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A computational model of banks' optimal reserve management policy☆

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Abstract

This paper uses numerical methods to model the demand for excess reserves by a representative bank in a framework that includes many realistic features of the current reserve market structure in the United States. In particular, the model incorporates a 14-day maintenance period and an accurate representation of carryover provisions. We use the model to evaluate the effect of various changes to the operating environment (increased uncertainty, modified penalties) and changes to policy (paying interest on reserves).

JEL classification: E5; G2

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1. Introduction

The demands for reserve balances and excess reserves figure in a number of issues in monetary economics. For example, the current operational strategy of

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the Federal Reserve is to target the federal funds rate. To do this, the open market desk attempts to supply the amount of reserves demanded by banks, less the expected borrowing from the discount window, at the targeted interest rate. This policy of targeting the interest rate on a day-to-day basis requires high frequency estimates of the demand for reserve balances in order to guide the actions of the desk. This is done daily by the staff at the Board of Governors of the Federal Reserve and the New York Federal Reserve Bank. In this framework, understanding the forces affecting the daily demand for reserves and forecasting this demand becomes central to the implementation of monetary policy.

The demand for excess reserves is playing a particularly important role in monetary policy now given the ongoing shift away from reserve requirements around the world. Several countries have already moved to monetary systems without reserve requirements so that their demand for reserves is entirely a demand for 'excess' reserves (Borio, 1997). The United States is also moving in that direction due to the adoption of 'retail sweep programs' by commercial banks. These programs, which transfer deposits from reserveable transactions accounts to non-reservable 'savings' accounts, have resulted in significantly lower levels of required reserves, leaving some banks in the position of not needing to hold reserve balances to meet their reserve requirements. Because of this, the demand for reserves has become more sensitive to levels of payment flows and the risk of overdraft penalties. Understanding how this demand behaves is becoming an important issue in applied monetary economics.

Because of the importance of understanding the demand for reserves, bank reserve management strategy has been the subject of a significant body of research. Following Poole (1968), the literature on reserve demand has generally focussed on a representative bank's precautionary motive for holding reserves. In such models, the prototypical bank faces uncertainty about its end-of-day reserve position at the Federal Reserve and must choose a targeted level of reserves that balances the costs of holding non-interest bearing excess reserves against the costs associated with not meeting reserve requirements. Poole developed the basic single period version of this reserve demand that lies at the heart of most of the subsequent work. He also extended his model to a multi-day maintenance period, but for convenience abstracted from daily overdraft penalties along with carryover provisions (which did not apply at the time).

Several other papers have extended this optimizing model of reserve demand, although they all abstract from important aspects of the reserve structure. Clouse and Dow (1999) examine optimal reserve demand in a two period maintenance period with heterogeneous banks and both fixed and variable costs, but without carryover options. Longworth (1989) examines optimal reserve demand in a multi-day maintenance period following the Canadian system but does not include carryover provisions (which do not apply in Canada) and used restrictive assumptions (in particular, uniform distributions)