

Research Statement

The landscape of financial intermediation has changed. In the past, commercial banks were the main intermediaries that transformed long-term illiquid loans to businesses into short-term deposits, which provided households with a liquid and convenient way to save and make payments. In the past few decades, however, this transformation of illiquid assets into more liquid claims has been increasingly performed by non-bank financial institutions (non-banks). These institutions expand the reach of financial intermediation but also pose new risks to the economy and call for an updated toolkit for central banks and regulators. In the March 2020 Covid-19 crisis, for example, the US Federal Reserve rolled out unprecedented measures targeting non-banks, whose actions disrupted important markets like that for US Treasuries.

My work sheds light on this evolving landscape of financial intermediation, where non-banks are increasingly engaged in liquidity transformation, while the traditional banking sector is transforming less liquidity than before. Applying a combination of reduced-form empirical methods, structural estimation, and theoretical models, I examine how this evolution affects asset prices, the stability of the financial system, the transmission of monetary policy, and the provision of credit to the real economy.

My research has three main building blocks. The first one examines the rise of non-banks and its implications. I develop a unified framework that defines and measures liquidity transformation by both banks and non-banks. Building on this framework, I focus on the different risks and frictions of each of the major non-banks, including mutual funds, money market funds, ETFs, and stablecoins.

The second strand of my work studies changes in liquidity transformation by the banking sector. I find that these changes may have been an unintended consequence of financial regulation, the Federal Reserve's Quantitative Easing (QE) policy, and advancements in payment technology. Although less liquidity transformation is generally associated with reduced fragility, I uncover that new financial stability risks may emerge from banks' new business model, which are important to monitor and guard against.

Finally, I analyze the interaction between bank and non-bank financial institutions. The literature has largely treated banks and non-banks separately, but in practice, their economic activities are interdependent in numerous ways. My work sheds light on these interdependencies and their implications for monetary policy transmission, systemic risk, and lending to the real economy.

My research has made an impact on academia and policy. My work has been taught in

graduate courses at Chicago Booth, Harvard, Wharton, NYU Stern, Kellogg, and UCLA, among others. I have also been featured in several panel discussions at academic and policy conferences, wrote a review article on topics central to my research agenda (Krishnamurthy and Ma, 2024), and serve as associate editor for the *Review of Financial Studies*, the *Journal of Financial Economics*, and *Management Science*. In terms of policy impact, my work has been cited by the Securities and Exchange Commission’s (SEC) proposed rule on Swing Pricing, the SEC’s proposed rule on Money Market Fund Reforms, the Federal Reserve’s Financial Stability Report, and the International Monetary Fund’s Financial Stability Report, among others. For the past few years, I have also been a consultant for the New York Federal Reserve and the European Central Bank on their policy initiatives for non-bank financial institutions.

The Rise of Non-Banks in Liquidity Transformation

Liquidity transformation—the conversion of illiquid assets, such as loans and bonds, into liquid claims for households—is an essential function of the financial system. It has traditionally been associated with banks transforming illiquid bank loans into liquid bank deposits, such as checking and savings deposits. Non-banks, however, are not allowed to issue deposits and resort to issuing other types of liquid claims to their investors, such as money market fund shares. The first building block of my work analyses non-bank liquidity transformation in the absence of deposits. Examining the leading non-banks, including money market funds, mutual funds, ETFs, and stablecoins, I show that the amount of liquidity transformation and the inherent risks vary widely by the type of non-bank and the claims they issue to investors. My work further demonstrates how optimizing the design of non-banks can help minimize these risks.

Bank Debt, Mutual Fund Equity, and Swing Pricing in Liquidity Provision (Ma, Xiao and Zeng, 2022a) develops a unified framework to measure liquidity transformation by banks and non-banks. While there are estimates of liquidity provision by banks, non-banks like mutual funds and money market funds have been viewed differently. These funds allow investors to redeem their shares at short notice but at share values that fluctuate with market conditions, i.e., an equity contract, unlike bank deposits that promise a fixed deposit rate, i.e., a debt contract. Our framework provides the first measure of liquidity provision that is generally applicable across banks and non-banks, the Liquidity Provision Index (LPI). The LPI shows that fund shares provide an economically significant amount of liquidity to investors compared to bank deposits. Intuitively, liquidity provision occurs as long as investors pool their money in a fund to jointly invest in illiquid assets, because they insure each other against unexpected withdrawal shocks that would otherwise force them to sell illiquid assets at a high cost. This

is a generalization of the liquidity insurance channel first introduced by the seminal Diamond and Dybvig (1983) model for banks. Further, our estimates reveal that the gap between bank and non-bank liquidity provision has narrowed over time, underscoring the growing importance of non-banks in transforming liquidity for the financial system.

Another key finding of this study is that non-banks would have the potential to transform more liquidity if they were better designed. Currently, mutual funds with illiquid assets are subject to run risk (Chen, Goldstein and Jiang, 2010, Goldstein, Jiang and Ng, 2017). If fund share values were adjusted in full expectation of future price movements, i.e., swing pricing, each investor would bear the full cost of their redemptions, and the incentive for investors to redeem from the fund in fear of others' redemptions would be reduced. When the risk of large-scale investor redemptions is reduced, funds can safely invest in more illiquid assets and ultimately provide more liquidity to investors. These benefits to financial stability and liquidity provision are in part why swing pricing is currently under consideration by the SEC, which has cited our work in its proposed regulations.

In the absence of swing pricing, large-scale redemptions from mutual funds indeed materialized and became a major contributor to the financial market turmoil during the Covid-19 crisis, as we show in **Mutual Fund Liquidity Transformation and the Reverse Flight to Liquidity** (Ma, Xiao and Zeng, 2022*b*). In March 2020, the market for US Treasuries was strained by pronounced selling pressure. This was puzzling because US Treasuries are the global safe asset, and investors bought, rather than sold, Treasuries in past crises, i.e., flight to safety. Our analysis traces the reverse flight to safety observed in the Covid-19 crises to corporate bond mutual funds. Corporate bond mutual funds invest mostly in illiquid corporate bonds and relatively less illiquid assets like US Treasuries. Their transformation of mostly illiquid assets amplified investors' incentives to redeem their shares, and they were faced with unprecedented redemption requests in response to the economic shock of the pandemic. In meeting these requests, bond funds chose to sell off their most liquid assets first, leading to concentrated strains in US Treasury markets on days of market distress. These strains were so pronounced in the Covid-19 crisis because of the rapid growth of corporate bond funds in the prior decade. As non-bank liquidity transformation continues to grow, liquid asset markets like that for US Treasuries may become increasingly vulnerable going forward. Our work was replicated for global funds in the IMF Financial Stability Report, cited in SEC regulations, and referenced by senior policy makers at the Fed and Treasury.

To prevent financial stability risks by bond mutual funds going forward, some have advocated for shifting from mutual funds to ETFs—an innovative investment fund type whose asset size has rapidly grown to exceed \$9 trillion in 2024. In **Steering a Ship in Illiquid Wa-**

ters: Active Management of Passive Funds (Koont et al., 2025), we show that liquidity transformation by ETFs also involves frictions, which ultimately spill over to the underlying asset markets. Bond ETFs also invest in a portfolio of illiquid bonds. If ETF investors want to cash out, they must sell their shares to another investor in exchange markets unlike mutual fund investors that redeem their shares from the mutual fund issuer. To improve the liquidity and efficiency of trading in these markets, select institutional investors are allowed to buy ETF shares from the market when the ETF share price is inefficiently low, swap them for a basket of the underlying bonds with the ETF issuer and sell those bonds in the bond market. We find that ETFs disproportionately include some bonds and a surprising amount of cash in these baskets to incentivize institutional investors’ participation. As a consequence, bonds that are disproportionately added to ETF baskets and sold into the bond market during crisis times become less liquid, exacerbating financial strains; while bonds included in baskets during non-crisis times become more liquid. This state-contingent effect of ETFs reconciles a debate in the literature of whether ETFs benefit or harm market liquidity. It also highlights that ETFs are not a panacea against all costs of liquidity transformation. Our work has attracted attention from various media outlets and government agencies, including the *Financial Times* and the New York Fed.

Another recent innovation in non-bank intermediation is US dollar stablecoins—blockchain assets whose value is promised by the issuer to remain stable at \$1. Stablecoins’ potential to compete with cash and bank deposits has attracted active discussions about their future role in the financial system. We shed light on the market structure of US dollar stablecoins and their optimal regulatory framework in **Stablecoin Runs and the Centralization of Arbitrage** (Ma, Zeng and Zhang, 2025). Similar to ETFs, stablecoins hold a portfolio of US dollar assets, such as Treasuries and corporate bonds, while investors buy and sell stablecoins on exchange markets. We show that a market price that deviates from \$1 reduces stablecoins’ price stability, and price stability is crucial for becoming an effective means of payment. To enhance price stability, a select set of institutions can buy stablecoins on exchange markets when the market price is below \$1 and deliver them to the issuer in exchange for \$1 in cash. This arbitrage trade helps stabilize the market price at \$1. Using novel blockchain data, we discover that the issuer approves very few of these investors, which is surprising because more arbitrage enhances price stability. Our model uncovers the reason behind limiting arbitrage: more efficient arbitrage makes it more attractive to sell stablecoins, thereby raising stablecoins’ run risk. Our results highlight a fundamental trade-off between the desirable yet distinct traits of price stability and financial stability, suggesting that some policies may attain one at the expense of the other. I was invited to share our findings in panel discussions at the Bank of International Settlements, Banque de France, and the Brookings Institution, as well as two

NPR Planet Money broadcasts. Our paper is also taught in graduate courses at Chicago Booth, UCLA, and Wharton.

Changes in Bank Liquidity Transformation

The second building block of my work examines the changing nature of bank liquidity transformation and its implications. In particular, I analyze why banks are transforming less liquidity than before, whereby they still produce liquid deposits but invest in fewer illiquid loans to firms. I further show that this reduced liquidity mismatch on banks' balance sheets may not always lead to a less fragile banking system, in contrast to conventional wisdom in the literature.

One important driver of the recent changes in bank liquidity transformation is QE, in which the central bank purchases securities, like government bonds, and then pays for these securities using central bank reserves. These reserves are a special type of cash that can only be held by banks. While a lot of work has analyzed the impact of QE's securities purchases, there has been less attention on the effects of QE's reserve injections, which grew from less than \$50 billion before the 2008 financial crises to exceed \$4 trillion in 2021.

In **The Reserve Supply Channel of Unconventional Monetary Policy** (Diamond, Jiang and Ma, 2024), we show that QE's reserve injections had the unintended consequence of crowding out bank lending to firms. In principle, a larger reserve supply could either increase or decrease bank lending. If liquidity transformation from investing in illiquid firm loans raises the risk of bank runs, having more reserves could reduce that risk and enhance banks' ability to lend. Conversely, if regulatory constraints make it costly to expand bank balance sheets, a larger reserve supply may cut lending. Answering this question is challenging because QE was implemented to stimulate the economy during recessions, so any observed reduction in lending could simply reflect low demand for bank loans in recessions rather than a result of QE. Hence, we develop a structural model and examine this question within the estimated model. On the demand side, banks compete in imperfectly competitive markets to provide deposits, loans, and mortgages. The supply side of our model is novel because it allows a bank's cost of lending to depend on its reserve holdings. With our estimated model, we show that each dollar of reserves injected crowds out 7.7 cents of bank lending during our sample period from 2008 to 2017. Therefore, our reserve supply channel points to a potential reduction in bank loan supply due to reserve injections, which is important to consider as central banks decide on future rounds of QE and the optimal size of their balance sheets. This paper, which was the lead article in the *JFE*, was featured by the NBER Digest and taught in PhD courses at Harvard and Kellogg.

In **The Dynamics of Deposit Flightiness and its Impact on Financial Stability**

(Blickle et al., 2025), we show that reserve injections also alter the composition of bank deposits on the liability side of bank balance sheets, which is another driver of bank stability. While different types of deposits have been studied in the cross-section, e.g., insured versus uninsured deposits, retail versus wholesale deposits, we first analyze how the flightiness of deposits evolves dynamically over time. We empirically document that the sensitivity of deposit flows to deposit rates exhibits pronounced fluctuations from 2000 to 2023. We find that increases in deposit flow sensitivity coincide with deposit inflows, which occurred during low interest rate environments and QE’s reserve expansions.¹ We then develop a dynamic bank run model to show that our empirical observations arise from heterogeneity in investors’ convenience value for deposits, e.g., how much investors enjoy bank services like ATMs. At a given time, investors who choose to deposit in banks value deposits more than those who invest their money in non-banks, e.g., money market funds and Treasury mutual funds. Following large deposit inflows from outside investors, as induced by QE’s reserve injections, the incoming depositors and, hence, the new depositor base values the convenience from deposits less. We show that investors who value deposit convenience less are more sensitive to deposit rates, consistent with our empirical results. As long as not all bank assets are fully liquid, low-deposit-convenience investors also increase run risk by amplifying the incentive to withdraw deposits for other investors. Our findings imply that QE’s reserve injections not only influence banks’ asset composition but also the flightiness of their deposits. In particular, any shock to the banking system, including monetary policy shocks, is amplified when the banking sector has a large and flighty deposit base following QE.

Another driver of bank liquidity transformation is innovation in payment technology, as we show in **The Effect of Instant Payments on the Banking System: Liquidity Transformation and Risk-Taking** (Gonzalez, Ma and Zeng, 2025). We analyze Brazil’s Pix, which allows consumers to send payments instantly using their bank deposits. While the immediacy of payments benefits consumers, our model shows that it also implies a loss in banks’ ability to choose the timing of their payment flows. In the absence of instant payments, banks can delay outgoing payments to net them with incoming payments within the same day. Flow netting is an important part of banks’ business models worldwide. In the US, for example, payment systems like Fedwire and ACH allow banks to delay payments until the end of the day or even several business days. With instant payments, however, banks can no longer delay and net payments. Empirically, we indeed find that exposure to instant payments causes banks to hold

¹As Acharya and Rajan (2024) and Lopez-Salido and Vissing-Jorgensen (2025) show, QE’s reserve expansions lead to deposit growth. This is because in QE, non-banks like hedge funds that sell Treasuries to the central bank do so through their bank. Consequently, their bank receives reserves from the central bank and issues deposits to the non-bank.

a larger proportion of liquid assets and a smaller fraction of illiquid assets like loans. Interestingly, liquid assets also act as a safety cushion and induce banks to lend to riskier borrowers. Therefore, as bank deposits become an instant means of payment, banks that rely on these deposits for stable funding may end up transforming less liquidity and taking on more risk in their illiquid assets. These are important considerations amidst the global push towards more efficient payment systems.

Finally, in **The Passthrough of Treasury Supply to Bank Deposit Funding** (Li, Ma and Zhao, 2025), we show how bank balance sheets are influenced by another structural trend – the growth of government debt. We find that Treasury supply crowds out bank deposits, especially in more competitive deposit markets. This reduction in deposit funding eventually contracts bank lending to the real economy and alters banks’ funding structure.

Interplay between Banks and Non-Banks

Finally, my work delves into the interaction between financial institutions. These interactions often involve frictions that trickle down to impact aggregate outcomes, so the sum of all financial institutions is not equal to its parts.

In **Intermediation in the Interbank Lending Market** (Craig and Ma, 2022), we study how banks’ lending and borrowing in the interbank market lead to a new form of systemic risk. We first discover that there are a few large intermediary banks in the German interbank market: they borrow from a large set of smaller banks and then lend these borrowed funds onwards to another large set of smaller banks. Further, borrowers consistently borrow, lenders consistently lend, and the network of connections is sticky and concentrated. Hence, a shock to one intermediary bank can reduce lending to a large number of borrowing banks and trigger a collective contraction in their lending to the real economy. We show that this is a new form of systemic risk that materialized in the 2008 financial crisis. Importantly, the magnitude of the amplification effect depends on the cost of forming new relationships. When costs are low, borrowing banks with exposed intermediary banks can easily form new relationships. As forming relationships becomes more costly, the rigidity of adjusting relationships increases, and borrowing banks become more exposed to the shocks of their connected intermediaries. We use the same intuition to uncover the cost parameter within a structural model of the interbank market. Specifically, we measure the size of each intermediary bank’s exposure and the implied increase in funding cost to their borrowing banks in the 2008 financial crisis. We then look at which borrowing banks could “afford” to form new relationships to avoid more expensive funding and infer their cost of setting up new relationships. Our estimated model

performs well out of sample and provides a framework to predict the systemic risk in future crises, where funding shocks to one bank can again amplify along a sticky interbank network to contract lending to the real economy by a large number of other banks. This paper received the AQR Top Finance Graduate Award and the Finance Theory Group Best Paper Award (Second Prize).

In two papers, I study the interlinkages between bank and non-bank financial institutions. This is an important question that we do not know much about because the literatures evolved largely separately from each other, while the functionalities of banks and non-banks are heavily intertwined in practice.

In **Monetary Policy Transmission in Segmented Markets** (Eisenschmidt, Ma and Zhang, 2024), we study the connection between monetary policy actions and the repo market. Repo markets are an important short-term funding market that serves as a crucial first stage of monetary policy transmission. In this market, a few large banks intermediate on behalf of a large number of non-banks. For efficient monetary policy transmission, intermediary banks should pass on the central bank’s monetary policy rate changes to repo rates, so that rate changes can be further transmitted to firms and consumers in the real economy. However, we find that in the Euro area, monetary policy rate changes are only partially transmitted to repo rates, and different non-banks receive substantially different rates even for identical repo contracts. Our model shows that this inefficient and unequal transmission arises from the high cost of forming relationships in repo markets, which is why non-banks rely on only a few intermediary banks that exert market power over repo rates. Our model also shows that allowing non-banks access to the central bank, such as through secured deposits in the Federal Reserve’s Reverse Repo Facility, could effectively enhance monetary policy transmission.

Another important dimension of bank and non-bank interaction is the rise of bank lending to non-banks. As bank-to-non-bank lending takes up an increasing share of bank balance sheets, we ask how aggregate credit supply to the real economy is affected in **Bank to Non-Bank Lending and the Reallocation of Credit** (Li et al., 2025). Using loan-level data from the Euro area, we observe that while some loans go to non-banks that lend to the real economy, e.g., private debt funds, a sizeable portion is comprised of loans to non-banks that primarily invest in securities rather than in loans to the real economy, e.g., hedge funds. At the same time, we find that loans to non-banks disproportionately crowd out loans to non-financial firms rather than other liquid assets on bank balance sheets. We show that this crowding out is driven by a rise in borrowing demand by non-banks, especially in short-term loans that fund government bonds (reverse repos), consistent with the global increase in government bond supply and the scaling back of central banks’ purchases of government bonds through QE. The crowding out of

firm loans is further amplified by regulatory constraints on bank capital. Taken together, our findings suggest that bank-to-non-bank lending is not merely a pass-through. Rather, when borrowing demand originates from non-banks that do not extend credit to firms, the aggregate supply of credit to the real economy contracts and the amount of liquidity transformation in the financial system declines.

1 Future Work

Going forward, non-banks will continue to expand in scope and become increasingly intertwined with the regulated financial sector. This evolution raises a set of important questions about the optimal design of monetary policy, the boundaries of central bank balance sheets, and the allocation of credit in the real economy. My future work will address these questions.

First, how should central banks conduct monetary policy in a financial system in which non-banks play an increasingly important role? Central banks have traditionally set policy rates for banks and relied on the banking system to transmit these rates to the broader economy. As intermediation increasingly shifts toward non-banks, however, the channels of monetary policy transmission may change, and thereby the optimal framework for interest-rate setting. Second, which financial institutions should have access to central bank liquidity and the central bank balance sheet? Should access extend to some non-banks, and if so, to which institutions and under what conditions? These questions are becoming particularly salient as stablecoin issuers increasingly provide payment services traditionally reserved for banks. Finally, I plan to study how the rise of non-banks affects the interaction between the financial system and the real economy. Does the expansion of non-bank intermediation make credit provision to households and firms more efficient? Which borrowers benefit from improved access to cheaper funding, and which may be crowded out? Ultimately, understanding how the rise of non-banks affects investment and growth in the long run is central to evaluating its welfare consequences.

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