



Interest on reserves, regime shifts, and bank behavior



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ABSTRACT

This paper demonstrates that in the post-2008 environment with interest on reserves, monetary policy actions can generate regime shifts that yield quantitatively and even qualitatively different responses of bank balance-sheet configurations and loan and deposit market outcomes to exogenous changes. In contrast to the view that a one-time structural change occurred in 2008, switching between several different regimes plausibly can arise depending upon settings of the reserve ratio, federal funds rate, and the interest rate on reserves. Our results explain stylized facts regarding excess reserves and interbank lending. Analysis with calibrated values indicates that such regime switching has occurred.

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1. Introduction

As discussed by Taylor (2016a), the high excess reserves holdings in the post-2008 financial crisis period stands as one of the most notable and important policy issues in U.S. banking. Depicted in Fig. 1A, prior to 2008 aggregate excess reserves of U.S. depository institutions as a percentage of their total assets were near-zero. But from October 2008 onward, excess reserves increased sharply and continued to rise well after the end of the financial crisis. Many believe that this post-2008 increase in excess reserves arose simply from large-scale Federal Reserve bond purchases, associated with quantitative easing, that also occurred during this time. Indeed, the monetary base nearly quadrupled from October 2008 until December 2015, from approximately \$1 trillion to nearly \$4 trillion. One might conclude that the banking system just absorbed these substantial injections of reserves by holding excess reserves.

Closer examination, though, indicates that high excess reserves reflects a fundamental change in bank behavior between the pre-crisis and post-crisis periods. Before October 2008, the Fed also conducted bond purchases and injected new reserves steadily over time, albeit not to the same magnitude. Still, from January 1997 to September 2008 the monetary base nearly doubled, from \$463 billion to \$910 billion. Yet the share of bank assets held as excess reserves remained near zero throughout. The explanation for this behavior in the pre-crisis period is standard. During this time, the banking system responded to injections of new reserves by lending in retail markets, with bank deposits and M2 increasing commensurately. Individual banks with surplus reserves loaned them to borrowing banks in the wholesale markets. As a result, these reserves were distributed across the fractional-reserve banking system, until this injection ultimately became an addition to aggregate required reserves. This logic raises a question: Why did banks change their behavior after 2008 to hold high excess reserves?

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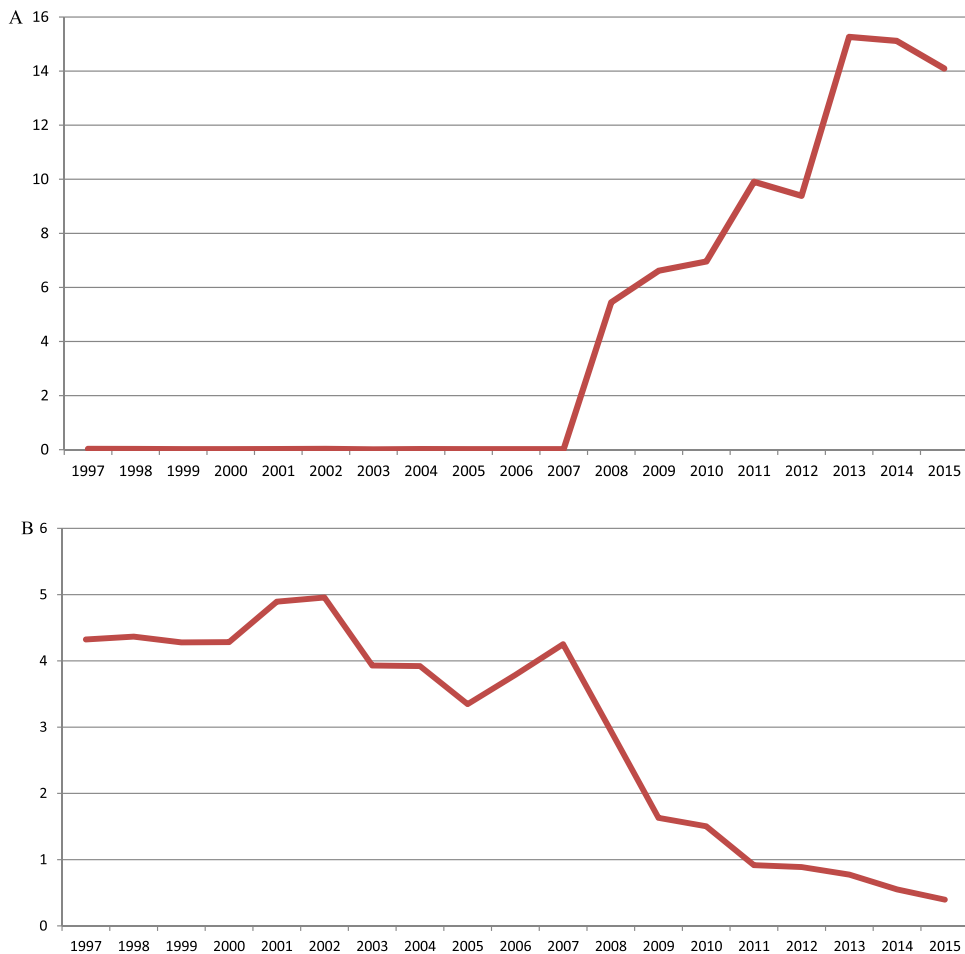


Fig. 1. (A) Year-end excess reserves as a percentage of year-end total assets of U.S. banks, 1997–2014. Sources: Board of Governors of the Federal Reserve System H.8 data release and FDIC Historical Statistics on Banking. (B) Year-end interbank lending of U.S. commercial banks as a percentage of year-end total assets, 1997–2014. Sources: Board of Governors of the Federal Reserve System H.3 data release and FDIC Historical statistics on Banking.

More evidence of structural change can be seen in the wholesale loaning market. Fig. 1B plots year-end interbank lending by U.S. commercial banks as a percentage of total assets. Before 2008, interbank lending operated in the range of 3–5% of total assets, but since then fell to approximately 0.4% by 2015. Wholesale lending has nearly vanished.

The fact that banks did not continue with their historical response to reserve injections in the post-2008 period, but instead held large amounts of excess reserves, clearly has had beneficial aspects. The macroeconomy avoided possibly disastrous affects of the massive increase in M2 that might have resulted. To this extent, recent analysis by [Anderson, Bordo, and Duca \(2016\)](#) suggests that this relatively subdued proportionate increase in M2 provides evidence that the Fed succeeded in avoiding policy spillovers to risk premia and inflation. The question remains, though: Why did banks so fundamentally alter their behavior?

To address this question, this paper formally examines this structural change in bank behavior in a model of profit-maximizing banks. The key element that emerges is another monumental banking and monetary policy event that took place in October 2008: Congress authorizing that the Federal Reserve could pay interest on required and excess bank reserves. We demonstrate that without interest on reserves, banks almost certainly operate in a regime of zero excess reserves and positive wholesale loaning. However, payment of a sufficiently high interest rate on reserves results in positive excess reserves and zero wholesale loaning. The separate individual regimes generate different responses of retail lending, deposits, and other bank choice variables to monetary policy instruments and other exogenous factors. Quantitative analysis indicates that switching between these two regimes occurred, which can explain the stylized facts in Fig. 1A and B. Moreover, our formal analysis shows that balance-sheet switching—banks moving back and forth between different regimes based upon changes in Fed’s policy’s use of the federal funds rate and interest on reserves—can continue. It also identifies circumstances under which it will occur.

Section 2 reviews the history of interest on reserves in the United States, its 2008 implementation, and recent research on its ramifications. We concur with [Cochrane \(2014\)](#) that the Fed since 2008 has engineered a regime shift. However, our

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