices admit closed-form characterization in this rich equilibrium environment.

There are two types of frictions in the payment system: (a) a liquidity constraint (cash-in-advance) on both households and banks, and (b) a collateral constraint (costly leverage) on both banks and the government. Therefore, there is a total of four constraints on three types of agents, and all of them are consequential. It is the intersection of these four constraints that creates the interesting equilibrium outcomes.

In the limiting case, the economy becomes a frictionless neoclassical economy where the constraints don't bind, and I will refer to it as a Friedman-rule economy. The Friedman rule is more complex in this economy. It not only guarantees that money and bonds have the same rates of return, but in fact that all assets have the same returns, and agents are indifferent about their portfolio choices, and no constraints are binding. Away from the Friedman rule, the constraints are binding, and the asset prices are different for different assets, and the allocation is not first best.

This is how the model works. First, consider the liquidity constraint on the household sector. In order to consume, the households need liquidity, and this liquidity is inside money, or deposits. In a conventional model, one needs to hold money, the reserves, in order to buy consumption. Here, one does not need money issued by the government to buy consumption. Instead, one uses deposits to finance consumption expenditure in each period. Therefore, the households need the deposits in order to pay for their consumption, hence they are willing to take lower interest rates on their deposits relative to

other assets, when the liquidity constraint is binding. As a result, the interest rate on deposits is lower than on the other assets, when the constraint is binding. In turn, this allows the banks to make profits using this gap in interest rates. The banks pay back these profits to their stakeholders, the households. To summarize, the first sign that the liquidity constraints are binding is that the rate on deposits is lower than the interest rate on other assets, and the banks are making profits off the deposits.

The second friction is also a liquidity constraint, but now on the banks. The banks issue deposits, and sometimes they need to quickly liquidate their positions. If people want their money back, the banks need to be able to pay them back on short notice. This is modelled as a random liquidity shock on the banks. In order to pay back, the banks need to have either reserves, which is the outside money issued by the government, or they can borrow in the interbank market. Because these funds are useful for the bank when liquidity constraints bind, the banks are willing to take lower interest rates on holding the reserves. If they hold bonds, they're also willing to hold them at a lower interest rate, as long as bonds provide liquidity (collateral) services.

This is not enough, however. The model also requires that the banks find it costly to hold too much of the reserves, as reserves are expensive and the banks need leverage to make profits. The banks face an exogenous real cost of leverage. As a result, there exists a collateral ratio – the ratio of liquid assets to liabilities – and the collateral costs decrease with the collateral ratio. If the banks have a lot of collateral, the leverage costs are low, but this means that the banks are not making the differential returns on assets and liabilities, and this creates a tradeoff. The leverage costs are real costs, and they reduce the amount of output left for consumption in the economy. To summarize, the banks want to hold the reserves to relax both the collateral constraint and the liquidity constraint. However, holding reserves is costly, if the returns on reserves are low relative to the returns on other assets. The Friedman rule increases the quantity of reserves in the economy, making them cheap and abundant, increasing the return on reserves, until both the liquidity and the collateral constraints of the banks are fully relaxed, and the economy approaches the first best.

What are the other assets? One can hold short-term bonds and the equity of the banks. But they are less effective as means of dealing with collateral and liquidity constraints, while reserves are most effective in relaxing both. Finally, why can't one get the high return on reserves? In principle, the government could provide a lot of reserves at no cost. But the problem is that the government also faces costs of leverage, and the leverage for the government is modelled as the size of the transactions in the economy relative to the size of the balance sheet of the government. Hence, the government also does not like to have a big balance sheet, and this is why it offers limited quantity of reserves, making them scarce and expensive, and driving low the return on reserves. This is the reason why the Friedman rule is not achieved in this economy.

Taking into account that increasing the balance sheets of both banks and the government is costly, there exists an internal solution for the optimal quantity of liquidity in the economy, and the constraints are binding in equilibrium. In the internal solution, there is a differential return on different types of assets. The government can choose the interest rates on reserves, and it can choose the growth rate of the outside money (the reserves), and it can also choose the composition of its balance sheet, subject to the constraints. Therefore, the government has three choice variables, with the goal of maximizing welfare in the economy, that is minimizing the aggregate collateral costs to both banks and the government. In

turn, the banks choose the collateral ratio and the liquidity ratio to maximize the value of their shareholders, taking as given the actions of the other banks.

A natural question then is what is the optimal thing to do for the government? The government would always want to minimize its balance sheet and simultaneously to relax both of the constraints for the banks. While it may seem as conflicting goals, in principle, it is possible to achieve both by simultaneously issuing lots of reserves and saving a comparable amount in the form of private bonds. In other words, the government could create lots of liquidity and simultaneously save in other assets to reduce its leverage costs, by expanding its balance sheet. Hence, in order to make the problem interesting, the paper must impose an upper bound on how much the government can save in private assets, or in other words on the size of the balance sheet of the government, which is feasible without recurring to government leverage. Empirically, it is an interesting question why the governments shy away from large balance sheets and do not want to provide more of the liquidity services.

I will next turn to my comments on the modelling approach in the paper. There are two related tradeoffs the paper must confront. The first, is how detailed versus concise the model must be. The paper opts for a very detailed model of the banking system, with a lot of details that are often ignored in the macro literature. It is very impressive how far the authors can go with such a detailed model. The natural question, however, is which details are absolutely essential and which ones may be dispensed with in the future, when we incorporate these mechanisms into the workhorse macro framework. Does there exist a concise version of this model, which maintains the main mechanisms and tradeoffs, but which we can easily wrap into a full macroeconomic model with production and other features? Or, perhaps, there are circumstances when all these micro details do not matter, and we can default to the baseline model (e.g., in “normal times”), and there are circumstances when these features become first-order for the macroeconomic outcomes, and need to be modelled in full detail (e.g., in “crisis times”)?

Having “complained” that the model is perhaps too detailed, my second comment is that it is arguably not detailed enough. Luckily, the format of the discussion allows me to not be fully coherent, and just explore different directions. Indeed, the second tradeoff the paper faces is between having some *ad hoc* constraints in the model and fully micro-founding them, which is not clear is feasible at all given the state of the literature. The main *ad hoc* constraint the model relies on is the collateral constraint, or rather the costs of leverage, on both the banks and the government. Literally speaking, when there is not enough collateral, the banks and the government need to burn resources. Of course, it is a parable for something. For example, in a partial equilibrium of the banking sector, it is perhaps not very consequential, and indeed intuitive. There are likely real costs for the banks of not being collateralized enough, and so one can just say that effectively the banks lose resources if that happens. But once we go to the general equilibrium, a specific model of such costs becomes consequential. Indeed, one needs to know whether the resources are burnt proportionally in every period, or instead in certain infrequent states of the world, e.g. when there is a crisis. This, in turn, is likely consequential for the macroeconomic outcomes such as inflation and aggregate consumption. Do we have a sense of robustness for which macro outcomes the stylized nature of the constraints is consequential and for which it is not?

Furthermore, and perhaps more importantly, once we go to a model with *ad hoc* constraints, studying optimal policy becomes very tricky. And indeed, the authors acknowledge this by carefully avoiding making strong policy prescriptions based on the model. Yet, of course, the questions of the optimal

aggregate liquidity management are of the highest applied interest, and it is hard to avoid thinking about this issue in the context of this paper. Unfortunately, answering these questions without knowing more about the particular micro nature of the collateral costs is difficult. In particular, we do not know how specific policies may affect the collateral cost functions for the banks and the government, whether they would keep unchanged or may alter them in some fundamental way. This is a version of the Lucas critique in the context of this model. And this is the main reason why the whole literature should think harder about the deeper micro foundations behind the liquidity and collateral constraints that are commonly adopted in the more positive work, which hence needs to avoid making strong normative recommendations.

It is also interesting to know what is the nature of the liquidity shock for the banking system. The banks need to have liquidity in certain states of the world. In partial equilibrium, this is very natural as a description of the environment for the banks. But once you start thinking about general equilibrium, you start wondering with which aggregate shocks do the micro-level liquidity shocks interact contributing to the cycle? Are these liquidity shocks something that could, in principle, be effectively diversified, so that the advances of technology would make these shocks less consequential for the macroeconomy? Or is it something about the aggregate state of the economy, which does not allow to effectively diversify the liquidity shocks, no matter what the market structure and technology used in the interbank market? Are these shocks rare correlated events like the one that happened in 2007, and hence there is no effective way of avoiding them? If yes, how frequent do we expect to see such shock in equilibrium?

A quick additional remark is about the welfare objective in the economy, which is exclusively to minimize the collateral costs, as it is an endowment economy. Of course, the natural next step is to extend the environment to a production economy, where sticky-price and/or financial constraints result in endogenous cyclical output fluctuations, which are then reinforced by the constraints in the banking system. Monika and Martin have a companion project where they do just that, and this is an important continuation to this research agenda.

I have three remaining comments, related to the empirical verification of the model's mechanism. First, the basic fact about the world is that deposit rates are low relative to other rates of return in the economy, even after controlling for the associated risk. One can go in at least two different ways about interpreting this fact. The way this paper interprets the fact is to say that liquidity constraints are binding, and hence return differentials. Thus, since we observe return differentials in the data, it must be that liquidity constraints are really binding, and we must take this mechanism seriously. An alternative interpretation of the data is that of the market paper: perhaps, the low deposit rates reflect the local monopoly power of the banks over retail customers. Is it possible to separate empirically the low rates on deposits due to market power versus due to liquidity constraints. Perhaps, the amount of market power changes slowly, at low frequencies (even though the recent crisis was followed by a wave of consolidation in the banking sector), and hence much of the cyclical fluctuation in the deposit spread is due to liquidity constraints. A further possibility is that the observed deposit spreads are due to some form of interaction between market power and financial frictions. Then it is interesting to know how the technological improvements in the high-tech financial sector may wipe out the market power of the conventional banks, and what are the implications of such changes for the cyclical analysis.

My last two comments are about the more direct ways one can look at the data to get some empirical validation of the model's assumptions. I think there are two salient predictions of the model. The first

salient implication is that the households don't want to hold the stock market other than the banking system, while the banking system will hold all of the non-banking equity. The banking equity offers high returns for the households, while the rest of the stock market is not particularly useful for the households, as it does not allow them to relax any of their liquidity needs. This is, of course, very stylized, and should not be taken literally. But one can ask a more nuanced question in the data. Specifically, in periods when liquidity constraints tighten, is it true that the expected equity returns for the banks are higher than equity returns on the rest of the stock market, and would an investor with deep pockets be able to take advantage of this?

The second salient implication of the model is about the cross section of countries with different institutions, and hence arguably different reduced-form leverage cost functions. In some countries, leverage is very costly for the government, while in others governments run very large balance sheets with a lot of leverage. For some governments, it is very easy to borrow, and for other governments it is much costlier. Such variation in the leverage costs should translate in different choices of collateral and liquidity ratios in the private sector, through the endogenous mechanisms of the model. This, in turn, should translate into different macroeconomic outcomes. Can we look at the cross section of countries, where governments have a differential ability to increase their balance sheets, and see whether this indeed translates into different equilibrium outcomes in the banking system, as predicted by the model? Perhaps, there exists anecdotal evidence of such effects.

This is a rich and insightful paper, and I look forward to the new developments in this exciting research agenda!