Research Statement

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Every financial crisis involves leverage. While the focus is typically on the borrowers taking on excessive debt, it's equally important to consider who is purchasing the debt and why. Debt of the financial sector is often regarded as a cash substitute, with examples including bank deposits and other money-market instruments. The rest of the economy are willing to hold these near-money assets that offer inferior risk-adjusted returns, paying the "money premium". Money premium in turn leads to overpricing of debt and excessive leverage in the financial sector (e.g., Stein, 2012). Therefore, after the Global Financial Crisis (GFC), there has been a revival of interest in money demand. However, the existing literature reduces it to money-in-utility (e.g., Krishnamurthy and Vissing-Jørgensen, 2015). My research delves into the deeper origins of money demand, showing that the factors driving it stem from secular economic trends, vary endogenously with business cycles and credit cycles, and result in unintended consequences of policy interventions ([1], [2]).

Money is not simply one type of asset but a set of institutions. Payment systems are at the core of the monetary system, and bank debt (deposits) is the primary means of payment (e.g., Cavalcanti and Wallace, 1999; Kiyotaki and Moore, 2002). However, there is still a lack of understanding of how payment systems operate and their implications for banking. My research on deposits and payment system uncovers how the setup and operation of payment systems affect banks' lending ([3]), their demand for central bank money (reserves) ([4], [5]), the effects of bank leverage regulation ([6]), and the interconnectedness and systemic risk in the banking system ([7]).

As the world evolves, new questions about the nature of money continue to emerge. In recent years, the rise of blockchain technology has challenged the traditional payment arrangement and banks' role in the monetary system. I have developed a line of research into cryptocurrencies and their implications for platform economics, financial stability, and regulations ([8], [9], [10]).

Money is unnecessary if the credit system is perfect. People pay for goods and services with IOUs, and every IOU is honored when a repayment is due—that is, money would not exist in a world with frictionless credit, as assumed in many macroeconomic models. While money demand drives excessive leverage for part of the economy—i.e., too much debt taken on by the financial sector—the lack of credit is in fact the root of money demand of the nonfinancial sector (Kiyotaki and Moore, 2002). My research examines ways to alleviate credit constraints, in particular, through policy intervention ([11]) and complex architecture of contractual relationships ([12]).

My research draws on methodologies from various fields in economics. While my primary focus is on questions in money and banking, my modeling approach often aligns closely with asset pricing theory and network analysis. My research interests naturally extend to asset pricing. The financial assets at the center of my research—deposits, stablecoins, and collateralized debt—are information-insensitive by design, whereas equity is information-sensitive. My research on equity valuation includes a valuation framework for data-driven firms (e.g., Google) that incorporates the hidden and extensive inter-firm network of data sharing ([13]) and the term structure of fundamental information that investors possess and its implications for expected returns ([14]).

The overarching theme of my research—the nature and institutional arrangement of money—remains central, but the specific research questions are motivated by contemporaneous events, such as the transition toward an intangible-intensive and data-intensive economy ([1], [2], [13]), the allocation of central bank money ([3], [4], [5], [7]), the ongoing debates on bank leverage regulations ([6]), the rise of blockchain and cryptocurrencies ([8], [9], [10]), credit policies during the Global Financial Crisis and Covid-19 pandemic ([11]), credit chains that channel funds through heterogeneous financial institutions for real estate financing and AI buildout ([12]). Below, I summarize my papers, highlighting the connections among these research projects.

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1 THE DEMAND AND ENDOGENOUS SUPPLY OF MONEY

Studies on money demand focus on households rather than firms, guided by the notion that households save while firms borrow. However, in recent decades, the nonfinancial corporate sector in the U.S. turned from a net borrower to a net saver (Quadrini, 2017). Unlike households whose savings are diversified across assets with different risk and liquidity attributes, firms mainly hold safe and liquid assets (cash substitutes). The root of firms' money demand is financial constraint. Holding cash would not be necessary if, whenever in need of cash, firms were able to freely resort to external financing. Under financial constraints, firms must hold liquidity internally. To explain the rising money demand of nonfinancial firms, it is intuitive to consider what leads to financial constraints in the production sector.

Fragile New Economy: Intangible Capital, Corporate Savings Glut, and Financial Instability. In my single-authored paper, "*Fragile New Economy: Intangible Capital, Corporate Savings Glut, and Financial Instability*" published in the American Economic Review (Part I of my job market paper "*Procyclical Finance: The Money View"*), I consider the rise of intangible capital in the U.S. economy and its implications on money demand. Intangibles cannot serve as collateral, so, as firms increasingly rely on intangibles in production, financial constraints tighten, which in turn incentivizes firms to hold more cash. The "cash and cash equivalents" that firms hold are mostly liabilities of the financial sector. Cash in its most common forms is "inside money", liquid assets held by one group of agents and liabilities of another (mainly financial intermediaries).[1]

The innovation of my paper is to take an equilibrium approach that emphasizes both the demand for money and the endogenous supply. As the rise of intangibles drives up firms' incentive to hold money, interest rates offered by these assets decline, allowing financial intermediaries to borrow at low costs. The cheap leverage in turn allows financial intermediaries to drive up the prices of collateral assets that back their issuance of monetary liabilities. My paper develops a dynamic (continuous-time) model that captures this mechanism and provides empirical evidence. It is the first paper to show that the transition towards an intangible-intensive economy leads to several secular trends, such as the rising corporate savings, declining interest rates in the money markets, debt-fueled growth of the financial sector, and rising valuation of collateral assets.

Moreover, by connecting these secular trends in the run-up to the GFC, my model reveals a new source of financial instability. Corporate savings are procyclical. During booms, firms generate earnings and increase savings. Their purchase of debts issued by the financial sector pushes down the debt costs of financial intermediaries; in contrast, households do not benefit because their debts are not deemed money-like. The funding cost advantage makes financial intermediaries the natural buyers of collateral assets.[2] The longer a boom lasts, the wider the funding-cost wedge is between financial intermediaries and households. When a negative shock hits the financial sector, forcing it to shrink balance sheets, the reallocation of assets to the household sector that faces

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[1] Outside money accounts for a small share of total monetary assets. One example of outside money is the physical dollar bills that are the owners' assets but not liabilities of any agents. Another example is gold.

[2] In He and Krishnamurthy (2013), the notion that financial intermediaries are the natural buyer of assets is reflected in the assumption that only intermediaries hold risky assets. In Brunnermeier and Sannikov (2014), the financial sector is the natural buyer of assets because asset productivity is higher when held by intermediaries. My model differs in the reason why intermediaries are the natural buyer of assets: their funding costs are lower than the rest of the economy.

higher funding costs and higher required return causes asset prices to decline sharply. Therefore, the model predicts that the longer a boom lasts, the more severe the next financial crisis will be.

The development of financial markets and institutions has a profound impact on the industrial structure (Rajan and Zingales, 1998). My paper demonstrates that the reverse is also true: the evolution of industrial structure shapes the financial system and can cause financial instability.

Public Liquidity and Intermediated Liquidity. A key theme of my research is an equilibrium perspective on monetary assets. While my paper "*Fragile New Economy*" explores the origin of money demand, the role of endogenous money supply by the financial sector is equally important. The emphasis on "inside money" (Brunnermeier and Sannikov, 2016)—what firms hold as cash are liabilities of the financial sector—is what distinguishes my paper from models of corporate liquidity management that assume an exogenous storage technology (e.g., Riddick and Whited, 2009; Bolton, Chen, and Wang, 2011; Hugonnier, Malamud, and Morellec, 2015).

In another single-authored paper, "*Public Liquidity and Intermediated Liquidity*" (Part II of my job market paper "*Procyclical Finance: The Money View"*), I explore the different sources of money supply. This paper raises two questions. First, when financial intermediaries cannot supply enough liquid assets ("intermediated liquidity"), can the government issue liquid securities ("public liquidity"), such as Treasury bills, to alleviate the shortage? Second, can financial instability caused by private money creation be alleviated by increasing public liquidity that crowds out intermediated liquidity? My dynamic analysis provides results that are distinct from those obtained in the static model developed by Holmström and Tirole (1998).

In the model, financial intermediaries incur costs when transforming risky and illiquid assets into safe and liquid debts (e.g., deposits).[3] Profits earned from supplying liquid assets compensate for intermediation cost in equilibrium. When the government issues liquid securities, intermediaries reduce their issuance to meet the residual demand so that their profits per dollar of liquid assets created remain the same. My analysis shows that introducing public liquidity can crowd out more private (intermediated) liquidity than it adds, resulting in a net reduction of liquidity supply.

Intermediation cost is modelled as equity issuance costs (Myers and Majluf, 1984).[4] A threshold of equity level is optimally chosen below which intermediaries choose to incur the issuance costs and raise equity. As in He and Krishnamurthy (2013) and Brunnermeier and Sannikov (2014), intermediation cost is countercyclical. When negative shocks deplete equity, costly equity raising becomes more likely, and the effective intermediation cost rises. In contrast, following positive shocks, equity raising becomes a more distant event, and the intermediation cost declines. Under this countercyclical intermediation cost, public liquidity supply makes financial intermediaries' leverage more procyclical: intermediaries compete with the government in supplying liquid assets (issuing debts) in booms when the intermediation cost is low; they cut debt issuance and deleverage sharply in downturns as the intermediation cost rises. Public liquidity, by amplifying the procyclicality of intermediary leverage, can contribute to financial instability.

[3] In the model, banks are always solvent and their debts always safe. Safe assets are information-insensitive, which explains why they are liquid and can be freely transferred from sellers to buyers in secondary market without the concern over adverse selection (i.e., information-insensitive assets are money-like).

[4] Banks often have complicated balance sheets. The logic in Myers and Majluf (1984) applies: shareholders incur dilution costs when raising equity, because under information asymmetry, the new shares are underpriced.

2 DEPOSITS AND PAYMENT SYSTEM

The money view of banking emphasizes the role of deposits as means of payment, the liability side of bank balance sheet (e.g., Friedman and Schwartz, 1963). The credit view focuses instead on the asset side: bank loans are important sources of financing for firms and households (e.g., Bernanke, 1983). The credit view has become dominant since the 1990s, especially for analyzing the role of banks in the macroeconomy (e.g., Gertler and Kiyotaki, 2010). Moreover, research on deposits in recent decades is no longer about deposits serving as means of payment but rather focuses on bank runs (e.g., Goldstein and Pauzner, 2005). In line with my research interests in money demand and endogenous money supply, my papers on banking revisit the money view.

2.1 PAYMENT OUTFLOWS AND LIQUIDITY RISK

Deposit contracts allow depositors to freely move funds out of their deposit accounts. The right to withdraw has been the focus because of interest in bank runs (depositors front run one another to withdraw money in fear of bank failure). While runs often occur and have severe consequences, most deposit withdrawals are due to payments. When Alice makes an electronic transfer to Bob, funds are withdrawn from Alice's bank and deposited in Bob's bank; simultaneously, Alice's bank transfers an equal amount of reserves at the central bank—the ultimate settlement asset—to Bob's bank. Alice's withdrawal is not driven by her fear of bank failure. This is how deposits circulate among depositors at different banks as means of payment. In Fedwire, the primary payment settlement system in the U.S., weekly payment volume easily surpasses the U.S. GDP.

Some may argue that in the example above, Alice's bank loses deposits, but it can borrow from Bob's bank that gains deposits. Given that deposit outflow at the payment sender's bank is often matched with inflow at the recipient's bank, interbank markets can smooth out such liquidity shocks. This has indeed been one of the primary purposes of interbank reserve markets, for example, the Fed funds market (Bhattacharya and Gale, 1987). However, both theoretical and empirical studies on the wholesale funding markets have shown various frictions.

Payment Risk and Bank Liquidity Management. In my paper, "*Payment Risk and Bank Liquidity Management*" (published in the American Economic Association Papers and Proceedings), we obtain payment settlement data from the Federal Reserve and develop the first bank-level measure of liquidity risk that is tied to the monetary role of deposits.[5]

After the GFC, the U.S. banking system has accumulated an unprecedented amount of liquidity holdings including reserves and other liquid assets. One might expect that banks' liquidity management decisions would become insensitive to payment risk, as the marginal impact of depositors' payment flows would be small relative to the substantial stocks of liquidity. However, this is not the case. We find that banks' decisions to hold liquidity did not depend on their payment risk exposure before the GFC but became sensitive afterward. We offer a preliminary explanation: Liquidity in the U.S. banking system has become highly concentrated among the very largest banks; meanwhile, payment volumes have grown substantially faster than liquidity for the vast majority of banks.

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[5] Quantifying the risk of funding stability can be very challenging. The Basel III definition of net stable funding ratio relies on rather ad hoc weights to funding sources. For example, retail deposits are assigned 100%, and bonds with a maturity of at least one year are assigned 85%. It is unclear how these percentages are calculated.

Payment Risk and Bank Lending. In my paper, "*Payment Risk and Bank Lending*" under revision (R&R) at the Journal of Financial Economics, we find that our measures of payment liquidity risk based on the Fedwire data are strongly and negatively correlated with bank lending. Depending on the payment risk measure, 10% to 20% of the standard deviation of loan growth can be explained by a bank's exposure to payment liquidity shocks. Intuitively, a bank that faces heightened risk of deposit outflows is reluctant to invest in illiquid loans. We find that the negative impact of payment liquidity risk on bank lending is more pronounced when the interbank market exhibited stress or when banks faced aggregate liquidity drain (e.g., liquidity transfer from the banking system to the U.S. Treasury). In the cross section, the sensitivity of bank lending to payment risk is higher among smaller banks and banks that are undercapitalized.

Our paper is the first to highlight the tension between the two key functions of banks, lending (loans on the asset side of balance sheet) and payment services (deposits on the liability side). Our findings echo the surging interest in reserve scarcity and the ongoing debates on the size of central bank balance sheet (e.g., Copeland, Duffie, and Yang, 2021; Acharya et al., 2023). After the GFC, should reserves be abundant, banks would not be concerned with payment-driven deposit withdrawals that drain reserves, and their lending would not be impacted by payment liquidity risk. Our paper demonstrates that this is clearly not the case.

Banks' money demand and interbank liquidity sharing. Banks may share liquidity and undo the liquidity shocks from depositors' payment activities: the payment recipients' banks can lend to the payment senders' banks, allowing the latter to replace the lost deposits with interbank borrowing. Interbank credit transactions take place in an OTC (over the counter) market with search frictions where a network structure emerges that determines the odds of transactions between banks. The extent to which a bank can rely on interbank borrowing to smooth out payment shocks (rather than hold reserves buffers) depends on its location in the network.

In "*Network Risk and Key Players: A Structural Analysis of Interbank Liquidity*" published in the Journal of Financial Economics (Editor's Choice), we develop a structural model that explains banks' reserve holdings with the entire network structure of interbank borrowing and lending and payment-system characteristics as the key inputs. The model is estimated with proprietary data on payment settlement and interbank credit from the Bank of England.

In our model, the interbank credit network can generate strategic substitution in banks' reserve holdings or strategic complementarity. When neighboring banks on the credit network hold more reserves, a bank can rely more on interbank borrowing rather than its own reserves to cover payment outflows. This free-riding incentive gives rise to strategic substitution, and it exists even when the amount of depositors' payment activities stays constant. Strategic complementarity arises when the amount of payments grows dynamically through the propagation of economic activities. When neighboring banks on the interbank credit network hold more reserves, a bank has more accessible liquidity and supports more payments, for example, by issuing more demand deposits. This allows the bank's depositors to be more payment-active, and their transactions trigger more economic activities, causing an increase in payment volume in the whole economy. In anticipation of a higher system-wide money velocity, the bank increases reserve holdings. We find that in regimes where strategic complementarity dominates, our estimated network multiplier indeed comoves closely with measures of money velocity.

The type of equilibrium on the network varies over time. In the run-up to the GFC, strategic complementarity is the dominant force. As a result, the interbank credit network amplified liquidity shocks to banks' reserve holdings. During the GFC, strategic complementarity weakened, and the liquidity free-riding incentive strengthened. Strategic substitution eventually became the dominant force as the Bank of England started its QE in 2009. The interbank credit network turned from a shock amplifier pre-crisis to a shock absorber.

We develop a framework to identify systemically important banks. The advantage of having the entire network as input (rather than several network statistics as often done in reduced-form network analysis) is that we are able to fully utilize the information on network nodes and edges in our measures of systemic risk. We demonstrate that systemically important banks are not necessarily the largest ones. Banks' contribution to systemic risk depends on network topology.

2.2 THE BURDEN OF PAYMENT INFLOWS

Research on deposits typically focuses on deposit outflows as bank runs have been at the center of banking literature. My papers above emphasize a different type of outflows that is driven by payments. Banks must deal with payments on a daily basis and in large magnitudes. A payment perspective on deposit flows also reveals interesting insights regarding payment inflows. Deposit accounts entitle depositors to receive payments unconditionally. The first instinct is that this is beneficial for banks, especially given that deposit rate is typically below the market rate.

In "*Dynamic Banking and the Value of Deposits*" published in the Journal of Finance, we show that payment inflows often pose a great challenge for banks. We develop a continuous-time model of a bank's dynamic balance-sheet management. The stock of deposits, which is the key state variable, loads on both positive and negative shocks as depositors receive and send payments. A sequence of positive shocks resembles what U.S. banks experienced during the Covid-19 pandemic: from Q4 2019 to Q1 2020, JPMorgan Chase had an 18% increase in its deposit liabilities, and the deposits at Citigroup and Bank of America increased by 11% and 10%, respectively. During this period, bankers consistently complained about deposit influx and some even went out of their way to persuade depositors to move money out of their accounts. This is inconsistent with the conventional wisdom that deposit inflow is beneficial (i.e., the marginal value of deposits from bank owners' perspective, or the "deposit marginal q", should always be positive). Moreover, banks did not increase lending following the deposit influx.

The key to understanding these phenomena is the combination of bank leverage regulation and equity issuance cost. Deposit influx forces a bank to increase leverage, and if the bank violates the regulatory cap on leverage, it must incur issuance costs to raise equity. Therefore, deposit inflows, by pushing the bank close to the regulatory boundary of equity raising, can decrease bank shareholders' value. Moreover, as the likelihood of costly equity raising increases following deposit inflows, the bank becomes increasingly cautious in risk-taking as negative shocks to earnings would deplete equity and further increase leverage. Therefore, in response to deposit influx, the bank may even cut lending. Since the bank cannot perfectly control the liability side of its balance sheet due to payment-driven deposit flows, it chooses to de-risk the asset side.

We introduce a zero lower bound on deposit rate and show that a low-interest rate environment is detrimental to banks.[6] The bank adjusts deposit flows via deposit rate. Once the deposit rate hits zero, the bank loses its ability to counteract deposit inflows through reductions of the deposit rate. In our model, the bank earns a spread between the market rate, $\mathbf{r}$, and deposit rate. When it is well

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[6] The bunching of deposit rates at zero is a salient empirical feature (Heider, Saidi, and Schepens, 2019).

capitalized (away from the boundary of costly equity raising), the bank raises the deposit rate to attract deposits as a cheap source of funds, and importantly, to gain slack so that when it becomes undercapitalized in the future, there would be more room to cut the deposit rate and deleverage before hitting the zero lower bound. Therefore, when **r** is high, the bank has more flexibility in raising deposit rate when it is well capitalized without squeezing too much the spread between **r** and deposit rate. The distance between **r** and zero essentially determines the degree of flexibility to control deposit flows. A low **r** makes it more difficult for the bank to manage deposits.

The way we model deposits allows us to sharply distinguish between deposits and a bank's short-term debts. With short-term debts, the bank can always choose to stop borrowing at maturity, and therefore, does not face the problem of unwanted leverage. In contrast, deposits are in effect long-term contracts without a well-defined maturity (Drechsler, Savov, and Schnabl, 2021; Jermann and Xiang, 2023). Deposits leave the bank only when depositors withdraw funds. We show that when the bank is well capitalized, it issues short-term debts to obtain additional financing for lending. Following negative shocks to bank earnings, the bank deleverages by first reducing its short-term debts. When the bank becomes severely undercapitalized and approaches the boundary of costly equity issuance, it switches from issuing short-term bonds to holding risk-free bonds issued by other entities (e.g., the government), thereby de-risking the asset side of its balance sheet, given that the risk on the liability side (deposits) cannot be fully controlled.

Deposit contracts allow depositors to freely put money in and take money out of their accounts, which is necessary for the seamless operation of the payment system. The consequence is that banks cannot perfectly control their deposit liabilities. The bank's inability to fully control the size of its liabilities gives rise to a balance-sheet management problem that is conceptually very different from that of non-depository intermediaries and nonfinancial firms.

2.3 INSIDE MONEY CREATION AND THE PAYMENT NETWORK

When extending loans, a bank conducts a debt swap: it acquires the borrowers' debts (loans) and issues its own debts (deposits) to the borrowers. This process of inside money creation—banks issue deposits to fund new loans—is how money supply grows. It may appear that banks possess the ability to create money out of thin air. However, the ratio of loans funded by deposit issuance to a bank's liquidity buffer—the money multiplier in my paper "*The Network Structure of Money Multiplier*"—cannot be overstretched. When the newly issued deposits are withdrawn, often as a result of the loan borrowers making payments, the bank cannot liquidate the loans immediately and must rely on reserves or other liquid assets to cover the deposit outflows. Therefore, payment liquidity risk imposes a constraint on banks' money creation through lending.[7]

However, a payment sending bank's liquidity loss is the payment-receiving bank's gain, and the payment inflows relax the liquidity constraint on the payment-receiving bank's money creation through lending (e.g., Parlour, Rajan, and Walden, 2022). As a result, the payment-receiving bank may extend new loans funded by deposit issuance. Therefore, one bank's money creation through lending and the subsequent liquidity spillover to other banks are followed by another round of money creation by the payment-receiving banks, and so forth. In this paper, we conduct a

[7] Our notion of money multiplier differs from the traditional deposits-to-reserves ratio. What matters is not the amount of deposits issued, but the liquidity property of assets funded by deposits. Issuing deposits to acquire liquid assets does not create liquidity mismatch and is not subject to liquidity constraint, because payment outflows can be covered by selling the newly acquired assets. In contrast, issuing deposits to fund loans requires the bank to have other (liquid) assets that buffer payment outflows as loans are illiquid.

systematic analysis of the network structure of payment inflows and outflows and characterize these ripple effects of money creation as an equilibrium outcome. Here, the topology of payment-flow network determines the equilibrium money multiplier, i.e., the ratio of banks' loans funded by deposit issuance (the amount of liquidity transformation) to the value of liquid assets held by the bank (the liquidity base).

After structurally estimating the model and analyzing banks' positions in the network, we are able to identify the systemically important banks that drive the aggregate fluctuation of credit and money creation. These banks are not necessarily the largest ones, but their liquidity shocks strongly affect the aggregate capacity of the banking sector to conduct liquidity transformation for any given amount of liquidity buffer held by banks.

This paper contributes to several strands of literature on money and banking. Bank lending and liquidity percolation via payments are known to be the key ingredients of money multiplier, but little has been done in modern literature to formalize the mechanism. Our paper fills in the gap. Recent studies on money and near-money assets focus on quantities and prices, i.e., estimating the money demand curve and the money premium (e.g., Krishnamurthy and Vissing-Jørgensen, 2012; Lucas and Nicolini, 2015; Nagel, 2016). Our paper goes beyond quantities and prices to analyze the circulation of money and its network structure. Finally, we show that the payment system redistributes reserves among banks. The fact that such redistribution affects the aggregate liquidity transformation by the banking sector suggests reserves are not abundant.

3 CRYPTOCURRENCIES

Economic activities are increasingly shifting to the digital space, as evidenced by the boom in e-commerce. On e-commerce platforms, transactions are settled using fiat currencies, with payment still relying on the deposit-centric system. In theory, platforms—much like countries—could develop their own payment system and introduce their own currency that serves as the settlement asset. Here, all the forces driving money demand discussed in this article would apply.

Then what prevents a platform from introducing its currency? The issuance can be excessive as the marginal cost of producing more digital currency units is zero. Countries face the same problem and solve it through commitment, for example, to an inflation target, and they set up institutional arrangements (e.g., central bank independence) to enable such a commitment.

Blockchain technology makes commitment feasible for digital platforms. Any changes made to the rules of money supply must receive consensus among the currency users. In recent years, many platforms have introduced cryptocurrencies. Some aim to become a universal payment system that supports trade of all products and services, including financial services, while others serve niche markets, such as sharing digital storage space and facilitating online advertising.

As discussed in the opening paragraphs, drawing an analogy between platforms and countries—where economic agents gather and trade—proves to be a fruitful approach. Understanding new phenomena through the lens of classic financial economics, rather than "reinventing the wheel," is more productive and is the approach I take. This approach identifies what is truly innovative in Fintech. My research on cryptocurrencies applies insights from the literature on money and banking and the modeling frameworks from the macro-finance and asset pricing literature.

Dynamic adoption and valuation. In "*Tokenomics: Dynamic Adoption and Valuation*" published in the Review of Financial Studies (Editor's Choice), we develop a dynamic model of money demand on a platform to answer two questions. First, how to value a platform's native currency (the "token") based on users' transactional demand? Second, how does introducing a platform currency affect the growth of the platform's user base? Agents hold tokens in anticipation of transaction opportunities. If the user base grows, the transactional benefit from holding tokens becomes greater, which reflects the adoption network effect. Therefore, a key input of token valuation is user-base dynamics. In equilibrium, the ratio of token market capitalization to the size of user base becomes a key valuation metric. Moreover, the dynamics of token price in turn affect user adoption through users' belief on price appreciation/depreciation. Therefore, these two key endogenous variables must be jointly determined in equilibrium.

The trade-off in theories of money demand is between transaction needs and the carry cost for holding money. As previously discussed in this article, means of payment (e.g., bank deposits) often deliver inferior returns relative to other financial assets. This is also true for tokens as they do not generate a stream of dividends. However, the expected token price appreciation can compensate for the carry cost and thereby stimulate user adoption of the platform and its currency. Our analysis focuses on a promising platform with growing productivity.[8] Productivity represents the quality of the platform and the variety of trade it supports. The prospective growth of user base driven by productivity growth leads agents to expect more users in the future and a stronger demand for tokens. Given a fixed token supply, which is a commitment enabled by blockchain technology, the expected user growth translates into expected token price appreciation. Therefore, user growth exhibits intertemporal complementarity: the expected growth of future user adoption makes holding tokens now more attractive, stimulating the current user adoption.

Introducing tokens also stabilizes user adoption. A negative productivity shock reduces users' transactional benefit from holding tokens and thus discourages user adoption, lowering the user base. This negative effect is mitigated by an increase in the expected token price appreciation (which encourages adoption), because a lower level of current adoption implies more users can be brought onto the platform in the future, which is associated with a greater expected token price appreciation. Admittedly, these beneficial effects can only be achieved when the stochastic process of platform productivity has a positive drift (i.e., an upward expected trajectory).

Our paper is the first to clarify the role of tokens in capitalizing endogenous platform growth and thereby reducing agents' effective carry cost of holding means of payment. In our model, the prominent adoption problem in the literature on platform economics (e.g., Rochet and Tirole, 2003) is connected with the trade-off between transactional benefit of money and its carry cost in the literature on monetary economics (e.g., Baumol, 1952; Tobin, 1956).

Token-based Platform Finance. In "*Token-based Platform Finance*" published in the Journal of Financial Economics, we develop a dynamic model of token ecosystem: the token demand side is modeled following "*Tokenomics: Dynamic Adoption and Valuation*", and the token supply side involves several decisions about the platform's "monetary policy". The platform issues tokens for investing in productivity growth or for rewarding its owners. It can also buy back tokens from the market using externally raised funds, subject to a financing cost. Our first contribution is to

[8] Platforms with declining productivity and even frauds exist. Those are beyond the scope of our paper.

provide a unified framework for analyzing endogenous token price and token-supply policies. Our model delivers several insights into the economics of tokens and platforms.

First, tokens are akin to durable goods but defy the prediction in Coase (1972). Even though the marginal cost of producing tokens is zero, the equilibrium price can be positive. The owners' concern over the franchise (continuation) value can generate incentive against over-supply and even induce the owners to buy back tokens. The endogenous growth of platform productivity and the resulting growth of user base and token demand are the ingredients that distinguish our model from standard models of durable goods and stationary demand (e.g., Stokey, 1981).

Second, under-investment arises from conflict of interest between the owners and users. Token-financed investment in productivity increases the token supply, but the impact on productivity is random. If productivity is improved, it benefits both the owners and users; if not, the downside is mainly borne by the owners. While the token users realize capital loss as the token price decreases, such risk was fairly priced when they bought the tokens in a competitive market. The owners care about the franchise value of the platform and, to maintain user base, may choose to support token price by buying back the token supply in excess (relative to platform productivity). Such buyback is externally funded and thus costly. The asymmetry in exposure to investment risk between the users and owners discourages the owners from token-financed investing and tilts the proceeds from token issuance towards financing the payout to the owners, which in turn reduces the users' welfare, the token price, and the long-term value of owners' token payouts.

Our paper revisits the classic issue in monetary economics: money issuance tends to be excessive, resulting in runaway inflation. However, "excessive" can be defined only in relative terms: issuing money to finance positive-NPV projects does not lead to inflation (Bolton and Huang, 2018). In our setting, issuing tokens to finance platform owners' consumption contributes to inflation, while issuing tokens to fund investment in productivity growth may not, depending on whether the stochastic outcome of investment is a success or failure.

The root of the under-investment problem is the owners' time inconsistency. If the owners were able to commit against under-investment and against excessive payout, the users would have demanded more tokens, which increases the token price and the long-term value of owners' token payouts. However, the predetermined rules of token-financed investment can be deemed sub-optimal ex post when the conflict of interest between the users and owners arises. Blockchain technology addresses this problem by enabling commitment to predetermined rules. Resolving the time inconsistency can increase both the platform owners' and users' welfare.

Stablecoin and the Fragile Seigniorage. The volatility of cryptocurrencies limits their usage as means of payment. Stablecoins are blockchain-based assets pegged to fiat currencies, typically backed by the issuers' reserve assets. The rapid growth of stablecoins in market capitalization and the regulatory momentum in major economies have drawn enormous attention: governments view stablecoins as instruments to extend the international reach of their currencies, and the risk profile of reserve assets is central to ongoing policy debates, as exemplified by the GENIUS Act in the United States. In "*Financial Intermediation with Fragile Seigniorage: A Dynamic Model of Stablecoin Issuers*", we develop a dynamic model of stablecoin issuers to address three questions: How does reserve-asset risk transmit to stablecoin users through depegging? What trade-offs shape an issuer's decision to depeg? How to evaluate various regulatory proposals? Unlike contemporaneous studies that focus on specific aspects of stablecoins, we jointly analyze the issuer's key decisions, including depegging, stablecoin issuance and buybacks, fees or interest payments for users, external financing, payout policies, and the valuation of the issuer's equity.

Our baseline model considers a laissez-faire environment in which the issuer is not bound to maintain the peg and has discretion over the value of its liabilities: a stablecoin is not a definitive claim on the issuer or its reserve assets, and major issuers can change redemption terms "without prior notice".[9] Therefore, stablecoin issuers differ from banks (or money market funds), whose commitment to redeem deposits at par (or NAV) underpins the classic run mechanism based on liquidity mismatch and coordination failures among depositors (Diamond and Dybvig, 1983). Our model features run-like dynamics, but they emerge instead from risk transformation and the central role of net worth in determining intermediation capacity (e.g., He and Krishnamurthy, 2013; Brunnermeier and Sannikov, 2014). Because stablecoin users derive transactional utility from holding the stablecoin, they accept a lower return, which reduces the issuer's funding cost—seigniorage revenues akin to the deposit spread that banks earn. At the core of our model is the endogenous fragility and procyclicality of this seigniorage. When negative shocks to reserve assets deplete net worth, the issuer's effective risk aversion rises, and it preserves net worth either by deleveraging—selling reserve assets to buy back stablecoins (*quantity adjustment*)—or, once net worth falls below a threshold, by depegging (*quality adjustment*). Depegging lowers the stablecoin's transactional utility, and the resulting inward shift of stablecoin demand resembles a run. Seigniorage thus declines precisely when it is most needed to rebuild net worth and restore the peg. As a result, the stablecoin enters an instability trap: once the system falls into the low-net-worth region, depegging is severe, and the system stays trapped there for a long time.

Depegging is disciplined by the users. When the users' monetary utility is sufficiently sensitive to stablecoin price fluctuations, the issuer may refrain from depegging at all levels of net worth and manage risk solely through quantity adjustment. One contribution of our paper is to characterize the conditions under which, even in a laissez-faire environment with risky reserve assets, a stablecoin is perfectly stable in price (though its quantity varies wildly). Perhaps surprisingly, this no-depegging region expands as reserve assets become riskier—a risk paradox that stems from the issuer's precaution against the instability trap: when reserve-asset risk is higher, offloading risk to users through depegging causes a more severe contraction of stablecoin demand, so the issuer optimally chooses a smaller scale of intermediation and prefers deleveraging for managing its risk exposure. Relatedly, in the parameter region where depegging does occur, the highest level of stablecoin volatility exhibits an inverse-U-shaped relationship with reserve-asset risk.

These results inform the evaluation of the two pillars of regulatory frameworks, restrictions on reserve-asset risk and capital requirements, both featured in the GENIUS Act. After calibrating our model to Tether, which is the largest stablecoin issuer, we find that requiring the issuer to operate as a narrow bank—holding only safe assets and maintaining positive net worth—lowers the stablecoin supply by 73–88% and users' welfare by 60–70% relative to the laissez-faire benchmark and cuts the issuer's equity valuation by 33%. Capital requirement alone already delivers a significant improvement in stability and user welfare, while the additional requirement of risk-free reserves brings only marginal improvement.

As a theoretical contribution, we show that capital requirement (or leverage regulation) plays a unique role in regulating stablecoin issuers. A cap on the ratio of stablecoin issuance to equity capital reduces the issuer's reliance on the seigniorage—net interest margin from stablecoin-

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[9] See, for example, Tether's Terms of Service at https://tether.to/en/legal.

financed carry trade on reserve assets—and tilts profit composition toward returns on equity-financed reserve assets that are determined in broader financial markets and thus immune to the feedback loop behind the instability trap. This improves stability and eliminates the risk paradox. In extensions, we show that when stablecoin demand grows stochastically and the demand shocks are correlated with the value of reserve assets, the instability trap is exacerbated, and capital requirement becomes particularly valuable.

4 CREDIT CONSTRAINTS

Credit frictions are the reason why money exists (Kiyotaki and Moore, 2002). Spot payments would not be necessary if agents could commit to repay any debt and make purchases with their IOUs.[10] Under credit frictions (e.g., limited commitment), agents must conduct spot transactions: the buyer hands the seller something valuable on the spot—the means of payment. This is particularly evident in the online world of anonymous agents, as it is difficult to develop a credit system based on reputation, proof of income and wealth, and contract enforcement. Therefore, various payment solutions, including cryptocurrencies, are particularly valuable in the digital space.

Relaxing the credit constraint: Government intervention. My research extends beyond the monetary system to study credit constraints in general. A key friction in this context is limited commitment (i.e., the inability to commit to repayment). The government, however, holds a unique advantage: its commitment to repay creditors can be supported by institutional and legal arrangements, and the government can enforce repayment from those who borrow from it. Thus, the government may act as a credit intermediary (Lucas, 2016).

Credit intervention has grown in size and become more direct. The programs during the GFC injected liquidity primarily through the banking sector. During the Covid-19 crisis, not only the GFC-era programs were promptly reinstated, but central banks and governments across the world initiated new programs that lent directly to nonfinancial firms. In light of this trend, it is important to consider: what are the long-term effects of direct credit support for nonfinancial firms, and in particular, what causes credit intervention to grow in scale from one crisis to the next? In "*Firm Quality Dynamics and the Slippery Slope of Credit Intervention*" (published in the Review of Economic Studies), we answer these questions from the perspective of firm quality dynamics.

In our model, firms differ in productivity. High-quality firms have larger debt capacity than low-quality firms. They can borrow more and thus are more likely to survive in crises. Thus, crises exhibit a cleansing effect: the economy emerges from crises with a greater fraction of firms being high-quality. Funding from the government dampens the cleansing effect because, unlike private-sector creditors, the government is unable to differentiate firms by their productivity.

Therefore, credit intervention alleviates the decline of aggregate output but reduces the average firm productivity. A slippery slope of intervention emerges: the economy enters into the next crisis with lower average productivity and thus requires a greater scale of intervention to sustain the output. In our calibrated model, increasing the scale of intervention in the current crisis by one dollar per unit of firm capital leads to an increase of 4 cents per unit of capital in the next

[10] Models without financial frictions all assume perfect credit systems (e.g., real business cycle models).

intervention should another crisis happen in ten years. Given that capital stock grows over time, the inter-crisis pass-through rate by the total dollar amount is even larger.

A key feature of our model is the trade-off between quantity and quality. Optimal intervention in crises strikes a balance between distorting the firm quality dynamics and preserving the overall production capacity. We show that ignoring the distortionary effects on firm quality dynamics results in a more aggressive intervention that almost doubles the welfare-maximizing amount.

Relaxing the credit constraint: Credit chains. The financial system operates through intricate networks of intermediated funding and collateral flows. This complexity has been widely criticized for its opacity: it obscures systemic vulnerabilities, creates regulatory challenges, and complicates crisis management. In "*Information-Concealing Credit Architecture*" under revision (R&R) at the American Economic Review, we argue that such complexity can benefit the economy by expanding credit capacity. Our starting point is a classic question: what is the best way to pledge an asset of uncertain value to obtain credit? When borrower and lender are symmetrically uninformed about asset value, credit capacity is maximized "in the dark": credit based on the expected asset value (an information-insensitive loan) exceeds average credit under revealed asset values (information-sensitive loans), because value revelation requires costly information production, and the cost is ultimately borne by the borrower in the form of reduction of financing capacity. The size of an information-insensitive loan is nevertheless limited by an incentive-compatibility (IC) constraint on the lender—the more credit the lender extends, the stronger her temptation to inspect the collateral as greater wealth is at stake.

Prior studies emphasize that assets can be structured to deter collateral inspection: pooling reduces value uncertainty through diversification, and layers of securitization raise examination costs. We instead take the asset characteristics as given and show that a network of debt contracts discourages costly examination. In our model, a firm pledges an existing asset of uncertain value to fund a project with unpledgeable returns. The asset already exists, so our paper does not seek to answer the question whether a lack of information production encourages origination of low quality assets. The goal here is simply to enlarge financing capacity as much as possible because the project is highly productive.

In our setting, debt is effectively a probabilistic asset ownership—the lender owns the collateral only if the firm defaults. A credit intermediation chain dilutes the asset ownership for both the end lender and the intermediary relative to that of a direct lender. If the end borrower defaults and the intermediary receives the collateral, the intermediary may still be solvent and repay the end lender rather than hand over the collateral, as we assume that the intermediary's failure is correlated but not perfectly correlated with that of the end borrower. Therefore, the end lender is less likely to end up owning the collateral—and has a weaker incentive to examine it—than if she financed the end borrower directly. The intermediary's incentive to examine the asset is also weaker than a direct lender, because when the end borrower defaults, it may itself fail and pass the collateral down to the end lender. As a result, the credit chain splits the collateral ownership probabilistically between the intermediate and end lenders, relaxing the IC constraints on the information-insensitive loan and thereby allowing more credit to flow to the end borrower.

Importantly, the intermediary does not need to contribute new resources. Consider two firms that both face liquidity needs: credit is maximized when each uses the other as an intermediary rather than borrowing directly—what drives credit capacity is the chain architecture itself.

We embed this ownership-dilution logic in a general model of credit chains with heterogeneous information costs and an arbitrary joint distribution of failures, where the chain's capacity to channel funds is pinned down by the bottleneck link. The optimal chain equalizes the temptation to examine the collateral across links: intermediaries with higher examination costs, or whose failures are more correlated with the end borrower's, should be placed upstream, closer to the end borrower. In short, agents more likely to get the collateral should be less likely to keep it. The optimal chain can emerge from decentralized formation: modeling chain formation as a sequential game of bilateral invitations and bargaining, we show that a subgame-perfect equilibrium implements the optimum, whether the chain is initiated by the end borrower or the end lender.

Our analysis provides a rationale for the seemingly excessive complexity of intermediated credit flows, with sharply structured predictions. Chains matter more when collateral is information-sensitive and direct lenders are tempted to examine it. Long chains add little value if intermediaries are homogeneous, as the bottleneck is always the same first link between the end borrower and the first intermediate lender. Safer or more diversified intermediaries should appear downstream, away from end borrowers, because once they receive the collateral, they tend to keep it, much as banks in practice finance riskier non-bank lenders that in turn lend to firms and households.

Finally, we highlight that whereas alternative arrangements for diluting asset ownership and discouraging costly examination, such as multilateral contracting, may face important frictions, the credit chains we characterize rely only on bilateral debt contracts: it is not the design of complex contracts that enlarges financing capacity, but the architecture of simple contracts.

5 Information and Asset Prices

The claims at the center of my research—deposits, stablecoins, and collateralized debt—are information-insensitive by design: they are meant to trade without private information produced about the issuer or the backing assets. Equity, by contrast, is information-sensitive, and the two papers in this section are about equity valuation. The first studies data as a productive asset whose benefits propagate through an inter-firm network of data sharing and provides a valuation framework for data-driven firms' equity. The second characterizes empirically the information that equity investors possess about firms' fundamentals—revealing a sharp information cliff beyond the one-year horizon—and shows how this cliff shapes the dynamics of expected returns and expected cash-flow growth, the state variables at the core of dynamic asset pricing models.

Data as a Networked Asset. In my paper "*Fragile New Economy*", I focused on one aspect of intangible capital—it cannot be easily pledged as collateral. In "*Data as a Networked Asset*" under revision (R&R) at the Journal of Political Economy, we focus on a type of intangible capital that has become increasingly important—data—and on the aspects that distinguish it from other intangible assets.

Data is non-rival: one firm's use of data does not diminish its availability to others, allowing the same data to be used by many firms simultaneously (Jones and Tonetti, 2020). Data also exhibits externalities: information collected by one firm on its customers can benefit other firms by revealing consumer preferences and broader economic forces and by serving as training data for prediction models. Non-rivalry, combined with externalities, expands the potential uses of a firm's data, often transcending industry boundaries. We ask: What is the marginal q of data as a productive asset? How is data collected by one firm shared with others, and what are the scope and network structure of data sharing? How does data sharing affect firms' decision-making and valuation and propagate shocks across firms? Which firms are systemically important in the data economy? And what are the impact and unintended consequences of data regulations?

We trace inter-firm data flows originating from mobile applications (apps), which have become the primary channels for data collection in the economy. Firms' apps collect data and transmit it to software development kits (SDKs) that specialize in data aggregation and analytics. A crucial function of these "data-sharing SDKs" is merging information from different firms' mobile apps associated with the same consumer into a comprehensive customer profile; by sharing data with the SDKs, firms gain access to these valuable signals in return. Using granular information on app-level SDK installations, we construct a measure of data-sharing conduits between firms—two firms are connected when a common set of data-sharing SDKs is installed on their apps. Data sharing turns out to be a powerful economic linkage. It induces comovement in firms' operational performances, with an economic magnitude more than double that of the product similarity measure of Hoberg and Phillips (2016). Moreover, data-connected firms exhibit stock-return correlations that cannot be explained by standard asset-pricing factors or by other common exposures, such as product similarity, supply-chain linkages, and common analyst coverage.

Our paper is the first to uncover this new form of economic linkage, and it speaks directly to policy debates on data privacy. With rising consumer awareness of privacy, regulations such as GDPR in Europe and CCPA in California have imposed strict rules on data collection and sharing. In a difference-in-differences framework, we examine the introduction of Apple's App Tracking Transparency (ATT), which allows app users to block identity tracking and thus makes it difficult for SDKs to merge data from different firms. We find that ATT significantly weakens the performance comovement between data-connected firms—an unintended consequence of privacy initiatives. This experiment also validates that firms' overlap in data-sharing SDKs is fundamentally about linkages in data: ATT does not affect the contribution of other inter-firm overlaps, such as product similarity, to performance comovement.

Because comovement ultimately emerges from shocks propagating from one firm to another, we further provide direct evidence using cyberattacks, which destroy firms' data stocks and impair data collection by diminishing the customers' willingness to engage with the mobile apps. When a firm suffers a cyberattack, its data-connected peers experience significantly greater deterioration in operational and stock-market performances than firms that are not data-connected.

Which firms, then, are systemically important in the data economy? Answering this question requires accounting not only for direct spillovers but also for higher-order ones—firm A's data may be shared with firm B, which in turn shares data with firm C—and for their persistent effect over time, as data drives customer engagement and engagement generates further data (Farboodi and Veldkamp, 2026). We therefore develop a dynamic network model in which data plays the role of productive capital. Each firm forecasts customer preferences with a precision that depends on both its own data and data from connected peers; more accurate forecasts enhance customer engagement, which boosts customer capital, product demand, and cash flows, and creates new data for the firm and its peers. The model takes the empirically measured network of data-sharing conduits as input, and simulations of the calibrated model replicate the data-induced comovement and the ATT effects. This framework allows us to derive a network-augmented Gordon growth formula for data-driven firms' valuation that captures direct and indirect data spillovers and the self-perpetuating growth of data over all horizons; absent data sharing, it collapses to the standard

Gordon growth model. Decomposing the aggregate valuation of all firms into individual firms' contributions, we find that a firm's contribution can differ substantially from its size: before the introduction of ATT, the ratio of Meta's aggregate-valuation contribution to its own valuation was 4.2—removing Meta would reduce the present value of aggregate cash flows by an amount equivalent to 4.2 times its own valuation—and after ATT, this ratio declined to 1.2.

The information cliff and expected returns. Understanding financial market participants' information about economic fundamentals is crucial: asset prices reflect expectations of future economic conditions, directly influencing resource allocation and policymaking. A large literature studies how information is processed, often emphasizing biases that distort expectation formation. In "*The Information Cliff*", we begin by characterizing the supply of information and uncover an information cliff—a sharp decline in available information on economic fundamentals beyond the one-year horizon—and show that it sheds new light on central objects of canonical asset pricing frameworks—the dynamics of expected cash flows and expected returns.

The information cliff emerges from the horizon of firms' information supply to equity investors via corporate disclosure, particularly the quarterly guidance that firms release, and we find that 96% of guidance pertains to performance within the next year. The cliff is mirrored in the information content of analyst forecasts: forecasts of aggregate earnings growth for the upcoming year deliver an R^2 above 70% in predicting realized growth, but the R^2 drops significantly when forecasts for the second or third year are used to predict growth in the corresponding periods, and long-term growth forecasts are similarly weak. Moreover, since corporate announcements in the first month of a quarter are the most informative about aggregate economic conditions, the wedge between the predictive power of next-year forecasts and that of longer-horizon forecasts should be—and indeed is—most pronounced in those months. The alignment between the timing of information supply and forecast accuracy across horizons lends support to the one-year cliff.

To derive asset pricing implications, we extend the model of Lettau and Wachter (2007), allowing the dynamics of cash flows and risk prices to be driven by an arbitrary set of latent state variables and shocks, and we do not impose rational expectations. The first step is to identify the state-space dimensionality. We show that the logarithms of dividend strip prices scaled by realized dividends ("valuation ratios") are linear functions of the state variables, so the valuation ratios of strips across maturities span the state space. Computing the valuation ratios of S&P 500 dividend strips (Binsbergen, Brandt, and Koijen, 2012), we find that the first two principal components account for 96% of the total variance, and pairs of valuation ratios forecast returns and dividend growth as well as three or more do.

Therefore, a two-dimensional state space suffices, despite the many economic forces affecting the aggregate stock market. The two state variables can be rotated to represent the conditional expected return and the conditional expected dividend growth rate, each following an AR(1) process—a structure that prior studies have assumed but not tested.

The conditional expected dividend growth rate encapsulates the information that investors have about future cash flows. A non-zero autoregressive coefficient would mean that the current information set contains persistent signals, allowing participants to forecast growth two, three, and more years ahead. The information cliff therefore implies a zero autoregressive coefficient—a sharp restriction on the persistence of expected cash-flow growth, one of the central objects in the asset pricing literature. Using analyst forecasts to proxy for cash-flow expectations, we estimate this coefficient to be consistently around zero across specifications, and fitting a state-space model to dividend data with a latent expected growth rate yields the same conclusion.

We then connect the information cliff to the expected market return. In the model, if expected cash-flow growth has a zero autoregressive coefficient, the expected return is a univariate function of the slope of the valuation term structure—the wedge between the market price-dividend ratio (pd) and the valuation ratio of the one-year strip; otherwise, the sign of the slope's return forecasting error aligns with that of the autoregressive coefficient. The return predictive power of the slope is intuitive under the information cliff: because market participants have little information on cash flows beyond the next year, a steepening of the valuation term structure is not driven by improved long-term growth prospects but by a lower discount rate, which benefits the valuation of long-duration cash flows more; a steepening thus predicts lower market returns. Empirically, the slope delivers an in-sample R^2 of 25% and an out-of-sample R^2 of 15%, subsumes the predictive power of pd, and cannot be improved upon by including other predictors—in line with the expected return being a univariate function of the slope. A linear regression on the slope even outperforms machine learning algorithms that nonlinearly aggregate a large set of predictors (Kelly, Malamud, and Zhou, 2024). And in rolling windows, when the estimated autoregressive coefficient of expected cash-flow growth deviates from zero, its sign aligns with the slope's return forecasting error, exactly as the model predicts.

Beyond discount-rate variation, our results admit a mispricing interpretation that reorients market timing. Traditional timing bets against the overall valuation level, pd. Since market participants are well informed about the near term but face an information cliff beyond one year, mispricing is likely to reside in long-term cash flows, and the focus should be on the slope rather than the level: to time the market is to reduce exposure when the valuation term structure steepens and increase exposure when it flattens—betting against exuberance or pessimism about the long term. This strategy delivers a Sharpe ratio of 0.58, 55% higher than that of buy-and-hold.

LIST OF PAPERS

[1] Fragile New Economy: Intangible Capital, Corporate Savings Glut, and Financial Instability, the *American Economic Review*, Volume 115 Issue 4, April 2025.

[2] Public Liquidity and Intermediated Liquidity, working paper.

[3] Payment Risk and Bank Lending, with Yi Li, under revision (R&R) at the *Journal of Financial Economics*.

[4] Payment Risk and Bank Liquidity Management, with Yi Li, the *American Economic Association Papers and Proceedings,* Volume 116, May 2026.

[5] Network Risk and Key Players: A Structural Analysis of Interbank Liquidity, with Edward Denbee, Christian Julliard, and Kathy Yuan, the *Journal of Financial Economics* (editor's choice), Volume 141 Issue 3, September 2021.

[6] Dynamic Banking and the Value of Deposits, with Patrick Bolton, Neng Wang, Jinqiang Yang, the *Journal of Finance*, Volume 80, Issue 4, August 2025.

[7] The Network Structure of Money Multiplier, with Yi Li, Huijun Sun, Sergey Sarkisyan, working paper.

[8] Tokenomics: Dynamic Adoption and Valuation, with William Lin Cong and Neng Wang, the *Review of Financial Studies* (editor's choice), Volume 34 Issue 3 March 2021.

[9] Token-based Platform Finance, with William Lin Cong and Neng Wang, the *Journal of Financial Economics*, Volume 144 Issue 3 June 2022.

[10] Financial Intermediation with Fragile Seigniorage: A Dynamic Model of Stablecoin Issuers, with Simon Mayer, working paper.

[11] Firm Quality Dynamics and the Slippery Slope of Credit Intervention, with Wenhao Li, the *Review of Economic Studies*, 2025 (in press; online advance access).

[12] Information-Concealing Credit Architecture, with Gary Gorton, Guillermo Ordoñez, under revision (R&R) at the *American Economic Review*.

[13] Data as a Networked Asset, with Bo Bian, Huan Tang, Qiushi Huang, under revision (R&R) at the *Journal of Political Economy*.

[14] The Information Cliff, with Chen Wang, working paper.

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