Chapter Six

The Financial Sector

6.1 INTRODUCTION

As mentioned in section 1.1, an important characteristic of the empirical model regarding the financial sector is the accounting for all flows of funds in the system. This allows the bill rate ($RBILL_t$) to be implicitly determined in the model through the solution of the 83 independent equations. There is no stochastic equation in the model in which the bill rate appears naturally as the left-hand side variable—i.e., naturally as the variable explained by the equation.

There are four stochastic equations in the financial sector, Equations 20–23 in Table 2–3, explaining, respectively: commercial bank borrowing at federal reserve banks ($BORR_t$), the corporate bond rate ($RAAA_t$), the mortgage rate ($RMORT_t$), and capital gains or losses on corporate stocks held by the household sector (CG_t). There is also an important nonstochastic equation explaining bank reserves (BR_t), Equation 45 in Table 2–2:

45. $BR_t = g_{1t} DDB_t$.

This equation and the four stochastic equations are explained in the next section. The treatment of the loan constraints in the model is then discussed in section 6.3.

6.2 EQUATION 45 AND THE FOUR STOCHASTIC EQUATIONS IN THE FINANCIAL SECTOR

Equation 45 in Table 2–2 links the level of bank reserves to the level of demand deposits and currency of the financial sector (DDB_t). g_{1t} in the equation is defined in Table 2–1 and is the actual ratio of BR_t to DDB_t observed in quarter t. The relationship between BR_t and DDB_t is thus reflected in g_{1t} in the model, and this relationship is taken to be exogenous.

Some experimentation was done with alternative specifications of the relationship between BR_t and DDB_t before deciding to take the relationship to be exogenous. It is possible, for example, to obtain data on actual reserve requirement rates on demand deposits from past issues of the *Federal Reserve Bulletin*. (See, for example, page A9 of the July 1974 issue.) These data were used to construct a variable, denoted as $\bar{g}_{1t}$, that was the quarterly average of the actual reserve requirement rates on demand deposits for reserve city banks. Given data on $\bar{g}_{1t}$ and g_{1t}, it is then possible to compare the two series to see how closely they correspond.

There are a number of reasons why the two series are not likely to correspond exactly. One reason is that there are different reserve requirement rates for different types of banks. $\bar{g}_{1t}$ pertains only to reserve city banks. Another reason is that DDB_t is not exactly the correct base to use to calculate required reserves. DDB_t, for example, excludes time deposits in commercial banks, for which there is also a reserve requirement rate, and it has netted out of it demand deposits held by nonbank financial intermediaries in commercial banks. (Remember that the financial sector in the empirical model is an aggregate of nonbank financial intermediaries and commercial banks.) A third reason g_{1t} and $\bar{g}_{1t}$ do not coincide exactly is that banks may at times hold excess reserves in the aggregate. BR_t includes all reserves, not necessarily just required reserves.

To summarize, then, the factors that cause g_{1t} to change (i.e., cause the ratio of BR_t to DDB_t to change) include not just changes in the actual reserve requirement rates set by the government, which $\bar{g}_{1t}$ does capture, but also changes in the proportion of excess reserves held by the bank sector, shifts of demand deposits among different types of banks, and shifts of funds between time deposits and other nondemand deposit securities, all of which $\bar{g}_{1t}$ does not capture.

Even though g_{1t} and $\bar{g}_{1t}$ are not expected to coincide exactly, a plot of g_{1t} and $\bar{g}_{1t}$ over time reveals a fairly close agreement between the two series. It did not seem unreasonable from observing this plot to take g_{1t} as exogenous in the model. Nevertheless, some experimentation was done to see if $BR_t - \bar{g}_{1t}DDB_t$, which one might interpret as a measure of excess reserves, could be explained as a function of the bill rate or other interest rates. One might expect there to be fewer excess reserves held when interest rates are high than otherwise. $BR_t - \bar{g}_{1t}DDB_t$ did not appear, however, to be sensitive to the level of the bill rate or any other interest rate, and so in the end the decision was made to take g_{1t} to be exogenous.

The treatment of BR_t here is in contrast to its treatment in the theoretical model, where it is treated as a residual. This difference is due to the view that on a quarterly basis banks are likely to have fairly close control over their reserves and thus that it is not reasonable to treat the level of bank reserves as a residual when quarterly data are used. It is interesting to note that if BR_t were treated as a residual in the empirical model, in the sense that no equation for it was specified, but yet it still was taken to be endogenous, then one would need an explicit equation determining the bill rate. The bill rate could no longer be taken to be implicitly determined in the model. In the theoretical model there is effectively an equation for the bill rate, since the bond dealer sets the bill rate.

It should finally be noted that the treatment of g_{1t} as exogenous implies nothing about the behavior of bank borrowing, $BORR_t$. As will be discussed next, $BORR_t$ is determined by Equation 20 and responds to the difference between the bill rate and the discount rate. The level of nonborrowed reserves is by definition $BR_t - BORR_t$, and since BR_t and $BORR_t$ are both endogenous variables in the model, the level of nonborrowed reserves is also endogenous.

The first stochastic equation in the financial sector to be discussed is Equation 20 in Table 2–3, explaining $BORR_t$. The equation is quite simple. The ratio of $BORR_t$ to bank reserves is taken to be a function of the difference between the bill rate and the discount rate (RD_t). The positive estimate of the constant term in the equation implies that there is still some borrowing even if the bill rate and the discount rate are the same.

Consider next Equations 21 and 22, explaining $RAAA_t$ and $RMORT_t$. In the theoretical model the bond rate was determined according to the expectations theory, i.e., as a function of the current bill rate and of expected future bill rates. $RAAA_t$ and $RMORT_t$ are likewise assumed here to be determined according to the expectations theory. Both are taken to be a function of the current bill rate, of past values of the bill rate, and of past values of the rate of inflation. The past values of the bill rate and the rate of inflation are used as proxies for the (unobserved) expected future bill rates.

Both Equations 21 and 22 are in log form. The same rate of inflation variable is used in both equations, namely a weighted average of the rates of inflation in the past three quarters, with weights of 3, 2, and 1. This weighted average was chosen after some experimentation with alternative weighting schemes. Each of the two equations includes as explanatory variables both the lagged dependent variable and lagged values of the bill rate, which implies a fairly complicated lag structure of the bill rate on both of the long term rates.

The last stochastic equation to be considered in the financial sector is Equation 23, determining CG_t. Not counting new issues and retirements, CG_t is the *change* in the market value of stocks held by the household sector. In the theoretical model the aggregate value of stocks is determined as the present discounted value of expected future dividend levels, the discount rates being the current and expected future bill rates. Consequently, the theoretical model implies that CG_t ought to be a function of the *changes* in expected future dividend levels and of the *changes* in the current and expected future bill rates.

The two explanatory variables in Equation 23 are the change in the bond rate and a weighted average of the change in the after-tax cash flow of the firm sector. The change in the bond rate is taken to be a proxy for the (unobserved) changes in expected future bill rates, and the weighted average of the change in after-tax cash flow is taken to be a proxy for the (unobserved) changes in expected future dividend levels. The weights for the cash flow variable are 3, 2, and 1, which were also chosen after some experimentation with alternative weighting schemes.

The coefficient estimates in Equation 23 are of the expected signs, but the fit of the equation is not particularly good. Only 16.7 percent of the variance of CG_t has been explained. For present purposes the equation does provide some link between other variables in the model and CG_t, but it is not likely to be an equation that one can use to make money in the stock market. Some attempt was made here to try to improve upon Equation 23, but to no avail.

6.3 THE TREATMENT OF THE LOAN CONSTRAINTS

The final issue to discuss regarding the financial sector is the treatment of the loan constraints. In Chapters Four and Five the loan constraints were handled by adding log ZR_t to the various equations (the equations being in log form). Log ZR_t is equal to $-(1/1000)(RBILL_t^* - 0.608)^2$, where $RBILL_t^*$ is $RBILL_t$ partly detrended. Some of the equations in Chapters Four and Five also, of course, include log $RBILL_t$ directly as an explanatory variable. The variables log $RAAA_t$ and log $RMORT_t$ are also explanatory variables in some of the equations, and both of these variables are in turn influenced directly by log $RBILL_t$.

In the estimation and solution of the model, log ZR_t is treated as an endogenous variable, since it is a function of $RBILL_t$. Consequently, adding log ZR_t to some of the equations of the model can be looked upon as merely allowing $RBILL_t$ to enter the model in a more nonlinear way than otherwise would be the case. The reason for this added nonlinearity is justified by the discussion in Chapter Four, where it is argued that adding log ZR_t (and log ZJ_t) to an equation converts the equation from one with an unobserved left-hand side variable (the unconstrained decision value) to one with an observed left-hand side variable (the constrained decision value).

The procedure of determining $RBILL_t$ by solving the complete model is equivalent to assuming that $RBILL_t$ is determined by equating each period the aggregate supply of and demand for funds in the economy. Because of the addition of log ZR_t, log ZJ_t, and log ZJ'_t to the model, however, this procedure is *not* equivalent to equating the *unconstrained* supply of and demand for funds. What enter on the left-hand side of the equations for the household and firm sectors are the constrained decision values, and these are the values that are used in solving the model. The "constrained" aggregate demand for funds is equated to the "constrained" aggregate supply.

Near the end of Chapter Four a brief comparison was made between the treatment of the housing market in [14] and its treatment here. It was pointed out that the two treatments are not inconsistent with each other, although it is true that the model in [14] is incomplete because the mortgage rate and deposit flows into Savings and Loan Associations and Mutual Savings Banks are treated as exogenous. It is now possible within the context of the present model to consider more explicitly what happens when there is disequilibrium in the housing market.

If the loan constraint is binding on the household sector, housing investment is less than otherwise. This means that the demand for funds on the part of the household sector is less than otherwise. This lower demand (the "constrained" demand) is what is in theory used in the solution of the model (and thus of the bill rate) within the period. Since, however, the loan constraint variable is itself a function of the bill rate, the effect of the loan constraint on the household sector is assumed to be captured by means of the bill rate entering the model in the constrained case in a more nonlinear way than othewise.

If the loan constraint is not binding on the household and firm sectors (i.e., ZR_t is almost equal to one), then this added nonlinearity does not exist. The hours constraint may, however, still be binding on the household sector, or the labor constraint may still be binding on the firm sector, so that it may still be the case that it is the "constrained" aggregate demand for funds that is equated to the "constrained" aggregate supply in the solution of the model. The supplies of and demands for funds are affected by all of the constraints, not just by the loan constraint.

The periods in which the loan constraint is not binding on the household and firm sectors can be referred to loosely as periods of "easy money." It is important to note, however, that periods of easy money do *not* correspond to periods in which the financial sector holds excess reserves. The financial sector never holds excess reserves in the model, since BR_t is always equal to $g_{1t}DDB_t$. Periods of easy money just mean that the bill rate is low, a low bill rate implying that the loan constraint is not binding (i.e., that ZR_t is almost equal to one). In the theoretical model, a period of easy money might correspond to the banks holding excess reserves because of expectation errors, but, as discussed above, the financial sector is assumed in the empirical model not to hold excess reserves on a quarterly basis.