"MacroPru in the Shadow of Declining Balance Sheet Model of Banking"

Greg Buchak, Gregor Matvos, Tomasz Piskorski, and Amit Seru

Lending activity to households and firms plays an important role in the economy and is considered one of the key elements of the pass-through of economic shocks -- including monetary policy and macro prudential regulation -- to the real economy (Di Maggio et al. 2017, Beraja et al. 2019, Eichenbaum et al. 2022). Consequently, accurately tracking aggregate lending activity is of central importance to policymakers and regulators as they assess the state of economic activity and financial stability as well as response of the economy to various macro prudential polices.

In this paper, we will start by noting that over the last two decades, the modern industrial organization of the financial sector has dramatically changed from the "textbook" model of bank balance sheet lending. Then, using micro-level lending data on the largest credit market in the US, we will show that failing to recognize this change can lead to systematic errors in assessing responses of lending to various polices (such as QE) relative to expectations from the textbook model. These errors emerge both in magnitude and direction. Moreover, the distributional consequences of such errors do not fall uniformly to households and firms. We will conclude by discussing how to debias such assessments of lending and financial stability

There are two key aspects which has resulted in the modern industrial organization of the lending market differing from the traditional bank balance sheet lending view (Buchak et al. 2018 and 2020). First, non-depository institutions, that is shadow banks, now account for a substantial part of the lending in many markets. Their increased penetration in some markets relative to others is driven by both higher regulatory burden faced by traditional banks as well as technological progress in the financial sector. Importantly, the lending activity of shadow banks is routinely missed in lending assessments employing only regulatory data on bank lending activity. Second, banks now sell significant a share of loans they originate (e.g., by securitizing them) as they respond to both new regulatory forces and competition from shadow banks. Together, these aspects result in systematic errors in gauging the risk in the financial sector as well as aggregate lending level and its growth if one focuses naively on bank balance sheet lending data. Notably, such assessments are routinely done both by academics and policymakers who commonly employ the so-called bank call report data to assess lending conditions both in the US and other countries (e.g., in Eurosystem studies).

We illustrate these points by focusing on the US residential mortgage market, the largest credit market in the US with about $11 trillion of loans outstanding. The key advantage of this market is that we have micro-level data on essentially every single loan made, regardless of whether (i) it was originated by a bank or shadow bank, and (ii) whether a financial institution retained a loan on its balance sheet or sold it. We show that insights from this market apply to other credit market segments, including corporate loans, credit cards, auto loans, and personal loans, where the industrial organization of financial intermediation has seen a similar change -- banks sell a significant share of their loans and shadow banks account for a substantial amount of lending.

To formalize our main ideas, consider an amount of balance sheet lending by bank i at year t, $Bank\ balance\ sheet\ lending_{i,t}$. Note that this information can be obtained from regulatory bank call reports that measure the amount of lending by a bank in terms of loans it retains on its balance

sheet. However, if a bank sells some of its loans, its $Total\ bank\ lending_{i,t}$ will be larger and given by:

$$Total\ bank\ lending_{i,t} = m_{i,t}^{Loan\ Sale} \times Bank\ balance\ sheet\ lending_{i,t} \quad (1)$$

where $m_{i,t}^{Loan\ Sale}$ is the lending "multiplier" due to loans sales that equals

$$m_{i,t}^{Loan\ Sale} = \frac{1}{1 - Loan\ Sale\ Share_{i,t}} \quad (2)$$

where $Loan\ Sale\ Share_{i,t}$ is the fraction of loans that bank *i* sells at time *t*. Aggregating across the banks we get that the total aggregate bank lending at time *t* is equal to

$$Total\ bank\ lending_t = m_t^{Loan\ Sale} \times Bank\ balance\ sheet\ lending_t \quad (3)$$

where $Bank\ balance\ sheet\ lending_t$ is the aggregate bank lending retained on balance sheet and $m_t^{Loan\ Sale}$ is the aggregate lending multiplier due to loan sales.

Next, even if we were to measure total bank lending correctly, we may underestimate the aggerate amount of lending in the economy if some lending activity is done by shadow banks outside of the traditional banking sector. In this case, the total amount of lending in the economy at time *t* equals

$$Total\ lending_t = m_t^{Shadow\ Bank} \times Total\ bank\ lending_t \quad (4)$$

where $m_t^{Shadow\ Bank}$ is the shadow bank lending multiplier equal to

$$m_t^{Shadow\ Bank} = \frac{1}{1 - Shadow\ Bank\ Share_{i,t}} \quad (5)$$

and $Shadow\ Bank\ Share_{i,t}$ is the fraction of loans originated by shadow banks. Importantly, both the multipliers vary across markets depending on various regulations as well competition faced by banks. Combining equations (3) and (4), we get the correspondence between the aggregate amount of lending in the economy and the amount of aggregate bank balance sheet lending:

$$Total\ lending_t = m_t^{Shadow\ Bank} \times m_t^{Loan\ Sale} \times Bank\ balance\ sheet\ lending_t \quad (6)$$

To understand this equation, consider an example where we have $300 billion of bank balance sheet lending in a given year, but banks sell 50% of their loans and 50% of lending activity is done by shadow banks. In this case, both multipliers are equal to two, aggregate bank lending is equal to $600 billion, and overall lending is equal to $1.2 trillion.

The traditional "textbook" lending view corresponds to the case where both lending multipliers are equal to one:

$$m_t^{Loan\ Sale} = m_t^{Shadow\ Bank} = 1.$$

In this case, banks retain all their loans on their balance sheets, there are no shadow banks, and the total lending equals the bank balance sheet lending. Macro prudential regulation that targets financial stability can do well by keeping track of lending on bank balance sheet. As we will illustrate empirically, not only are these lending multipliers substantially different from one, they vary across time, vary across markets -- both within a market (e.g., mortgages of different sizes) as well as across markets (e.g., mortgages versus auto) -- and vary across various policy regimes.

We will show this can lead to systematically biased inferences if one tries to use bank balance sheet lending data, as is commonly done by academics and policymakers, to make inferences on the state of overall bank lending and the total amount of lending in the economy. These errors affect inferences on levels, growth rates, and the distribution of lending across lending institutions as well as the aggregate amount of financial risk.

To preview some of our findings, we will first start with the loan sale multiplier. Figure 1A shows the fraction of banks that follow the traditional bank model in the residential loan market, that is, they retain all their loans on their balance sheets, so their loan sale multiplier is equal to one. Throughout our sample period, about half of the banks in the US do not sell any residential mortgages they originate between 2005 and 2020. However, as Figure 1B shows these "traditional" banks make up only around 7% of the overall bank loan origination volume. In other words, most bank lending activity occurs among banks that sell some of their loans and hence do not follow the traditional balance sheet-based lending model.

Figure 2A shows that banks indeed sell large share of their loans. Aggregated over all banks, the loan sale propensity varied widely between 2005-2020, reaching a peak of 76% during the Great Recession and falling by more than half to a low of 34% in 2018 before the pandemic. These trends are closely mirrored in the top 50 banks. Figure 2B shows the implied aggregate loan sale multiplier, while Figure 2C shows the estimated loan sale multiplier at the bank level along with its confidence bounds. As we will discuss in greater length in our paper and document empirically, there are at least a few explanations for the rapid increase in loan sales following the Great Recession. First, the loan sale propensity increased among less capitalized banks that suffered losses during the Great Recession. Second, Quantitative Easing focused on acquiring large amount of mortgage-backed securities (MBS) and made securitization more attractive to banks, leading financial institutions to sell more loans instead of keeping them on balance sheet. Finally, there was increased competition from shadow banks in some markets, increasing pressure on bank margins.

As we will analyze in our paper in greater detail, not recognizing the loan sale margin by only using the bank balance sheet data would lead to a very biased inference on total bank lending. To preview these results, first note that as bank loan sales were particularly high during the Great Recession, focusing on bank balance sheet lending data would severely underestimate the overall amount of bank lending in that period. Moreover, doing so would also result in directional errors regarding the change of the aggregate lending around the Quantitative Easing launch.

To illustrate this, Figure 3 shows the annual bank balance sheet lending growth rate (grey) and the aggregate bank lending growth rate (black). As we observe, not only are there significant differences in the magnitudes of these growth rates, but also during 2009-2011 they have the opposite sign. Consider 2009, where the bank balance sheet lending data shows an annual decline in bank mortgage lending relative to 2008 by about 10%. Note that the Federal Reserve Bank launched QE1 in November 2008 and started buying hundreds billion of dollars in mortgage-backed securities to stimulate mortgage lending activity. Despite that, one would conclude that bank mortgage lending declined during this period if one only focuses on bank balance sheet data. Yet if one focuses on the total bank lending growth, it shows an increase in bank lending by about 26% in 2009 relative to 2008. What happened?

Building on insights of Buchak et al. (2020), a plausible explanation that we will explore in our paper is that as QE made securitization more attractive, banks reduced their balance sheet lending and increased their lending for securitization. In other words, the policy led to a simultaneous decline in bank balance sheet lending and increase in the loan sale multiplier, resulting in a decline in bank lending as measured by balance sheet data while in fact overall bank lending increased. A suspension of the acquisition of mortgage-backed securities by the Federal Reserve System may explain the opposite effects in the 2010-2011 period, the aggregate lending growth and loan sales decline while the bank balance sheet lending growth increases. This example empirically illustrates the broader point that the endogenous *bank balance sheet retention* margin of adjustment driven by loan sales plays an important role in the transmission of monetary and regulatory shocks through the lending market.

Next, we will empirically illustrate the importance of recognizing the shadow bank substitution margin of adjustment for correct inferences regarding the state of the lending market. To preview some of our findings, Figure 4 shows the fraction of residential mortgages originated by shadow banks along with the shadow bank loan multiplier. As we see, shadow banks originate a significant share of loans, and their propensity to sell loans substantially increases over time from about 30% in 2005 to close to 60% by 2020. As shadow banks now originate most residential loans in the US market, focusing only on bank lending data would result in very biased inferences regarding aggregate lending, especially in more recent periods. Importantly, like in the case of the loan sale multiplier, the equilibrium interaction between banks and shadow banks can lead to simultaneous effects of various polices on both banks and shadow banks, complicating the assessment of overall lending conditions from bank data.

To preview our results, consider an increase in the required bank capital ratios. As explained by Buchak at al. (2020), such a policy will lead to a decline in bank balance sheet lending. However, the overall decline in bank lending would be more muted as banks would increase their loan sales. Moreover, shadow banks would take advantage of the deterioration in bank lending conditions and increase their origination volume. Again, looking just on bank balance sheet data would lead to an erroneous inference regarding the impact of capital ratios on the aggregate lending level. In our paper we will use empirical data to illustrate the extent of such biases over time, across markets and across policies.

We will conclude our paper by discussing the broader implications of our results. First, the analysis of the credit intermediation sector must incorporate the ability of lenders to sell their loans and the equilibrium interaction of banks and shadow banks. In doing so, one needs to recognize that both the *bank balance sheet retention* margin and the *shadow bank substitution margin* will respond to changes in the economic environment, including monetary policy and regulatory shocks. Not recognizing these effects will usually lead to a significantly biased inference, not only in terms of magnitudes but often in terms of the directions of the aggregate lending as well as where the risk resides in the economy. Second, the extent of such biases will also depend on the ease of loan sales and shadow bank penetration, that as we will discuss in greater detail in our paper, varies across market segments and countries. This further complicates using evidence from one market segment or country for making inferences regarding the impact of polices in other countries and other credit market segments. We will provide a set of guidelines on how to make such inferences more comparable.

More broadly, our paper underscores the limitations of only zooming into bank balance sheets (i.e., focusing solely on call report data by traditional banks) and highlights the critical importance of collecting and making available data on overall lending that includes lending done by shadow banks and loans that were not retained on the balance sheets of financial institutions. Our paper suggests that in the interim researchers and policy makers could rely on quantitative lending models that recognize the modern industrial organization of credit markets and allow more complete and less biased inferences from the limited data.

In terms of progress, we are about 40% done with the analysis and writing and need some more time to put the paper together.

References:

Beraja, Martin, Andreas Fuster, Erik Hurst, and Joseph Vavra, 2019, Regional Heterogeneity and the Refinancing Channel of Monetary Policy, *Quarterly Journal of Economics* 134, 109–83.

Buchak, Greg, Gregor Matvos, Tomasz Piskorski, and Amit Seru, 2018, Fintech, Regulatory Arbitrage, and the Rise of Shadow Banks, *Journal of Financial Economics* 130, no. 3: 453–83.

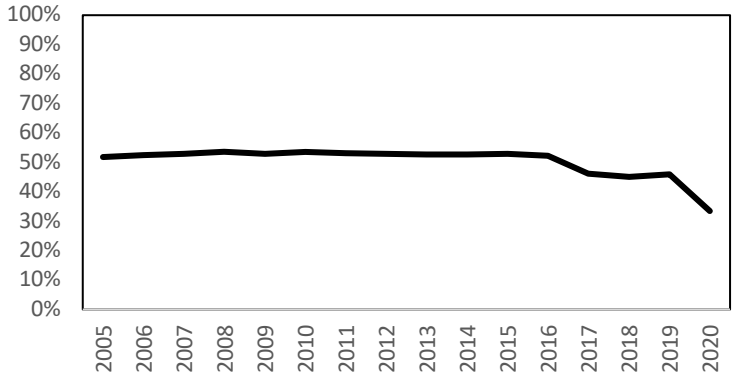
Buchak, Greg, Gregor Matvos, Tomasz Piskorski, and Amit Seru, 2020, Beyond the Balance Sheet Model of Banking: Implications for Bank Regulation and Monetary Policy, Working Paper 25149, National Bureau of Economic Research.

Di Maggio, Marco, Amir Kermani, Benjamin J. Keys, Tomasz Piskorski, Rodney Ramcharan, Amit Seru, and Vincent Yao, 2017, Interest Pass-Through: Mortgage Rates, Household Consumption and Voluntary Deleveraging, *American Economic Review* 107, 3550–3588.

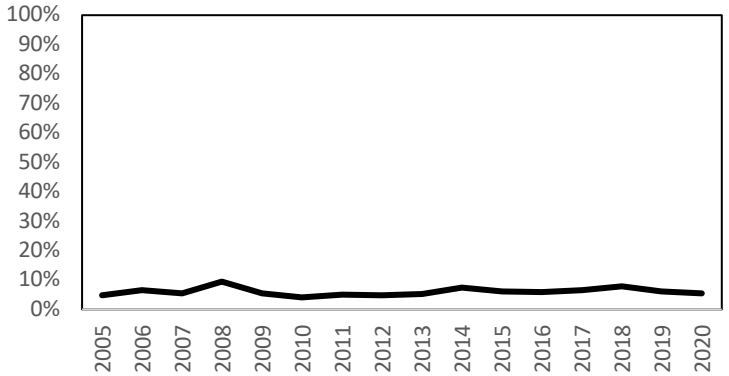
Eichenbaum, Martin, Sergio Rebelo, and Arlene Wong, 2022, State Dependent Effects of Monetary Policy: The Refinancing Channel, *American Economic Review* 112, 721-761.

Figure 1: Traditional Balance Sheet Lending Banks in the Residential Mortgage Market

Panel A of this figure shows the percentage of banks among the US mortgage loan originators that do not sell any residential loans in each year, and hence follow traditional bank balance sheet lending model. Panel B shows the percentage of annual bank loan origination volume these traditional balance-sheet only lending banks account for in each year. While almost half of all banks do not sell any loans during our sample period, they make up only around 7% of the loan origination volume. Data Source: HMDA Data.



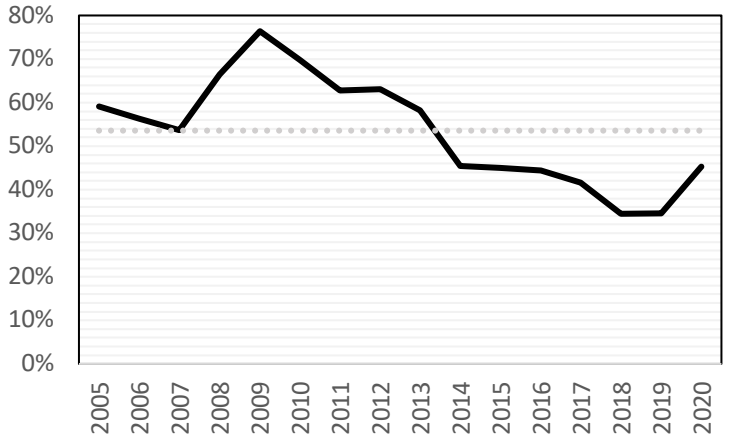
A. Percentage of Banks that do not sell any loans



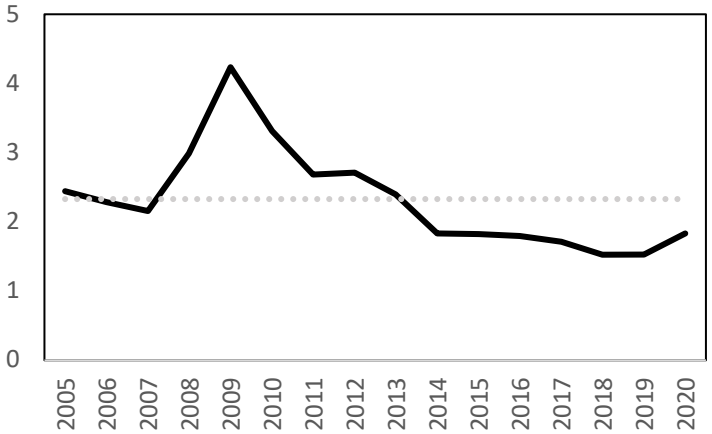
B. Percentage of Origination Volume by Banks in left panel

Figure 2: Bank Loan Sales Propensity and the Loan Sale Lending Multiplier

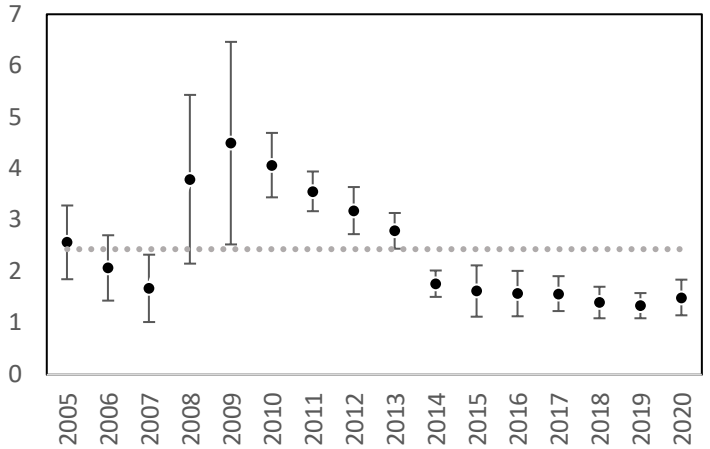
Panel A of this figure shows the percentage residential loans that banks originate and sell per year. The dashed line shows the sample mean. Panel B shows the implied loan sale multiplier at the aggregate level. Panel C shows the estimated loan sale multiplier in each year based on the estimation of equation (1) with individual bank data with 95% confidence intervals. The coefficient of interest indicates the estimated dollar volume of loans originated by a bank in that year for each dollar of lending retained on the bank balance sheet. Data Source: HMDA Data.



A. Percentage of loans sold by banks



B. Loan sale mutiplier ($m_t^{Loan\ Sale}$)



C. Estimated loan sale multpilier across banks

Figure 3: Growth Rates of Aggerate Bank Balance Sheet Lending (Grey) and Aggregate Total Bank Lending (Black)

This figure shows the annual growth rates of aggerate bank balance sheet lending (in grey) and the aggregate total bank lending (in black). As we observe, not only these growth rates are different in magnitudes but during the Great Recession they have the opposite signs (in 2009-2011). Source: HMDA Data.

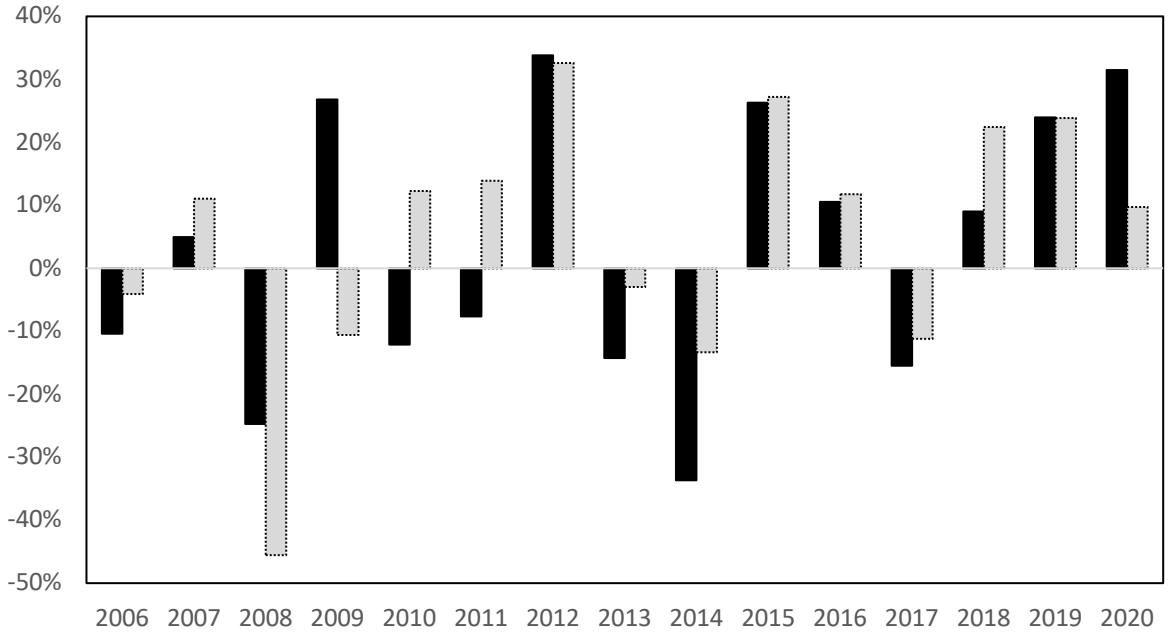
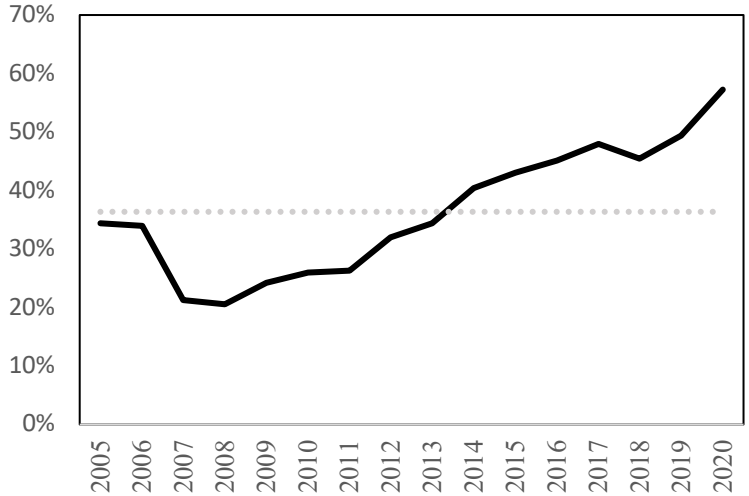
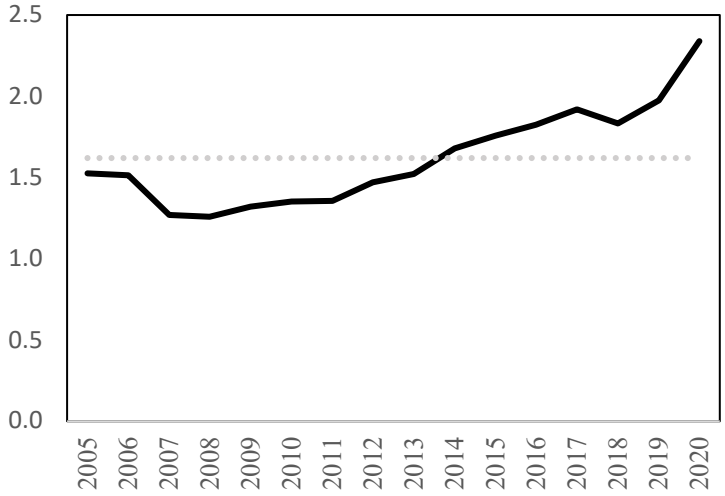


Figure 4: Shadow Bank Market Share and the Shadow Bank Loan Multiplier

Panel A of this figure shows the percentage of residential mortgage loans originated by the shadow banks in the US. The dashed line shows the sample mean. Panel B shows the implied shadow bank multiplier. Data Source: HMDA Data



A. Shadow bank market share



B. Shadow bank lending multiplier $m_t^{Shadow\ Bank}$