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# Banks and financial markets in a digital age

*Understanding the future of banking in an increasingly  
diffuse financial system*

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## *Abstract*

This paper reviews recent developments in banking as they pertain to the explosion of financial innovation, the emergence of fintech, BigTech and BigData, and the blurring of boundaries between banks and markets, and what these portend for the future of banking. The discussion draws upon the rich insights developed in the extensive theoretical and empirical research in financial intermediation and capital markets, and raises many questions for future research.

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### 3.1 INTRODUCTION

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The financial services industry is going through massive changes. Information technology is key in this process of change. The recent focus on fintech – basically, new information technology oriented players entering the financial services industry – is possibly the most visible manifestation of the impact that information technology has on the industry. This chapter will focus on the structure of the banking industry going forward. We will extract insights from the fundamental theories of financial intermediation, and relate these insights to the ‘modern’ world of information technology and fintech.

While banks are still core to the financial system (Philippon, 2015), fintech is widely seen as a disruptive force in the banking industry (Vives, 2019; Thakor, 2020; Boot et al., 2021). New information technology-focused entrants, including large platform-oriented firms like Google and Amazon, are seen as potential threats to the position of banks. They may have access to relevant databases and often proprietary information, via their platforms. This potentially allows them to inject themselves between banks and their customers, giving those customers easier access to multiple providers and potentially more transparent product offerings (via two-sided platforms, see Doerr, et al., 2024, this volume). Banks, though, are not passive bystanders, they invest heavily in information technology and digitalization of services and processes as well.

While fintech is often seen as a relatively recent phenomenon, many waves of technological innovation have affected banking over time, including innovations in distribution like ATMs in the 1970s, telephone banking in the 1980s and online banking more recently.

Information technology has also deepened links between banks and financial markets. One way this deepening has occurred is via securitization and other forms of asset sales that remove assets from a bank's balance sheet, allowing those assets to become tradeable. This intertwines markets and institutions, blurs their boundaries, and gives impetus to a growing shadow banking system. This shadow banking system suggests the evolution of a more diffuse financial system which, with the more recent wave in fintech, may mushroom further and reduce the centrality of banks in the financial system.

At no stage has the blurring of boundaries been more evident than during the events leading up to the Global financial crisis that began in 2007, events that have highlighted how large the shadow banking sector has become. The Financial Stability Board (FSB, 2022) estimates the size of the shadow banking system in the US at \$20.5 trillion in 2021, but estimates (and measures) vary greatly (see Claessens et al., 2012; and Pozsar et al., 2013).<sup>1</sup> A major issue with shadow banking is that because it involves qualitative asset transformation, it is inherently risky and may pose systematic risk that threatens financial stability (FSB, 2022).<sup>2</sup>

More recent fintech related developments have the potential of creating unforeseen risks as well. For example, since the 2007-09 financial crisis, P2P lending has grown rapidly both in the US and Europe, raising questions about the role of non-intermediated credit

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<sup>1</sup> In its Global Shadow Banking Monitoring Report 2022, the Financial Stability Board covering 29 jurisdictions with over 80% of world GDP, reports \$67.8 trillion assets in shadow banks. See their 'narrow' definition that confines shadow banking to activities posing financial stability risk; e.g. it excludes assets in institutions that are not susceptible to runs like pension funds, (unlevered) closed-end funds and insurance companies.

<sup>2</sup> In the definition of Adrian and Ashcraft (2016), shadow banking consists of financial institutions that are involved in credit, maturity, and liquidity transformation (which could create financial stability risks), but without the access to public backstops that banks have. Gorton and Metrick (2012) define the shadow banking system as one consisting of the following key components: (i) money-market mutual funds or other institutional (market-based) lenders who replace depositors as a primary funding source for shadow banks; (ii) securitization of bank-originated loans, which permits the creation of asset-backed securities that then serve as collateral for the bank's borrowing from mutual funds and other institutional lenders; and (iii) repurchase agreements (or repos), which represent the financial contract used by banks to raise funding from investors.

relative to intermediated credit. Many papers have recently studied the competitive credit market interactions between banks and P2P lending platforms (e.g. Tang, 2018; de Roure, Pelizzon, and Thakor, 2022; and Osberghaus et al., 2024, this volume).

This chapter reviews the literature related to these developments and uses it to examine the importance of this changing landscape for the structure of the financial services industry going forward, and the policy challenges that it may entail.

The organization of the chapter is as follows. In Section 3.2, we focus on the economic role of financial intermediaries. The primary focus here is on the banks' role in lending and how this compares to non-intermediated finance directly from the financial market. We also discuss the potential complementarities and conflicts of interest between intermediated relationship banking activities and financial market activities (underwriting, securitization, etc.), and analyze the effects of competition on the banks' lending relationships. Does competition harm relationships and reduce their value and hence induce more transaction-oriented banking, or does competition augment the value of relationships? This discussion will summarize the key insights from the modern literature of financial intermediation and discusses how they help us address this question.

In Section 3.3 we discuss the increasingly interconnected nature of banks and financial markets, with a focus on securitization. This "technology" has been at the center of the 2007–2009 Global financial crisis. In Section 3.4 we focus on fintech and its impact on credit via P2P lending, the role of fintech in payments, and the (potential) role of large platform-based BigTech firms like Amazon and Google in the financial arena. We also contrast banks to fintech/BigTech, and discuss their competitive advantages. Policy challenges are discussed in the concluding section 3.5.

## 3.2 UNDERSTANDING BANKS AS INFORMATION-PROCESSING INTERMEDIARIES

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In this section we discuss two issues: (1) what is the key role of banks vis-à-vis financial markets? and (2) how does competition impinge on this role?

### 3.2.1 The Economic Role of Banks

We first discuss the role of banks in qualitative asset transformation—i.e., the process by which banks absorb risk to transform both the liquidity and credit risk characteristics of assets (see Bhattacharya and Thakor, 1993). For example, banks invest in risky loans but finance them with riskless deposits (e.g., Diamond, 1984; Ramakrishnan and Thakor, 1984; Dang et al., 2017). They also invest in illiquid loans and finance them with liquid demandable deposits (e.g., Diamond and Dybvig, 1983). The theory of financial intermediation has placed special emphasis on the role of banks in monitoring and screening borrowers in the process of lending. Bank lending is typically contrasted with direct funding from the financial markets. What are the comparative advantages of bank loans over public capital market-bond financing?<sup>3</sup>

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<sup>3</sup> Much of the discussion that follows focuses on bank loans versus bond financing in the capital market, rather than equity financing in the market. In reality, we would expect the market to segment itself into some firms going for bank loans, some going for bond market financing, and some going for equity market financing. Boot and Thakor (1997) develop a theory that predicts the choice between bank loans and bond market financing. Brown, Martinson and Petersen (2017) provide evidence that better-developed stock markets support faster growth of high-tech industries, whereas better-developed bank-oriented credit markets foster growth in industries that rely on external financing for physical capital.

The most striking insight of the contemporary theory of financial intermediation is that banks are better than markets at resolving informational problems<sup>4</sup>. The possession of better information about their borrowers allows banks to get closer to, and possibly more aligned with their borrowers. Interestingly, a feedback loop is generated, as this proximity between the financier and the borrowing firm in bank lending arrangements may also help mitigate the information asymmetries that typically plague arm's length arrangements in market transactions. This has several aspects. A borrower might be prepared to reveal proprietary information to its bank that it may have been reluctant to reveal to the financial markets (Bhattacharya and Chiesa, 1995). A bank might also gather information about prospective borrowers through their depository relationships with the bank,<sup>5</sup> and may also have better incentives to invest in costly information acquisition. While costly, the substantial stake that it has in the funding of the borrower and the enduring nature of its relationship with the borrower—with the possibility of information reusability over time— increase the marginal benefit of information acquisition to the bank.<sup>6</sup> Boot and Thakor (2000) analyze the economic surplus that relationship banking can generate.

Such borrower–lender proximity may also have a dark side. An important one is the hold-up problem that stems from the information monopoly that the bank may develop

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<sup>4</sup> In a recent theory, Donaldson, Piacentino and Thakor (2018) show that banks have another advantage over non-banks, and that is in safeguarding wealth/output. This allows them to create private money and enable the economy to invest more in real projects than its entire initial endowment.

<sup>5</sup> Empirical evidence that depository information about potential borrowers is relevant to the bank is provided by Puri, Rocholl and Steffen (2017). That paper uses data on a million German loans to show that when a bank extends loans to those who have had a depository relationship with the bank (and continue to have it) exhibit lower default probabilities than those without depository relationships with the bank, consistent with one of the predictions in Donaldson, Piacentino and Thakor (2018). See also Merton and Thakor (2019).

<sup>6</sup> Ramakrishnan and Thakor (1984) focus on pre-contract information asymmetries to rationalize the value that financial intermediaries add relative to markets. Diamond (1984) focuses on post-contract information asymmetries to rationalize intermediation. Coval and Thakor (2005) show that financial intermediaries can provide an institutional resolution of the problem of cognitive biases at the individual investor level, acting as a “belief’s bridge” between pessimistic investors and optimistic entrepreneurs. James (1987), Lummer and McConnell (1989), and Gande and Saunders (2005) provide empirical evidence on the informational value of bank financing. See also the “stories” provided by Berlin (1996) supporting the special role of banks.

due to the spontaneous generation of payoff-relevant proprietary information about borrowers. Such an informational monopoly may permit the bank to charge higher loan interest rates *ex post*; see Sharpe (1990) and Rajan (1992). Boot (2000) provides a review of the relationship banking literature. The threat of being “locked in,” or informationally captured by the bank *ex post*, may dampen loan demand *ex ante*, causing a loss of potentially valuable investment opportunities. Alternatively, firms may opt for multiple-bank relationships (see Carletti, Cerasi, and Daltung, 2007). This may reduce the informational monopoly of any individual bank, but possibly at a cost. Ongena and Smith (2000) show that multiple-bank relationships indeed reduce the hold-up problem, but can worsen the availability of credit.

Another aspect is that relationship banking could accommodate an intertemporal smoothing of contract terms (see Boot and Thakor, 1994; Allen and Gale, 1995, 1997) that would entail losses for the bank in the short term that are recouped later in the relationship.<sup>7</sup> Petersen and Rajan (1995) show that credit subsidies to young or “de novo” companies may reduce the moral hazard problem and informational frictions that banks face in lending to such borrowers. Banks may be willing to provide such subsidized funding if they can expect to offset the initial losses through the long-term rents generated by these borrowers. The point is that, without access to *subsidized* credit early in their lives, “de novo” borrowers would pose such serious adverse selection and moral hazard problems that *no* bank would lend to them. Relationship lending makes these loans feasible because the *proprietary* information generated during the relationship produces

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<sup>7</sup> One strong implication of the Boot and Thakor (1994) theory is that the gains from relationship lending will take some time to be manifested. Recent empirical evidence in support of this prediction is provided by Lopez-Espinosa, Mayordomo and Moreno (2017) who document that the gains from relationship lending accrue only when the relationship is of longer duration than two years.

“competition-immune” rents for the bank later in the relationship and permits the early losses to be offset. The importance of intertemporal transfers in loan pricing is also present in Berlin and Mester (1999). They show that rate-insensitive core deposits allow for intertemporal smoothing in lending rates. This suggests a complementarity between deposit taking and lending. Moreover, the loan commitment literature has emphasized the importance of intertemporal tax-cum-subsidy schemes in pricing to resolve moral hazard (see Boot, Thakor, and Udell, 1991; Shockley and Thakor, 1997) and also the complementarity between deposit taking and *commitment* lending (see Kashyap, Rajan, and Stein, 2002).

The bank–borrower relationship also displays greater contractual flexibility than that normally encountered in the financial market. This flexibility inheres in the generation of hard and soft proprietary information during a banking relationship. The information gives the bank the ability to adjust contractual terms to the arrival of new information and hence encourages it to write “discretionary contracts” ex ante that leave room for such ex post adjustments. This is in line with the important ongoing discussion in economic theory on rules versus discretion, where discretion allows for decision-making based on more subtle—potentially non-contractible—information (see, for example, Simons, 1936). In particular, Boot, Greenbaum, and Thakor (1993) develop a theory in which legally unenforceable discretionary contracts –like loan commitments with an “escape clause” called the Material Adverse Change clause—may be preferred to legally-enforceable contracts that do not give any of the contracting parties discretion about whether to honor the contract.

The papers by Stein (2002) and Berger et al. (2005) highlight the value of “soft information” in lending. Soft information could be an example of more subtle and non-



contractible information. On this issue, two dimensions can be identified. One dimension is related to the nature of the bank–borrower relationship, which is typically long term, with accompanying reinforcing incentives for both the bank and the borrower to enhance the durability of the relationship. This allows for *implicit*—non-enforceable—long-term contracting. An optimal information flow is crucial for sustaining these “contracts.” Information asymmetries in the financial market, and the non-contractibility of various pieces of information, would rule out long-term alternative capital market funding sources as well as *explicit* long-term commitments by banks. Therefore, both the bank and the borrower may realize the added value of their relationship, and have an incentive to foster the relationship.<sup>8</sup>

The other dimension is related to the structure of the explicit contracts that banks can write. Because banks write more discretionary contracts, bank loans are generally easier to renegotiate than bond issues or other public capital market funding vehicles (see Berlin and Mester, 1992). Such renegotiability may be a mixed blessing because banks may suffer from a “soft-budget constraint” problem: borrowers may realize that they can renegotiate ex post, which could give them perverse ex ante incentives (see Dewatripont and Maskin, 1995; Bolton and Scharfstein, 1996). The soft-budget-constraint problem is related to the potential lack of toughness in enforcing contracts due to the ex post distribution of “bargaining power” linked with relationship banking proximity (see Boot, 2000)<sup>9</sup>. In

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<sup>8</sup> Hellwig (1991) discuss the commitment nature of bank funding. Bolton et al. (2016) discuss the implicit commitment in bank funding to local markets in times of crisis. Boot, Thakor, and Udell (1991) address the *credibility* of commitments.

<sup>9</sup> Recently, Donaldson, Piacentino and Thakor (2021) show that this soft-budget constraint problem can also be resolved if the financier’s cost of capital is high enough. They use this observation to develop a general equilibrium theory of “intermediation variety” in which banks, with a low cost of capital and a soft-budget constraint, provide financing to one type of project, and non-banks, with a higher cost of financing but without the soft-budget-constraint burden, provide financing for a different kind of project. Thus, banks and non-banks coexist in a general equilibrium despite the funding cost advantage enjoyed by banks.

practice, one way that banks can deal with this issue is through the priority structure of their loan contracts. If the bank has priority/seniority over other lenders, it could strengthen the bank's bargaining position and allow it to become tougher. These issues are examined in Diamond (1993), Berglöf and von Thadden (1994), and Gorton and Kahn (1993).

The bank could then credibly intervene in the decision process of the borrower when it believes that its long-term interests are in jeopardy. For example, the bank might believe that the firm's strategy is flawed, or a restructuring is long overdue. Could the bank push for the restructuring? If the bank has no priority, the borrower may choose to ignore the bank's wishes. The bank could threaten to call the loan, but such a threat may lack credibility because the benefits of liquidating the borrower's assets are larger for higher-priority lenders, and the costs from the termination of the borrower's business are higher for lower-priority lenders. When the bank loan has sufficiently high priority, the bank could *credibly* threaten to call back the loan, and this may offset the deleterious effect of the soft-budget constraint. This identifies a potential advantage of bank financing: *timely intervention*. Of course, one could ask whether bondholders could be given priority and allocated the task of timely intervention. Note that bondholders are subject to more severe information asymmetries and are generally more dispersed (i.e., have smaller stakes). Both characteristics make them ill-suited for an "early intervention" task.

### **3.2.2 Intermediation and Competition**

Since relationship banking is an integral part of the economic services provided by banks and generates rents for banks, it also potentially invites multiple-bank entry, which then generates interbank competition. An interesting question this raises is how competition

might affect the *incentives* for relationship banking. While this may ultimately be an empirical question, two diametrically opposite points of view have emerged theoretically. One is that competition among financiers encourages borrowers to switch to other banks or to the financial market. The consequent shortening of the expected “life span” of bank–borrower relationships may induce banks to reduce their relationship-specific investments, thereby inhibiting the reusability of information and diminishing the value of information (Chan, Greenbaum, and Thakor, 1986). Banks may then experience weaker incentives to acquire (costly) proprietary information, and relationships may suffer. There is empirical evidence that an increase in relationship length benefits the borrower. Brick and Palia (2007) document a 21-basis point reduction in the loan interest rate due to a one-standard deviation increase in relationship length.

Moreover, increased credit market competition could also hurt relationship lending by imposing tighter constraints on the ability of borrowers and lenders intertemporally to share relationship-generated surplus (see Petersen and Rajan, 1995). In particular, it becomes more difficult for banks to “subsidize” borrowers in earlier periods in return for a share of the rents in the future. Thus, the funding role for banks that Petersen and Rajan (1995) see in the case of young corporations (as already discussed) may no longer be sustainable in the face of sufficiently high competition. This implies that interbank competition may have an ex post effect of diminishing bank lending.<sup>10</sup>

Another way in which competition can hurt relationship lending is through consolidation. An extensive empirical literature focuses on the effect of consolidation in the banking sector on small-business lending. This consolidation may in part be a response to

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<sup>10</sup> Berlin and Mester (1999) provide a related, albeit different argument. Their analysis suggests that competition forces banks to pay market rates on deposits, which may impede their ability to engage in the potentially value-enhancing smoothing of lending rates.

competitive pressures. The effects on small business lending, however, are not clear-cut. Sapienza (2002) finds that bank mergers involving at least one large bank result in a lower supply of loans to small borrowers by the merged entity. This could be related to the difficulty that larger organizations have in using “soft information” (Stein, 2002; Berger et al., 2005). However, Berger et al. (1998) show that the actual supply of loans to small businesses may not go down after bank mergers, since they invite entry of “de novo” banks that specialize in small-business lending (see also Strahan, 2007).

The opposite point of view is that competition may actually *elevate* the importance of a relationship-orientation as a distinct competitive edge. The idea is that competition pressures profit margins on existing products and increases the importance of financier differentiation, and more intense relationship lending may be one way for the bank to achieve this. Boot and Thakor (2000) formalize this argument to show that a more competitive environment may encourage banks to become more client-driven and customize services, thus generating a *stronger* focus on relationship banking.<sup>11</sup> They distinguish between “passive” transaction lending and more intensive relationship lending by banks. Transaction lending competes head-on with funding in the financial market. Greater interbank competition results in banks engaging in more relationship lending, but each relationship loan has lower value to the borrower. By contrast, greater competition from the capital market leads to a lower volume of relationship lending, but each relationship loan has greater value. In this context, it is also interesting to note that Berger

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<sup>11</sup> In related work, Hauswald and Marquez (2006) focus on a bank’s incentives to acquire borrower-specific information in order to gain market share, and Dinç (2000) examines a bank’s reputational incentives to honor commitments to finance higher-quality firms. Song and Thakor (2007) theoretically analyze the effect of competition on the mix between relationship and transaction lending, and focus on fragility issues raised by the bank’s desire to match core deposit funding with relationship lending and purchased money funding with transaction lending.

et al. (2008) find empirically that bank ownership type (foreign, state-owned, or private domestic) affects the bank's choice between transaction and relationship lending.

Relationships may foster the exchange of information, but may simultaneously give lenders an information monopoly and undermine competitive pricing. As discussed above, the informational monopoly on the "inside" lender's side may be smaller if a borrower engages in multiple-banking relationships. This would mitigate the possibilities for rent extraction by informed lenders and induce more competitive pricing (see Sharpe, 1990; Petersen and Rajan, 1995). Transaction-oriented finance, however, may give banks little incentive to acquire information but is potentially subject to more competition. This suggests that markets for transaction-oriented finance may fail when problems of asymmetric information are insurmountable without explicit information acquisition and information-processing intervention by banks. This argument is used by some to highlight the virtues of (relationship-oriented) bank-dominated systems (e.g., Germany and Japan) vis-à-vis market-oriented systems. This is part of the literature on the design of financial systems (see Allen, 1993; Allen and Gale, 1995; Boot and Thakor, 1997). One objective of this literature is to evaluate the economic consequences of alternative types of financial system architecture.

What this discussion indicates is that the impact of competition on relationship banking is complex; several effects need to be disentangled. However, empirical evidence (see Degryse and Ongena, 2007) seems to support the Boot and Thakor (2000) prediction that the orientation of relationship banking *adapts* to increasing interbank competition, so higher competition does not drive out relationship lending.<sup>12</sup> Despite this adaptation, there

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<sup>12</sup> See also Berger and Boot (2023). They provide an overview of the empirical insights on the effects of competition on financial intermediation.

is also evidence that in recent years the geographic distance between borrowers and lenders has increased (see DeYoung, Glennon, and Nigro, 2008). The latter might suggest an increasing availability of data and data processing capacity that might challenge relationship banking. New specialized lenders have arisen that seek to replace relationship lenders and traditional credit scoring with sophisticated algorithms based on Big Data mining (data analytics).

### **3.3 BANK LENDING, SECURITIZATION, AND CAPITAL MARKET FUNDING**

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Much of our focus in the previous section was on interbank competition. Nonetheless, banks also face competition from the capital market. The standard view is that banks and markets compete, so that growth in one is at the expense of the other (see Allen and Gale, 1995; Boot and Thakor, 1997). In this context, Deidda and Fattouh (2008) show theoretically that both bank development and stock market development have positive effects on growth, but the growth impact of bank development is lower when there is a higher level of stock market development. They also present supporting empirical evidence. What this shows is that the dynamics of the interaction between banks and markets can have real effects. How banks and markets interact is therefore of great interest.

In contrast to the standard view that they compete, the observations in the previous section suggest that there are also potential complementarities between bank lending and capital market funding. We argued that prioritized bank debt may facilitate timely

intervention. This feature of bank lending is valuable to the firm's bondholders and other capital market investors as well. They might find it optimal to have bank debt take priority over their own claims, because this efficiently delegates the timely intervention task to the bank. The bondholders will obviously ask to be compensated for their subordinated status. This—ignoring the timely intervention effect—is a “wash.” In other words, the priority (seniority) and subordination features can be priced. That is, to the same extent that senior debt may *appear* to be “cheaper” (it is less risky), junior or subordinated debt will appear to be more expensive, and there should be no preference for bank seniority, other than through the timely bank-intervention channel—a variant of the Modigliani and Miller indifference reasoning. Consequently, the borrower may reduce its total funding cost by accessing both the bank-credit market and the financial market.<sup>13</sup> A theoretical analysis of complementarity appears in Song and Thakor (2010) who show that banks and markets exhibit three forms of interaction: competition, complementarity and co-evolution.

Another manifestation of potential complementarities between bank lending and capital market activities is the increasing importance of securitization, this being an example of the unbundling of financial services. Securitization is a process whereby assets are removed from a bank's balance sheet, so banks no longer permanently fund assets when they are securitized; instead, the investors buying asset-backed securities provide the funding. Asset-backed securities, rather than deposits, thus end up funding dedicated pools of bank-originated assets. More specifically, the lending function can be decomposed

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<sup>13</sup> The complementarity between bank lending and capital market funding is further highlighted in Diamond (1991) and Hoshi, Kashyap, and Scharfstein (1993). Diamond (1991) shows that a borrower may want to borrow first from banks in order to establish sufficient credibility *before* accessing the capital markets. Hoshi, Kashyap, and Scharfstein (1993) show that bank lending exposes borrowers to monitoring, which may serve as a certification device that facilitates simultaneous capital market funding. In related theoretical work, Chemmanur and Fulghieri (1994) show that the quality of the bank is of critical importance for its certification role. This suggests a positive correlation between the value of relationship banking and the quality of the lender. See Petersen and Rajan (1994) and Houston and James (1996) for empirical evidence.

into four more primal activities: origination, funding, servicing, and risk processing (Bhattacharya and Thakor, 1993). Origination subsumes screening prospective borrowers, and designing and pricing financial contracts. Funding relates to the provision of financial resources. Servicing involves the collection and remission of payments as well as the monitoring of credits. Risk processing alludes to hedging, diversification, and absorption of credit, interest rate, liquidity, and exchange-rate risks. Securitization decomposes the lending function such that banks no longer fully fund the assets, but continue to be involved in other primal lending activities.

One potential benefit of securitization is better risk sharing (see Gorton and Pennacchi, 1995 for an economic rationale for bank loan sales and securitization). The proliferation of securitization may, however, also be induced by regulatory arbitrage—for example, as a vehicle to mitigate capital regulation. And a third benefit is highlighted by Boot and Thakor (1993), who show that the pooling of assets and tranching of claims in securitization achieve both a diversification of idiosyncratic information and the creation of *information-sensitive* claims that increase the issuer's revenues from selling these securities.

Securitization thus offers an interesting opportunity for financial innovations through new security designs. See Allen and Barbalau (2023) for a thorough review of securitization from this perspective. These innovations may also enable securitization sponsors to cope with increasing competition. See Haslag, Srinivasan and Thakor (2023) for evidence that higher competition among securitization sponsors led to more innovation in the underlying mortgages that were being securitized.

Central to the extensive academic work on securitization is the idea that it is not efficient for originators to completely offload the risks in the originated assets. The originating bank needs to maintain an economic interest in the assets in order to alleviate



moral hazard and induce sufficient effort on the originating bank's part in screening and monitoring. What this implies is that, even with securitization, banks do not become disengaged from the assets they originate. Banks still continue to provide the services involved in screening and monitoring borrowers, designing and pricing financial claims, and providing risk-management and loan-servicing support. As such, securitization preserves those functions that are at the core of the *raison d'être* for banks. This militates against the notion that securitization effectively lessens the importance of banks.

Boyd and Gertler (1994) have argued that the substitution from on-balance-sheet to off-balance-sheet banking induced by securitization may have falsely suggested a shrinking role for banks. Indeed, by keeping banks involved in their primal activity of pre-lending borrower screening, securitization preserves much of the banks' value added on the asset side, and even creates new opportunities for innovation and growth.

Up to the 2007–2009 Global financial crisis, securitization was rapidly gaining in importance. In fact, prior to the summer of 2007, securitization became prevalent for ever-wider types of credits, including business credits that were previously thought to be difficult to securitize because of their information opaqueness. Also, a relatively new market for securitization involving asset-backed commercial paper (ABCP) conduits emerged at that time as a significant force. As the Global financial crisis showed, these developments were not without problems. The structure of real-world securitization transactions had taken a rather fragile form. In particular, it is important to note that much of the securitization leading up to the crisis involved the financing of long-term assets with short-term funding, which induced substantial liquidity risk. While this liquidity risk was sometimes mitigated by liquidity guarantees (e.g., stand-by letters of credit and refinancing commitments), the underwriting institutions often underestimated the risks

involved and overstretched themselves.<sup>14</sup> Also, because the originating institutions appeared to have retained minimal residual risk, monitoring incentives may have been compromised (see Mian and Sufi, 2009).<sup>15</sup> The eagerness of banks to securitize claims—and keep the repackaging “machine” rolling—may have also adversely impacted the quality of loans that were originated through a dilution of banks’ screening incentives due to lower retained residual risks (e.g., subprime lending; see Keys et al., 2010).

One of the most powerful economic justifications for banks to securitize assets was that it enabled them to offload a variety of risks from their balance sheets and pass them on to diversified investors in the capital market who were perhaps better equipped to absorb these risks. One of these risks is credit risk. However, it is not clear that banks actually transferred as much credit risk as indicated by the standard text-book argument. Acharya, Schnabl and Suarez (2013) analyze asset-backed commercial paper conduits, which experienced a shadow-banking run during the financial crisis of 2007–2009. They document that, in order to engage in regulatory (capital requirements) arbitrage, commercial banks set up conduits to securitize assets worth \$1.3 trillion while insuring the newly-securitized assets using explicit guarantees, structuring these guarantees to reduce regulatory capital requirements. However, they find that the conduits provided little risk transfer during the run, as losses from conduits were absorbed by the banks instead of outside investors.

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<sup>14</sup> Most noteworthy are the bankruptcies among German Landes-banks that were involved in providing liquidity guarantees.

<sup>15</sup> Securitization is facilitated in part by credit enhancement, including partial guarantees by the arranger of a securitization transaction (and/or he holds on to the most risky layer of the transaction). In the Global financial crisis, this disciplining mechanism broke down; residual risk with the arranger was minimal or framed as liquidity guarantees to off-balance-sheet vehicles without appropriately realizing the inherent risks. The marketability of securitized claims had also been facilitated by accreditation by credit rating agencies. The role of rating agencies turned out to be questionable, see Boot and Thakor (2019).

The 2007–2009 Global financial crisis brought securitization almost to a grinding halt. However, the risk diversification that securitization can accomplish appears to be of more than just ephemeral importance. Thus, it re-emerged, albeit in a form that entails lower levels of liquidity risk, as well as lesser moral hazard in screening (loan underwriting standards) and monitoring. Also, securitization as mechanism to perform capital arbitrage was discouraged via strengthening of regulation.

Another effect of the interaction between banks and markets is that as markets evolve and entice bank borrowers away, banks have an incentive to create new products and services that combine services provided by markets with those provided by banks. This allows banks to follow their customers to the market rather than losing them. There are numerous examples. For instance, when a borrower goes to the market to issue commercial paper, its bank can provide a backup line of credit. In similar spirit, Drucker (2005) shows that junk-rated firms and companies in local lending relationships are more likely to select an integrated (universal) commercial investment bank when they expect to issue public debt in the future. This revealed preference for commercial investment bank relationships by firms that issue informationally sensitive securities suggests that there might be benefits for banks to use private information from lending in investment banking. A similar picture emerges if one looks at US banking following the 1999 Financial Services Modernization Act. It appears that information collected through the banks' commercial lending businesses may have reduced the costs of underwriting debt and equity (see Drucker and Puri, 2005; Schenone, 2004). While this suggests a potential for value creation, an extensive literature has focused on the potential conflicts of interest related to banks combining lending and capital market activities; particularly, conflicts of interest in universal banking. Much of earlier work is motivated by the Glass–Steagall regulation in

the US (see Kroszner and Rajan, 1994; Puri, 1996; Ramírez, 2002). Typical findings are reassuring, i.e. conflicts were found to be limited.

In more recent work, a somewhat more critical picture has emerged; the problems with securitization, as already discussed, are a good example. Moreover, as Boot and Ratnovski (2016) show, combining relationship banking with financial market-oriented transaction activities (like trading) might undermine the commitment needed for relationship banking. More specifically, the ability to shift resources to trading activities within financial institutions may undermine relationship banking activities by violating (implicit) funding commitments to those borrowers. This might be particularly acute because trading activities are typically more readily scalable than relationship banking activities; i.e. the latter depend on more long-term engagements leading to more cultivated relationships. This suggests that combining banking and trading activities could lead to lack of commitment and loss of franchise value. Consistent with this, Laeven and Levine (2007) find that banks that combine lending and non-lending activities lose value relative to engaging in these activities separately (see also Schmid and Walter, 2009). Even more fundamentally, the theory of Donaldson, Piacentino and Thakor (2018) highlights the importance to the real economy of combining lending and deposit creation within the same bank, so an open research question is the extent to which securitization, when viewed in a general equilibrium context, generates a cost due to the separation of these.

The impetus for market-based activities grows stronger as interbank competition puts pressure on profit margins from traditional banking products, and the capital market provides access to greater liquidity and lower cost of capital for the bank's traditional borrowers. As a consequence, there is a natural propensity for banks to become increasingly *integrated* with markets, and a "co-dependence" could emerge that makes

banking and capital market risks become more intertwined.<sup>16</sup> Following the 2007-09 Global financial crisis, regulators have tried to contain these risks; e.g. by putting constraints on banks' involvement in proprietary trading (Greenbaum, Thakor and Boot, 2019).

### 3.4 FINTECH AND THE BANKING INDUSTRY

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Fintech refers to profound information technology driven changes in business models, processes and services in the financial sector (Vives, 2019). Or, similarly, it is about finance-sector related digital innovations and technology-enabled business model innovations (Philippon, 2016). Sometimes, it points at new digital players entering the financial arena. Fintech firms can be found across the full spectrum, from lending, payments, clearing/settlement, to insurance. Banks themselves, as alluded to in the Introduction, heavily invest in information technology as well and could (sometimes) be considered fintech players themselves. Banks also collaborate with fintech players; for example, ApplePay builds on a bank's payment infrastructure. Generally, when we talk about banks versus non-bank fintech firms, we think of banks as depository institutions that lend as intermediaries, and non-bank fintechs as firms that link investors directly to borrowers without using deposits and the related intermediation activities.<sup>17</sup>

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<sup>16</sup> Innovations integrating banks and markets went far beyond securitization. For example, OTC derivatives, especially credit default swaps, showed in the period preceding the 2007-09 crisis enormous growth, outpacing real investment by a factor of twelve (Posen and Hinterschweiger, 2009).

<sup>17</sup> As a separate category, one could identify neobanks – new innovative digital-only banks, also called fintech banks. These clearly have banking licenses and operate as depository institutions, but are fully based on digital platforms without any physical presence. Well known ones include in N26, Revolut and Bunq (all European), and Chime, Wise and Varo among many others in the US. The distinction between traditional banking institutions and neobanks (fintech banks) is blurring as several existing institutions are transforming themselves in digital-only banks as well (e.g. ING in The Netherlands and several Nordic players).

### 3.4.1 Fintech and BigTech

It has become customary to separate out so-called BigTech firms, like Amazon, Google and Apple, from fintechs in general. BigTech firms have their own, typically two-sided platforms with billions of customers who deal through the platform with suppliers and each other.<sup>18</sup> The platforms involve many services including online shopping, social media, search activities, etc. Building on network benefits, BigTech firms bring together providers of services and customers across many activities, and obtain massive amounts of (customer) data in the process.

While the role of BigTech in financial services is limited so far, a future with combinations of both financial and nonfinancial offerings is a distinct possibility. BigTech firms could invite banks and other providers of financial services to their platforms, and have the platform become the direct customer interface integrating financial offerings with other (nonfinancial) products and services.

A key implication might be that BigTech involvement could lead to the disaggregation of the banking value chain with the online platforms becoming the direct point of contact for customers. Clearly, this could have negative repercussions for banks. Banks then might become suppliers to the platforms and lose their direct contact with customers.<sup>19</sup> BigTech firms could accumulate massive quantities of (proprietary) customer data on their platforms, and via BigData analytics further erode the traditional informational advantage that banks have about their customers (Vives, 2019; Thakor, 2020).

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<sup>18</sup> Doerr et al. (2024, this volume) define BigTechs as involving online multi-sided- platforms where users transact through the platform enabling direct interactions between two or more groups of users.

<sup>19</sup> The consultancy McKinsey talks about platforms creating ‘a customer-centric, unified value proposition that goes beyond what users could previously obtain [...]’ and is ‘often more central in the customer journeys [...]’ (McKinsey, 2017). This points at empowerment by customers, and simultaneously could cast further doubt on whether banks will be able to continue to control the customer interface.

With these platforms, specialized financial players may gain in importance. They could become suppliers to the BigTech platform as well and reach a wide customer base. Their services could then be combined with other services on the platform. For banks, it would mean that they would not only lose their hold over customers via their own proprietary one-stop-shopping distribution networks, but that they may now also face head-on competition from specialized players (Boot et al., 2021).<sup>20</sup>

However, how this will play out is speculative. As of yet, it is unclear what the role of BigTech in financial services will be, and it is also an open question whether some banks can make inroads in the business of BigTech by creating their own (multi-purpose) platforms that offer access to nonfinancial services and other providers. Especially some of the really large banks may try to follow this route, and in doing so offer a challenge to Bigtech.

Very visible already is credit that is provided by non-banks. Osberghaus et al. (2024, this volume) discuss the massive inroads that non-banks have made in non-real-estate small business lending. Non-banks dominate the market; banks have retreated and are left with a very small market share. In mortgages the picture is similar, yet slightly less extreme. While finance companies are the largest non-bank lender, P2P fintech lending has started making inroads.

### **3.4.2 Banks and P2P**

P2P lending refers to parties engaging in direct lending without involving the balance sheet of a bank. It is also referred to as marketplace lending or fintech lending. P2P is not (just) an innovation that develops independently of banks and/or without involvement of banks.

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<sup>20</sup> A counter effect might be that banks would still be able to generate informational synergies across business lines Hibbeln et al. (2020).

Banks and institutional investors often provide funding and other services to the platform (Balyuk and Davydenko, 2019; Thakor, 2020). As with securitization, banks may serve essential functions in that lending process—functions like compliance, screening, monitoring and funding.<sup>21</sup> All this suggests the existence of complementarities between banks and fintech players.

Another issue is the extent to which the market served by P2P overlaps with that of banks. Demyanyk, Loutskina and Kolliner (2017) find that P2P primarily serves a predatory-type segment, causing excess borrowing by often vulnerable consumers. Given that this segment is not a primary banking segment, the overlap would be limited.<sup>22</sup> Buchak et al. (2018) highlight competitive effects in the U.S. residential lending market. They show that shadow banks (including fintech) grow strongly in the more risky, yet guaranteed segment (via government sponsored enterprises – GSE) where banks retreat for regulatory compliance reasons. Using German data, de Roure, Pelizzon and Thakor (2022) document that when banks are hit with a capital shock and are (temporarily) constrained in their lending, fintech firms tend to fill the lending vacuum. Interestingly, they tend to engage in “bottom fishing”, taking the banks’ riskiest customers, and they are most successful in doing so when there is greater awareness among customers of the availability of P2P lenders.<sup>23</sup> Vallee and Zang (2019) use investor-level data to document that sophisticated investors

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<sup>21</sup> Some fintech (P2P) lending platforms only engage in screening, and do little monitoring and/or funding, see Balyuk, Berger and Hackney (2023).

<sup>22</sup> In analyzing Lending Club (a well-known U.S. P2P platform), Jagtiani and Lemieux (2017) find that relatively high risk consumers are being served (compared to those by banks). They also see some ‘inclusion’ benefits by pointing to P2Ps role in providing credit to areas that could benefit from additional credit supply. The latter contrasts with Demyanyk, Loutskina and Kolliner (2017) who do not find that P2P covers markets underserved by traditional banks, hence they are skeptical about P2P improving financial inclusion.

<sup>23</sup> The way banks and fintech lenders compete has not crystallized yet. The work by Huang (2023) suggests that both may have different ways of information gathering and learning, effectively having different lending technologies and may coexist. Interestingly, Chen et al. (2023) using data for 23 countries, document a “fintech gender gap”—while 29% of men use fintech products, only 21% of women do—and this exceeds the gender gap in bank account ownership.



systematically outperform others in interacting with the platforms, and this outperformance shrinks when the platform reduces information provision to investors.

The prospects for P2P in corporate lending are more difficult to assess. Banking skills might be indispensable, for example, those needed to deal with controlling risk (moral hazard) and distressed assets. Again, this suggests the possibility of banks buying P2P platforms as a separate business of non-deposit-funded lending. More risky, information-sensitive corporate loans may not be a good fit for a P2P platform (Dermine, 2017).

However, one may envision that the growing availability of inexpensive information allows for public certification of creditworthiness similar to the trustworthiness scores on eBay, or the client satisfaction scores on TripAdvisor. Similar developments may enable P2P business lending in the future as well (Greenbaum, Thakor and Boot, 2019).<sup>24</sup> Nonetheless, the Thakor and Merton (2022) theory of trust in lending suggests that banks have an advantage over non-banks in being trusted lenders, so it possible that banks will acquire some of the technology company platforms—to the extent permitted by regulators—in order to benefit from the technology and closer customer contact while still retaining the advantages they have over non-banks.

At the retail customer level, we might see a (re)emergence of more community-oriented arrangements. As P2P lending and crowdfunding suggest, customers may take matters in their own hands; Local arrangements may emerge where communities organize their financial affairs directly among themselves. Information technology therefore may not only invite an increase in scale, but might also facilitate more tailor-made local arrangements. The latter would fit the empowerment that customers may increasingly

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<sup>24</sup> Recent research argues that investors on the lending platform may face adverse selection problems which may discourage business lending on the P2P platform (Vallee and Zeng, 2019).

desire. A variant of this can be seen in the Farm Credit System in the U.S, which exists to provide financing to farmers and ranchers and relies on a network of cooperatives that have customers on the boards of directors of the lending institutions. For these institutions, it is relatively easy to adopt new technology to provide customer-centric solutions that do not involve traditional banks.

### **3.4.3 Reach of Fintech in Payments**

An area which seems most open to fintech is payments, and particularly retail-related payments; see for an overview Carletti, Claessens and Fatas (2020). This core area of banking is being coveted by technology firms and payment specialists like Google, Apple and PayPal. Thus far, banks have maintained their central role in payments. Also, the payments innovators are not typically independent of banks, but have developed in joint ventures or other types of alliances with traditional banks. In some countries, banks themselves have managed to offer the leading on-line payments solution.<sup>25</sup> While retail payments were the initial point of entry of fintech players, getting into payment solutions for corporates might be a next step.

Regulatory developments, like PSD2 in the EU, may further elevate competition in this area. PSD2 forces banks to share payment information with others on the request of their customers. This is designed to encourage competition in the payments sphere.

In this context, blockchain technology also deserves discussion. This decentralized system of record keeping and transactions promises to have an impact on the banking industry. It might undermine the centrality of banks in the financial system. Cryptocurrencies, like Bitcoin, that use the blockchain technology, could offer an alternative

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<sup>25</sup> Wyman (2014) and BIS (2014).

payment infrastructure that bypasses the banking system. However, these developments are still at their infancy, and highly unpredictable.<sup>26</sup> Also, banks may choose to embrace these developments, and be part of the new paradigm. The response of banks and the more general threat (or opportunity) of fintech for the banking industry is still an open question.

#### **3.4.4. Partner or Perish?**

Increasingly, partnering is seen as crucial for banks. A study for the World Economic Forum concluded that “all financial institutions will need to find ways to partner with large techs without losing their core value proposition” (WEF, 2017). Agility and flexibility in setting up and finding value enhancing partnerships are seen as distinct skills.<sup>27</sup> In doing so, banks may face dilemmas. When is partnering with fintech optimal, and when is it not? An example of such a dilemma is a bank faced with the prospect of partnering with Apple or Google in payments. Will banks continue to be important for such partnership, or only in the beginning, and redundant subsequently?

Banks, however, also have some competitive advantages. Banks benefit from the anxiety of people about the safety of their liquid wealth. The Global financial crisis of 2007-2009 may have created anxiety about the stability of banks, but banks are still seen as the place where money is safe. Vatanasombut, et al. (2008) highlight that trust plays a key role in the retention of customers with online banking. They also find that perceived security

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<sup>26</sup> The World Economic Forum states, “DLT (distributed ledger technology – blockchain) is not a panacea; instead it should be viewed as one of many technologies that will form the foundation of next generation financial services infrastructure” (WEF, 2016). One could also envision central bank issued digital currencies gaining the upper hand (Bank of England, 2014; BIS, 2021; Beck et al., 2022).

<sup>27</sup> For a strong stand on partnering, with the motto: ‘Partner or perish’, see a report by the consultancy EY (EY, 2017). It also argues that the major risk for a bank does not come from fintech players but from banks that are better at partnering. *The Economist* notes that banks and fintech become increasingly collaborative (*The Economist*, Special Report, International Banking, May 6<sup>th</sup> 2017, page 12), a point echoed as well by the World Economic Forum, “Many fintechs [...] have shifted to building partnerships as they struggle with scale and customer adoption” (WEF, 2017).

reinforces trust. Thakor and Merton (2022) argue theoretically that banks' access to cheaper funding via insured deposits makes them endogenously more trustworthy than non-banks.<sup>28</sup>

Thus, whatever the popularity of Apple, will people trust technology companies to safeguard their money? Being a bank with a license and an implicit guarantee from the government has value. Banks may also have valuable compliance expertise, and having extensive customer data is a distinct competitive advantage as well.

These comments also highlight that some of the competitive advantages that banks have are derived from regulation, and not natural economic forces, although regulation may be motivated by the forces that provide a *raison d'être* for banks and interact with these forces. As Philippon (2016) puts it, "What we do know, however, is that a combination of restrictive regulations and powerful incumbents can certainly prevent entry." Particularly, as alluded to above, the implicit guarantee that banks have from their governments may give them an edge over new entrants, including possibly fintech players. Indeed, safeguarding fair opportunities for new players is a challenge when strong and highly politically connected incumbents are present.<sup>29</sup>

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<sup>28</sup>Gurun, Stoffman and Yonker (2018) provide evidence that investors moved money out of risky securities accounts into bank deposits after the Madoff scandal, but that money managers who were able to build trust with their clients through the provision of additional services—such as providing financial planning advice—suffered very little from trust-based withdrawals.

<sup>29</sup> On the importance of political connections in banking, see Calomiris and Haber (2014) who argue that politics has been central to banking for centuries, and Huang and Thakor (forthcoming) who provide evidence that politics affects banks' capital structure and lending decisions. Observe that banks that embrace fintech developments may do this to neutralize innovations and protect their existing ways of operating. A potentially relevant historic example is Moody's (the rating agency) acquisition of KMV in 2002. KMV had developed a novel approach for assessing credit risk that arguably Moody's saw as a threat. More recently, some consortia of banks are setting up blockchain systems that are closed for others, and thus possibly frustrate the open architecture that blockchain is based on. An example is ING's participation in a 'blockchain-based platform for energy commodities' which involves a limited number of participants; see ING, press release, November 6, 2017, 'ING joins forces on blockchain-based platform [...]'. To be fair, ING states in the same press release that its intention is to open it up to others: "The technology is intended to be made available to all market participants and service providers in the energy trading sector."

It is fair to say that the future of the industry and its structure in particular are highly uncertain. Developments in technology have inherently a level of unpredictability. The financial services industry is in the middle of it. Some banks may play a leading role in the new universe, perhaps by becoming leading BigTech-like platforms themselves. What seems clear is that new competitors and the potential disaggregation of the value chain will put pressure on existing players.<sup>30</sup>

### 3.5 CONCLUSION

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The latest incarnation of information technology has led to a ‘fintech revolution’ where banks face new competitors with different – often more specialized – business models potentially forcing a disaggregation of the financial services value chain. With technology-driven solutions, they offer alternatives to key banking services, including payments and lending. An important question is to what extent existing financial institutions can lead this transformation. Can they be at the vanguard of new developments, for example, by absorbing fintech players and their innovations? Will banks and fintech be complementary and collaborative or competitive? Or will new technology-linked players cause depositories to fade away and replace them as the center of the

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<sup>30</sup> Also legislative developments within the banking sector- play a role. For example, legislation in the UK and EU (PSD2) seeks to fuel competition among banks by enforcing data sharing via so-called open banking. It would – following the request and/or consent of a customer – obligate a bank to make its information about this customer available to other providers of financial services (see Vives, 2019).

financial services universe? While we have commented on the resilience of banks, only time will tell. There are many questions, fewer answers.

For policymakers, the uncertain environment of banking brings major challenges. Information technology has made banking more fluid. We saw this in the 2007-09 Global financial crisis, particularly on the asset side, given rise via securitization of bank assets to a growing shadow system (see Osberghaus et al., 2024, this volume). More recently, the liability side of the bank balance sheet shows ‘fluidity’ as well: the deposit base of banks has become less stable. Further dispersion in the financial system can be expected. The shadow system, the emergence of fintechs, mushrooming of specialized players—which may include some banks that become specialized niche players— and also developments surrounding central bank digital currency (CBDC) may all contribute a further disaggregation of banking. For regulation and supervision, the challenge is: how do we have a holistic approach that seeks to contain system-wide risks?. How do we prevent regulatory arbitrage? And indeed, the fintech revolution in part might be precisely a symptom of regulatory arbitrage (Buchak et al., 2018). What is the answer? Perhaps functional regulation is the way to go, i.e. regulate by focusing on the *economic functions* institutions serve rather than the *labels* we put on them, as advocated by Merton (1995). Indeed, had regulators adopted this view of regulation, perhaps we would have had risk-mitigating regulation of the Credit Default Swaps (CDS) market by insurance regulators well before the 2007-09 crisis.

The BigTechs offer unique challenges as well. Will reintermediation occur on the BigTech platforms with BigTechs having superior data and using network effects to have a strong hold customers? Will competition suffer? And will TBTF problems reemerge together with substantial operational risks in these highly concentrated platforms? Indeed, as the Bank of England had formulated the question, will “[...] the distress or failure of a

technology-enabled alternative finance provider have implications for financial stability?” (Bank of England, 2015). We just do not know.

And will the new financial system – based on large databases and data analytics – become more cyclical, as hard information rather soft relationship-based-information may become prevalent? And relatedly, will, for example, robo-advice and risk management algorithms lead to more uniformity, and induce herding, and thus have potentially destabilizing procyclical effects.<sup>31</sup>

What we do know is that policymakers have not been standing still. In the EU, US and elsewhere, policymakers have been challenging the potential market power of BigTech.<sup>32</sup> Privacy concerns surrounding the use of data is high on the agenda as well (e.g. the GDPR legislation in the EU). The same is true for the potential drawbacks of the use of AI (artificial intelligence) and the cyber security risks associated with the digital economy, with calls for possible regulation.

More risks can be identified: will there new stability risks emerge from existing institutions that could lose out in the technology race? Noteworthy are several blockchain-based initiatives of incumbent banks and insurance companies that have failed.<sup>33</sup> While this may just be the learning that goes with the trial-and-error of discovering the possibilities that new technologies offer, failure may cause serious risks.

But there might also be an upside: fintech developments could increase diversity in the financial sector that actually strengthens the resilience of the system. Also new opportunities may emerge that benefit society. Fintech may lead to greater inclusion,

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<sup>31</sup> See Boot, et al. (2021); Doerr, et al. (2024, this volume); and Carney (2017) for further insights on the implications of fintech for financial stability.

<sup>32</sup> See for example, Reuters reporting on China: “Beijing’s regulatory crackdown wipes \$1.1 trillion off Chinese Big Tech” (*Reuters*, July 12, 2023).

<sup>33</sup> See, for example, “Case for blockchain in financial services dented by failures”, *Financial Times*, December 30, 2022.

although the earlier-cited evidence on the fintech “gender gap” suggests that this may take some time. Furthermore, banks could think of expanding their traditional activities to serve sectors they may not have served much before, such as biotech. Lo and Thakor (2023) point out the enormous potential for banks to play a more prominent role in financing biomedical innovation. Thus, banks can expand their boundaries and contribute to social welfare in doing so. How best to achieve this presents an interesting and challenging research agenda for the future.



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