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RESEARCH ARTICLE • FORSCHUNGSARTIKEL • ARAŞTIRMA MAKALESİ

HOW DOES THE FINTECH INNOVATION WAVE AFFECT FINANCIAL MARKETS, THE BANKING INDUSTRY, AND CUSTOMER BEHAVIOR?

FİNTECH İNOVASYON DALGASI FİNANSAL PİYASALARI, BANKACILIK SEKTÖRÜNÜ VE MÜŞTERİ DAVRANIŞINI NASIL ETKİLER?

Nuray YÜZBAŞIOĞLU*

Abstract

This study examines the impact of FinTech on financial markets, the banking sector, and consumers, as well as the role of FinTech in the delivery and usage of financial services. The study focuses on FinTech investment areas in prominent countries such as the United States, Canada, Brazil, Germany, France, Israel, China, and India. Panel data with fixed effects models were used for the period 2012-2022, and the data were obtained from the World Bank and KPMG. FinTech investments were categorized into payment management, insurance, information technology, software, financial services, and other categories, and their relationships were analyzed. The dependent variable was the amount of FinTech investment, and independent variables included inflation, the number of branches, unemployment, and GDP. The results indicate that an increase in FinTech investments is negatively affected by inflation and the number of branches. However, the results show that individual internet usage positively influences the amount of FinTech investment. These findings provide strong empirical evidence that FinTech investments can enhance profitability levels in the financial and banking sectors. This study emphasizes the impact of FinTech on the transformation process in the financial sector and provides valuable insights for financial service providers and policymakers. Such studies are also important in understanding consumer demand and expectations for financial technologies and will serve as a necessary roadmap.

Keywords: FinTech, Financial Markets, Banking Industry, Banks profitability, FinTech Investments.
Jel Cod: G2, G3, G21, G23, G39

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Öz

Bu çalışma FinTech'lerin finansal piyasalar, bankacılık sektörü ve tüketiciler üzerindeki etkilerinin yanı sıra FinTech'in finansal hizmetlerin sunumu ve kullanımındaki rolünü incelemektedir. FinTech yatırımlarında öne çıkan Amerika, Kanada, Brezilya, Almanya, Fransa, İsrail, Çin ve Hindistan gibi ülkelerdeki FinTech yatırım alanlarını konu alan çalışmada 2012-2022 yılları arasında panel veri yöntemi ile sabit etkiler modeli kullanılmış ve veriler dünya bankası ve KPMM'den elde edilmiştir. FinTech yatırımları ödeme yönetimi, sigorta, bilgi teknolojileri, yazılım, finansal hizmetler ve diğer kategorilere göre gruplandırılmış ve aralarındaki ilişkiler analiz edilmiştir. Bağımlı değişken olarak FinTech yatırım tutarı, bağımsız değişken olarak enflasyon, şube sayısı, işsizlik ve GSYH kullanılmıştır. Elde edilen sonuçlara göre FinTech yatırımlarındaki artışın enflasyon ve şube sayısından olumsuz etkilendiğini göstermektedir. Ancak sonuçlar bireysel internet kullanım değişkeninin FinTech yatırım tutarını pozitif yönde etkilediği sonucu ortaya çıkmıştır. Bu bulgular, FinTech yatırımlarının finans ve bankacılık sektörlerinde karlılık düzeylerini artırabileceğine dair güçlü ampirik kanıtlar sunmaktadır. Bu çalışma, FinTech'in finans sektöründeki dönüşüm süreci üzerindeki etkisini vurgulamakta ve finansal hizmet sağlayıcılar ve politika yapıcılar için değerli bilgiler sunmaktadır. Bu tür çalışmalar tüketicilerin finansal teknolojilere yönelik talep ve beklentilerini anlamak açısından da önemlidir ve gerekli bir yol haritası olacaktır.

Keywords: FinTech, Finansal Piyasalar, Bankacılık Sektörü, Bankaların karlılığı, FinTech Yatırımları.
Jel Cod: G2, G3, G21, G23, G39

1. Introduction

Technological developments have long played a critical role in the advancements in finance. In recent years, the spread of information technologies in the banking and finance sector has led to the rapid development of digital technologies, which has led to the popularization of FinTechs (Begley & Srinivasan, 2022; Jünger & Mietzner, 2020). The advancement of digital technologies such as artificial intelligence, blockchain, cloud computing, and big data has made FinTechs stand out in the global financial markets, which has led to increased investment amounts in FinTechs (Buchak et al., 2021). The development of FinTech allows financial services to be provided more efficiently, securely and user-oriented. For example, AI-based algorithms can improve financial analysis and risk management processes; blockchain technology enables secure and transparent transactions. At the same time, big data analytics can help understand customer behavior and deliver personalized services (Hendershott et al., 2021). The increase in the investment amounts of FinTech supports the financial sector's digital transformation and improves customer service. This causes financial markets and the banking sector to change and adapt. FinTechs increase competition by offering alternative solutions to traditional financial institutions while expanding access to financial services (Cruz-García et al., 2021). This leads to changes in customer behavior and demands for more innovative financial products and services.

The main innovation points of this study are to examine how the leading countries (USA et al.) in FinTech investments affect the determinants of FinTech investment amount, financial markets, banking sector, and customer behavior, and the link on banks' profitability levels. In addition, the trends shaping the future, the relationship between these trends and technology and the banking sector, and the technologies used (blockchain, big data, data mining, the internet of things, artificial intelligence, machine learning, and deep learning) are discussed in the study. This study aims to

understand the changes and developments in the financial sector, reveal the determinants and effects of FinTech investments, and investigate the effect on banks' profitability levels. This information can inform decision-makers about future threats and opportunities as they formulate their strategies. The study provides a detailed analysis to understand the relationships between financial markets, the banking sector, and customer behavior (Chishti & Barberis, 2016). This analysis contributes to understanding how FinTech investments differ on a regional basis and how they affect banks' profitability levels. Unlike previous studies, this article explores the impact of FinTech investments on financial markets, the banking sector, and consumer behavior (Buchak et al., 2018; Fuster et al., 2019; Goldstein et al., 2019; Berg et al., 2020; Lee et al., 2021). FinTechs have an essential role in financial markets and the banking sector, and there is a strong relationship between these two areas (Campanella et al., 2017). FinTechs provide an alternative to traditional financial institutions by offering innovative products and services in financial markets. For example, through investment platforms, individual investors can participate in financial markets in an easier and more accessible way. Payment systems and digital wallets make daily financial transactions faster and easier. The digitalization of financial markets and the rise of FinTechs have allowed the development of faster, more efficient, and user-friendly financial services (Goldstein et al., 2019). However, issues such as regulation and security are also important factors affecting the integration of FinTechs with financial markets. Therefore, the relationship between financial markets and FinTechs is constantly evolving and changing (Hasan et al., 2020).

The rapid development and gaining importance of the FinTech sector attracts the attention of the academic community and the business world. FinTech is thought to represent a new era in the financial services industry and is therefore followed with great interest by researchers, academics and business people. (Chen, 2016; Anagnostopoulos, 2018; Fuster et all., 2019; Phan et all., 2020; Chen and Zhang, 2021; Guo et all., 2022). Literature studies on FinTechs are carried out by researchers from different disciplines. Many studies are carried out in the fields of finance, economy, business, information technologies, marketing and so on. These studies address FinTechs' business models, technological innovations, impacts on financial markets, customer behavior and many more (Boot, et all., 2021). Literature studies on FinTechs are conducted to understand the size, potential and effects of the sector, to guide the business world and to guide policy makers (Buchak et al. 2018). In addition, purposes such as evaluating the risks and opportunities of FinTechs, providing guidance on regulation and compliance, and making predictions about the future of financial services are also included in these studies. Literature studies on the interactions of FinTechs in the banking sector and financial markets are growing rapidly and ensure that the sector is followed intensively by the academic community and the business world (Buchak et al., 2018; Berg et al., 2020; Boot et al., 2021). ; Dadoukis et al., 2021; Lee et al., 2021; Wang et al., 2021). These studies help us understand the impact of FinTech on the financial services industry, predict future trends, and offer insights into business innovation and competitiveness (Frame & White 2004).

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Studies conducted to measure the determinants of FinTech investment amount and its effect on the profitability level of banks were included in the financial literature. These studies generally focus on analyzing the growth and impact of the FinTech sector. They conducted to understand the growth of the FinTech sector, analyze its impact and evaluate its effects on the financial system. These studies aim to understand better the growth dynamics of the financial technology sector and its effects on the financial services sector. This information can be helpful for decision-makers and stakeholders as they formulate strategies for the FinTech sector and guide the transformation of the financial system (Begenau et al., 2018). It can also play an essential role in shaping the strategic decisions of financial institutions and providing better services to their customers. The digital transformation of financial markets and the growth of FinTechs are vital factors shaping the future of financial services. Collaboration and interactions between traditional financial institutions and FinTechs foster innovation and increase the potential to serve customers better (Bollaert et al., 2021). FinTech solutions enable customers to perform financial transactions with ease. İmproves the customer experience and facilitates access to financial services. FinTechs provide personalized services to customers using big data analytics and artificial intelligence technologies (Gomber et al. l., 2017). They recommend financial products and services that fit customers' needs by analyzing customer data. In this way, customer satisfaction increases, and unique solutions are offered to customers (Al Nawayseh, 2020). The innovative and user-oriented services provided by FinTech using these technologies can influence customer behavior and significantly impact financial markets. Therefore, research on the effects of FinTechs on financial markets and customer relations plays an important role.

In line with the findings of some studies in the literature, the fact that banks accumulate large amounts of customer information and transaction data reveals that FinTechs have a complementary effect on traditional banking (Begley & Srinivasan, 2022; He et al., 2021; Jünger & Mietzner, 2020). By adopting technological innovations, FinTech can provide a competitive advantage to traditional financial institutions and provide customers with more modern and user-friendly services (Jünger & Mietzner, 2020). By adopting technological innovations, FinTechs can gain a competitive advantage

over traditional financial institutions and offer more modern and user-friendly services to their customers. On the other hand, FinTechs can offer financial services as an alternative to traditional financial institutions and reach a broader customer base. These collaborations and interactions enable financial services to become more innovative, accessible, and sustainable (Guo et al., 2020). FinTech solutions such as technological infrastructure, big data analytics, artificial intelligence, and blockchain enable financial markets to operate more efficiently and improve risk management. In addition, collaborations between FinTechs and financial institutions can contribute to promoting sustainable financial services (Türkmen et al., 2019). Sustainable investment and financing models increase the sustainability of financial decisions by considering environmental, social, and governance (ESG) factors (Romer, 1990). With the digital transformation of bankers and financial markets and the growth of FinTechs, collaborations and interactions between traditional financial institutions and FinTech are becoming increasingly important (Cheng & Qu, 2020). Therefore, it stated that FinTechs have a complementary effect on traditional banking, and banks can cooperate with FinTechs by taking advantage of significant data sources. These collaborations make financial services more innovative, efficient, and customer-oriented.

The study will fill the academic gap in the field by examining how FinTechs affect financial markets, the banking sector, and customer behavior. FinTechs encourage innovation and technological progress in the sector by using new technologies to deliver financial services (Maier, 2016; Manrai & Manrai, 2007). Innovative technologies such as mobile payments, blockchain technology, artificial intelligence, and big data make financial transactions faster, safer, and more efficient. They also enable more people to benefit from the financial system by increasing access to financial services and expanding financial inclusion. FinTechs such as digital banking, microcredit platforms, and online investment applications offer new opportunities to those who do not have access to financial services (Gomber et al., 2017)

Numerous studies have examined how emerging technologies have the potential to radically transform financial services by making transactions cheaper, easier, and more secure (Begenau et al., 2018; Fuster et al., 2019). FinTechs provide services at a lower cost and more efficient way than traditional banking transactions. Technologies such as digital payments, automated processes, robotic process automation, and data analytics enable the automation of operational processes and reduce operating costs (Zhang et al., 2022). Mobile applications, online banking platforms, and personalized services provide customers with faster, more accessible, and more cost-effective financial services (Lee et al., 2021).

In the second part of this study, explanations about the concept of FinTech, its development process, and financial product diversification are given. The third chapter examines the applications of Big Data and Artificial Intelligence technologies in FinTech. In the fourth chapter, information about the effects of FinTech initiatives on the banking and finance sector is explained. The fifth chapter explains the variables used and the research methodology. In the sixth section, the empirical results are presented. The seventh chapter shares the study's results, recommendations, limitations, and future research directions. This sequence of chapters will help us understand the study's general structure and content. Specific topics are discussed in each chapter, and analysis and results are presented.

2. Institutional Context

2.1. Definitions of FinTech

Although there is no generally accepted definition of FinTech, it can be expressed as using information technologies in the financial field. Thus, financial services become faster and more accessible, and innovative business models can be created. Today, the new and vast possibilities offered by the digital world to its users have increased their importance by keeping financial technologies on the agenda (Sezal, 2020). The developments in FinTech have eliminated traditional financial services and have provided financial services to consumers in an easier, faster, safer, and more economical way by using digital technologies such as data analysis, the internet, and mobile (Gimpel et al., 2018).

The increase in internet and mobile usage has made consumers' lives easier. Consumers can efficiently perform their financial transactions thanks to the mobile applications they use(Hou et al 2016). Consumers previously excluded from the financial system are now included in the system with the digitalization of the financial sector. The rapid development and growth of technology have affected every sector, as well as the finance sector. The development and automation of financial services using technology have increased the speed of information transfer. This has, in turn, increased the processing speed. Using special software and algorithms, consumers, business owners, and companies can now perform their financial transactions quickly and reliably with computers and smartphones (Baber & Billah 2022).

FinTech applications are increasing day by day. FinTech applications are used in many areas, such as banking, money transfers and payments, fundraising, investment management, asset management facilitation, education and consulting, and financial literacy. Some prominent FinTech verticals areas are listed below (T.R. et al. Office, 2021; Demirci, 2021);

- Peer-to-peer lending (P2P Lending),
- Personal finance management,
- Payments (Digital payments, e-money companies, cross-border payments),
- Cryptocurrency and Blockchain,
- Digital banking,
- Microinsurance,
- Crowdfunding,
- Financial API Economy,
- RegTech (models that digitize regulations),
- FinTech models focused on money markets

There are many types of FinTech startups today. The field of finance covers not only financial activities but also infrastructure work that optimizes systems. For this reason, data security, cyber security,

technological search comparison, and technological infrastructure are significant when classifying financial technologies. (Demirdöğen, 2020).

2.2. Development Process of FinTech

The historical development of FinTech can be divided into three periods. The first period lasted from 1866-1967 (FinTech 1.0), the second period was from 1968-2008 (FinTech 2.0), and the third period continued until 2009-present (FinTech 3.0). In addition to the historical periods of FinTechs, the FinTech 3.5 period is also mentioned together with the developing and growing market economies (Kömürcüoğlu & Akyazı, 2020).

The first period is the transition period from analog applications to digital applications. Up to the First World War, the foundations of financial infrastructures were laid to enable rapid realization of financial transactions, financial information, and payments using railways, canals, telegraphs, and transatlantic telegraph cable. In the FinTech 2.0 era, developments in digitalization technologies have also enabled digitalization in financial transactions. At the same time, the rapid development of communication technologies has brought with it the process of globalization. FinTech's second term comes to an end with the 2008 economic crisis. The FinTech 3.0 era started, and in parallel with the developments in technology, financial initiatives called FinTech began to be established with the introduction of Bitcoin and the launch of cryptocurrencies in 2009. As a result of the development of the functions of the Internet and smartphones, these initiatives have made it easier for consumers, banks, and companies to use various financial products and services over the Internet (Arner et al., 2017). In this way, financial and technological innovations have become much more visible daily (Kavuri & Milne, 2019).

The FinTech sector in the world has reached billions of dollars. FinTech startups are widely used today, especially in the United States (USA) and England. The global FinTech ecosystem has five main hubs. These centers are Silicon Valley and New York in the USA, London in Europe, Singapore, and Beijing in Asia. Apart from these five cities, Shanghai, Boston, Hong Kong, Paris, Chicago, Los Angeles, and Toronto are essential centers. Asia took the lead (Startup Genome's Research Report, 2021). Silicon Valley and London are some emerging markets with Indian and China FinTech startups. China-based FinTech companies such as Alibaba, Baidu, and Tencent influence every aspect of the global financial system. This situation causes FinTech companies in China to develop more and more and the Chinese economy to grow even more. The increase in graduates with engineering and technology degrees in economies such as China and India has played an essential role in making FinTech an undeniable part of these economies.

FinTech companies completed 2020 with a total investment of 31 billion USD. This value reached 29.8 billion USD by the end of April 2021. In other words, even as of the third quarter of 2021, 93% of the previous year's total funding has been reached. In the five years between 2015-2020, an average of 30 billion dollars was invested every year in the global arena in the FinTech field. In 2023, it is estimated that customer service robots will pay banks 7.3 billion USD, and artificial intelligence applications will bring 1.3 billion USD to the insurance industry. Figure 1 shows the annual global FinTech funding amounts. (KPMG, 2021).

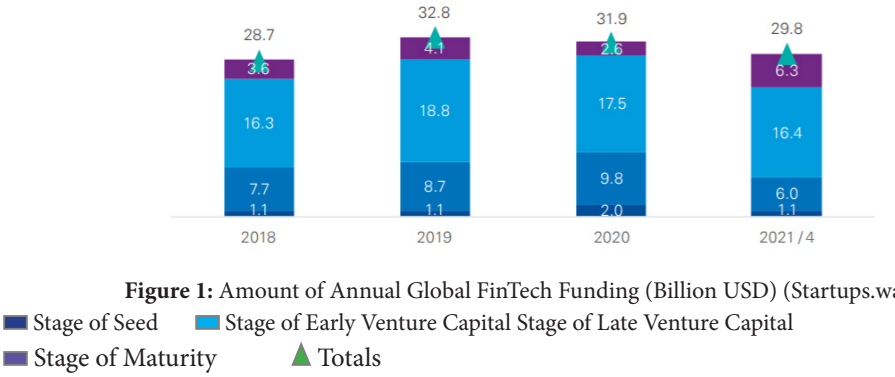

Figure 1: Amount of Annual Global FinTech Funding (Billion USD) (Startups.watch)

Although it is seen that the consumers in Latvia are not aware of FinTech and the innovations and new financial products offered by FinTechs (Saxonova & Kuzmina Merlino, 2017), it is understood that these innovations in the FinTech sector have a positive impact on the financial sector (Palmaie et al., 2019). When the effect of FinTech in risky situations is examined, it has been reported that the use of financial technologies is much more significant when the risks are high. In such cases, it is recommended to use FinTechs (Lai & Order, 2017).

The number of FinTech startups is increasing day by day in cities such as San Francisco, London, and New York, where FinTech applications are robust (Taştan & Uralcan, 2019: 43). The USA ranks first in the world in the ranking of FinTech venture investments in 2020, followed by the UK. According to 2020 data, 44 billion dollars of FinTech investment was made from 3,052 transactions.

FinTech investment amounts increased by 14% compared to the previous year, 2019. The largest of these investments was 22 billion dollars in the USA. It then amounted to $4.1 billion in the UK, $3.3 billion in Indonesia, and $3.6 billion in India. FinTech investments in the European region reached $39.1 billion in the first half of 2021. England is the first country in Europe. Figure 2 shows the top five European countries by FinTech investments (Innovate Finance, 2021).

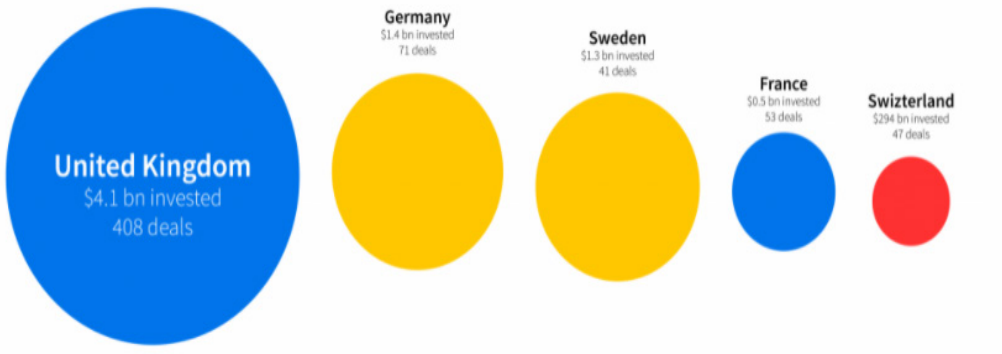

Figure 2: FinTech Investment in European Countries (KPMP)

Recently, investment companies established by banks and insurance companies worldwide have preferred to invest in FinTechs, which will contribute to their products and services today and in the future using the funds they invented. Banks in many countries, especially the USA, invest significantly in FinTechs. They try to respond to the changing consumer needs and preferences with the solutions of FinTechs.

One of the critical reflections of FinTech applications in European Union countries is in the field of crowdfunding. When the crowdfunding data in the European Crowdfunding Network is analyzed, it is observed that the penetration of FinTech services has contributed significantly to crowdfunding. Accordingly, there has been a sharp increase in the amount of money collected and the financing of projects in the last few years (Baber, 2020).

As can be seen in Figure 3, with the funding volumes in European and Middle Eastern countries, among the top three countries are the United Kingdom with 13.6 billion USD, France with 5.3 billion USD, and Germany with 5.1 billion USD.

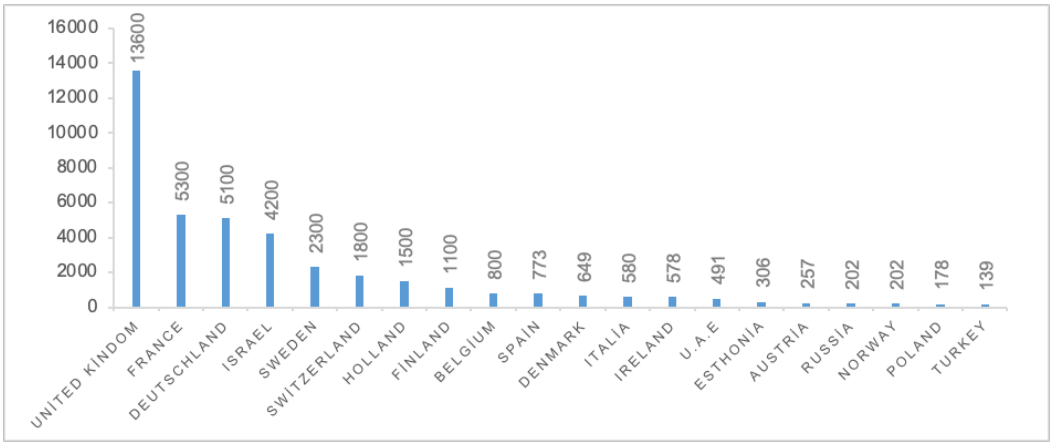

Figure 3: European and Middle Eastern Countries Funding Volumes in 2020 (USD million) (KPMG)

Globally, FinTech has caught a steady growth trend with new entrepreneurs, investors, and regional development. FinTech investments are made intensively in the world's American, Asia Pacific, Europe, Middle East & Africa FinTech regions. In 2020, American and European FinTech companies made 29.3 billion dollars in FinTech investments. In 2021, this amount reached 70.0 billion dollars. Figure 4 (KPMG, 2022) presents Global FinTech Enterprise activities by Region.

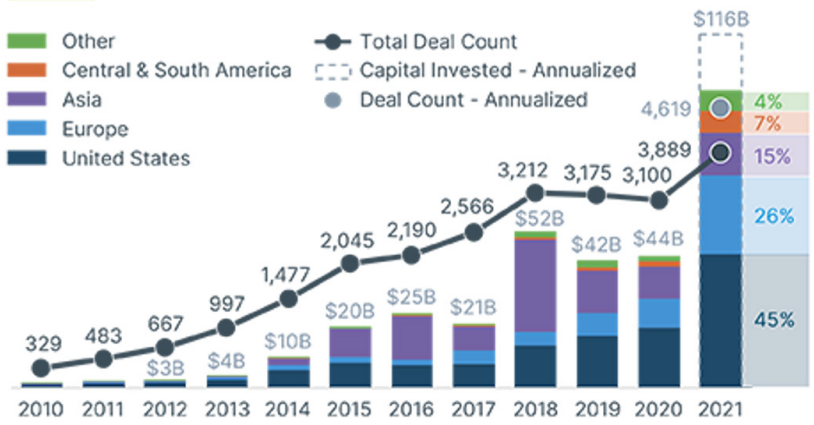

Figure 4: Global FinTech Venture Activity by Region (PitchBook and SVB Analysis)

Today, FinTech sector investments are made in many areas in both worlds. It is predicted that the COVID-19 epidemic will continue in 2022. This will continue to be an active driving force for FinTech investments. Changing conditions have led to the emergence of new financial products and services and the diversification of products. Venture investments in FinTech, such as the growth of the financial service network, applications used in digital banking, and alternative payment channels, are increasing daily. The transaction volumes formed in the FinTech vertical are given in Figure 5.

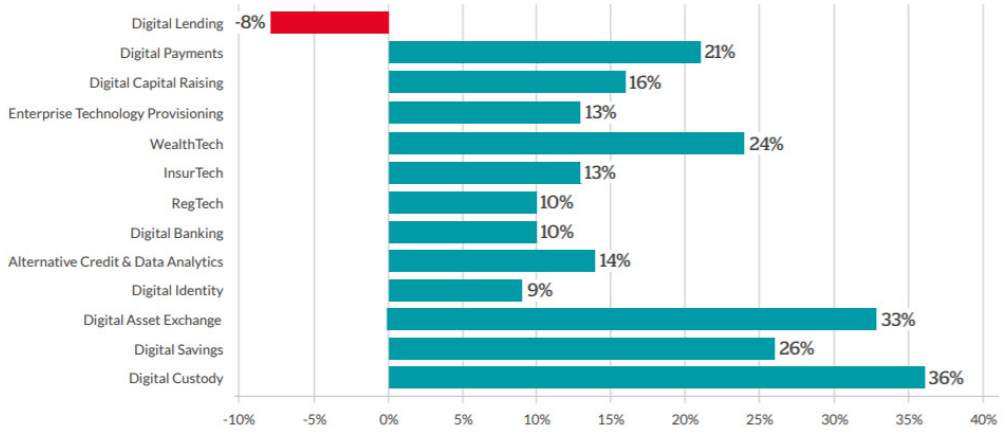

Figure 5: Transaction Volumes, All FinTech Verticals (% change, first six months of 2020 compared to the same period of the previous year)

***Source: The Global Covid-19 FinTech Market Rapid Assessment Study

Generally, similar approaches can be seen in the literature regarding FinTech activities. Dorfleitner (2017) has gathered companies in financial technologies according to their primary fields of activity, generally underpayments, asset management, finance, and other financial issues (Aktuğ, 2020).

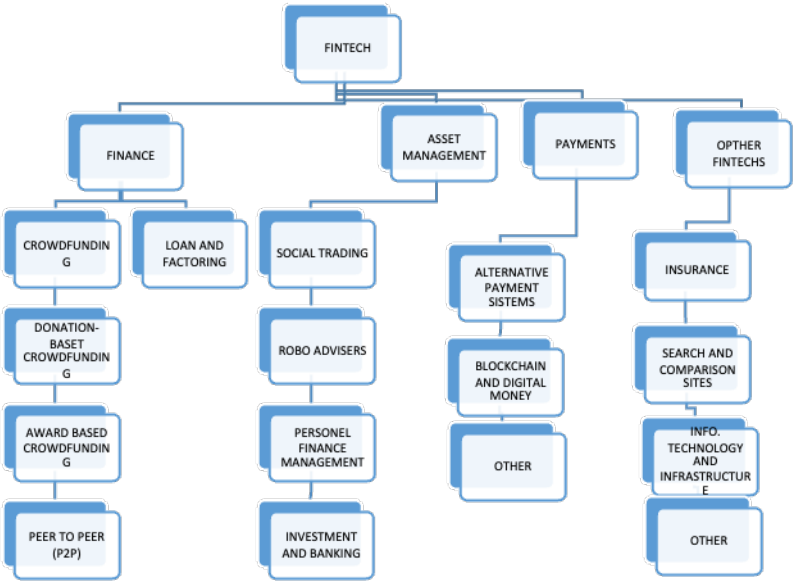

Figure 6: Sections According to Subject of Activity in the FinTech Sector

Globalization has also led to a change in sectoral needs. Changing conditions have led to the emergence of new financial products and services and the diversification of products. At this point, FinTech is a significant starting point for the financial sector. Thanks to the developments in the FinTech sector, business models for the finance sector are diversified, and new job opportunities are emerging daily. Financial services have grown and expanded with the different technologies used.

3. Applications of Big Data and Artificial Intelligence in FinTech

Technological innovations provide significant gains such as the production and processing of information, decision-making processes, and access to new markets (Srivastava & Gopalkrishnan 2015). Individuals have more accessible and faster access to financial services thanks to the new generation of devices used Therefore, FinTechs are on the way to shaping the future and becoming a part of social life (Reyes-Mercado & Reyes-Mercado 2021).

The FinTech industry is in rapid progress. Five technologies affect the sector's development: Machine Learning and Artificial Intelligence, Application Programming Interfaces, Quantum

Computing, and Blockchain. FinTech startups aim to provide the best service to their customers by intensively using innovative products, services, business models, and cutting-edge technologies (Taştav & Uralcan, 2019). The reasons for the widespread use of FinTech are digitalization, increased information processing power, eliminating intermediaries, more accessible and faster access to goods and services, and low transaction costs.

FinTech was first introduced by adapting existing financial systems to today's technologies. FinTech fields and practices that transform the process appear in different sectors and industries, such as training, retail banking transactions, and investment management. Apart from all these points, FinTech is also frequently used in developing cryptocurrencies. FinTech entrepreneurs contribute significantly to the faster advancement of financial technologies. Transactions with FinTechs can be listed as follows:

- Use of mobile payment technologies,
- Implementation of interpersonal money transfers (P2P Lending),
- Customer representation through chatbots,
- Contactless payment options,
- Increased security features such as fingerprints, face scanning,
- Managing portfolios with artificial intelligence support,
- Creation of cryptocurrencies and blockchain.

The fact that thousands of transactions are made every day in the banking and finance sector naturally leads to the formation of a large data pool. Thanks to the created Big data pools, personalization of the data is ensured, and essential operations such as getting to know and understanding the customer better, responding to customer requests faster, and developing customer-specific products and services can be performed (Baker &Dellaert, 2017). Big data provides the opportunity to provide services focused on customer requests and needs, thus reducing marketing costs. Big data provides benefits to banks in terms of storing customer information securely, detecting the connection between the accuracy of customer data and customer behavior, and reducing risks by early detection and prevention of fraudulent actions (Srivastava & Gopalakrishnan, 2015).

It is observed that the applications of big data in the banking sector are increasing rapidly around the world. When 60 articles on big data in banking between 2012 and 2020 were examined, it was seen that big data themes included FinTech, investment, profit, competition, banking crime, and credit risk analysis (Nobanee et al., 2021).

In 2020, humans created 1.7 MB of data per second. By 2022, 70% of the world's GDP is predicted to be digitized (Wu et al., 2022). The banking and financial sector has a large amount of data flow. FinTech enables making strategic decisions, predicting customer behavior, risk assessment, minimizing risks, and predicting the future using big data.

4. The Effects of Banking and FinTech Initiatives on the Finance Sector

The technology and finance sectors are different from each other, not static, and open to dynamic innovations. Institutions operating in the financial sector have started to provide faster and higher-quality customer services by merging these two dynamic sectors (Omodero, 2021). Therefore, integrating the technological infrastructure with the financial markets has enabled faster and more effective solutions without losing time by eliminating the procedures of complex transactions.

The first application of FinTech in the banking sector is automated ATM services. Thanks to FinTech initiatives, mobile payment applications and money transfer systems started to be developed. Developments in FinTech have developed the financial sector, leading to new opportunities (Monika et al., 2021). Thanks to many applications developed, the products and services offered in the financial sector have been made less costly. It has reduced the need for banks for many banking activities, such as money transfers and personal payments. In the future, banks may choose to use digital values as a medium of exchange to offer their products and services rather than using physical currencies (Hornuf, et al., 2021). Thanks to the developments in financial technologies, it is predicted that there will be significant changes in payment systems in the future, and banks and financial services will change gradually. The payment industry is becoming more robust and innovative today (Sezal, 2020).

FinTech startups radically impact the transformation of banks and financial institutions. FinTech startups have started to gain a remarkable place in finance, with applications such as machine learning, API, data-centered marketing, and behavioral analysis developed using new technologies. The global financial crisis 2008; has enabled the more effective use of FinTech, the restructuring and development of banks and the financial sector, and the offering of new opportunities to its customers. Bill Gates emphasized the importance of FinTechs in 1994, saying, "Banking is necessary, not banks" (Beck, 2001).

The emergence of innovative technologies for a long time has changed the traditional way the financial sector works. The financial sector has a large volume on a global scale. FinTech startups are proliferating in Europe and especially in America. Therefore, the share of FinTechs in the market is increasing daily (Palmié et al., 2020).

Thanks to mobile banking services, bank customers can perform many banking transactions without any problems, without going to a bank branch. As a result of, the banking applications downloaded to smartphones, it enables real-time transactions and offers customers meaningful financial solutions and innovative solution proposals (Kathuo et al., 2015). The most significant advantage of FinTech startups over the financial sector is that they can focus on unilateral and high-yielding businesses by using the latest technology available (Huei et al., 2018).

Many deals came to a standstill in early 2020 due to the worldwide pandemic. Institutions and organizations worldwide had to switch to remote work and make heavy use of online channels. This has resulted in an increased amount of money spent on cybersecurity. In the year's second half,

investors and FinTechs took advantage of this situation. While cyber security investments were 500 million dollars in 2019, they increased to over 2 billion in 2020. In the second half of 2020, $105.3 billion in FinTech investments was made in 2,861 transactions. In the first half of 2020, $33.4 billion was invested in global payments (PE M&A) and venture capital (Venture et al.) transactions, and a total of $71.9 billion in FinTech in the second half. In the first half of 2020, digital banks made VC investments worth $533 million in US-based digital bank Chime, $580 million in Revolut, and $650 million in Sweden-based Klarna. FinTechs reached the highest level of investment since 2018, with $42.3 billion in VC investment despite the pandemic since 2019. Some innovations encountered in 2020; Contactless banking, e-payment solutions, e-commerce platforms, digital customer service channels, e-wallet, growing demand for organizations that invest or associate with FinTech startups to adapt to innovations, mature FinTechs and BigTeks (Tech Giants) offer new opportunities to the consumer. They turn to mergers and acquisitions to grow and expand geographically to create value (KPMG, Pulse of FinTech H2'20, 2020).

While the growth and development of FinTech is nothing new, its potential in emerging markets is clear. FinTech startups took market share from the financial sector and added a different dimension to the relations between banks and consumers. Customers in the finance sector can efficiently perform their banking or financial transactions by accessing their accounts from anywhere, anytime, thanks to mobile media over the Internet (Romānova & Kudinska 2016). Transactions in the financial sector have become faster and safer, and costs have decreased due to the innovative solutions offered by FinTech. For this reason, many institutions in the financial sector allocate serious budgets to financial technologies. Considering that investments in the financial sector will yield results in the medium and long term, it is evident that there will be significant developments in the next five years (Omarini, 2018).

Another area where FinTech is used is Islamic finance. The future of Islamic finance, sustainability, and the contribution of FinTech to sustainable development have been examined in various studies (Saksonova & Kuzmina-Merlino 2017). Ultimately, FinTech applications have been shown to have a positive impact on a wide variety of components such as account opening process, digital identity, anti-money laundering process, electronic 'know-your-customer' process, digital payment systems, innovative artificial intelligence, blockchain-based Islamic financial services, financial inclusion, government service delivery, sustainable development, and sharia compliance (Atif et al., 2021).

4.1 FinTech Bank Efficiency

Banks are institutions that naturally contain many inputs and outputs and serve as economic decision units. Banks want the most output with minor input to increase their efficiency (Knight & Wójcik 2020). Therefore, banks will be able to increase their efficiency and immediately impact their customers; There are three areas of development: automation (online applications), activation instead of an application, and faster activation. Using FinTech startups will help these areas be developed more effectively and efficiently. Thus, banks will be able to increase their efficiency even more. It has

been observed that the use of FinTechs has increased in the leading banks of Europe and the USA and the financial services sector in different countries (Romanova & Kudinska, 2016).

In recent years, people's intense use of the internet has increased the interest and demand for mobile technologies. Therefore, many banking and financial transactions can be done very quickly thanks to some applications downloaded to smartphones. (Ntwiga, 2020). While this situation has made the life of customers in the banking sector easier, it has also increased their expectations for quick solutions. Therefore, banks started to implement the internet branch and then mobile banking applications in line with the wishes and expectations of their customers (Buchak et al., 2018).

Banks have closed their low-income branches, reducing costs by using the mobile branch more effectively (Shen & Guo 2015). Therefore, there has been a decrease in transaction costs, personnel expenses, and general expenses. Efficiency increases due to these reductions and increases in processing speed (Dsouza et al., 2022).

4.2. FinTech Bank Profitability

Banks invest heavily in information and communication technologies to continue their activities effectively, increase profitability, and provide better customer service. Banks that adopt new-generation banking offer more products quickly with lower costs thanks to FinTech initiatives. New-generation banks have increased their profit margins thanks to their marketing strategies. (Anand and Mantrala, 2019).

Banks that keep up their traditional banking activities offer fewer products and services at higher costs for a longer time. Innovative, low-cost products and services banks offer to their customers increase their profitability levels (Li et al., 2021). Banks can provide better services to their customers and increase their turnover by using fewer resources with the help of FinTech applications. Thanks to FinTech, banks provide innovative solution opportunities by using new-generation applications. Therefore, banks will increase the average transaction volume of their customers by providing more services to their customers, thus increasing the product usage volume of the customers. In terms of banks, this situation will cause them to both gain customers and increase their turnover. In addition, banks will not have to bear an operational burden by not using capital for these works. It is anticipated that using FinTech will contribute significantly to increasing banks' profitability and gaining competitive advantages (Goldstein et al., 2019).

In a study conducted by Okoli (2021), the relationship between financial technology (FinTech) and bank credit risk measured in terms of Non-Performing Loans to Total Loans (NPL)/total credit was investigated in BRICS (Brazil, Russia, India, China, and South Africa) countries between 1995 and 2018. As a result, this study showed that macroeconomic and bank-specific factors increase credit risk. In addition, the study revealed a non-linear relationship between FinTechs and credit risk (Davydov et al., 2021). Finally, the study pointed out that FinTechs reduce the ratio of NPL (bank

credit risk) to a certain threshold in BRICS countries. In light of these findings, it is understood that FinTech significantly affects banks' profitability (Okoli, 2020).

5. Data and Empirical Methodology

This study, aimed at identifying the determinants of the FinTech investment amount and measuring the impact of banks on the profitability level, begins with a description of the methodology and data set, and then the empirical analysis is included. In the empirical analysis, payment management, insurance, information technologies-software financial services, and others determined by using the panel data analysis method were grouped according to FinTech investment domains in America, Canada, Brazil, Germany, France, Israel, China, India, which are the leading FinTech investments on a regional basis in the year between the years 2012-2022. The dependent and independent variables in the study and the information on all of them are listed in Table 1.

Table 1: Variables İncluded in the Study

Dependent Variables	Independent Variables	Source
	Gross Domestic Product Per Capita (GDP)	www.worldbank.org
	Inflation	www.worldbank.org
	Unemployment	www.worldbank.org
	Users who have access to the Internet	www.worldbank.org
	Number of branches of commercial banks in countries.	www.worldbank.org
FinTech Investment Amount		www.kpmg.com

Various studies on the FinTech industry use panel data analysis (Li et al., 2017; Fan, 2018; Mention, 2019; Ntwiga, 2020; Wang et al., 2021; Gautam et al., 2022; Dsouza et al., 2022). Using the panel data analysis method in the FinTech field is a powerful approach to examining the sector's performance in a certain period and the factors affecting it. Panel data analysis analyzes data sets with repeated observations on different units over time. By using panel data analysis in the FinTech sector, it is possible to identify the factors affecting the performance of FinTech companies in a given period and evaluate their impact on profitability, growth, or other financial indicators. This analysis method can be used to examine the factors that affect FinTech investments (for example, regulations, technology use, and market intensity) and the effects of these factors on the profitability, growth, or competitiveness of FinTech companies. Panel data analysis includes various statistical techniques, for example, fixed effects model, random effects model, dynamic panel data models, panel Granger causality tests, etc. These techniques can be used to obtain statistically reliable results, taking into account the FinTech industry's characteristics and the data set's structural characteristics (Kanga et al., 2022). By using the panel data analysis method in the FinTech sector, it is possible to identify the factors affecting the sector's performance and to understand the impact of these factors on the profitability, growth, and competitiveness of FinTech companies (Mohsin et al., 2022).

In this work, it will be analyzed which model will be used initially. There are a couple of tests that need to be done for the selection of the model. These tests are the F test, in which the classic model is tested against the fixed effects model, and the Likelihood Ratio test, in which the classic model is tested against the random effects model. As a result, the model to be employed using the help of the F test will be determined. The Stata 15 package program was used to analyze empirical findings.

6. Empirical Results

Summary statistics were obtained for the eight selected countries. China was found to be the country with the most significant FinTech investments between 2012 and 2022.

Table 2: Summary Statistics N Mean SD Min Max by (rank)

rank	N	mean	sd	min	max
Brazil	8	496.472	592.284	54.7	1539.688
Canada	8	1317.275	1607.554	90.5	4677.6
China	8	5612.725	5880.587	114.5	18230.7
France	8	1743.575	3421.073	25.6	10088.2
Germany	8	1154.125	698.586	68.1	2057.9
India	8	1789.438	1234.711	165	3587.8
Israel	8	90.325	56.568	17.8	180.2
USA	8	50.988	34.664	14.2	119.9

The classic model was first tested against the fixed effects model with the help of F test in this work. Because the probability value (0.13) of the F statistic (1.70) is more than 0.10, the null hypothesis stating that the classic model should be preferred could not be rejected as an outcome of the test. The Likelihood Ratio test was employed as the study's second test. The null hypothesis stating that the classic model should be preferred could not be rejected because the probability value of test statistics (0.33) is more than (0.859 0.10).

It was decided to exclude the GDP_pc variable from the model because its VIF value is more than 10. The model has been defined and predicted as follows.

$$Investment = \beta_0 + \beta_1 percent\_int_{it} + \beta_2 BranchNumber_{it} + \beta_3 Unemployment_{it} + \beta_4 Inflation_{it} + \beta_5 CostIncome_{it} + u_{it} \quad (1)$$

Breush-Pagan and Wooldridge's tests were performed, respectively, to test whether the model had varying variance and autocorrelation. Because the probability value (0.000) of the test statistic (17.6) was less than 0.10 due to the Breusch-Pagan test. As the result of the Breusch-Pagan test, the probability value (0.000) of the test statistic (17.6) was less than 0.10, and the null hypothesis representing constant variance was rejected at all traditional significance levels. The null hypothesis that no first-order autocorrelation in the model could not be rejected at any of the traditional

significance levels due to the Wooldridge test because the probability value of the test statistic (0.07) (0.81) was more significant than 0.10. The model was estimated with standard solid errors due to the variable variance problem, and the estimation results are given in Table 3.

Table 3: The Results of The Classic Model (Selected model)

Investment	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Inflation	-318.401	139.574	-2.28	.026	-597.789	-39.013	**
Unemployment	44.542	56.635	0.79	.435	-68.824	157.908	
Branch number	-99.179	56.193	-1.76	.083	-211.661	13.302	*
Cost-Income	53.115	161.39	0.33	.743	-269.943	376.173	
Internet	2696.422	1267.206	-2.13	.038	-5233.01	-159.833	**
Constant	5480.949	1423.319	3.85	0	2631.867	8330.031	***

Mean dependent var	1531.865	SD dependent var	2919.639
R-squared	0.128	Number of obs	64
F-test	3.614	Prob > F	0.007
Akaike crit. (AIC)	1205.181	Bayesian crit. (BIC)	1218.134

*** *p<.01,* ** *p<.05,* * *p<.1*

Hypothesis tests were evaluated only according to the analysis results of all variables included in the model.

Table 4: Hypothesis Tests, Analysis Results

Hypothesis No	Description of Hypothesis	Coefficient	Significance Level	Outcome
H1	The increase in the annual consumer inflation rate has an effect on FinTech investments.	-318.401	**	Accepted
H2	The increase in the annual unemployment rate has an effect on FinTech investments.	44.542	0.435	Rejected
H3	The increase in the number of branches has an effect on FinTech investments.	-99.179	*	Accepted
H4	The increase in cost-income ratios has an effect on FinTech investments..	53.115	0.743	Rejected
H5	The increase in the rate of the population using the Internet has an effect on FinTech investments.	2696.422	**	Accepted

Our results show that the evolution of FinTech investments leads to better management efficiency, consistent with the existing literature (Zhao et al., 2022; Singh et al., 2021; Medyawati et al., 2021; Wang et al., 2021; Fuster et al., 2019; Jakšič & Marinč, 2019). According to the findings of our study, while inflation and the number of branches have a negative and statistically significant impact on FinTech investment amount, the effect of individual internet usage variables on FinTech investment amount, which is an independent variable, is positive and statistically significant. Consequently, an increase in the bank's cost-income ratio positively affects FinTech investments; however, this effect is not statistically significant. In countries with an increase in the cost-income ratio of banks, this

indicates that the profitability level in the banking and finance sector is sound. This leads to an increase in FinTech investments, but this relationship was not found to be statistically significant due to the model. The workforce, the level of investments, and the number of institutions in the FinTech sector globally are at a different levels. A skilled and experienced workforce is needed. However, even though the sector appears proliferating regarding investment and workforce, the sector still needs to mature. It is concluded that FinTechs hurt the unskilled workforce, but this effect is not statistically significant. It has led to people using the Internet to do their banking transactions rather than visiting a branch. Banks have achieved higher profitability because of the reduced number of branches and costs. FinTech investments decrease as the inflation level rises. This has been important for the countries economies.

7. Conclusions and Discussion

7.1. Conclusions

Empirical research is conducted based on the world bank data of the countries of America, Canada, Brazil, Germany, France, Israel, China, and India, which are the leading FinTech investments. Results (1) It has been determined that the increase in the cost-income ratio of banks has a positive effect on FinTech investments. In countries with an increase in the cost-income ratio of the banks, the profitability level in the banking and finance sector is high. In addition, it has been observed that FinTech investments have increased in countries where the profitability level in the banking and finance sector is sound. In the first stage (2), it was determined that while FinTech investment amounts negatively affected inflation and the number of bank branches, increased customer internet usage positively affected FinTech investment amounts. It has been determined that the decrease in the number of branches of banks significantly affects profitability by reducing bank costs. (3) It has been determined that FinTech investment amounts are negatively related to inflation and the number of bank branches. However, the increase in customers' internet usage positively affects FinTech investment amounts. It has been determined that the decrease in the number of branches of banks significantly affects profitability by reducing bank costs. (4) It has been concluded that FinTech investments have increased over the years in certain countries, and there are positive relationships between FinTech investment amount and internet usage, unemployment rate, and cost-income rates. When the distribution of FinTech investments by countries is analyzed, it is concluded that China is a significant country. In addition, it was determined that the increases in internet usage, unemployment rate, and cost-income ratios were positively related to the number of bank branches. According to the results obtained from the study, the coefficient of the inflation variable is significant at the 5% significance level; since the sign of the coefficient is negative, a decrease in investment is expected when there is an increase in inflation. The coefficient of the number of branches variable is significant at the 10% significance level. Since the coefficient is negative, increasing the number of branches reduces the investment. The coefficient of the population variable using the Internet is significant at the 5% significance level. Since the coefficient is positive, there is an increase in investment in case of

an increase in the population using the Internet. The research states that independent variables such as inflation, number of branches, and internet usage affect FinTech investments. While a decrease in investment is expected with the increase in inflation, the increase in the number of branches reduces the investment. As the use of the Internet increases, an increase in investment is observed. These results show that FinTech investments significantly affect the banking sector, and certain factors shape these investments. This empirical research reveals the effects of FinTech investments on the banking and finance sector and the factors that shape these investments. These findings show that FinTech investments contribute to the transformation process in the financial sector and that future research can offer a broader perspective.

7.2. Suggestions

Using FinTech significantly and positively impacts banks and the financial sector. With the rapid development of FinTechs, banks need to adopt FinTech applications more proactively to improve their profitability continuously. Measures can be taken from the following aspects: (1) Banks should increase their investments in FinTechs. Banks can reduce the marginal costs of financial services by investing in their organizational structures, human resources, and business models. In this way, banks can improve their profitability by simultaneously achieving the objectives of "cost reduction" and "increasing efficiency.". For example, Zhao et al. (2022) found that increases in FinTech investments increase the level of bank performance. (3) The workforce, investment levels, and the number of institutions in the FinTech sector are generally different. Therefore, banks should invest in specialized human resources in the FinTech sector. The demand for specialized human resources and investments in the FinTech sector is essential for the sector's growth. Banks can develop training and employment programs to attract and train talented employees in this field. In addition, they can encourage the sector's growth by supporting FinTech startups (4). Banks can apply a strategy of "incentivizing the outside in" to improve the creative ability of local banks. The experience of FinTech in developed countries can inspire banks in other countries and help them increase their innovation. This way, local banks can benefit from FinTech development and gain a competitive advantage. (5) Banks should invest in business models that focus on FinTechs. FinTechs can lower the costs of financial services, optimize business processes and improve the customer experience. Banks' adaptation of their business models to FinTechs increases efficiency and competitiveness. (6) Regulation and policy adjustments: Appropriate regulation and policy adjustments are essential to support the growth of the FinTech sector. By collaborating with banks, governments, and regulators, they can contribute to creating regulations that foster the growth of the FinTech sector. These regulations should protect consumer safety and financial stability while promoting innovation. (7) Banks can collaborate with FinTech companies to ensure a smooth transformation. Banks and FinTech startups have the benefits of working together. This collaboration may be the best option for banks that want to transform without further investment. Collaboration between banks and FinTech enterprises encourages banks to acquire customers en masse, improves product innovation capability, and can lower the financial sector entry threshold for FinTech startups. For example, Hornung et al. show in their study that banks generally invest in small FinTechs but establish product-oriented

collaborations with larger FinTechs. These measures can help banks improve their profitability and efficiency by increasing their use of FinTech. It can also enable the financial sector to exploit its innovative potential and better serve customers. As a result, banks and the financial sector need to increase their investments, cooperate and encourage appropriate regulation to increase the use of FinTech. In this way, the financial sector can provide more efficient and innovative services, improve customer experience and increase competitiveness.

7.3. Limitations and Future Research Directions

Although our results are statistically significant, our analysis also has limitations. First, this article only includes data from the eight leading countries in FinTech investment (America, Canada, Brazil, Germany, France, Israel, China, India) and the world bank for 2012-2020. Our research's limited analysis time, scope, and data sources may limit the generalization of the results and the complete determination of the overall effects. Basing future research on more comprehensive and long-term data can offer a broader perspective Factors such as the continued development of financial institutions and the rapid growth of banks may require future research to expand the scope and timeframe of research topics to achieve more complete results. It is an important issue that FinTech shows different development processes between different regions and countries, which may change its effects. That is the point. Considering regional differences is essential to understand FinTech's impact on banks' profitability in different countries. Future research should incorporate these differences to understand better the impact of FinTech development in different regions and regional factors on the profitability of FinTech investments of banks. Future research can examine how FinTech investments affect banks' profitability in different countries. In this way, it can assess how different countries' regulatory environments, financial infrastructures, and other factors might change the impact of FinTech investments. These are some points that future research can address to provide a more comprehensive understanding. These points can make future research more comprehensive and inclusive.

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Resume

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