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The Future of Banking: The Role of Information Technology

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Abstract

This article analyzes how information technology (IT) is transforming individual banks and the entire banking industry. Even though the basic economics of banking have not changed, IT developments may lure banks into transaction banking (due to IT-driven cost efficiencies). However, banks should not give up on relationship banking. Instead, banks need to adjust themselves to consumers' new preferences for IT-driven products and use IT developments to reconfigure or even reinvent relationship banking. Drastic changes are also imminent in banking due to the entry of FinTech startups and IT companies in traditional banking businesses. Government intervention and regulation give banks additional time to adjust.

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1. Introduction

Information technology is rapidly entering the traditional banking business. Recent survey among US bank managers reveals that 47% of them discuss technology at every board meeting. Three-quarters of them worry about competition from unregulated non-bank companies. They see Apple, Walmart, peer-to-peer lenders, Google, PayPal, Amazon, and Facebook as a formidable threat among nonbank competitors (Bank Director, 2015). The future for banks is largely unknown. Are banks ready to defend their turf, and what are their competitive advantages?

To at least vaguely predict a road ahead for banks, we first revisit the economics of banking. We argue that the rationale for banking has not changed. Banks act as information agents with the main purpose of mitigating information problems among bank customers. Bank regulation ensues due to banks' special importance for the real economy. What has changed, however, is bank customers. A generational shift is taking place. Bank customers increasingly wish to be empowered, continuously connected, and entertained.

IT developments will drastically change the way banking business is done. Banks may be lured into investing in IT technologies that create cost efficiencies. We argue that relationship banking may still be the right path ahead. Human decision-making still has an advantage over computers in an uncertain environment weakened by information problems. There, bankers might still prevail in a struggle with artificially intelligent systems. In this view, IT should be used to increase relationship banking. Banks can use new technology to acquire additional information about their clients and to empower their customers.

The banking industry is also changing. New competitors arise in the form of FinTech startups as well as established IT companies. The core banking business is expected to remain highly regulated, giving banks a competitive advantage against new players.

This article is organized as follows. Section 2 reviews the economics of banking in the current banking environment. Section 3 discusses the impact of IT developments on an individual bank. Section 4 analyzes the changes that IT has brought to the banking industry. Section 5 concludes the article.

2. Economics of banking and the current banking environment

2.1. Raison d'être of banks

In order to analyze the impact that information technology might have on banking, it is important to understand the basic economics of banking. Abstracting from the detailed overview (see, e.g., Greenbaum, Thakor, and Boot, 2015), contemporary financial intermediation theory sees banks as information agents and, as such, intermediators among providers and users of financial capital. Banks alleviate information problems through two main functions.

In a brokerage function, a bank matches counterparties with complementary needs. For example, an investment bank matches investors with firms that issue securities in an IPO. Whereas each investor could search for the perfect investment alone, hiring an investment bank removes the duplication of search efforts across investors, generating economies of scale. A brokerage function may be employed especially in transaction-oriented banking, which focuses on a single transaction with a customer being repeated across multiple customers (see Boot, 2000).

In a qualitative asset transformation function, a bank goes further. A bank directly contracts with counterparties and exposes itself to risks (e.g., credit and liquidity risk) that stem from maturity, liquidity, and size transformation. A prime example of qualitative asset transformation is a traditional commercial bank that collects deposits and lends to companies. Deposits are typically liquid and safe instruments with short maturities and in small denominations, whereas loans are typically risky, illiquid, and have longer maturities and larger denominations.

Banks engage in qualitative asset transformation to serve customers and their needs. Banks manage and absorb the risks and alleviate information problems among firms and investors. More specifically, banks lower adverse selection and moral hazard problems by carefully screening and monitoring firms. The competitive advantage of banks in mitigating information problems mainly stems from relationship banking (Boot, 2000). Relationship banking is a process in which banks acquire proprietary information about their borrowers through repeated interaction with the same borrower across time, across many different bank products and services that the borrower uses, and across different access channels through which the borrower transacts with the bank. Such information might be soft and difficult to quantify, especially if it is based on evaluation of borrowers' incentives. For example, a local banker may estimate with high precision the thinking of a long-term client, his sincerity, his reputation, and his probable future actions and future risks; such assessment, however, may be difficult to quantify.

2.2. Bank regulation

Banks are crucial for smooth operation of the real economy. The global financial crisis presents a prime example of how important stability in banking is and, in particular, how broad the negative externalities of bank failure are. Bank failures may contagiously spread across the financial

system, resulting in a systemic banking crisis with huge costs for the real economy. Without banks, small firms, riddled with information asymmetries and unable to tap financial markets, may not obtain funds to pursue their projects. Savers might postpone investments if the option of safe deposits is no longer on the table. Even the payment system may be at threat, leading to suffocation of the real economy, as the recent example of Greece indicates.

Negative externalities of bank failures call for an extensive safety net in banking, ranging from deposit insurance, central bank intervention policies, and government support, or even bailout, to outright nationalization of failed banks. The recent regulatory overhaul upgraded the capital regulation framework and established a new liquidity regulation framework, but also resulted in further focus on structural reforms in banking. Policymakers acknowledged that certain bank business (e.g., payment system operations, deposit-taking activity, and retail lending) is so important that it needs to be saved in times of crisis and therefore needs to be insulated from riskier bank activities (e.g., investment banking, trading, and bank activities on capital markets).

2.3. Changing customer preferences

Despite the enormously complex regulatory framework, banks are aware that their primary role is to serve their customers and that they need to adapt to the digital society. Bank customers are changing quickly. They want inexpensive service that is tailor-made to their needs and accessible anywhere and at any time. They want a perfect multichannel experience. Bank customers want to be empowered to make their own decisions. Interaction is important. The quality of bank products and services still matters, but experience is also important. Banks are aware that they need to become an attractive place.

The upshot of these arguments is that banks acquire their competitive advantage in mitigating information problems, partially through brokerage but mostly through qualitative asset transformation and relationship banking. Banking will remain a heavily regulated business at its core. The question then is how to adapt to the new preferences of customers and how to embrace innovations that stem from information technology developments.

3. Transformational effects of information technology on a bank

Information technology developments have resulted in unprecedented changes. Large-scale transfer through the internet allows for permanent connectivity. Vast data make possible low-cost data mining potentially through cloud computing and based on open-source software. Fast algorithms are becoming smarter due to strong improvements in artificial intelligence.

3.1. Communication

Online banking is starting to disrupt bank branch networks. In the euro area, the number of branches of credit institutions fell from 182,478 in 2010 to 159,397 in 2014 (ECB, 2015). A new generation of bank customers is proud to avoid visiting the bank branch network. When surveying 10,000 US "millennials" (i.e., the generation born between 1981 and 2000), 68% said that "in five years, the way we access our money will be totally different." Seventy-one percent would "rather go to the dentist than listen to what banks are saying."[3]

This is not to say that the branch network is becoming obsolete. Instead, internet banking may transform the role of traditional bank access channels. Campbell and Frei (2010) found that online banking acts as a complement and increases the importance of a branch network, but

[3] See Viacom, 2013, http://www.millennialdisruptionindex.com/.

reduces the importance of other less personalized delivery channels, such as the ATM network (see also Xue, Hitt, and Chen, 2011).

Gilje, Loutskina, and Strahan (2013) found that the bank branch network integrates US lending markets. The branch network mitigates contracting frictions, especially on information-intense markets. One can conclude that the branch network needs to be reconfigured towards highly information-driven and personalized bank products and services, the ones present mostly in relationship banking.

3.2. Automation

Evidence shows that IT developments create substantial cost savings, especially in several areas of transaction banking. A bank can achieve economies of scale in payment processing (Beijnen and Bolt, 2009) and clearing and settlement systems (Schmiedel, Malkamäki, and Tarkka, 2006). Electronic payments, such as credit and debit cards, e-money purchases, and mobile payments, are replacing paper-based payments. Online access channels create further cost savings. To build on economies of scale, banks may be lured into scalable transaction banking rather than focusing on building long-term relationships with their clients.

Boot and Thakor (2001) point to the problem of this strategy. Competition in transaction banking is more intensely eroding bank rents. Therefore, turning to relationship banking may still be an optimal route for banks.

3.3. Decision-making

IT developments have also led to automated decision-making in bank lending. Several transaction lending techniques, such as financial statement lending, small business credit scoring,

asset-based lending, factoring, and fixed-asset lending, allow banks to gather, combine, and use a vast array of quantitative information about their clients (Berger and Udell, 2007). One may worry that artificially intelligent computer programs may surpass humans in credit assessment of bank customers. Can automatized decision-making in transaction lending techniques make human decision-making based on the soft information present in relationship banking obsolete?

Long ago, computers surpassed humans at chess. The developments in IT have been enormous since then. In 2011, the IBM program Watson continually outperformed the best human competitors in the US open-question quiz show *Jeopardy!* Computers seem to be fortifying their presence in financial markets. Computer programs currently perform more than half of all trades on the US Treasury market.[4]

Ben Bernanke, the former chairman of the Federal Reserve, claimed that bankers still have an edge. "The largest banks typically rely heavily on statistical models to assess borrowers' capital, collateral, and capacity to repay, and those approaches can add value, but banks whose headquarters and key decision-makers are hundreds or thousands of miles away inevitably lack the in-depth local knowledge that community banks use to assess character and conditions when making credit decisions. . . . The IBM computer program Watson may play a mean game of Jeopardy, but I would not trust it to judge the creditworthiness of a fledgling local business or to build longstanding personal relationships with customers and borrowers."[5]

Although Citigroup partially refuted Bernanke by hiring Watson to redesign products in its retail operations, locally present banks building on relationship banking may continue to have an edge. They need to focus on segments where information problems are the most pronounced. Parkes

[4] http://www.treasury.gov/press-center/press-releases/Documents/Joint_Staff_Report_Treasury_10-15-2015.pdf.
[5] Ben S. Bernanke, Community Banking in a Period of Recovery and Change, Speech on 23 March 2011, at the Independent Community Bankers of America National Convention, San Diego, California.

and Wellman (2015) argue that artificially intelligent computer programs might grasp the concept of *Homo economicus*—a mythical, completely rational, and self-interested agent. However, that might be quite distinct from how humans behave. For example, a game of incomplete information such as a poker game is much more difficult for computers to master compared to chess. Only in 2014 did computers learn to play a standard two-player poker game perfectly according to the Nash equilibrium. That is, the computer could match a flawless opponent without giving him any profits on the long run. Computers, however, would follow the same strategy regardless of who the opponent was. That is, they could not improve their strategy when competing with an error-prone human player.

Artificial intelligence is still grasping with dealing with incentives, information problems, and irrational human behavior. In addition, the vast data on the internet are mainly built on a cross-sectional basis. Finding a time dimension seems to be more difficult. Relationship banking that builds on long-term and informationally intense cooperation with bank customers continues to be important (e.g., informational problems are pervasive in SME lending, and consequently data are hard to quantify).

IT solutions also support fast but risky expansion tactics. The Icelandic bank Landsbanki offered Icesave online savings accounts with high interest rates. It gathered €1.7 billion in its five-month presence in the Netherlands and failed shortly afterwards. Whereas banks cannot disregard IT developments and IT-generated cost savings, focusing only on cost efficiency is not enough. Banks need to use IT to increase the relationship component of their services (see Marinč, 2013).

3.4. Empowering bank customers

Bank customers increasingly want tailor-made services that suit their needs. They want to make decisions and not just follow the bank norms. Entertainment matters. Bank branches feature digital messaging, cash recyclers, or video conferencing with bank officers. The banking platforms are becoming highly interactive, offering advices through different media channels (e.g., through online video interaction with a personal banker or with artificial intelligent assistants such as Siri by Apple or Echo by Amazon). Mobile banking can offer not only balance check and account history, but also photo bill paying, discounts with merchants, or voice assistance. For example, Barclays is pursuing technology to enable customers to talk to a robot computer system to make financial transactions.

4. Challenges for the banking industry

IT developments have expanded the markets, increased competition in banking, and resulted in several new competitors. FinTech startups are emerging, but already-established IT companies are also entering the traditional banking businesses.

Peer-to-peer lenders employ IT platforms for lending in a similar way as Uber does for cars and Airbnb for accommodation. Peer-to-peer lenders such as Lending Club, Prosper, and SoFi match borrowers and lenders together. Although the sector is tiny in comparison to bank lending, it is growing quickly and doubling its size every nine months.[6] Peer-to-peer lenders collect the arrangement fees and do the credit-scoring analysis primarily based on available consumer data from credit bureaus (e.g., FICO or Experian) or from the internet. Some peer-to-peer lenders are developing innovative techniques for credit scoring such as analyzing the on-line behavior of potential borrowers (e.g., how fast they move the mouse, how many clicks they make, etc.). The

[6] See *The Economist*, Special Report International Banking: Slings and Arrows, May 9th, 2015.

contractual features differ across peer-to-peer lenders. Some of them allow lenders to pick the borrowers, and others feature protection funds to offer some compensation for defaulted loans.

Crowdfunding startups such as Kickstarter bundle funding with selling goods that are otherwise difficult to trade (Agrawal, Catalini, and Goldfarb, 2014). Crowdfunding uses the wisdom of crowds for raising funds. Information about the demand for a product is a valuable signal of the future success of the company. Crowdfunding platforms may even exploit behavioral biases of humans, such as herding. For example, evidence shows that investors are much more eager to invest in projects that already have a high level of accumulated capital.

Payments have traditionally been a lucrative business for banks. Lately, the payment landscape has been drastically reshaped, challenging traditional players: banks and credit-card providers (Visa and MasterCard). In the US, peer-to-peer money transfer is booming. Venmo, part of the PayPal company, allows for easy transfer of small amounts of cash. Major IT companies are joining the battle. Facebook has entered the money-transfer market. Apple Pay, Android Pay, and Google Wallet are boosting mobile payments.

FinTech startups are mushrooming in mobile payments. Banks compete for their turf not only with established IT companies such as PayPal, but also with new providers such as Stripe or Square. Square provides mobile payment processing for in-person payments. Stripe, now valued at $5 billion, focuses on internet payments and has partnered with Visa. Established companies in the payment system are already raising concerns about the new competition, calling for more regulation of alternative payment providers (The Clearing House, 2015).

Innovative solutions also decentralize the notion of trust. Historically, trust has been built by centralization either in banks or central banks and supported by the regulatory, supervisory, and

legal system, and by government funds. Blockchain technology allows for decentralization. It uses cryptology and peer-to-peer verification to enable issuance of crypto-currencies such as Bitcoins. Although Bitcoins have suffered recently due to substantial volatility in their value and weaknesses on the sensitive points of the infrastructure (e.g., Bitcoin exchanges), the notion that trust can be established in a decentralized way is astounding. Large US banks and other financial firms are working on using blockchain technology to transfer assets other than Bitcoins without the need for the intermediary in the transaction (e.g., for cross-border money transfer and trading shares for closely held companies).

5. The road ahead for banks

It has been seen that IT developments are drastically reshaping the notion of what banks are and what they do. IT platforms for matching such as peer-to-peer lending have provided a substitute for the brokerage function of banks, particularly important in transaction banking. Automation and algorithmic decision-making based on artificial intelligence have brought further competition in transaction banking. Where should traditional banks seek their competitive advantage?

Traditional banks might retain a competitive advantage in relationship banking; that is, when dealing with soft and proprietary information about their clients. Such information is gathered through long-term cooperation with clients through various products and access channels. Relationship banking alleviates information problems and deals with human incentives. In this area, banks may have (partially) retained an advantage over automatic IT-driven decision-making. Banks should boost their IT systems to enhance customer experience. The process of information gathering has changed and banks should put their customers to the fore.

Another area where banks have an edge is banking business with a large systemic component. Regulators and policymakers are aware that certain parts of banks are crucial for smooth operations of the real economy. Certain bank activities, such as deposit taking, cannot be left to market participants without regulation and supervision (see the structural changes promoted by the Vickers report, the Liikanen report, and the Volcker rule). Here, banks might retain their competitive advantage. Banks have better knowledge and understanding of the insurmountable regulatory framework.

Banks might still be more trusted with money and sensitive proprietary business information than the IT or FinTech companies. FinTech companies might be great innovators, but the failure rate among them is high. IT solutions allow for fast changes and pronounced risk-taking. If technology companies become further involved in banking, regulators will need to intervene to control systemic risk. Burdening regulation is the last thing that FinTech startups or companies like Google, Facebook, or Apple want.

This is not to say that banks should avoid IT developments. Banks should leverage on their relationship banking business and systemically important business using novel approaches. In this respect, they should embrace IT developments. How to do so is a challenging question. The road ahead for banks is not easy, but it is certainly interesting.

Bibliography

Agrawal, A., C. Catalini, and A. Goldfarb (2014). Some Simple Economics of Crowdfunding. *Innovation Policy and the Economy*, 14(1), 63–97.

Bank Director (2015). 2015 Growth Strategy Survey. August 2015 http://www.bankdirector.com/issues/growth/2015-growth-strategy-survey-are-banks-missing-out-on-millennials

Beijnen, C. and W. Bolt (2009). Size Matters: Economies of Scale in European Payments Processing. *Journal of Banking & Finance*, 33(2), 203–210.

Berger, A. N. and G. F. Udell (2006). A More Complete Conceptual Framework for SME Finance. *Journal of Banking & Finance*, 30, 2945–2966.

Boot, A. W. A. (2000). Relationship Banking: What Do We Know? *Journal of Financial Intermediation*, 9, 7–25.

Boot, A. W. A. and A. V. Thakor (2000). Can Relationship Banking Survive Competition? *Journal of Finance*, 55, 679–713.

Campbell, D. and F. Frei (2010). Cost Structure, Customer Profitability, and Retention Implications of Self-Service Distribution Channels: Evidence from Customer Behavior in an Online Banking Channel. *Management Science*, 56(1), 4–24.

Clearing House, The (2015). Ensuring Consistent Consumer Protection for Data Security: Major Banks vs. Alternative Payment Providers. August 15, https://www.theclearinghouse.org/~/media/files/research/tchconsumer%20protection%20for%20data%20security%20august%202015%20final.pdf?la=en

Gilje, E. P., E. Loutskina, and P. E. Strahan (2013). Exporting Liquidity: Branch Banking and Financial Integration. Forthcoming in *Journal of Finance*.

Greenbaum, S. I., A. V. Thakor, and A. W. A. Boot (2015). Contemporary Financial Intermediation, 3rd Edition, Academic Press, Elsevier, Amsterdam.

Marinč, M. (2013). Banks and Information Technology: Marketability vs. Relationships. *Electronic Commerce Research*, 13(1), 71–101.

Parkes, D. C. and M. P. Wellman (2015). Economic Reasoning and Artificial Intelligence. *Science*, 349(6245), 267–272.

Xue, M., L. M. Hitt, and P. Chen (2011). Determinants and Outcomes of Internet Banking Adoption. *Management Science*, 57(2), 291–307.