Why Commercial Banks Held Excess Reserves: The Japanese Experience of the Late 1990s

We investigated, empirically, why Japanese banks held excess reserves in the late 1990s. Specifically, we pin down two factors explaining the demand for excess reserves: a low short-term interest rate, or call rate, and the fragile financial health of banks. The virtually zero call rate increased the demand for excess reserves substantially, and a high bad loans ratio largely contributed to the increase in excess reserve holdings. We found that the holdings of excess reserves would fall by two-thirds if the call rate were to be raised to its level prior to the adoption of the zero-interest-rate policy, and the bad loans ratio were to fall by 50%.

JEL codes: E42, E51, E52, G21

Keywords: excess reserve, bad loans, zero-interest-rate policy.

Japanese banks have chronically held excess reserves since the late 1990s. Figure 1 illustrates the ratio of actual reserves to required reserves for commercial banks as a whole. The increasing trend in the excess reserve ratio has been conspicuous since the summer of 2001, and this ratio reached a high of 5.88 in October 2003. The excess reserve ratio typically parallels the supply of reserves. In fact, the reserve supply began to increase when the Bank of Japan announced that it would provide ample funds to push down the uncollateralized overnight call rate, or short-term inter-bank money market rate, as low as possible, in February

1. There are two spikes in the figures, each of which corresponds to Year 2000 and Fiscal Year 2002 problems. On those occasions, the policy authority provided ample liquidity to meet a surge in demand and secure stability in the financial markets.

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Why Commercial Banks Held Excess Reserves: The Japanese Experience of the Late 1990s

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Introduction

In the midst of severe depression during the 1990s, the Bank of Japan (BOJ) adopted the “zero-interest-rate policy” to set the call rate or the short-term inter-bank interest rate as low as possible in February 1999. Furthermore, the BOJ switched its operating target for money market operations from the call rate to the outstanding balances of the reserves held at the BOJ in March 2001. The BOJ committed herself to fulfill its policy goal and supplied tremendous amount of reserves to commercial banks. Commercial banks are required to hold certain amount of reserves, depending on the amount and type of deposits, at their current accounts at the BOJ. The reserves in excess of required reserves are called excess reserves. It should be noted that even if the banks keep excess reserves, there is no interest earned on it. In spite of no interest income the banks can earn, the banks still held reserves in far excess of required ones. Figure 1 shows the ratio of actual reserves to required reserves for commercial banks as a whole. The increasing trend in the excess reserve ratio has been conspicuous since the summer of 2001, and this ratio reached a high of 5.88 in October 2003. Figure 2 illustrates the frequency distribution of the excess reserve ratios of 145 commercial banks of our panel data set in 1994, 1999 and 2001. The frequency distribution was more dispersed and less skewed to the right in later years.

The purpose of this paper is twofold. First, we construct a theoretical model to explain this phenomenon. Second, we test the implications derived from the theoretical model using the panel data of Japanese commercial banks. We find that our theoretical model explains the banks’ behavior to hold excess reserves reasonably well. Empirical investigation reveals that virtually-zero short-term interest rate and banks’ balance sheet deteriorated by bad loans are responsible for bank’s holding excess reserves.

A Theoretical Model of Bank Demand for Reserves

We assume that the bank optimally allocates its resources between the interest-bearing asset and reserves with no interest, to maximize its expected interest income, while simultaneously taking into account the cost incurred in the case of reserve shortages (Freixas and Rochet(1997)). It is possible for the bank to put all the resources into interest-bearing asset but then the bank runs the risk of being unable to meet large, unanticipated withdrawals of deposits. Such a situation may be costly for the bank, as it gives rise to apprehension among depositors regarding the fragility of the bank’s balance sheet, and depositors may thus be prompted to further withdraw their deposits.

It is shown that the optimal demand for reserves is determined so that marginal decrease in the liquidity shortage cost brought about by increasing reserves, or the marginal benefit of increasing reserves may be equal to the marginal cost of increasing reserves. Figure 3 illustrates the way in which the optimal level of excess reserves is determined. The vertical axis measures the probability that the deposit withdrawal exceeds reserves and the horizontal axis measures reserves. The downward-sloping curve shows the bank’s subjective probability that the deposit withdrawal exceeds reserves, which decreases as reserves increase. When the downward-sloping curve intersects with the ratio of interest rate (r_i) to the penalty rate (r_{p,i}) or marginal cost of holding reserves, the optimal reserve holdings (R_i^*) is determined. The penalty rate is the loss the bank will incur in case of reserve shortage. The ratio of interest rate to the penalty rate measures the opportunity cost of holding reserves.

The demand for reserves increases as the interest rate falls and the penalty rate rises. This model, while simple, can explain the surge in excess reserve holdings by Japanese banks that took place in the late 1990s. The call rate was virtually zero under the zero-interest-rate policy, and the BOJ maintained the call rate to a level as low as possible under the new monetary policy regime.

When the balance sheet of a bank deteriorates by non-performing loans, the bank may anticipate a large amount of...
deposit withdrawals. In other words, the downward-sloping curve of the bank’s subjective probability of deposit withdrawal might shift upward. It implies that the bank maintains higher level of reserves for precautionary purpose.

Estimation of Bank Demand Equations for Reserves

As was shown above, the optimal demand for reserves crucially depends on the bank’s perception of deposit withdrawal. By assuming a specific distribution function for stochastic deposit withdrawal, we can derive the optimal demand equation for reserves to be estimated. In particular we assume a Pareto distribution with its parameters affected by the bank’s balance sheet or the ratio of bad loans to total loans as well as deposits.

For estimation purposes, we transform the demand equation for reserves into the deviation from required reserves. In one case, banks do not hold any excess reserves, so the deviation of optimal reserves from the required level is zero. In the other case where the optimal demand for reserves exceeds the required level, the demand for excess reserves is expressed as a function of deposit, bank’s health and opportunity cost of holding reserves (the ratio of call rate to the penalty rate). Since we can identify from the data which banks held excess reserves, we may estimate the system of reserve demand equations, using censored regression models.

Using the panel data set of 145 individual banks (9 city banks, 3 long-term credit banks, 7 trust banks, and 126 regional banks) during 1991-2002, we estimate the optimal demand equation for reserves. Note that the bad loans ratio is only available after 1997, so that we also use the rate of change in the share price of individual banks. Use of share price change has the merit that we can make full use of the whole sample period from 1991 in estimation.

The estimation is conducted for six specifications, where three variables are used to represent the banks’ financial health (two measures of bad loans ratio and rate of change in the bank’s share price), and where two account for the penalty rate (constant case and the ratio of operating profits to total equity as the variable penalty rate). The estimation results are quite satisfactory and stable irrespective of specifications. The coefficient estimates of the three key variables determining the demand for reserves are statistically significant. Deposits exert a significantly positive effect on reserve holdings. The call rate has a negative effect on the demand for reserves. The two bad loans ratios also affect the demand for reserves positively, which implies that banks with higher bad loans ratios increased their reserves. Furthermore, increases in the rate of change in share prices decreased the demand for reserves significantly.

Based on the parameter estimates of the demand equation for reserves, and using simulation analysis, we evaluated quantitatively the extent to which changes in the short-term interest rate and/or banks’ bad loans ratios affected the demand for excess reserves. Specifically, we took the following steps. First, we calculated the theoretical values of excess reserves by substituting the actual exogenous variables for 2002 into the estimated demand equation for reserves, and subtracted the required reserves. Next, we calculated the predicted value of excess reserves under different scenarios of the call rate and the bad loans ratio. We assumed that the call rate was raised to its level prior to the adoption of the zero-interest-rate policy. In other words, the call rate was set to its level in March 1998, or to 0.25%. With regard to the banks’ financial health, we considered a case in which the bad loans ratio was halved. This scenario is consistent with the Koizumi Structural Reform Plan, introduced in October 2002, which specified that non-performing loans should be reduced by 50% within one year. The predicted excess reserves thus calculated were summed up across banks, and the aggregated excess reserves were compared with their baseline value. Figure 4 shows the extent to which banks’ excess reserves are reduced under the different scenarios for the call rate and the bad loans ratio under the specification where the penalty rate is constant and the ratio of non-performing loans under the Financial Reconstruction Law is used. When the call rate is raised, excess reserves are reduced by as much as 70%. When the banks’ financial health is improved, excess reserves are reduced by 13%. When increases in both the call rate and banks’ financial health are implemented simultaneously, the holdings of excess reserves are reduced almost by 73%.

Conclusions

We empirically investigated why Japanese banks held excess reserves in the late 1990s. We were able to pin down two factors that explain the demand for excess reserves: a low short-term interest rate, or call rate, and banks’ fragile financial health. The nearly zero call rate substantially increased the demand for excess reserves, and the high bad loans ratio also contributed to the observed increase in reserve holdings. A quantitative evaluation of these factors was also conducted. It turns out that our simulation exercise is pretty accurate in predicting the amount of excess reserves thereafter. After the bad loans ratio peaked in 2002, it has exhibited a declining trend and now it is more than halved than its peak value for the banking sector as a whole. The call rate also started to rise after the BOJ ceased quantity-easing policy in 2006 March. Then the actual total excess reserves in 2006 were reduced by 71% compared to 2004 figures. It is exactly what our model predicted, hinting that our model of the bank’s demand for reserves in the late 1990s is correctly specified.

References