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journal homepage: [www.elsevier.com/locate/jeb](http://www.elsevier.com/locate/jeb)Interest on reserves and Federal Reserve unwinding<sup>☆</sup>Donald H. Dutkowsky<sup>a,\*</sup>, David D. VanHoose<sup>b</sup><sup>a</sup> Maxwell School of Citizenship and Public Affairs, Syracuse University, 110 Eggers Hall, Syracuse, NY 13244-1090, United States<sup>b</sup> Baylor University, One Bear Place #98003, Waco, TX 76798, United States

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## ABSTRACT

This paper investigates the effects of reductions in the Federal Reserve's asset portfolio on bank lending in the context of the Dutkowsky-VanHoose model of interest on reserves and regime shifts. Based upon relative magnitudes of structural resource cost parameters, we argue that retail lending becomes considerably less responsive to exogenous monetary base changes in the post-October 2008 regime of positive excess reserves and virtually zero wholesale lending. The model provides an explanation for the observed relationship between retail loans and the monetary base before and after October 2008. Our analysis indicates that the Fed can unwind its balance sheet with minimal disruption in retail lending, as long as it continues settings of the federal funds rate and the interest rate on reserves so that banks operate in the post-October 2008 regime. However, unwinding while returning to the pre-October 2008 regime of zero excess reserves and positive wholesale loans could lead to more adverse effects on retail lending.

## 1. Introduction

In recent years, the Federal Reserve has signaled an intention to begin “unwinding” its balance sheet by reducing its holdings of the assets it has accumulated since late 2008 [see, for instance, [Federal Open Market Committee \(2017\)](#)]. This unwinding is in response to the substantial amounts of bond purchases that the Fed conducted, on almost a continuous basis, from October 2008 to the summer of 2014.

The Fed initially applied the expansion of reserve liabilities on the part of banks by making substantial loans collateralized by toxic assets, with the value of that collateral being subject to a haircut based on its risk. Although in almost all cases the borrower was liable for the full amount even if the assets turned out to be worth less than the loan, these transactions were clearly riskier than normal loans. Later, the Fed continued these large increases in the monetary base by conducting quantitative easing, through purchases primarily of U.S. Treasury securities. Since the summer of 2014, the Fed has been gradually shrinking its balance sheet, reducing the monetary base from its peak of \$4.04 trillion in second quarter 2014 to \$3.73 trillion as of the first quarter of 2017.<sup>1</sup> But even with the Fed's limited unwinding efforts, the monetary base and Fed assets remain over four times greater than levels observed in the third quarter of 2008. Bank excess reserve holdings also remain notably elevated relative to pre-October 2008 levels.

Recently a wide range of observers, including [Lachman \(2017\)](#), J. P. Morgan CEO Dimon [see [Dugan \(2017\)](#)], and Darda from

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<sup>1</sup> A review of Federal Reserve assets indicates that the degree of unwinding to this point may in fact be considerably less. Based upon data from FRED, as of the first quarter of 2017 Fed assets equal roughly \$4.46 trillion, a decline of less than \$50 billion from their peak of \$4.50 trillion in the first quarter of 2015. Looking at several balance sheets from the Fed's H.4.1 release, the relatively larger decrease in the monetary base appears to stem from increases in reverse repurchase agreements and U.S. Treasury deposits.

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MKM Partners [see Cox (2017)] have publically expressed concerns about Fed unwinding. A number of these and other observers assert that the resulting Fed balance-sheet shrinkage has the potential to bring about or at least contribute to a significant contraction in bank lending, which in turn could lead to a recession. Selgin (2017) and Taylor (2016c, 2017), though, suggest that the effects of a Fed balance-sheet contraction could be relatively benign.

This paper applies the model of Dutkowsky and VanHoose (2017) to formally analyze the issue of Federal Reserve unwinding. Our analysis focuses on comparative statics results from general-equilibrium solutions of bank choice variables within this model, retail loans in particular. In doing so, we carefully examine structural banking parameters that the model reveals to be key influences on these responses. Our results offer an explanation for the observed difference in responsiveness of bank retail lending to changes in the monetary base beginning in October 2008. We in turn apply the findings to analyze the potential of Fed unwinding to generate instability or other adverse effects in retail lending.

The novel policy procedure introduced by the Federal Reserve in October 2008—payment of interest on reserves at a rate well in excess of the federal funds rate along with the beginning of large expansions in the monetary base—has created considerable confusion among monetary economists.<sup>2</sup> At one extreme, Dressler and Kersting (2015) and Ireland (2014) utilize banking frameworks with markets for aggregate bank loans that lead them to conclude that the overall implications of the Fed's altered policy approach will be relatively minor. Furthermore, a calibration-based analysis by Canzoneri, Cumby, and Diba (2017) implicitly assumes an unaltered regime with regard to banks' demand for reserves by deriving parameters from a U.S. reserve demand function estimated using data prior to the Fed's policy change. In contrast, on the basis of an analysis couched within the fiscal theory of the price level but absent a theory of bank behavior, Cochrane (2014) argues that the new procedure constitutes a major regime change that undermines traditional monetary theory.

Dutkowsky and VanHoose (2017) reach a conclusion between these extremes. Like Ireland (2014) and Dressler and Kersting (2015), Dutkowsky and VanHoose (2017) develop and analyze a banking model, but their framework allows for distinctive markets for retail loans and wholesale interbank loans. Their model emphasizes the regime shift in bank behavior that occurred due to the Fed decision, beginning in October 2008, to pay interest on reserves at a rate well above the federal funds rate. Consistent with Cochrane (2014), Dutkowsky and VanHoose (2017) conclude that the Fed's change in policy constitutes a new regime.

Martin, McAndrews, and Skeie (2016) address possible implications of Fed unwinding by putting forth a general-equilibrium model including bank behavior. Their framework includes interest on reserves, no reserve requirements, and non-interest costs incurred by banks consisting of a function based upon the size of their balance sheet. The authors' results imply that under zero or moderate balance sheet costs, bank loans will be independent from the quantity of reserves determined by the central bank, although loan responses may be contractionary under sufficiently large reserves and balance sheet costs. In all cases, their results yield an equality between the equilibrium loan rate and the interest rate on reserves. A key distinction between the models of Dutkowsky and VanHoose (2017) and Martin et al. (2016) centers upon bank non-interest costs. The latter study puts forth separate and independent resource costs for each component within the bank's balance sheet.

In addition, the Dutkowsky and VanHoose (2017) model emphasizes regime change. Their results imply that under different regimes banks will exhibit markedly different responses, quantitatively and even at times qualitatively, in their balance-sheet choices. The regime that becomes operative for banks is determined largely by relative magnitudes of the interest rate on reserves and the federal funds rate, as set by the Fed.

In this regard, Fig. 1 offers a clear picture of the regime shift that likely occurred, beginning at the value of the monetary base approximately equal to \$1 trillion. The corresponding time period is the end of 2008, as from third quarter 2008 to fourth quarter 2008 the monetary base jumped from \$0.87 trillion to \$1.42 trillion, and steadily increased thereafter.<sup>3</sup> This behavior arguably reflects the Fed's policy changes in October 2008, in particular with regard to the interest rate on reserves.

The Dutkowsky and VanHoose (2017) model shows that in the pre-October 2008 regime, in which the Fed set the interest rate on reserves to be sufficiently lower than the federal funds rate (in fact, the interest rate on reserves was equal to zero during this time), banks had the incentive to operate within a regime with positive wholesale interbank lending and minimal holdings of excess reserves. Correspondingly, as shown by the cluster of points along the horizontal axis of Fig. 1, Fed expansions of the monetary base prior to October 2008 (monetary base < \$1 trillion) had miniscule effects on banks' excess reserve holdings.

Since October 2008, however, the Fed has paid interest on reserves and, more importantly, has done so at a rate sufficiently higher than the federal funds rate. Dutkowsky and VanHoose (2017) show that this action changed the regime within which banks operate. In this different regime, banks have an incentive to hold positive balances of excess reserves, with evidence of this behavior appearing in Fig. 1. As shown in Fig. 1 by the upward-sloping cluster of points in the post-October 2008 regime (monetary base > \$1 trillion), Fed expansions of the monetary base led to continual increases in excess reserves.

The Dutkowsky and VanHoose (2017) model shows that this regime change also induced banks to engage in minimal wholesale interbank lending activity.<sup>4</sup> This result is consistent with the behavior depicted in the graph of the ratio of interbank lending to total

<sup>2</sup> Early analyses, such as VanHoose (1991) and Keister and McAndrews (2009), presumed that the Fed would set the interest rate on reserves as a lower bound on the federal funds rate. But as discussed by Goodfriend (2015) and Dutkowsky and VanHoose (2017), with the exception of brief periods following October 2008, the rate paid on reserves by the Fed has consistently exceeded the federal funds rate. Goodfriend (2015) calls for measures to be taken to establish the interest rate on reserves as a floor in this way.

<sup>3</sup> The data in Figs. 1 and 2 are in quarterly units and come from FRED.

<sup>4</sup> Bech and Klee (2009) and Goodfriend (2015) provide explanations as to why the federal funds rate tends to be well below the interest rate on reserves in the post-October 2008 era. The chief sellers of federal funds have become Government Sponsored Enterprises and Federal Home Loan Banks [the latter source also emphasized by Afonso et al. (2013)]. These institutions must hold deposits at the Fed but do not receive interest on them. Banks seeking to buy federal funds, then, can offer a relatively low interest rate which enables the sellers to earn some interest on these reserves. This situation creates possible arbitrage opportunities for banks to borrow federal funds and then hold them as excess reserves at the higher rate. Goodfriend (2015) puts forth reasons why banks limit this behavior.

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