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Financial intermediation services and competition analyses: Review and paths forward for improvement

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ABSTRACT

Financial intermediation has distinct value from transforming financial claims to create liquidity and mitigate risks. However, research and policy competition analyses often neglect this value or minimally account for it. We review findings to better incorporate this value. We suggest shifting the mix of individual services analyzed to better represent the distinct value, focusing more on topics closely aligned with the distinct value concept beyond individual services, and accounting for the multimarket nature of financial intermediation. We recommend attention on future competition with digital FinTech, BigTech, and DeFi firms and policies to best preserve the distinct value of financial intermediation.

1. Introduction

Extensive research spanning over four decades reveals the distinct value of financial intermediation. Financial intermediaries (FIs) transform primary securities they hold into secondary securities that are claims on the FIs that create liquidity and mitigate risks for customers. Distinct value applies to this transformation only, and not from exchanging claims without altering liquidity or risks. This transformation that serves the financial needs of customers and generates distinct value may be considered the *raison d'être* of financial intermediation.

Research and policy analyses of competition for FI services often neglect this distinct value or account for it in minimal fashion. Existing studies and policies are instead often oriented to issues raised in the general competition debate that apply broadly and are not geared to financial intermediation or its distinct value. We review existing findings to suggest improved incorporation of the distinct value revealed by the financial intermediation research.

Section 2 discusses research underlying the distinct value. We show that value arises from the liquidity creation and risk mitigation roles of FIs. These are embodied by the loans, deposits, and off-balance sheet activities that make customers more financially liquid and safer. We also describe the main methods FIs employ to fulfill these roles using their comparative advantages.

Section 3 considers static research and policy analyses of competition for existing financial services and technologies – i.e., excluding any innovations that generate new services or technologies. Many research and policy analyses focus on general economic hypotheses using advantageous FI datasets. These may be improved by shifting the mix of services analyzed to better represent the distinct value. Static analyses may also focus more on topics closely aligned with the distinct value concept transcending individual services, such as competition effects on liquidity creation and risk mitigation, and treatment of relationship customers for which much of the liquidity is created, risks are mitigated,

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and value is generated. Static analyses may also be improved by better incorporating the multimarket nature of financial intermediation.

Section 4 highlights important but understudied dynamic analyses of financial intermediation competition that result in new services and technologies. FIs invest heavily in such innovations that in some cases create and spread significant downside risks for society that are not well understood. The financial services and technologies of the future may merit even more attention. Digital Financial Firms (DFFs), such as FinTech, BigTech, or DeFi, combine nonfinancial digital innovations with financial innovations. Competition from DFFs may significantly affect the distinct value of financial intermediation for better or worse, suggesting additional scrutiny and careful policy choices.

Section 5 concludes with paths forward for competition analyses.

2. The distinct value of financial intermediation

The distinct value concept reflects modern financial intermediation research. The research points to qualitative asset transformation in which financial claims are transformed by FIs in ways that create liquidity and mitigate risks for their customers. Certain secondary financial claims issued by the intermediaries on themselves – on-balance sheet loans and deposits, and off-balance-sheet guarantees and derivatives – are more liquid and/or safer for FI customers – than the primary securities the FIs hold themselves. Customers include nonfinancial firms and households, other financial firms, governments, and others in the real economy and financial system.

To illustrate, financing illiquid and risky loans with more liquid and safer deposits increases liquidity and reduces risks for both borrowers and depositors (Diamond and Dybvig, 1983; Bhattacharya and Thakor, 1993). Borrowers are more financially liquid as they receive liquid funds from the FI in exchange for the illiquid loan held as a primary security by the FI. Borrowers are also safer, as some of their risks are absorbed by the FIs that stand ready to lose if loans are not repaid. Depositors enjoy access to liquid funds in their accounts with minimal credit risks. Off-balance sheet financial guarantees such as loan commitments provide safe liquid funds to customers when they wish to take down the funds (Holmström and Tirole, 1998) and derivatives such as interest rate swaps offset customers' market risks (Merton and Perold, 1993). The liquidity creation and risk mitigation are often, but not always, coincident in the same secondary securities.

FIs also impose illiquidity and higher risks on some economic and financial agents as part of the financial intermediation process. These include investors that purchase illiquid risky liabilities and equity shares, and are compensated with interest and dividend payments plus any net capital gains. FIs purchase and retain safe liquid securities such as U.S. Treasuries and thus remove them from the pool of safe liquid securities available for other investors. The illiquid liabilities, equity, and liquid securities are inputs, helping FIs create liquidity and mitigate risks for borrowers, depositors, and off-balance sheet customers. The distinct value reflects the net of the benefits for some and costs for others and is ideally positive, but this is not always the case.

Financial intermediation also imposes significant costs on government and central bank regulators, supervisors, and deposit insurers. They provide lender-of-last-resort facilities, too-big-to-fail bailouts, deposit insurance, and other safety net protections that aid in the liquidity creation and risk mitigation processes for FIs, although not in conventional voluntary market fashion.

The distinct value is unique to FI services, as only intermediaries engage in qualitative asset transformation. Exchanges of financial claims such as stocks and bonds without significantly altering the liquidity and risks of these claims are brokerage services (Niehans, 1978). FIs also engage in brokerage services, which have value, but only the asset transformation function generates distinct value associated with financial intermediation.

Empirical researchers measure liquidity created and risks mitigated and test their determinants, including competition. Most studies use data on a single loan, deposit, or off-balance sheet category, while others test the concepts more comprehensively. The latter often employ liquidity creation measures based on Berger and Bouwman (2009) that take account of all asset, liability, and off-balance sheet items in a single inclusive measure (Jiang, Levine, and Lin, 2019; Nguyen, Ahmed, Chevapatrakul, and Onali, 2020). Some researchers also separately analyze asset-side, liability-side, and off-balance sheet-side liquidity creation. Liquidity creation measures are net quantities, inclusive of portfolio items that create, destroy, and little affect customer liquidity, using positive, negative, and zero weights, respectively.

There are currently no analogous comprehensive measures of risk mitigation that account for all portfolio items because risks from these items are more difficult to compare and combine. However, given that liquidity creation and risk mitigation roles are often coincident, as illustrated above, liquidity creation measures could in principle also proxy well empirically for the output of FIs. Findings that bank liquidity creation has strong positive effects on economic output and growth, controlling for other determinants, are consistent with this possibility (Berger and Sedunov, 2017; Beck, Döttling, Lambert, and Van Dijk, 2022).

Theorists and empirical researchers also investigate two main methods FIs use to create liquidity and mitigate risks. One method is acquiring and processing information, often accomplished using lending technologies. Each technology is characterized by a primary information source, set of screening, monitoring, underwriting practices, and loan contract structures (Berger and Udell, 2006; Berger and Black, 2011). FIs use these technologies as delegated screeners and monitors to make lending decisions on behalf of depositors and others (Diamond, 1984). Technologies differ in the extent to which they employ more hard quantitative information that is relatively easily processed and transmitted within an intermediary organization versus soft qualitative information that is more difficult to handle and communicate. Most soft information resides with the collecting loan officer (Stein, 2002; Karolyi, 2018). All technologies involve both soft and hard information – at least some loan officer judgment based on soft information and some hard numbers.

A key distinction separates relationship lending from transactions technologies. Relationship lending generally relies more on soft information gathered through contact over time, while transactions lending is based primarily on hard information collected starting at the time of loan application (Petersen and Rajan, 1994; Berger and Udell, 1995). Theoretical and empirical research suggests large intermediaries may generate more value applying transactions technologies to larger, more informationally transparent borrowers, whereas small FIs may provide greater value using relationship lending for smaller, more opaque borrowers (Berger and Udell, 2002; Stein, 2002; Cole, Goldberg, and White, 2004; Berger, Miller, Petersen, Rajan, and Stein, 2005).

The second main method of financial intermediation is designing and enforcing financial contracts. Loans, deposits, off-balance sheet guarantees, and derivatives have contract features in some cases to incentivize counterparties and elicit information as well as to increase liquidity and reduce risks. Loan contract terms can reduce borrower adverse selection and moral hazard incentives and help reveal private information, augmenting the information acquired in the first method. To illustrate, FIs may offer applicants multiple combinations of interest rate spreads and collateral requirements to encourage observationally equivalent loan applicants to signal their private information. A separating equilibrium may arise – riskier applicants choose higher spreads/no collateral, while safer ones choose lower spreads/with collateral because of differences in chances of collateral loss (Besanko and Thakor, 1987; Berger, Frame, and Ioannidou, 2011).

FIs have comparative advantages in these two methods that allow them to generate distinct value. They use specialization, scale economies, diversification, the law of large numbers, and other tools in applying lending technologies and engaging in financial contracting (Diamond, 1984; Calomiris and Kahn, 1991).

Distinct value applies more broadly than what others describe as bank specialness, bank uniqueness, or bank differences. These vary as to whether the value is from banking services only or also includes the same or similar services of other intermediaries and which of the services generate the value – loans (Fama, 1985; James, 1987); deposits (Gorton and Pennacchi, 1990; Merton and Thakor, 2019); off-balance-sheet commitments (Boot, Greenbaum, and Thakor, 1993; Holmström and Tirole, 1998); or combinations of a few of these (Kashyap, Rajan, and Stein, 2002; Egan, Lewellen, and Sunderam, 2022). Distinct value encompasses liquidity creation and risk mitigation from all assets, liabilities, and off-balance sheet activities from all FI types.

3. Improving static analyses of financial intermediation competition

In this section, we focus on static research and policy analyses of competition for existing financial intermediation services using existing technologies. Section 3.1 covers applications of the general competition literature to individual financial services, Section 3.2 focuses on broader topics aligned with the distinct value of financial intermediation, and Section 3.3 suggests taking better account of the multimarket nature of financial intermediation.

3.1. Applications of the general competition literature to financial intermediation

The general competition literature often employs banking data because of advantageous datasets. Call Reports from U.S. regulatory agencies provide detailed output and performance data for almost all U.S. banks over decades. FDIC Summary of Deposits (SoD) supply addresses and total deposits of U.S. bank and thrift branches to construct geographic markets for competition.

Competition studies applied to the banking data test the Structure-Conduct-Performance Hypothesis (SCP) of Bain (1959) and the Relative Market Power Hypothesis (RMP) of Shepherd (1982) in which firms in markets with high concentration and those with large market shares, respectively, exercise market power. Firms harge prices unfavorable to customers, resulting in allocative inefficiency of too little output. Researchers regress deposit or loan interest rates or spreads on market concentration and/or market share with mixed results (Rhoades, 1985; Evanoff and Fortier, 1988; Berger and Hannan 1989; Berger, Kravitz, and Shibut, 2022). Others find that banks in more concentrated markets adjust deposit rates asymmetrically – more quickly downward in response to decreased market interest rates, and more slowly upward when market rates increase (Hannan and Berger, 1991; Neumark and Sharpe, 1992; Drechsler, Savov, and Schnabl, 2017). These actions harm depositors, consistent with SCP. Berger and Hannan (1989) find banking evidence supporting the "Quiet Life" Hypothesis of Hicks (1935) in which market power from concentration reduces managerial effort, lowering X-efficiency.

Some test SCP and RMP against the Efficient-Structure Hypothesis (ES) of Demsetz (1973, 1974) and Peltzman (1977) in which firm efficiency drives both profits and market structure, as efficient firms gain dominant market shares that concentrate markets. Smirlock (1985) tests SCP versus ES and finds support for ES only. Berger (1995) tests the SCP, RMP, and scale- and X-efficiency versions of ES, finding partial support for RMP and the X-efficiency version of ES, and no consistency with SCP or the scale version of ES. De Jonghe and Vander Vennet (2008) find support for interactions between SCP and RMP and for the X-efficiency version of ES.

These applications oriented to general economic issues and not to financial intermediation may nonetheless inform distinct value issues. These studies are on deposits and loans – coincidentally two of the most important outputs that create liquidity and mitigate risks and thus promote the distinct value of financial intermediation.

Additional research testing these general hypotheses on financial intermediation data could also be improved to be more informative. The support for the X-efficiency hypotheses suggests that researchers and policy makers in financial intermediation might shift more attention to X-efficiency when conducting competition research and implementing competition policies. Such a conclusion would be consistent with other findings of the general competition literature that welfare triangles of allocative inefficiency losses to society from imperfect competition are small, while X-inefficiencies are often significant (Harberger, 1954; Leibenstein, 1966).

The mix of financial intermediation services studied may be adjusted to better represent the range of services generating FI value. Off-balance sheet loan guarantees, along with deposits and loans, tend to provide more of the distinct value of financial intermediation than other activities, so competition studies of loan guarantees might also be usefully pursued.

3.2. Static competition applications to topics closely aligned with the distinct value of financial intermediation

3.2.1. Effects of competition on the roles of liquidity creation and risk mitigation

Liquidity creation and risk mitigation are the two main roles that FIs play to generate value, so investigating competition effects on these roles is a logical priority. Theory offers opposing views on whether more intense competition would increase versus decrease liquidity creation. Under the Financial Fragility-Crowding Out Hypothesis, more competition would increase liquidity creation, whereas the Risk Absorption Hypothesis predicts a decrease. These hypotheses were first described and tested by Berger and Bouwman (2009), motivated by the effects of FI capital on liquidity creation. Essentially the same arguments apply to the effects of competition, since more intense competition can be costly to FIs and act as a negative shock to bank capital.

For the effects of competition, under the Financial Fragility-Crowding Out Hypothesis, more intense competition makes FIs more fragile and subject to deposit runs, encouraging the FIs to enhance their monitoring of risky borrowers, increasing lending and loan commitments (Diamond and Rajan, 2000, 2001). Competition may also increase deposits under this hypothesis if the competition results in lower equity capital, lessening the crowding-out of deposits by equity (Gorton and Winton, 2017). Loans, loan commitments, and deposits are all main positive contributors to liquidity creation, so their increases may result in substantially greater total liquidity creation. In contrast, the Risk Absorption Hypothesis predicts lower liquidity creation from more competition, as the FIs may have less capacity to take on risks associated with creating liquidity (Allen and Gale, 2004; Von Thadden, 2004).

Empirical studies test the competition effects on bank liquidity creation in different nations and find negative impacts, suggesting empirical domination of Risk Absorption over Financial Fragility-Crowding Out in most cases (Horváth, Seidler, and Weill, 2016; Jiang, Levine, and Lin, 2019; Ali et al., 2022). We suggest additional tests to confirm or refute these relatively sparse findings, particularly using more recent data on the COVID-19 crisis period.

Studying effects of competition on risk mitigation directly is impractical in the absence of comprehensive measures that incorporate all portfolio items as in the case of liquidity creation. However, this topic may be indirectly addressed by studying the effects of risk on the FIs themselves. Riskier FIs are less able to absorb the risks of customers in need of risk mitigation and are more likely to suffer financial distress or failure that impedes their abilities to perform. Customers also tend to run on deposits, draw down their loan commitments, and shun lending relationships with riskier FIs, adding to their risk mitigation difficulties.

The literature on competition and FI risk is extensive, with research supporting opposing views. The competition-fragility view predicts higher risk from more competitive pressures due to the erosion of franchise value. The drop in franchise value increases moral hazard

incentives for intermediaries to take on more risks and lessens incentives to maintain capital and otherwise control risks to protect the franchise (Keeley, 1990; Hellmann, Murdock, and Stiglitz, 2000). Under the competition-stability view, increased competition decreases loan portfolio risk, as lower spreads charged from reduced market power ease repayments and reduce borrower moral hazard and adverse selection problems (Boyd and De Nicolò, 2005).

Some empirical studies support the empirical domination of the competition-fragility view, finding that increased competition measured by state geographic deregulation (Keeley, 1990), changes in interest rate ceilings (Hellmann, Murdock, and Stiglitz, 2000), concentration for deposits and loans (Berger, Klapper, and Turk-Ariss, 2009), Lerner Index (Beck, De Jonghe, and Schepens, 2013), and other measures of increased competition result in higher individual bank risk and systemic risk (Jiang, Levine, and Lin, 2019). Other studies support the competition-stability view at both the individual intermediary level (Boyd, De Nicolò, and Jalal, 2006; Schaeck and Cihák, 2014; Goetz, 2018) and the systemic level (Beck, Demirgüç-Kunt, and Levine, 2006; Schaeck, Cihak, and Wolfe, 2009; Anginer, Demirgüç-Kunt, and Zhu, 2014).

Competition-fragility and competition-stability are not necessarily inconsistent, nor do they need to have conflicting empirical predictions. The former is about distress risk for a financial intermediary, while the latter is about loan portfolio risk, which can have different signs. Berger, Klapper, and Turk-Ariss (2009) find empirical support for both views using the same dataset – more competition brings lower portfolio risk that is more than offset with lower capital that brings about higher net bank risk. Predicted effects might also differ by the range of competition. Martinez-Miera and Repullo (2010) theorize nonmonotonic relations between competition and risk. Empirical studies with flexible specifications support this theory as well (Tabak, Fazio, and Cajueiro, 2012; Jimenez, Lopez, and Saurina, 2013; Berger, Imbierowicz, and Rauch, 2016). Whether and when competition increases or decreases risk is important and remains unsettled and in need of additional research efforts.

3.2.2. *Effects of competition on the treatment of relationship customers*

Relationships with customers allow FIs to create liquidity and/or mitigate risks in ways that generate greater value. The FI may optimize over the multiple supply interactions – reuse information from one service provision to another, coordinate services in an integrated fashion, and/or employ cross-subsidies to increase value (Boot, 2000; Degryse and Ongena, 2015).

The issue on which additional analysis may be most useful is whether greater competition yields better or worse treatment for relationship customers. FIs may share much of the additional value and provide relatively favorable bright-side treatment to retain these customers (Boot and Thakor, 1994) versus unfavorable dark-side treatment, exploiting market power to hold up these customers (Sharpe, 1990; Rajan, 1992). To clarify, the market power underlying dark-side treatment arises from the relationship, such as access to proprietary information, and is not directly tied to the competition for financial services, which is the research concern.

Theory offers opposing views. Boot and Thakor (2000) predict more competition may result in better treatment of relationship customers. Erosion of market-power-driven profits encourages intermediaries to shift orientation from transactions to relationships, where profit margins are more protected by access to private information.[2] Petersen and Rajan (1995) alternatively predict less favorable treatment as competition intensifies. Competition discourages investing in relationships with customers that may be more likely to exit relationships.

[2] Boot and Thakor's (2000) modeling also suggests the effects of increased competition on treatment of relationship customers may depend on the source of the competition – from capital markets versus other intermediaries.

Empirical findings are mixed on competition effects on relationship borrowers. Some find unfavorable effects (Petersen and Rajan, 1995), others find favorable effects (Cetorelli and Strahan, 2006), while still others find that effects vary by competition measure (Carbo-Valverde, Rodriguez-Fernandez, and Udell, 2009) and loan type (Berger, Cerqueiro, and Penas, 2015).

The few competition studies of deposit relationships find unfavorable treatment of relationship depositors (Deuflhard, 2018; Adams, Hunt, Palmer, and Zaliauskas, 2021; Berger, Kravitz, and Shibut, 2022). However, these competition effects are not fully investigated, and findings conflict on the role of depositors' inertia in their reluctance to switch banks.

3.3. *The multimarket nature of financial intermediation*

Static research and policy competition analyses may also be significantly improved by taking better account of the multimarket nature of financial intermediation or accounting for it at all. We illustrate this multimarket nature with a simple example.

3.3.1. *Simple example of the multimarket nature of financial intermediation*

Consider a commercial bank with only large corporate loans and small household deposits. The bank faces competition for large corporate loans in national, international, or global markets against only large intermediaries capable of making such loans. The loans are often syndicated and traded in secondary markets. Household depositors with small sums may primarily choose among local depositories – large and small banks, savings banks and other thrifts, cooperatives, and credit unions (Kim and McKillop, 2019). Households using online banking may also choose among out-of-market banks and Digital Financial Firms (DFFs) such as FinTech, BigTech, and DeFi.

Thus, in this simple example, the markets with which the bank must contend involve different services (loans versus deposits), different customers (large corporations versus small households), rivals (large FIs and other loan market participants versus local depositories plus remote suppliers of all sizes), and geographic/virtual markets (national/international/global and syndicated lending networks versus local and online).

The bank optimizes by accounting for competitive conditions in both the loan and deposit markets in making its price, other contract terms, and quantity decisions for both services. In loan choices, the bank considers in addition to loan market conditions its costs of funds from its competitive position in deposit markets. Similarly, deposit choices by the bank would consider in addition to deposit market conditions, the expected profitability and risks on the loans that the deposits will finance, which vary with corporate loan market conditions.

Based on this example, the FI cannot create liquidity and mitigate risks for the loan customers without also doing so for the deposit customers. Otherwise, there are no funds to lend to the borrowers. Similarly, the bank cannot create liquidity and mitigate risks for the depositors without the expected earnings from the loan customers. The bank must contend with markets for both loans and deposits to generate the distinct value of financial intermediation.

This multimarket nature is another key feature distinguishing FIs from other firms. A manufacturer also considers labor market conditions, real estate market conditions, and markets for its other inputs in making output decisions. However, the labor, real estate, and other inputs are generally not also crucial outputs of the manufacturer. FIs have main outputs on both sides of the balance sheet and off the balance sheet, and the nature of financial intermediation is to compete in the markets for these simultaneously in their operations. As noted, there are exceptions in which FIs impose illiquidity and higher risks on some agents – such as investors in illiquid/risky FI liabilities and equity shares – as part of the financial intermediation process, so intermediated funds are not always outputs.

To improve static research and policy competition analyses, we suggest more inclusion of this multimarket nature. Researchers studying either loans or deposits would ideally include both loan and deposit market competition measures in their regressions or combine them in some logical way. This is difficult in practice because they often lack needed competition data on both loans and deposits, and no current analytical method is available to fully combine them. Policy makers considering merger applications or other competition policy decisions would similarly employ competition measures for both loans and deposits or combine them, but face the same difficulties. We next consider a solution often used.

3.3.2. The cluster approach to multimarket competition using U.S. banking data

Most researchers and policy makers using U.S. banking data employ the cluster approach than contends with multimarket competition issues in a very specific way. This emanated from the 1963 *United States v. Philadelphia National Bank* Supreme Court decision that established the approach for antitrust bank merger analyses, for which it is still for used today. It also dominates much of U.S. banking competition research and data collection.

The cluster approach focuses almost exclusively on competition for a single service – local market deposits – and effectively assumes the same market shares for other services. Based on this assumption, data need only be collected for the location of deposits, and antitrust analysis need only focus on the local deposit market Herfindahl-Hirschman Index of concentration (HHI). Competition for other services is considered only if deposit concentration thresholds are violated.

The broader implications include that the FDIC Summary of Deposits (SoD) dataset became the only information collected on the location of total deposits by branch office generally available for policy and research. Research focused on or controlling for banking competition in the U.S. generally continues to employ HHI or other measures using SoD data on total deposits and office locations. This is the case if the research issue is about competition for deposits, loans, or other services. Researchers in some cases find substitutes for the SoD for customer locations, but other data sources are less comprehensive in this regard.

The cluster approach assumptions are likely to be significantly violated today, as corporate loans may be competed for on national/international/global bases and small business loans are made at greater distances as time passes (Petersen and Rajan, 2002). Regulatory, technological, and financial innovations over time allow for online competition and other ways in which the associations among the markets for financial services become more disparate.

3.3.3. Research making inroads on multimarket issues

Drechler, Savov, and Schnabl (2017) find that market power in deposit markets affects lending behavior. Increases in open-market interest rates from monetary policy tightening widens spreads on deposit rates in concentrated deposit markets, consistent with earlier findings. Their key innovation is that this additionally causes intermediaries with deposit market power to contract their lending more than others, part of a new deposits channel of monetary policy. Drechler, Savov, and Schnabl (2021) also find that bank market power over depositors reduces interest rate risk from deposits. This allows for relatively low interest expenses for banks across all interest rate environments, facilitating steady long-term lending. Li, Loutskina, and Strahan (2019) find that deposit market concentration encourages intermediaries in these markets to increase long-term lending and reduce loan maturity premiums because of reduced funding risks on long-maturity loans. Carlson, Correia, and Luck (2022) find exogenous changes to market contestability for deposit and loan markets both affect credit supply.[3]

4. Improving dynamic analyses of financial intermediation competition

Dynamic analyses of competition in financial intermediation consider its effects on innovations of new products and technologies. These have broad implications for the industry, the real economy, and financial markets. Financial intermediation is a dynamic industry, investing heavily in new nonfinancial and financial technologies and innovating with new financial services. It also increasingly faces dynamic competition from outside the industry.

We discuss how to improve dynamic analyses. In Section 4.1, we focus on financial and nonfinancial innovations already manifested. In Section 4.2, we look at future dynamic competition issues that may change and take on greater significance. We focus on threats and enhancements to financial intermediation value from competition with Digital Financial Firms (DFFs) of FinTech, BigTech, and DeFi, defined below.

4.1. Current issues in dynamic financial intermediation competition

4.1.1. Nonfinancial innovations employed by financial intermediaries

Information technology (IT) innovations – such as computers that process hard quantitative information used in lending and software that aids in monitoring economic and financial conditions efficiently – are heavily employed by FIs. Of particular importance are smartphones and other telecommunications technologies that enable delivery of financial services almost anywhere, even in nations without significant physical infrastructure. IT innovations are generally created by technology companies, but competition for FI services encourages their production and adoption by FIs and their customers.

Some research suggests IT adoption by FIs significantly improves their productivity, helps remove excess capacity in the industry, and benefits customers (Berger, 2003). Other findings raise questions as whether innovations have improved performance over time (Philippon, 2015).

Of potential greater concern are the potential effects of these nonfinancial technologies in causing and spreading risks and crises around the world. Computer and internet technologies increase operational risk loss events, such as computer hacks to steal customer identities or using ransomware to take FI systems hostage. Large operational risk losses increase systemic risks in the financial system (Berger, Curti, Mihov, and Sedunov, 2022).

Software apps on mobile devices can also be employed in destructive ways. Social media posts of unfavorable information can quickly lead to large withdrawals using mobile banking apps. The runs on Silicon Valley

[3] There are many other ways in which financial intermediation research has improved competition research over time, including employing data on competitor locations, efficiency, and financial health; competition from different types of physical and virtual competitors; geographic deregulation of banking competition in U.S. states; international differences in creditor and shareholder rights, regulations, openness of trade and entry, and foreign and state ownership of banks; and use of nonstandard methodologies. See competition surveys by Berger, Demirgüč-Kunt, Levine, and Haubrich (2004); Claessens and Laeven (2004); Degryse and Ongena (2008); Osberghaus, Degryse, Morales-Acevedo and Ongena (2024).

Bank (SVB) and others in March 2023 had other root causes, but IT allowed these runs to occur in record time. Similarly, while telecommunications did not cause the Global Financial Crisis, it was likely instrumental in accelerating the destructive flows of funds and information that spread the crisis quickly.

Dynamic analyses of competition for nonfinancial innovations employed by FIs and their customers might be improved by additional analyses of the effects of competition in causing and spreading risks and crises as well as the more basic questions of FI productivity.

4.1.2. *Financial innovations employed by financial intermediaries*

Financial innovations such as derivatives, securitization, and syndication are also widely employed by FIs. These innovations are often invented by few FIs and adopted by many more. Relatively simple and understandable forms of these services often provide value to society, such as interest rate and foreign exchange rate swaps, securitization of relatively safe conformable residential mortgages, and syndication of large loans to well-known corporations. Additional research on the roles of competition in inventing and adopting these innovations may be helpful.

However, some current complex, highly engineered securities are difficult to understand and pose significant downside risks. Such innovations contribute to large and sometimes crippling damages to FIs. Direct financial losses from errors in trading complex financial securities in some cases – such as for JP Morgan Chase's "London Whale" incident – have magnified effects from reputational damages, fines, and restrictions imposed by supervisory authorities.

In some cases, widespread damages arise during crises from complex financial innovations, and competition may have helped push these innovations to market prematurely. To illustrate, competition appeared to pressure FIs to create and quickly market new types of complex subprime MBS prior to the Global Financial Crisis (GFC). The combinations of financial modelling, engineering, and reengineering of return tranches, and so forth did not work in periods of financial stresses leading up to the GFC. These securities, while profitable to some, led to massive losses among FIs and taxpayers that bailed out some of them (Lewis, 2011). Additional research on the roles of competition in inventing and adopting these innovations may be helpful, as well as how policy might mitigate or offset adverse pressures from competition.

4.2. *Future threats and enhancements to financial intermediation value from Digital Financial Firm (DFF) competition*

We next consider future dynamic competition issues involving DFFs that provide financial services by employing advanced IT such as blockchain and data-analytics techniques including artificial intelligence (AI). DFFs exploit large datasets with conventional data in some cases, and in others employ behavioral- and social-media-related Alternative Data or Big Data combinations. DFFs apply these digital technology tools to financial technologies, such as lending technologies to devise credit scores in seconds and transmit them even more quickly. DFFs communicate with to customers primarily remotely using the internet, smartphones, and application programming interfaces (APIs). Their services currently compete with many FI assets, liabilities, and off-balance sheet activities, as well as payments and other financial services.

We consider DFFs primarily as competitors of the future, given their short existence, small current market share, and rapid growth and evolution. The smartphone integral to competitive success of DFFs dates back only to the 2007 iPhone introduction. Blockchain and distributed ledgers that are key to many DeFi applications only started with the bitcoin rollout in 2009. The GFC of 2007 to 2009 that increased distrust of banks was also a spark (Gopal and Schnabl, 2022).

The rapid growth and changing variety of DFFs and the competitive responses of traditional FIs are suggestive, but not definitive. Existing FIs are embracing new technologies as well, sometimes in cooperation with their digital competitors, and sometimes in competition with them. In some places, such as the Nordic countries, online services have almost entirely replaced brick-and-mortar – essentially emulating some characteristics of DFFs.

We analyze the possible future outcomes of this competitive battle. We show how future competitive success of DFFs through direct competition or through cooperation may either significantly threaten the distinct value of financial intermediation or greatly enhance it. We consider cooperation as part of the competition process. When DFFs cooperate with FIs to provide a service previously supplied only by traditional FIs, it is competition nevertheless and could also be a waystation toward largely replacing traditional FIs. We also clarify that the concern is about the value generated by financial intermediation, and not about the form that future FIs may take.

We impose simplifying assumptions, employing three idealized versions of the DFFs we label as FinTech, BigTech, and DeFi. There is no consensus on these labels, the technologies may not remain fixed, and DFFs may also evolve in unknown ways. We try to design these three types broadly enough to cover the waterfront in terms of current and likely future permutations, as opposed to precise predictions. We discuss firms focused on cryptocurrencies and central bank digital currencies (CBDCs) under DeFi in the spirit of completeness, although these cryptocurrencies and CBDCs are often considered separately from DeFi.

4.2.1. *FinTech*

FinTech describes firms that use advanced financial and information technologies to engage in services including but not limited to lending, payments, clearing/settlement, robo-advising, insurance-tech, and mobile wallets. FinTech firms typically offer much smaller sets of services than banks and other FIs, and do not share many of their features as providers of multiple services. FinTechs in some cases directly compete with FIs by offering similar services, and other times cooperate to provide existing services more efficiently.

To illustrate, consider FinTech lending platforms, also known as marketplace lenders, that interface with small business and consumer loan applicants using internet and smartphone. They were first called Peer-to-Peer (P2P) because of funding by individuals, but funds now mostly originate with investors, including banks (Thakor, 2020). After receiving loan applications, these platforms apply digital technology tools to process Alternative Data/Big Data sources to devise credit scores. In seconds and without significant human intervention, the platforms transmit the scores and other information to potential investors, some of whom may fund the loans (Balyuk and Davydenko, 2019; Vives, 2019).

This procedure differs significantly from FI lending in additional ways. FIs actively perform all three lending methods of screening, monitoring, and funding, while FinTech lending platforms such as Prosper and Funding Circle typically only actively screen and do very little monitoring and funding (Balyuk, Berger, and Hackney, 2023, Fig. 3).

We recognize that some FinTechs and other DFFs monitor their borrowers' operations and cash flows (Gambacorta, Huang, Li, Qiu, and Chen, 2020; Boualam and Yoo, 2022). Monitoring by DFFs appears to be improving, demonstrating the evolving and uncertain nature of external competitive threats from DFFs (Berg, Fuster, and Puri, 2021).

FinTech credit scoring technologies also contrast with traditional credit scoring lending technologies. FIs use scores based on conventional small business and consumer data, such as prior loan and bill repayments, and FIs often purchase the scores from outside vendors, such as Fair, Isaac and Company (FICO). Credit scoring technologies employed also differ by institution size, and vary in the extent to which they rely more on rules versus discretion in implementation (Berger, Frame, and Miller, 2005; Berger, Cowan, and Frame, 2011).

FIs both compete and cooperate with FinTech lending platforms. Many small and large banks engage in cooperative agreements with platforms. In some cases, banks refer applicants they do not wish to serve themselves. In other cases, banks make loans initiated by the

FinTech platforms. Other banks choose to compete only and not cooperate (Vallee and Zeng, 2019).

A key question concerns local market penetration of FinTech lending platforms. FinTechs may be able to penetrate primarily where large and out-of-market FIs using more hard information lending technologies are prevalent. Alternatively, FinTechs may compete for customers better in localities served more by small and in-market FIs specializing in soft information technologies. The answer may depend on the comparative advantages of the FinTech technologies in processing hard information versus effectively hardening soft information. The data are more consistent with FinTech advantages processing hard information – FinTechs primarily penetrate when the presence of large/out-of-market bank lending is greater (Balyuk, Berger, and Hackney, 2023).

The larger issue of the distinct value of financial intermediation if FinTechs are successful in the future can go either way. FinTech success could severely limit the value of financial intermediation by outcompeting traditional FIs in many separate slivers of services. FinTechs may cherry-pick the most profitable services, causing FIs to shrink dramatically (Stulz, 2019). Surviving FIs may be weakened and less able to play their roles.

We illustrate this with the potential loss of value from FI relationships. As discussed, FIs may better serve relationship customers by optimizing over multiple supply interactions, reusing information, coordinating services, and/or cross-subsidizing. Relationships with FIs may be particularly important during future crises. Soft information used in relationship lending may better retain its value over the cycle than hard information (Grunert, Norden, and Weber, 2005) and is particularly valuable during crises when the market prices on which much of the hard information is based are less accurate (Liberti and Petersen, 2019). Relationships with FIs also allow for intertemporal smoothing in which customers obtain better treatment, such as more favorable credit terms, during crises when most needed, compensated for by harsher treatment other times (Bolton, Freixas, Gambacorta, and Mistrulli, 2016).[4]

FinTech firms supplying individual services may not be able to serve customers as well, particularly during crises. FinTechs do not gather significant soft information and at present have weaker or nonexistent relationships that would allow for intertemporal smoothing. FinTechs may also be challenged to find liquidity for customers during crises.

FinTech success could alternatively significantly enhance the value of financial intermediation. FinTechs may better serve customers with otherwise limited access to financial services. Their online services to firms and households in developing nations with little in the way of physical infrastructure and without high-quality collateral to pledge may be more efficient. FinTech cooperation with FIs, such as providing screening for loans that FIs provide, could enhance value by making these FIs more efficient in liquidity creation and risk mitigation.

4.2.2. BigTech

BigTech refers to large technology companies, such as Amazon and Alibaba, that operate online platforms providing many services, such as search, shopping, entertainment, social media, and other services to billions of customers around the globe. They are currently in various states of expansion into financial services and may in the long run have relatively complete sets of online financial and commercial services through their platforms, although there is no assurance when or if they will arrive there.

BigTech may be viewed in part as a modern effort to circumvent government restrictions on banking and commerce combinations, largely prohibited by law, with exceptions.[5] These prohibitions are due to concerns about conflicts of interest and extensions of government safety net protections such as deposit insurance and too-big-to-fail (Saunders, 2000). The wide reach of BigTech across borders and access to data and customers at massive scale with market power and network benefits may allow these firms to successfully avoid such restrictions.

BigTech resources may also eventually break the grip that FIs traditionally had on their customers through their own distribution networks and relationships that involve both soft and hard information (Boot, Hoffman, Laeven, and Ratnovski, 2021). BigTech has already eroded some FI competitive advantages (Botch and Vanasco, 2019; Frost, Gambacorta, Huang, Shin, and Zbinden, 2019). Specifically, BigTech firms gained shares in lending relative to both traditional FIs and FinTech lending platforms by using their connections with merchants (Cornelli, Frost, Gambacorta, Rau, Wardrop, and Ziegler, 2021), consistent with theory (Li and Pegoraro, 2023).

In terms of how BigTech competition might affect the distinct value of financial intermediation, the cooperation outcome described above for FinTech may be less likely to apply to BigTech, given the resources and scale of these firms. A competitively successful BigTech industry could defeat FIs and improve the value of financial intermediation if customers prefer the combination of services and/or if BigTechs can deliver them more efficiently.

Alternatively, any BigTech advantages in using hard information may fall short of meeting some key customer needs. Similar to FinTechs, BigTechs may struggle with implementing relationship services and fail to serve customers well during crises.

4.2.3. Decentralized Finance (DeFi)

DeFi offers a potentially complete replacement of the financial architecture of society, including its currency, central bank controls, deposit insurance, and prudential regulation and supervision safeguards. For some, decentralized finance offers a liberating experience away from governments and rules. This framing has given it a sizable following. In terms of technologies, DeFi firms use distributed ledgers and often transact in cryptocurrencies.

Recent events as well as historical episodes of financial bubbles suggest that there may be more risks involved than are fully appreciated. The losses due to digital wallet thefts, high-profile bankruptcies and CEO resignations of crypto-based firms that were not always informationally transparent (Celsius, FTX, Alameda Research) may have awakened some to the risks of losses from actions taken behind closed doors. Sentiments about underlying valuations of digital assets may change quickly, increasing losses from runs, bankruptcy costs, investigations, and regulation. In addition, the DeFi promise of independence from the centralized financial system may also have faded. Traditional financial intermediaries, such as JP Morgan Chase are entering DeFi spaces and investors are holding cryptocurrency assets as parts of portfolios with traditional assets.

While data are insufficient for complete analysis, casual observation suggests parallels with prior real estate bubbles that were based on assumptions of ever-increasing asset values that resulted in insufficient diversification such as the GFC and S&L Crisis in the 1980s. As occurred following these prior crises, there is also a risk of more government regulation and supervision, reducing part of the liberating experience competitive advantage of these firms.

If DeFi firms are competitively successful in the future, there is again a range of possibilities. Widespread cooperation with traditional FIs is

[4] Empirical findings from the GFC support the intertemporal smoothing theory (DeYoung, Gron, Torna, and Winton, 2015; Bolton, Freixas, Gambacorta, and Mistrulli, 2016). COVID-19 evidence suggests credit card relationships may have provided such benefits (Berger, Bouwman, Norden, Roman, Udell, and Wang, 2024), but not commercial loan relationships (Berger, Bouwman, Norden, Roman, Udell, and Wang, 2023).

[5] Industrial loan companies in the U.S., particularly in Utah, allow some combinations of banking and commerce and some large commercial firms such as Walmart have tried to obtain these licenses. Some manufacturers in Europe have financing arms with banking licenses, such as Volkswagen Bank GmbH.

problematic as it would undermine the basic nature of DeFi. DeFi competitive success would essentially replace a significant portion of the financial services industry. A key issue is the extent to which DeFi has its own distinct value that can substitute for the value of services of traditional FIs.

As noted, we include central bank digital currencies (CBDCs) under DeFi, recognizing that central banks are far from decentralized or anti-establishment. CBDCs could be considered an alternative to cash which is also a claim directly on the central bank.[6] CBDCs might also be viewed as alternatives to cryptocurrencies. The Libra/Diem initiative of Facebook to introduce a stablecoin anchored to the U.S. dollar may have triggered some central bank interest in CBDCs.

Access of firms and households to the safety and other features of CBDCs could undermine the traditional roles of depository FIs, reducing deposit synergies with other services. This may reduce real investments and lessen the value of financial intermediation (Keister and Sanches, 2023). The loss of deposit role could also decrease the centrality of banks in the financial system (Beck, Cecchetti, Grothe, Kemp, Pelizzon, and Sánchez Serrano, 2022). Stability may suffer as depositors may move into CBDCs during financial crises.[7] However, there may also be benefits to the introduction of CBDCs (BIS, 2021a; Bordo and Levine, 2017). Drawing conclusions about the costs and benefits of CBDCs is beyond our scope, but warrants additional investigation.

5. Paths forward

Financial intermediation research identifies distinct value from transforming financial claims to create liquidity and mitigate risks for customers. Paths forward for improving research and policy analyses of financial intermediation competition involve more fully and comprehensively incorporating this value. Useful avenues for static analyses that treat services and technologies as given include adjusting the mix of financial services and concepts analyzed to more closely align with the distinct value. We also recommend accounting to the extent possible for the multimarket nature of financial intermediation.

For dynamic competition analyses, productive paths forward include scrutiny of the risk externalities of the new services and technologies that result from the competition. More research on benefits and other costs of these innovations would allow for a more balanced view.

Even more consequential may be research and policy responses to the dynamic competition issue of the future. As discussed, future competitive successes of Digital Financial Firms (DFFs) may lead to significant losses or gains in the distinct value of financial intermediation.

We suggest a balanced research approach. Some resources might be expended to clarify which of the loss or gain scenarios are most likely to be the case as the world shifts digitally. We also suggest analyses to predict which traditional FIs more likely will shrink or disappear versus evolve to compete with or outcompete the future DFFs.

We also recommend a balanced approach to considering policy reforms to cope with this issue, including "second thought" analyses of unintended consequences. We apply this approach to two types of policy reforms.

First, policy makers might tighten prudential policies for traditional FIs to reduce their likelihood of creating and quickly adopting risky financial innovations such as occurred in the past (e.g., subprime MBS). Lower risks from innovations by traditional FIs might offer a buffer of safety against the unknown risks from dynamic innovations by DFFs. However, "second thought" analysis suggests that such prudential reforms may have unintended consequences of these innovations migrating to the DFFs where they are less supervised, regulated, and transparent. Research suggests that avoidance of prudential scrutiny promotes DFFs (Buchak, Matvos, Piskorski, and Seru, 2018; Kim, Laufer, Stanton, Wallace, and Pence, 2018).

A second type of policy reform would be to enact guardrails on the potential effects of DFFs on the financial system. This may occur by extending existing prudential policies to also cover DFFs. This expansion of the policy umbrella may help keep risks under control and provide needed data for research analysis of DFFs' risks. However, "second thought" analysis suggests that such broadened regulatory and supervisory control may unleash unintended consequences. These include stifling competition with potential inefficiencies and other unfavorable effects. This policy may also discourage innovations that would serve customers well.

Thus, while we offer suggestions to improve research and policy analyses to better incorporate the distinct value of financial intermediation, we appreciate the difficulty of this task.

CRediT authorship contribution statement

Allen N. Berger: Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Conceptualization. **Arnoud W.A. Boot:** Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Conceptualization.

Data availability

No data was used for the research described in the article.

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[6] CBDCs could be anonymous, similar to traditional cash, or account-based (ECB, 2020; BIS, 2021a,b).

[7] To contain the risk of fleeing deposits, limits have been proposed on the amounts the public can put in these vehicles (Bindseil, Panetta, and Terol, 2021). Limits may have implications for the adoption of CBDC and open the door for private-sector currencies that CBDC tries to preempt.

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