

Finclusion: The nexus of Fintech and financial inclusion against banks' market power[☆]

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ABSTRACT

The banking literature does not provide consensus over the impact of Fintech on banks. On the one hand, Fintech advancements are poised to enhance the accessibility of financial services; on the other, it can lead to alterations in market structure. Thus, it is important to ascertain the impact of Fintech entry from both perspectives. We examine the impact of Fintech entry on financial inclusion (FI) and banking competition by introducing conditionalities and non-linearity to uncover the potential transmission channels for Fintech to affect inclusion and market structure. Findings suggest episodes of low and medium inclusion from 2005 till 2018. However, post 2018, there has been a significant increase in FI. Similarly, persistent monopolistic tendencies were observed with most banks enjoying higher Lerner margins. The extent of Fintech reveals highly sluggish growth over 2005 to 2015. However, post 2016, drastic increase is observed commensurate with the central bank's regulatory push. Further, Fintech is inversely related to banks' market power indicating a diminishing effect. We propose three transmission mechanisms for Fintech effects: the inclusion channel, the growth channel, and the regulatory environment. In addition, we find a significant and positive impact of Fintech on FI however, the relationship is essentially non-linear.

1. Introduction

In 1994, Bill Gates forewarned the world that “*banking is necessary, banks are not ...*”. Though at the time, it seemed like a distant possibility as a world without banks is hard to understand for the reasons being that banks today are more than *integrated* into our daily lives and business operations. However, under the auspices of industrial revolution 4.0, banking has become an industry which is facing irresistible forces for change [1]. In this way, Fintechs¹ and digital transformations coupled with widespread deregulation has proven to be disruptive for banking industry. Rapid technological evolutions and disruptions in the financial services is shaping the

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¹ A Fintech can be simply defined as the use of digital technologies (such as AI, Blockchain, Cloud and Digitalization) for financial services (such as payments, saving, borrowing, investing, advisory services and risk management). Source: IMF, “Fintech and Financial Services: Initial Considerations”, June 19, 2017. Available at: <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2017/06/16/Fintech-and-Financial-Services-Initial-Considerations-44985>.

future of banking whereby banking services outside its traditional ambit are now deemed possible. And so, it seems like today, the statement by Bill Gates is merely a euphemism—a sweet shot of sorts for most of us. As today Fintech seems to be a profound reality and has become a buzz word for innovative financial services capable of shaping the evolving needs and expectations of customers. As a result, we are witnessing a revolution about the way people bank; anytime, anywhere.

However, and still, despite so much technological advancements, 1.7 billion people around the globe are excluded from financial services [2]. Still, the discussion about the economics of Fintechs is pre-dominantly centered around the idea that whether Fintechs and traditional financial services providers are complimentary or supplementary to each other [3]. In addition, in many markets, the infancy of Fintechs and regulatory constraints still limits its disruptive capacity which necessarily implies that banks may not be outdated—yet; but banks' interactions may need to change forever. As concluded by PwC, 2014, “*While we are not looking at the end of banking, we are surely looking at the end of banking and banks as we currently know them*”.

The diffusion of Fintech is considered to be a promising solution for widening the reach and accessibility of financial services to the masses [2,4] as digital networks such as ATMs, payment systems and mobile money provides a technological platform which can be utilized to enhance accessibility and reach of financial services thus enhancing FI [5]. In this way, Fintech is argued to be the ‘key driver’ for Financial Inclusion (FI) under the auspices of the UN’s SDGS [6]. Market imperfections such as transaction costs and information asymmetry are some major hurdles in limiting access to formal financial services to the masses, particularly to the poor thus Fintechs are seen as key enablers for FI [7]. In addition, Fintech innovations are dubbed as the game changer for an inclusive and deep financial sector [8]. Thus, UN and world Bank along with governments around the world have placed high hopes on Fintech innovations to ensure access, usage and availability of financial services to all—leading to poverty reduction, improving income inequality and wealth distribution [8,9].

Similarly, Fintech is also viewed to enhance competition in the financial sector arising from alterations in market structure characterized by changes in entry and exit barriers, size and number of market players among others [10]. There are two opposing strands of literature in this regard—the one suggesting a supportive role of Fintech whereas the other poses a competing role of the same. The supportive role of Fintech stems from the theoretical notion of ‘*Finance-Growth*’ nexus and views Fintechs as complimentary in nature—improving and positively affecting banking efficiency in core operations such as credit allocation [11], payment settlements, risk assessments [12] and enhancing diversity in banking operations among others [13]. In contrast, the opposing view stems from the ‘*Finance-Fragility*’ hypothesis and views that Fintechs are usually observed to enter a multi-dimensional and a multi-product industry with an unorthodox business model which is sometimes alien to the universal banking practices. They usually operate in a single and or in an unregulated segment of the market enjoying much more flexibility in terms of regulations and cost burden compared to formal banking institutions. This not only gives them competitive advantage but also adversely affects banks’ market power² [14] exacerbating moral hazard and adverse selection and may add on to the fragility of the financial system through risk shifting mechanism. Furthermore [15], indicates that financial innovations increase the risk appetite of banks which may lead to excessive credit extensions resulting in higher chances of defaults and systemic failures.

Given the opposing views, the banking literature does not provide clear consensus over the impact of Fintech on banks [13]. In this way [16] goes to the level that “*everybody talks about financial innovations, but (almost) nobody empirically tests hypotheses about it*”. Thus, it is of great economic importance and policy significance to ascertain the impact of Fintech entry from both perspectives—the much talked about and promising benefits of FI and the feared ramifications of alteration in market structure in terms of banks’ market power. However, to the best of our knowledge, no such evidence exists to gauge the impact of Fintech entry on FI and banking competition at the same time. This study in particular, is designed to traverse this gap. Specifically, we aim to determine the impact of Fintech entry on FI in expanding and diversifying inclusion efforts taking Pakistani economy under consideration. Further, we aim to determine the impact of Fintech entry on the banks’ market power for the banking sector of Pakistan. In addition, we also allow for non-linearities and aim for certain conditional effects of Fintech and FI on banks’ market power. In doing so, we aim to uncover the transmission channels and mechanisms for Fintech to affect inclusion and market structure for the first time. Finally, we compare a pre and post impact of Fintech entry on Pakistani banking industry.

1.1. Overview of FI in Pakistan

Currently, approximately 1.7 billion adults globally remain un-banked. The 2017 Global Findex database shows that 1.2 billion adults have obtained an account since 2011 showing an increase of 35%, the share of adults having access to mobile account or to financial service increased from 62% to 69%, globally. This percentage rose from 54% to 63% in developing countries. Since 2010, around 55 countries are committed to facilitate FI and around 60 jurisdictions have devised a national inclusion strategy. Globally, in 2017, 69 % of adults had a bank account, an increase from 51 % in 2011. The number of ATMs per 100,000 adults increased from 41.6 in 2011 to 53.5 in 2017 [17].

However, FI in Pakistan has lagged mainly on account of cost and time having to be spent by predominantly rural population to reach out to distantly located bank branches for low value transactions. Women have had faced additional constraints owing to lack of mobility due to cultural reasons. In recognition of the state of financial exclusion in Pakistan, various measures have been adopted by government and SBP to change the overall landscape and create an enabling environment for all-inclusive financial system in the country. In this regard, SBP has taken various initiatives (Fig. 1). Launch of Microfinance Ordinance 2001 was one of such initiatives

² market power is the ability of a firm to negotiate and or set prices above its marginal costs [33].

which was aimed to regulate the establishment, business and operations of microfinance institutions in Pakistan. It was needed to promote microfinance institutions for providing organizational, financial and infrastructural support to marginalized segments particularly poor women, for reducing poverty and promoting social welfare through social mobilization. This initiative was followed by a number of other measures such as the expansion and modernization of the online credit information bureau (e-CIB) in 2005, establishment of the Pakistan Interbank Settlement System (PRISM) in 2008 to modernize the payment system, the adoption of Branchless Banking Regulations in 2008 and the launch of a Financial Literacy Program in 2012 for the masses. In addition to above mentioned milestones, among various measures, most notable one is adoption of National Financial Inclusion Strategy (NFIS) in 2015.

The strategy aimed to establish a national vision for achievement of FI in Pakistan. The NFIS has laid-out a comprehensive action plan along with timelines and targets.

It was envisioned that formal financial access will be enhanced to 50% of the adult population by 2020.

The progress has been promising, however, significant potential remains on a lot of fronts to achieve the objective of universally inclusive financial system in Pakistan. Comparing Pakistan with its peer countries like India and Bangladesh (Fig. 2), the percentage of adults maintain bank account is very low. From 2014 to 2017, the percentage has increased from 13% to 21%; whereas this increase is comparatively high India i.e. from 53 % to 80% followed by Bangladesh i.e. from 31% to 50%.

As per recent data reported by SBP, the number of active accounts in Pakistan have also been increased i.e. 24.53 Million in 2019, 37.020 Million in 2020 and 45.887 Million in 2021 (Fig. 3). Similarly, the number of branchless banking have also been increased from 189,991 in 2019 to 246,280 in 2021 (Fig. 4). With regards to total deposits, there is an increase from Rs 28,770 Million in 2019 to Rs 55,259 Million in 2021 (Fig. 5). The gender distribution of account holders also presents a bleak picture (see Fig. 6).

Although above matrices show an overall upward trend, however, disaggregated data exhibit a concerning picture in terms of gender polarization. As per available stats 36 % (2017: 20 %) of Pakistan's adult male population is now estimated to be financially included; the ratio for adult women is still in the single digits i.e., 7 % (2017: 7 %). In order to address above marking gender wise disparity, SBP has taken significant steps to address the concern. Most recent one is the *Banking on Equality policy document* issued in December 2020. The document entails short-term, medium-term, and long-term policy measures aimed at encouraging uptake of formal financial services by Pakistan's adult female population.

1.2. Landscape of fintech in Pakistan

In 2021, Fintech investments clocked a record number of deals to drive total investment of booming \$210 Billion globally. As Fintech brings more and more convenience and affordability in unique ways in delivering financial services, the industry is only going to expand moving forward. In Pakistan, digital financial services (DFS) have grown significantly during the last decade primarily due to younger population (64 % is less than the age of 30), high-bandwidth penetration which has surged past 43% and mobile penetration has increased beyond an overwhelming 77%; hence making Pakistan a hotspot for Fintech solutions. This could provide Fintechs better positioning to leverage technology and install a new wave of digital financial services in country [18]. The nascent Fintech ecosystem has consistently attracted global venture capital funding from market leaders. In this regard, Credit Book, a digital ledger for SMEs and digital payments provider Safe Pay and Naya Pay are notable examples.

However, despite the growing population with healthy proportion of youth, Pakistan still remain a slow mover in digital financial services front. With FI ratio of 21 %, it stands significantly low as compared to neighboring countries like India and Bangladesh (global index 2021). The introduction of Branchless banking regulation in 2008 was a major breakthrough as it acted as a catalyst for Digital finance service providers to construct agent networks and reach out to distant rural areas. EasyPaisa was the first to enter Branchless

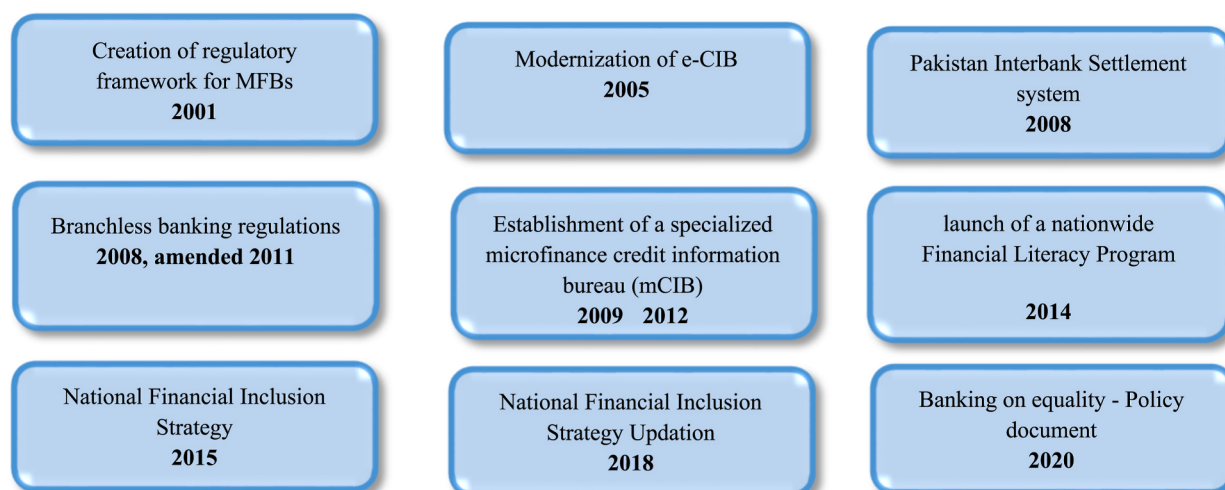


Fig. 1. Key Milestones achieved in the journey towards Financial inclusion in Pakistan. Source: Authors' rendition.

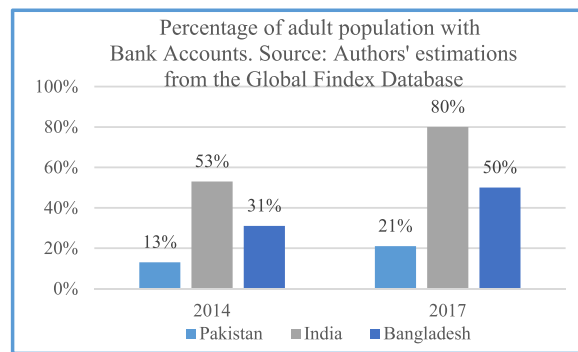


Fig. 2. Percentage of adult population with Bank Accounts. Source: Authors' estimations from the Global Findex Database.

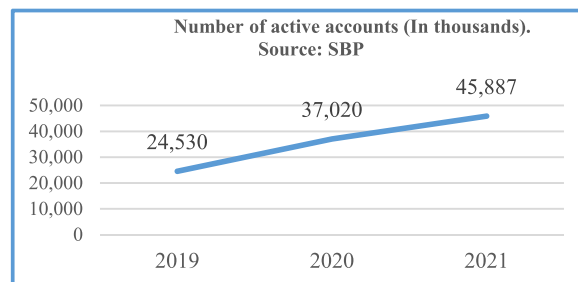


Fig. 3. Number of active accounts (In thousands). Source: SBP.

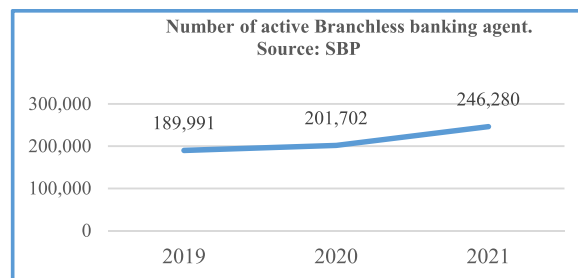


Fig. 4. Number of active Branchless banking agent. Source: SBP.

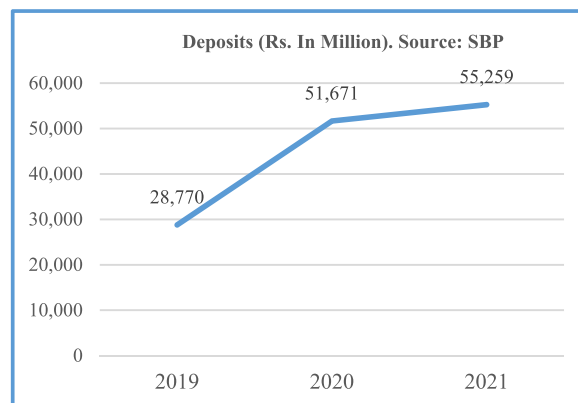


Fig. 5. Deposits (rs. In million). Source: SBP.

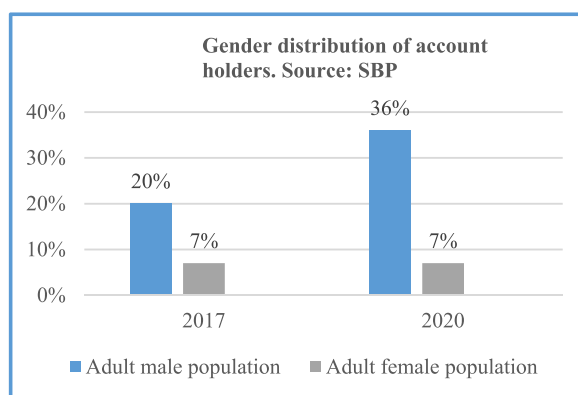


Fig. 6. Gender distribution of account holders. Source: SBP.

Banking and capitalizing on first mover's advantage quickly captured a significant market share. EasyPaisa and Jazz Cash serve almost 70 % of the branchless banking. Promising low transaction cost, ease of access and convenience, Mobile money accounts have seen a healthy growth over the years (Fig. 7).

To further provide impetus to spread DFS, SPB introduced Basic Banking regulations in 2005 and subsequently Asaan Accounts in 2015 which provided guidelines for simplified due diligence of low-risk bank accounts. Another, major development was merger of 1Link and MNET in 2008. Before 2008, 1Link served as the ATM switch for 28 banks whereas MNET was connected to 10 banks. This resulted in ATM interoperability.

As per "The State of Financial and Digital Inclusion Project Report for 2017" by the Brookings Institute, Pakistan is ranked 16th out of 26, with a score of 69 %. The fast growing mobile & internet technology has provided an opportunity to enhance FI. As a result, many market players such as telecom companies and donor organizations such as Karandaaz are focusing on financial innovations on fast-track basis in the country [19].

2. Literature review

2.1. The promise of FI, fintech and the role of market power

For most of developing economies around the world, inter alia, poverty, unemployment and uneven distribution of wealth remain a fundamental concern. Governments and policy makers remain in quest to find ways to uplift social welfare of masses to ensure inclusive growth and sustainable development. The linkage between financial development and economic growth has widely been discussed in literature. For instance Ref. [20], has established that economic growth is driven by financial deepening through rapid capital accumulation and productivity. A well-functioning financial system catalyzes economic growth by linking various sectors of the economy and facilitates a conducive environment for the implementation of government policies. Efficiency of such financial system depends on its *inclusiveness* as achievement of stated objectives will not be possible with larger percentage of economy remaining outside the purview of government and regulatory frameworks. Therefore, a key feature of financial development is 'Financial Inclusion' that stimulates the efficacy of overall financial system of an economy [21].

The reason behind increasing attention is the potential economic and societal benefits that FI which include efficiency of financial intermediation, enhancement of entrepreneurial activities and employment [22]. Numerous research theories are proponent of the narrative that FI can play a significant role in economic development and social uplifting. According to Ref. [23], FI results in achieving faster economic growth while [24] posits that being financially included can result in developing net wealth benefits and bigger welfare benefits compared to those who are financially excluded. Similarly [25], has termed FI as a key instrument to achieve inclusive growth in India. As FI is the most effective way of mobilizing resources which are required for achieving inclusive growth. They further add that FI is a key contributor to promote a culture of savings and developing efficient payment mechanisms which in turn strengthens the resource base of financial institutions. Moreover, achievement of many SDGs such as i) no poverty, ii) no hunger, iii) good health and wellbeing, iv) gender equality and reduced inequalities can only be enabled through a well inclusive financial sector [26]. In addition, G20 nations have also identified FI as an important pillar of the agenda for global development.

Considering these assertions, studies have identified factors that directly and or inversely affect FI. For instance Ref. [27], proposed that FI is positively impacted by indicators of infrastructure such as subscriptions of cell phones. Whereas rural-urban divide and the ratio of unemployment are important factors that adversely affect the level of inclusiveness. Among various other factors, banking industry's market structure and market power dynamics have also shown considerable linkages with FI. Studies, such as [28] show that countries where banks are facilitated through regulations to involve in wider scope of activities also demonstrate deep penetration of financial system. In addition, competition in banking industry helps in achieving greater FI through enhanced reach to deposit accounts. In this way [29], provide evidence of a direct relationship between banking competition and accounts' penetration at the municipal level in Mexico.

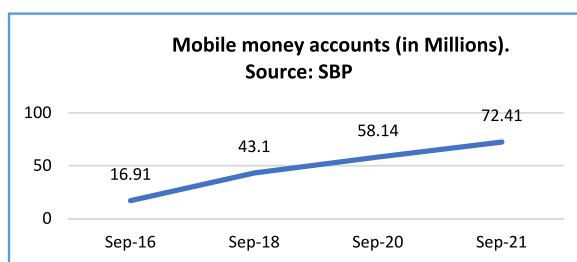


Fig. 7. Mobile money accounts (in Millions). Source: SBP.

On the other hand, in the past couple of decades, digital transformations have shown significant development in areas of financial services, lending, payment systems, insurance and financial advising. In these areas, Fintechs have greatly progressed by decreasing the cost of intermediation which has remarkable impact on enhancing access to finance to masses [30]. Today, we have access to a wide range of digital financial services including internet banking, branchless banks, Mobile banking and digital lending solutions among many others with affordable rates and relatively quick turnaround time.

However, as per the Basel Committee on Banking Supervision (BCBS), Fintechs are disruptive to banking industry as they have potential to reduce the impediments of entry to banking services. Unlike traditional financial services, Fintechs treat data and information as a basic commodity. This has changed the role of banking services with respect to risk and scope [31]. Fintech firms adapt technology to provide financial solutions with the objective to digitize the financial sector, resulting in cost reductions and new ways of working to gain transparency in the market [32]. Finally, Fintechs have the ability to lower intermediation costs and enhance access to finance by improving financial-inclusion. However, and still there is dearth of research on the channelizing effects of Fintech on inclusion efforts and market structure dimensions in the banking industry and hence this study has tried in this regard.

To sum up, the evolution of Fintechs is posing dual challenges to the banking sector. On the one hand, its benefits in terms of enhancing FI is very much promising along with positive effects on banking operations. However, on the other, it may lead into changes in the market structure of financial services providers characterized by the number of participants, exit and entry barriers, competitive conditions and market power. These alterations and adjustments may have long term ramifications in terms of the binding effects of Fintech entry and FI on market structure dimensions. However, the empirical literature in this regard does not provide clear consensus as to how Fintech might impact the overall banking industry [13]. Further, there is no evidence available on the transmission mechanism for a well-inclusive financial system augmented with Fintech that may result in improved competitive conditions. In addition, the literature is mute in terms of the binding effects of FI through Fintech on banks' market power. The traditional banking system is facing issues like stringent regulations, high operating costs, conventional business lines, average risk proposition and low involvement of customers. However, Fintechs relatively stay at a mile from these concerns and has the potential to significantly alter the market structure dimensions of traditional banking industry.

3. Materials and methods

3.1. Measuring market power

A firm's ability to negotiate and set prices above its marginal costs is known as market power. The degree of market power is inversely related to competition, higher market power indicates low competition and vice versa. Market power is usually estimated through Lerner Index which indicates a relative differential between input prices and marginal costs vis a vis a firm's output prices and is thus inversely related to competition [33,34]. There are other several measures to estimate the degree of competition in the banking industry such as the Panzer and Rosse H-Statistics, and the Boone Indicator. However, the Lerner index measures market power at the bank year level. The Boone indicator in particular is time dependent and reflects the logic behind structure efficiency hypothesis [35]. However, in this study, we invoke the theory behind structural conduct performance (SCP) hypothesis owing to neo-organizational approach [33,36]. Similarly, the H-Statistic is a non-structural measure of competition (Apergis, 2015). In addition, Lerner index provides a direct measure of pricing power per year at bank level. The index ranges from 0 to 1, with 0 means perfect competition and 1 indicating monopoly.

We follow the same line of literature and to measure banks' market power, a localized Lerner Index for Pakistani banks has been estimated following [3,33,34,37,38] and express the Lerner index using equation (1) as inverse of the price elasticity as such that:

$$Lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \dots \quad (1)$$

Where P_{it} represent output prices and MC_{it} represents the marginal costs. All the variables follow the definitions provided in Table 1 accordingly. The marginal costs are estimated through stochastic frontier analysis by setting up a translog cost function as per equation (2) as follows:

$$\ln TC = \alpha + \sum_{k=1}^1 \beta_k \ln(Q_{kit}) + \sum_{h=1}^3 \beta_h \ln(W_{hit}) + \sum_{h=1}^3 \sum_{m=1}^3 \frac{1}{2} \gamma_{hm} \ln(W_{hit}) \ln(W_{mit}) + \sum_{k=1}^1 \frac{1}{2} \delta_k (\ln(Q_{kit}))^2 + \sum_{h=1}^3 \times \sum_{k=1}^1 \vartheta_{hk} \ln(W_{hit}) \ln(Q_{kit}) + \sum_{n=1}^1 \pi T^n + \sum_{h=1}^3 \sigma_h \ln(W_{hit}) T + \sum_{k=1}^1 \varphi_k \ln(Q_{kit}) T + \sum_{p=1}^p X_{pit} + u_{it} \dots \quad (2)$$

Where TC_{it} represents total cost, Q_{it} representing output prices and $W_{h,it}$ are the three input prices emulating from the prices of labour W_1 , the price of physical capital W_2 , and W_3 the price of funding and time trend (T) representing technological and technical changes. Finally, X_p is a vector representing bank level control variables. We estimate the above specification as constrained linear regression with linearity and homogeneity. The Marginal costs are then obtained by taking a partial differential as indicated in equation (3).

$$MC_{it} = \frac{\partial TC_{it}}{\partial \ln Y_t} = \frac{TC_{it}}{Q_{it}} \left[\beta_1 + \beta_2 \ln Q_{it} + \sum_{k=1}^3 \varphi_k \ln W_{hit} \right] \dots \quad (3)$$

3.2. The construction of financial inclusion index for Pakistan

The multidimensionality of an inclusive financial system warrants that FI should be treated and assessed as such. Thus, we follow [39,40] to compute a composite index of FI. Following the seminal work of [39] several studies have estimated several indices with various dimensions across the globe. A few examples to outline would be [9,37,39–46] among others. However, and to the best of our knowledge, there is no such attempt exclusively and indigenously done for Pakistan. Most of the empirical literature comes from developed nations to which one can argue that since the bulk of the unbanked and poor population come from developing nations with characteristics of case dependency and case to case variation, thus needs to be studied accordingly. In addition, most of studies about FI on Pakistan are either cross country evidence or adopt a few individual indicators³ of inclusion such as the number of ATMs, bank branches among several others. In other cases, and in most official statements, usually figures are quoted either from the Global Index Database or Financial Access Survey by IMF. The only closely relevant study available to date is that of [47] who estimates an index of FI for Pakistan. However, their study lacks in several ways and does not provide considerably reliable and conclusive measure of FI for the country. Thus, we estimate a composite index of FI for Pakistan with broader dimensional depth and more indicators for a relatively extensive sample.

We consider a number of indicators capable of capturing the depth and breadth of the outreach of a financial sector necessary to assess the extent of FI and the outcome of inclusiveness. These indicators are categorized into three distinct dimensions including i) penetration/access of financial services (D_1) ii) availability of financial services (D_2) and iii) usage of financial services (D_3). We consider the usage dimension to be the output of an inclusive system as in Ref. [46]. In the first stage, these three dimensions are estimated as sub-indices and then aggregated to form a composite index of FI as a weighted average index of individual dimensions. The categorization of indicators into three sub-indices provides us with disaggregated and meaningful information which is helpful in policy making by pointing towards the need for necessary interventions. Further, the construction of a composite index gives us the advantage of aggregating several indicators into a single, monotonous, and homogenous index capable of summarizing the complex nature of FI.

There are two important concerns while estimating FI such as i) the selection of indicators and ii) weights assigned to each indicator and dimension. The indicators are selected with well-established economic theory and long-standing relationships following the literature (Fig. 8) The weights have been assigned to each dimension to enable the best Index estimation, which is based on extracting information from all variables and keeping the biases at their minimum level.

In the first stage, each dimension indexes d_i is estimated as:

$$d_i = w_i \frac{X_i - m_i}{M_i - m_i} \dots \quad (4)$$

Where w_i is the weight assigned to each indicator for dimension i as such that $0 \leq w_i \leq 1$.

X_i = indicates actual value of dimension i

m_i = is the minimum value or the lower limit for dimension i .

M_i = is the maximum value or upper bound for dimension i .

In equation (4), higher value indicates higher achievement in a particular dimension and vice versa. The composite index for FI is then estimated through normalized Euclidean distance between the ideal situation W and the worst situation 0 , and the normalized inverse Euclidean distance as in equation (5). The composite FI index is then obtained as in equation (6).

$$X_1 = \frac{\sqrt{d_1^2 + d_2^2 + \dots + d_n^2}}{\sqrt{(w_1^2 + w_2^2 + \dots + w_n^2)}} \dots \quad (5)$$

³ Camara and Tuesta (2014) argue that individual indicators cannot accurately capture the state of inclusiveness of a financial system.

Table 1
Sample distribution.

Banks	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Public	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5
Private	14	14	14	14	14	14	14	15	15	15	15	15	15	15	15	15
Islamic	2	4	4	4	4	4	4	4	5	5	6	6	6	6	6	6
Total	20	22	22	22	22	22	23	24	25	25	26	26	26	26	26	26

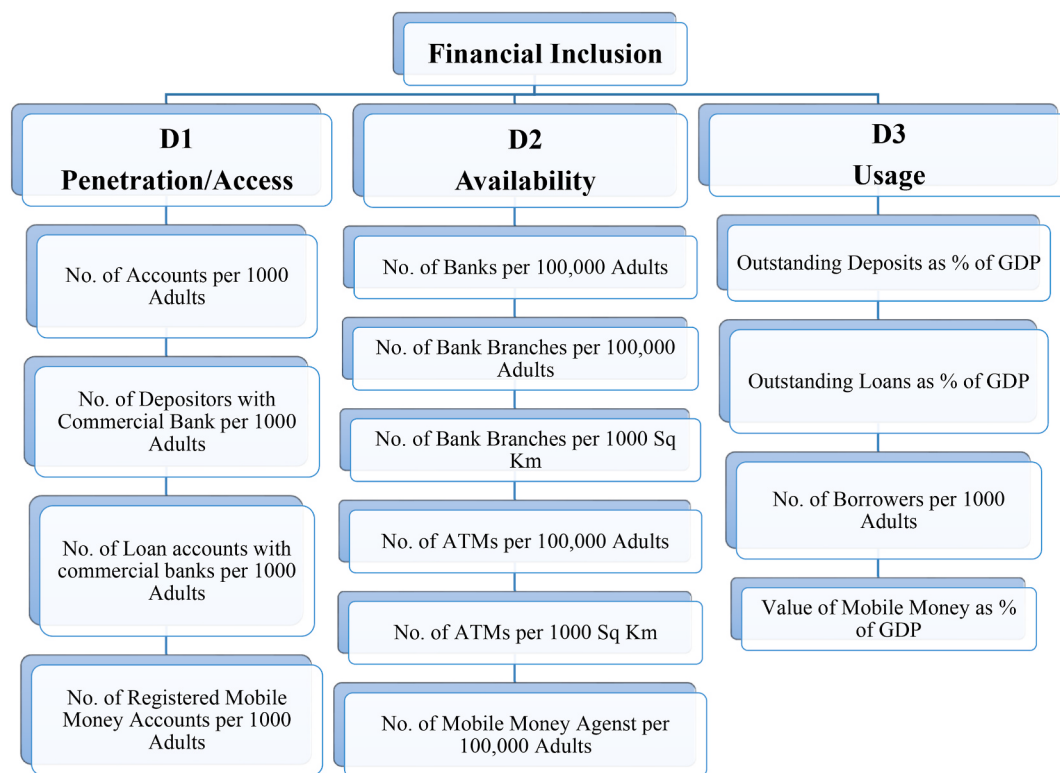


Fig. 8. Indicators and Dimensions of FI. Source: Authors' rendition.

$$X_2 = 1 - \frac{\sqrt{(w_1 - d_1)^2 + (w_2 - d_2)^2 + (w_n - d_n)^2}}{\sqrt{(w_1^2 + w_2^2 + \dots + w_n^2)}} \dots \quad (6)$$

$$CFII = \frac{1}{2} [X_1 + X_2] \dots \quad (7)$$

The expression in equation (6) gives us the mean of Euclidean distance between 0 and W. A higher value would suggest higher degree of FI and vice versa. The composite index thus ranges between 0 and 1 where 1 is the highest level of inclusion. Thus, depending on the value of our estimated CFII, the following levels of inclusiveness can be categorized by the following ranges [44]:

- 1) When $0 \leq CFII \leq 0.4$, indicates low financial inclusion
- 2) When $0.4 \leq CFII \leq 0.6$, indicates medium financial inclusion
- 3) When $0.6 \leq CFII \leq 0.1$, indicates high financial inclusion

3.3. Measuring fintech: digital financial services

For a country's economic and financial development, it's important to foster financial innovations such as Fintechs to enhance competitiveness, operational performance, lowering of costs and providing diversity in terms of financial services [13]. However, as a relatively new industry, there is no consensus that how to measure the extent of Fintech and there is no unified measure available. Most of the literature either relies upon consumer level surveys about the usage of particular services or look towards text mining practices for extracting relevant information from various sources such as [48,49] who gauges Fintech development for China by capturing media's attention towards Fintech related information. There are very few studies, which rely upon some crude measures of Fintech and or quantify the same. One of the main reasons could be that the multifaceted nature of Fintechs makes it difficult to rely on a single measure across the board. Hence, a variety of indicators have been adopted in literature to capture several dimensions of Fintech for various purposes. For instance Ref. [13], develops a Fintech development index for China based on enterprise level data including, number of Fintech startups, their registered capital, total number financing events and the amount of financing acquired. Similarly [50], relies upon the number ATMs and Mobile Phone usage to proxy the extent of Fintech diffusion [51], adopts Fintech Startups formation. Similarly [52], uses volume of funding and the number of rounds to proxy for Fintech [53], proxies Fintech by using mobile phones to pay bills following [54]. In a survey-based study [8], proxies Fintech through mobile money to understand the antecedents of

Fintech Use. On a much promising note, the global Findex database aims to collect indicators of Fintech indicators such as using internet or mobile phones to pay bills and or access financial services etc. However, the data is only available for 2017.

It's clear from the above discussion that various indicators have been used to capture several dimensions of Fintech across different conditions and there is no clear consensus through the available empirical literature. However, none of these indicators are applicable in our case due to several reasons. The foremost is the lack of data availability for almost all of the above-mentioned indicators. Thus, we needed a relatively different and unorthodox approach to measure the extent of Fintech in the case of Pakistan by constructing a relatively new proxy indicating 'Digital Financial Services'. We estimate DFS by the value of internet banking plus mobile banking expressed as percentage of GDP. Our proxy is robust across various specifications and indicates the extent, access and adoption of digital financial services in the country.

3.4. Control variables

To account for various bank level and economy wide heterogeneity, we adopt several bank specific and economic control variables. For example, to control for possible heterogeneity arising from economies of scale, we include the variable for size. Similarly, for business cycle fluctuations, we include GDP growth rate and interest rate. To account for regulatory and political characteristics, we include rule of law. Other bank specific variables are also included in various specifications as indicated in Table A1 following the literature.

3.5. Econometric specifications

We follow a two steps estimation methodology. First, we see for the effects of Fintech on FI in the presence of market power. While in the second, we test for the effects of Fintech on banks' market power in the presence of bank specific and macroeconomic control variables. In addition, we also specify conditional effects. These specifications can be generally represented as below⁴:

$$CFII_{it} = DFS_{it} + Lerner_{it} + Control\ Variable(s)_{it} + e_{it} \dots \quad (8)$$

Where $CFII$ indicates Composite FI Index and DFS indicates Digital Financial Services. In doing so, if Fintech is sufficiently affecting the inclusion efforts in the country, then it could be evidence to the fact that Fintech can lead to significant market alterations such as market power. This leads us to specify the effect of Fintech on banks' market power as follows:

$$MP_{it} = DFS_{it} + Bank\ Specific\ Controls_{it} + Macroeconomic\ Controls_{it} + e_{it} \dots \quad (9)$$

Where MP indicates market power. In addition, we condition the enhanced effect of FI through Fintech on market power along with some other conditional effects as shown below:

$$MP_{it} = DFS_{it} + Bank\ Specific\ Controls_{it} + Macroeconomic\ Controls_{it} + Conditioning\ Variable_{it} + e_{it} \dots \quad (10)$$

For instance, the conditional effects of FI through Fintech would look like:

$$MP_{it} = Bank\ Specific\ Controls_{it} + Macroeconomic\ Controls_{it} + CFII * DFS_{it} + e_{it} \dots \quad (11)$$

Similarly, the conditional effects of FI and Fintech through enhanced economic activity would be as:

$$MP_{it} = Bank\ Specific\ Controls_{it} + Macroeconomic\ Controls_{it} + DFS * GDP_{it} + e_{it} \dots \quad (12)$$

$$MP_{it} = Bank\ Specific\ Controls_{it} + Macroeconomic\ Controls_{it} + CFII * GDP_{it} + e_{it} \dots \quad (13)$$

And finally, we condition the rule of law with Fintech and FI against market power as:

$$MP_{it} = Bank\ Specific\ Controls_{it} + Macroeconomic\ Controls_{it} + DFS * RLaw_{it} + e_{it} \dots \quad (14)$$

$$MP_{it} = Bank\ Specific\ Controls_{it} + Macroeconomic\ Controls_{it} + FI * RLaw_{it} + e_{it} \dots \quad (15)$$

3.6. Testing methodology

We adopt panel regression estimation techniques with bank level fixed effects for our models (equation (7) to equation (14)) commensurate with the literature [33,34]. Owing to the fact that there is a possibility of the presence of bank level heterogeneity. There might be certain unobserved bank specific characteristics that may be related to market power and risk like business model and risk management expertise. The literature suggests that these characteristics are largely time invariant indicating bank level heterogeneity. To account for such time invariant bank level heterogeneity, we include fixed effects in all these estimations accordingly. Data analysis is performed using Stata version 16.

⁴ For definition, measurements and summary of variables, refer to the appendix.

3.7. Data and sample

Data for bank specific and macroeconomic variables have been collected from the State Bank of Pakistan (SBP) official website.⁵ Whereas indicators of FI are acquired from the Financial Access Survey by IMF.⁶ Similarly, the Rule of Law indicator has been adopted from the worldwide governance indicators⁷ by World Bank. The sample period consists of post reforms era of 2005 to most recent 2020 whereby the regulatory requirements of Basel III were adopted by the commercial banks in Pakistan. The choice of our sample period is governed by the fact that internet banking (DFS) in the country was started in 2005. We collect annual data for all the commercial banks excluding specialized and foreign banks to obtain a relatively homogenous sample. In this way, we ended up with a panel of 26 commercial banks with the following distribution:

4. Results and discussions

4.1. Composite financial inclusion index

Summary statistics for the indicators of FI index are shown in Table 2. Similarly, the composite FI index is indicated in Table 3 below.

The results of CFII indicates that in Pakistan, the FI remained relatively low over the sample period. It can be observed that during 2005 and 2006, FI was considerably low followed by a brief episode of slightly medium FI in 2007 and 2008. The trend is again reversed in 2009 till 2013 whereby lower FI can be observed. This can be due to the negative effects of the global financial crisis. However, the inclusion efforts seem to bear fruits after 2015 and onwards whereby medium level of FI can be observed with a consistent increasing trend. This persistent effect can be attributed to the NFIS post 2015. Further, significantly higher FI is observed during the years 2018 and onwards. This positive effect can be attributed to the renewed commitment of SBP to inclusion efforts through the revised NFIS in 2018.

In addition, the trend of FI over the sample period presented in Fig. 9 below signifies a positive upward trend from 2011 and onwards which can be due to the introduction of mobile money indicators from 2011 and onwards. This further, highlights the importance of mobile money in expanding the inclusion efforts across the country.

4.2. Lerner Index for market power

The mean Lerner index indicates that very little has changed in Pakistan in terms of market power over the years. The banking industry in Pakistan remained considerably monopolistic over the years as can be inferred from the higher Lerner margins. Market power over the sample period is presented in Table 4. However, overall a steady negative trend can be observed as indicated in Fig. 10 which is a good indication.

However, the significantly higher Lerner margins indicates higher market power and warrants that further competition should be induced to improve the competitive conditions of the banking industry. These findings are consistent with [33,34].

4.3. digital financial services

The evolution of DFS is presented through Fig. 11. It can be observed that from a humble beginning in 2005 when internet/mobile banking was introduced in the country, a steady growth is observed till 2018 whereby the ratio of DFS was almost 1.5 % of GDP. However, post 2018, a steep growth in DFS can be observed reaching to 4.6 % in 2020. This sharp increase can be attributed to the pandemic of Covid-19 and the associated nationwide lockdowns whereby DFS were preferred.

4.4. Impact of fintech on market power

Descriptive Statistics for our main regressors are presented in Table 5 along with the pairwise correlations.

To find out that whether banks' market power is affected by Fintech, we ran fixed effect regression with the results being presented through various specifications in Table 6. It can be observed in (specification 1) that Fintech is negatively and significantly affecting banks' market power implying that further increase in digital financial services can considerably lower banks' market power. our findings are in contrast to those of [3] who finds increase in market power positively related to Fintech entry in Kenya. Another important finding is that of interest rate which is positively affecting market power. Thus, policy makers should be cognizant of the fact when increasing interest rate, if competition in the banking sector is on the agenda. This effect can be attributed to the fact that historically, interest rate spreads remained quite high in Pakistan [33]. Further, bank specific variables such as leverage, and net interest margins are negatively impacting market power while increase in loan share and size are found to be positively affecting the same indicating potential economies of scale effects for Pakistani banks.

Interacting FI and Fintech against banks' market power (Specification 2), we find supporting evidence in favor of the inclusion

⁵ <https://www.sbp.org.pk/index.html>.

⁶ <https://data.imf.org/?sk=e5dcab7e-a5ca-4892-a6ea-598b5463a34c>.

⁷ https://databank.worldbank.org/reports.aspx?Report_Name=WGI-Table&Id=ceea4d8b.

Table 2
Descriptive Statistics for FI indicators.

Variables	Mean	Std. Dev.	Min	Max
Accounts	276.05	85.61	133.3	418
Depositors	275.72	77.31	137.33	402.27
Loan Accounts	33.02	10.54	18.46	50.11
Mobile Accounts	175.52	158.14	8.08	435.86
Banks 100K	0.0245	0.0035	0.0192	0.0307
Branch 100K	9.0619	0.9585	7.670	10.41
Branch 100 KM	14.2598	3.2793	9.5709	19.265
ATM	10.453	6.5398	1.4529	20.808
ATM 100 KM	6.3268	3.3773	1.1639	11.1412
Mobile Agents	209.0235	119.9044	19.5893	334.6588
OD	32.2230	2.7908	27.9818	38.1394
OL	20.5440	4.3437	15.9603	28.3231
Borrowers	24.7267	3.8230	16.8924	31.3226
Mobile Money	7.4160	4.6557	0.9801	16.2624

Table 3
Classification of Financial Inclusion into different categories from 2005 to 2020.

Year	X1	X2	CFII	CFII Range	Category
2005	0.426989	0.172550017	0.299770	$0 \leq \text{CFII} \leq 0.4$	Low FI
2006	0.470404	0.228360288	0.349382		
2007	0.562432	0.278639542	0.420536	$0 \leq \text{CFII} \leq 0.6$	Medium FI
2008	0.538854	0.288227621	0.413541		
2009	0.409608	0.265784223	0.337696	$0 \leq \text{CFII} \leq 0.4$	Low FI
2010	0.373334	0.271268300	0.322301		
2011	0.342971	0.240549558	0.291760		
2012	0.349779	0.282527785	0.316153		
2013	0.391809	0.331978580	0.361894		
2014	0.44231	0.370744378	0.406527	$0 \leq \text{CFII} \leq 0.6$	Medium FI
2015	0.520158	0.411903509	0.466031		
2016	0.589187	0.467896098	0.528542		
2017	0.669211	0.522807064	0.596009		
2018	0.722809	0.499219798	0.611014	$0 \leq \text{CFII} \leq 1.0$	High FI
2019	0.781698	0.581414296	0.681556		
2020	0.846187	0.548963666	0.697575		

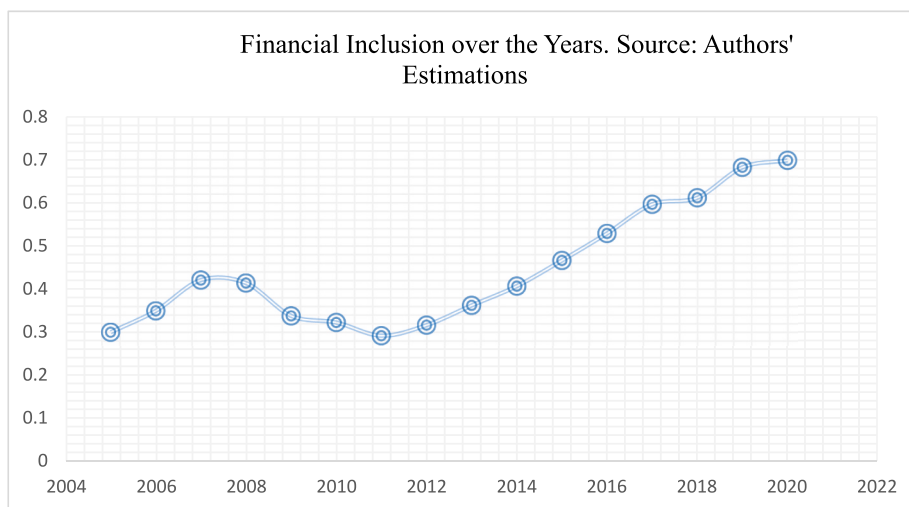


Fig. 9. Financial inclusion over the years. Source: Authors' estimations.

channel for Fintech with negative relationship against market power. The interaction coefficient was found statistically significant, implying that a well-inclusive financial system augmented with Fintech will result in improved competitive conditions among the banking sector. This is an interesting and important finding, strengthening the notion for the need and promise of digital financial

Table 4
Market power over the sample period.

Year	Mean Lerner Index	Std. Deviation	Min	Max
2005	0.8415	0.1820	0.0903	0.9171
2006	0.7610	0.2472	0.0700	0.9182
2007	0.7727	0.2004	0.0469	0.9074
2008	0.7999	0.0968	0.4237	0.8875
2009	0.7303	0.1836	0.0933	0.8752
2010	0.753	0.1074	0.3380	0.8750
2011	0.7331	0.1491	0.0863	0.8378
2012	0.7249	0.1400	0.0922	0.8232
2013	0.7299	0.0812	0.4105	0.8147
2014	0.7091	0.1395	0.0752	0.8040
2015	0.6870	0.1904	0.0796	0.8171
2016	0.6740	0.1864	0.0623	0.8129
2017	0.6437	0.1616	0.0867	0.7743
2018	0.6667	0.1470	0.1268	0.8279
2019	0.6197	0.1685	0.1148	0.7736
2020	0.7103	0.0839	0.3710	0.7752

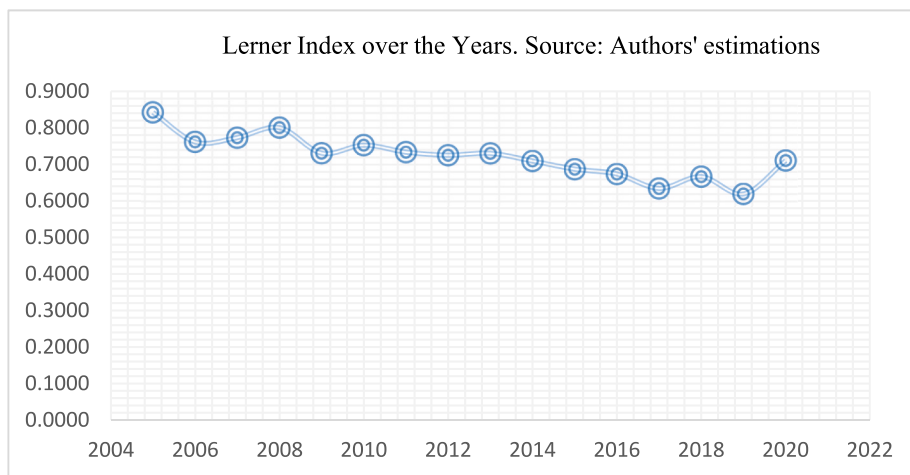


Fig. 10. Lerner Index over the Years. Source: Authors' estimations.

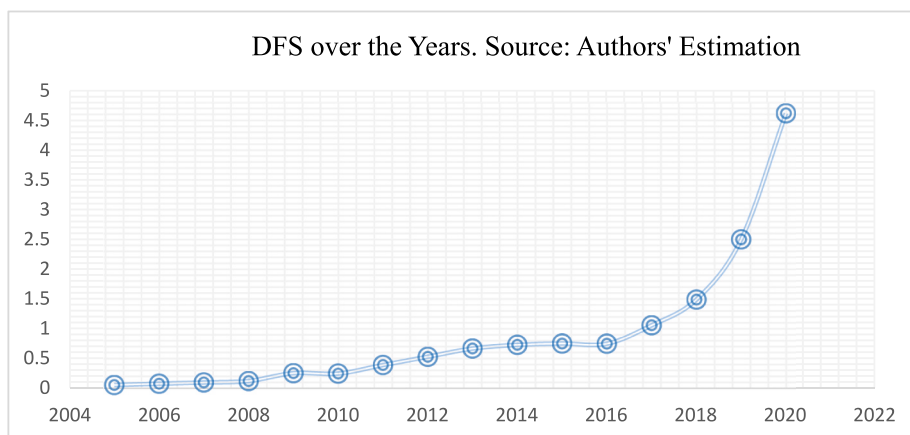


Fig. 11. Dfs over the years. Source: Authors' estimation.

Table 5

Descriptive Statistics and correlation for Main Variables.

Variables	LERNER (1)	FI (2)	DFS (3)	GDPGR (4)	IR (5)	LEV (6)	LIQ (7)	LS (8)	SIZE (9)	RLAW (10)	NIM (11)
Mean	0.7185	0.4502	0.9378	3.6799	11.431	0.1117	0.3594	0.4351	5.3437	−0.8026	0.0475
Median	0.7532	0.4135	0.6638	3.9400	11.730	0.0866	0.3756	0.4317	5.4054	−0.8046	0.0381
Maximum	0.9182	0.6976	4.6151	5.5600	14.538	0.9907	0.8305	1.0000	6.5619	−0.6674	0.5196
Minimum	0.0469	0.2918	0.0516	−0.4700	8.2100	−0.1008	0.0524	0.0843	3.6047	−0.9687	−0.0225
Std. Dev.	0.1658	0.1349	1.1632	1.7317	2.0464	0.0941	0.1710	0.1133	0.5964	0.0889	0.0578
Skewness	−2.4501	0.5938	2.1562	−1.0980	−0.084	4.2826	−0.162	0.2636	−0.405	−0.0005	6.1214
Kurtosis	9.5565	1.9408	7.0002	3.3720	1.8218	30.9311	2.1017	3.9498	2.6320	1.8564	43.888
Jarque-Bera	1046.85*	39.56*	540.59*	77.50*	22.14*	13336.07*	14.25*	18.43*	12.37*	20.43*	28465.4*
1	1.000										
2	−0.240	1.000									
3	−0.161	0.809	1.000								
4	0.071	−0.292	−0.250	1.000							
5	0.107	−0.544	−0.218	−0.391	1.000						
6	−0.307	−0.194	−0.214	0.072	0.096	1.000					
7	0.025	0.099	0.235	−0.086	0.082	0.042	1.000				
8	0.133	−0.124	−0.196	−0.116	0.053	−0.164	−0.352	1.000			
9	0.236	0.372	0.349	−0.103	−0.163	−0.476	0.061	−0.113	1.000		
10	−0.254	0.766	0.674	−0.170	−0.395	−0.215	0.080	−0.164	0.368	1	
11	−0.332	−0.130	−0.087	0.003	0.131	0.054	−0.008	−0.022	−0.064	−0.093	1

Table 6

Effects of Fintech on market power.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
C	−3.0018* (0.9777)	−0.0358 (0.3213)	0.77734* (0.17187)	0.5103** (0.2205)	0.71581* (0.21123)	0.93420* (0.22010)
lnGDPGR	−0.0191 (0.0266)	−0.0054 (0.0093)	−0.0451*** (0.0071)	−0.0034** (0.0034)	−0.01135* (0.00473)	−0.00981** (0.00410)
lnIR	0.2745*** (0.1008)	0.0688** (0.0343)	0.07551** (0.03727)	0.0713** (0.0333)	0.12076** (0.05019)	0.09285** (0.03951)
lnLIQ	−0.0217 (0.0264)	−0.0083 (0.0091)	−0.01245 (0.00912)	−0.0111 (0.0091)	−0.00953 (0.00961)	−0.01383 (0.00995)
lnLEV	−0.1811** (0.0599)	−0.0615* (0.0209)	−0.08555* (0.01952)	−0.0791* (0.0197)	−0.08525* (0.02072)	−0.08589* (0.02039)
lnLS	0.2286* (0.0846)	0.0853* (0.0290)	0.10678* (0.02829)	0.0875* (0.0293)	0.13259* (0.02889)	0.13733* (0.02893)
lnNIM	−0.0688** (0.0350)	−0.0244** (0.0121)	−0.01980 (0.01216)	−0.0199*** (0.0120)	−0.01563 (0.01274)	−0.01541 (0.01267)
SIZE	0.2719*** (0.1647)	0.0720 (0.0566)	−0.07880* (0.02600)	−0.0257 (0.0382)	−0.09728* (0.03065)	−0.11913* (0.03374)
lnDFS	−0.0686*** (0.0392)					
lnFI*DFS		−0.0351* (0.0117)				
lnFI*GDP			−0.00143 (0.01013)			
lnDFS*GDP				−0.0148*** (0.0079)		
lnFI*RLaw					−0.12330 (0.13185)	
lnDFS*RLaw						−0.01963*** (0.01119)
Adj. R ²	0.58	0.61	0.59	0.51	0.54	0.44
F-Statistics	16.10*	17.60*	17.44*	17.75*	14.72*	14.89*

revolution to enhance inclusion efforts and improve competitive conditions simultaneously.

Similarly, FI is dubbed to improve economic conditions of developing nations across the globe resulting in higher economic growth. We test this phenomenon (Specification 3) and interact FI with GDP growth rate against market power. However, we do not find evidence in favor of the growth channel for FI to affect banks' market power in the case of Pakistan. Though the coefficient of the interaction term is found to be negative as expected. However, its statistically insignificant implying that FI coupled with economic activity does not affect market power.

We also see for the conditional effect of Fintech through economic activity against market power by interacting digital financial services and GDP growth rate (specification 4). As expected, Fintech coupled with enhanced economic activity may lead to improve competitive conditions in the country. The interaction coefficient is statistically significant and negative implying that increase in digital financial services and GDP growth can lead to a reduction in banks' market power.

Rule of law plays a crucial role for enhancing FI. The literature suggests that weak rule of law and other regulatory constraints significantly lowers FI in emerging economies [45]. Thus, we test for the interaction of rule of law and FI (Specification 5) in the case of Pakistan to find that whether increased regulatory quality coupled with inclusion efforts will enhance competitive conditions in the country? However, our findings are insignificant and does not render support to this notion.

Similarly, we interact rule of law with Fintech (specification 6) assuming that supporting regulatory environment for Fintech may result in improved competitive conditions in the banking sector. Our findings support this notion and suggest that increase in digital financial services coupled with supporting regulatory environment significantly leads to a decrease in market power for Pakistani banks.

4.5. Impact of fintech on financial inclusion in Pakistan

Contemporary literature declares Fintech a key driver for FI for achieving balanced development under the auspices of UN's SDGs [6]. Thus, we expect that increase in digital financial services can significantly enhance FI efforts in the case of Pakistan and test the above in the presence of banks' market power. The results are presented in Table 7 and suggests that Fintech is significantly and positively impacting the inclusion efforts in the country. However, the market power is found to be statistically insignificant suggesting that banks' market power does not influence FI.

However, judging by the behavior of Fintech against FI reveals that the relationship between the two may not be linear. Thus, we allow for non-linearity by including a squared term for Fintech. It can be observed that the squared term is significantly positive against FI along with a negative and significant coefficient of market power suggesting that the relationship is essentially non-linear. It can be inferred that increase in digital financial services is essentially important for enhancing financial inclusion efforts. At the same time, the presence of market power in the banking sector can be a potential hurdle against FI. Thus, improving competitive conditions of the banking industry is advised to boost inclusion efforts through Fintech initiatives. This line of reasoning is consistent with that of [48].

4.6. Pre and post fintech analysis

Finally, to uncover the impact of Fintech entrance on the market power of Pakistani banks, we conduct a pre and post Fintech entry analysis. This could be evidence that whether Fintech entrance improved competition among the banking industry or not? For this purpose, the pre-Fintech period is selected to be from 2005 to 2011 while the post-Fintech period is from 2012 to 2020. We identify 2011 as the breakpoint for the pre and post Fintech eras accordingly. This is substantiated by finding significant structural breaks in the data during this period. This can be further attributed and alluded to the fact that globally Fintech related developments such as mobile money etc. are mainly reported through 2011 and onwards. We perform equality of means test for the means of Lerner index over the two time periods as presented below in Table 8. In addition, the descriptive statistics for the same are also presented along with a graphical comparison for illustrative and comparative purposes. A cursory look indicates a considerable difference in both periods. These findings are in line with [3] suggesting that Fintech entry has significantly resulted in lowering the market power of banks resulting in relatively and significantly higher competitive conditions in post Fintech period (Fig. 12).

5. Conclusion

In this paper, we examine the impact of Fintech entry on FI and banking competition along with introducing conditionalities and non-linearity for the first time in the case of Pakistan. Further, we looked for the potential transmission channels for Fintech to affect inclusion and market structure for the first time. In addition, we also look for a pre and post Fintech entry effect on Market Power of banks. Our empirical analysis reveals several conclusions and can be summarized as follows:

First, the country has recorded significant improvement in terms of inclusion efforts. The composite index indicates that the country witnessed episodes of low and medium inclusion from 2005 till 2018. However, post 2018 we observe a significantly positive and a relatively high trend of FI in the country. *Second*, our Lerner index suggest the persistence of monopolistic tendencies across the sample period whereby most of the banks enjoy higher Lerner margins indicative of higher market power.

Third, the extent of Fintech is measured through the level of DFS and find that the growth in DFS was highly sluggish during 2005 till 2015. However, from 2016 and onwards a drastic increase is observed, courtesy of central bank's measures post NFIS in 2015. *Fourth*, moving forward with our main regression estimations to uncover the impact of Fintech on market power, we find that DFS significantly reduce banks' market power. This has serious and important implications for banks and policy makers to improve competitive conditions in the banking industry by promoting digital financial channels. Whereas the banks should be cognizant of the fact that Fintech channels can be of significant competition to regular banking operations. *Fifth*, our conditional models where we interact FI with Fintech against market power significantly reduces market power. This is indicative of the inclusion channel of Fintech that a well-inclusive financial system augmented with Fintech will result in improved competitive conditions. This is an interesting and

Table 7
Impact of Fintech on FI.

Variable	(1)	(2)
C	−0.720388* (0.017176)	−0.104237* (0.032011)
ln DFS	0.176944* (0.008495)	0.061187* (0.011286)
ln LERNER	−0.022633 (0.030631)	−0.035963** (0.019144)
ln DFS ²		0.020334* (0.004321)
Adj. R ²	0.53	0.87
F-Statistics		

Table 8
Market power: Pre and post Fintech.

	PRE_FINTECH	POST_FINTECH
Mean	0.770123	0.684036
Median	0.761048	0.686995
Maximum	0.841458	0.729858
Minimum	0.730337	0.61967
Std. Dev.	0.03944	0.038854
Skewness	0.790568	−0.439187
Kurtosis	2.504396	1.928822
Jarque-Bera	0.800804	0.719611
Test for Equality of Means Between Pre and Post Fintech Eras for Market Power		
t-test	−4.368191*	
Satterthwaite-Welch t-test*	−4.359431*	
ANOVA F-test	19.08109*	
Welch F-test*	19.00464*	

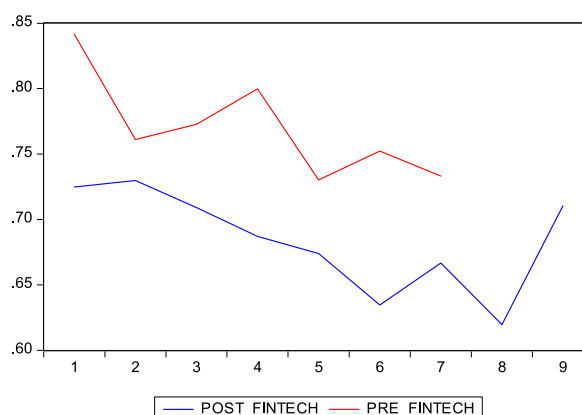


Fig. 12. Market power pre and post fintech entry. Source: Authors' estimations.

important finding, strengthening the notion for the need and promise of digital financial revolution to enhance inclusion efforts and improve competitive conditions simultaneously. However, we do not find any supporting evidence in favor of the growth channel for FI to affect banks' market power. Suggesting that enhanced economic activity may be shielding banks from the positive externalities of inclusion in terms of competition. In contrast, the growth channel for Fintech was found to be significantly affecting market power suggesting that Fintech coupled with enhanced economic activity may lead to improved competitive conditions in the banking industry.

Sixth, by interacting FI with the rule of law, we find that a supportive and quality regulatory environment for Fintech may result in improved competitive conditions in the banking sector. Our findings support this notion and suggest that increase in DFS coupled with supportive regulatory environment significantly leads to a decrease in market power. *Seventh*, further, we find that Fintech is significantly and positively impacting the inclusion efforts in the country as expected. This should be further encouraged and enhanced to reap the positive benefits of the same as evidenced from the various aforementioned transmission channels. *Eighth*, we also check for the associated nonlinearity between FI and Fintech owing to the nonlinear nature of the two. Our findings suggest that the relationship is essentially nonlinear and indicates that DFS are essentially important for improving inclusion efforts in the country. The diffusion of further DFS is expected to enhance inclusion significantly and positively. *Finally*, we also look for a pre and post Fintech entry analysis of banks' market power and find that market power is significantly lower in the post Fintech era. This implies that Fintech channels are essential for improving competitive conditions in the country.

5.1. Enabling interventions and policy implications

FI is a key enabler of economic development. It has also been featured as a goal in UN's SDGs. It has been noted that digital finance can impact FI; thus, Fintech may play an important role. Digital finance is revolutionizing the banking industry of Pakistan especially with the launch of National Payment Strategy (NPSS) in 2019. Further, during COVID, there has been an increase in transaction volumes of Fintech on both supply and demand sides. However, it is important to develop a Fintech ecosystem in Pakistan. A lot has been done on the payment side such as PRISM and RAST and implementing regulatory framework for electronic money institutions. In this way, the payments segment is most likely to see enhanced activity in the near future, followed by the infrastructure segment. However, the lending segment has still to witness a rise in interest by Fintechs. It is recommended to developing digitalized lending

mechanisms for individuals and businesses. It may also need to develop Digital Credit Scoring models at banks level which can help to allow instantaneous lending approvals and can increase the disbursements processes.

Above all, it is also important to create awareness among the masses about the usage of initiatives taken on improving FI and DFS in Pakistan. Still a majority is not aware about technological measures taken by government and SBP. Though RAAST has been promoted through electronic media, the total numbers availing services is still low. Further, with the emergence of EMIs, it is also important to provide incentives such as tax relief, fee waiver on digital transactions. Additionally, it is important strengthen the cyber security of using banking in general and Fintechs in particular. With emerging scams, such initiatives lose the confidence and interest of people at large. Incentives to banks to invest in developing their in-house Fintech capacities in tandem with FI aiming at financial consolidation which will ultimately benefit the banks. In the current, banks are acting against regulatory push only. Previously banks have been sluggish to innovate on the digital front, given the complexity of their businesses and strict regulatory and compliance environment. However, entrance of non-banking entities such as Fintechs providing digital financial solutions has affected the monopolistic power of banks.

In addition, a common misconception is that both channels are targeting a different market segments and operating at a different level given our demographics, social dynamics and financial needs across rural and urban landscapes. And thus, financial institutions are largely believed to be safe from these Fintech ventures. However, the monopoly of banks in the financial arena—particularly on the debt market can be broken and it's just a matter of time that someone pulls the right strings at the right time.⁸

Similarly, any digitization effort should come with lesser intermediation costs so that it should benefit the customers. As cash has zero cost, thus any digitalization effort and mechanisms as such should be at least competitive with cash. This will not only bring unbanked and underserved segments of the society under formal umbrella but will also help in reducing dependence on cash in circulation.

Further, SECP also needs to simplify the regulatory sandboxing to incentivize Fintechs in Pakistan. This will open venues for regulated ventures and crowdfunding options. A national policy is needed to broaden DFS access to rural underserved areas as well as unbanked areas. Associated with this, a policy on protection against identity theft and misuse is also needed. In addition, a framework to tackle unlawful cyber financial activities is also the need of the day among others.

5.2. Limitations and future research

This research is based on data obtained from annual accounts of banks due to not having any specific index available from the regulatory bodies. It has mostly relied either on World Bank indices or self-developed indices. Further, the study relied on supply-side (banks) information only; demand-side data has not been considered. Since Fintech industry/market is not well-established and well-regulated in Pakistan, thus, we relied upon a conventional proxy of DFS which should be contextually interpreted with caution.

Future researchers may focus on developing separate FI index including Electronic Money institutions as many of EMIs are being issued licenses in order to increase the usage and outreach of DFS. Further market power of microfinance banks and institutions may also be checked separately in pre and post digital finance era which could be an interesting continuation of the same. In addition, it would be a significant continuation to segregate FI on provincial levels—even district levels to pin point areas of neglect and to plan need based interventions accordingly. Furthermore, it is also important to conduct an impact study on the profitability of banking sector due to increase in DFS as many of the services such as RAAST are being launched free of cost.

Data availability statement

The datasets used in this study are publicly available on the State Bank of Pakistan's official Website, Financial Access Survey by IMF, and the Worldwide Governance Indicators by the World Bank.

CRediT authorship contribution statement

Abdur Rahman Aleemi: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Fatima Javaid:** Writing – review & editing, Writing – original draft, Resources, Investigation, Data curation. **Syed Sajid Hafeez:** Writing – review & editing, Resources, Project administration.

⁸ For instance, and as a use case; take the potential of RAAST for example: SBP has integrated RAAST with the National Savings recently. As a next step, imagine if RAAST enables people to directly participate in auctions and buy government's debt. This will not bring down the cost of borrowing for the government but will also affect banks' market power. The effect would be huge as every cell number can be linked to an account through RAAST at zero cost. In addition, depositors will get much higher returns than what banks can ever offer. In this way, retail deposits become less sticky for the banks as RAAST allows customers to easily switch between accounts. Imagine if an account can also be linked to an IPS account—the first barrier is crossed and the potential is now limitless. It's theoretically plausible as the technology and infrastructure is now already there. It would be really difficult for banks to survive or they would simply become 'post offices if they do not evolve along for reasons being that RAAST could connect customers and Fintechs just by integrating and building onto it instead of developing a separate system for each bank.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Abdur Rahman Aleemi reports financial support and administrative support were provided by the Institute of Chartered Accountants of Pakistan. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table A1
Summary and Definitions of variables

S. No	Indicator	Symbol	Measure
Panel A: Main Variables			
1.	Market Power	LERNER	Lerner Index: Estimated through Stochastic Frontier Approach by setting up a translog cost function with the following indicators.
2	Total Costs	TC	Overheads: calculated as the sum of personnel and other administrative expenses
3	Marginal Costs	MC	Estimated through stochastic frontier approach by setting up a translog cost function
4	Output	Q	Total Earning Assets
5	Cost of Labor	W1	the ratio of expenses of salaries & allowances on employees to the total number of employees of the banks
6	Cost of Physical Capital	W2	The Ratio of Operating Expenses over fixed assets
7	Cost of Financial Capital	W3	The ratio of interest expense over total borrowed funds
8	Output Prices	P	Total Income over Total Assets
9	Financial Inclusion	CFII	Composite Financial Inclusion Index developed by following (Sarma, 2012; 2015) and (Park & Mercado, 2018) with the following indicators
10	Branches per 100,000	Branch 100K	No of Branches per 100,000 adults
11	Branches per 1000 KM	Branch 1000 KM	Branches per 1000 squared kilo meter
12	Banks per 100,000	Banks 100K	No. of Banks per 100,000 adults
13	ATMs	ATM	No. of ATMs per 100,000 adults
14	ATMs per 1000 KM	ATM100KM	No of ATMs per 1000 Squared Kilo Meters
15	Accounts	Accounts	No. of Bank Accounts per 1000 Adults
16	Borrowers per 1000	Borrowers	No of borrowers from commercial banks per 1000 Adults
17	Outstanding Deposits	OD	Outstanding deposits with commercial banks as % of GDP
18	Outstanding Loans	OL	Outstanding Loans with commercial banks as % of GDP
19	Borrowers	Borrowers	Borrowers per 1000 Adults
20	Loan accounts	Loans	Loan accounts with Commercial Banks per 1000 Adults
21	Depositors	Depositors	Depositors with Commercial Banks per 1000 Adults
22	Mobile Money Accounts	Mobile Accounts	Number of Registered Mobile Money Accounts per 1000 Adults
23	Mobile Money Agents	Mobile Agents	Number of Mobile Money Agents per 100,000 Adults
24	Mobile Money Value	Mobile Money	Value of Mobile Money as % of GDP
Panel B: Control Variables			
25	Size	Size	Log of total assets
26	Economic Activity	GDPGR	Real GDP growth Rate in %
27	Liquidity	Liquid	Liquid Assets over total assets
28	Leverage	Lev	Total Equity over total liabilities
29	Loan Share	LS	Net loans over total assets
30	Interest Rate	IR	Lending Interest Rate (1 Year KIBOR)
31	Net Interest Margin	NIM	Net Interest Margin
32	Rule of Law	RLaw	The Rule of Law index obtained from the World Governance Indicators of the World Bank
Panel C: Fintech			
33	Digital Financial Services	DFS	A proxy for Fintech, computed as the value of internet plus mobile banking as percent of GDP.
34	Pre and Post Fintech	–	A dummy variable, whereby the Pre-Fintech era is determined to be before 2011 and vice versa

References

- [1] PWC, The future shape of banking: time for reformation of banking and banks?, Retrieved from, <https://www.pwc.com/im/en/publications/assets/pwc-the-future-shape-of-banking-v4.pdf>, 2014.
- [2] World Bank, World Bank Annual Report 2018, The World Bank, 2018.
- [3] D. Ndwiaga, The Effects of FinTechs on Bank Market Power and Risk-Taking Behaviour in Kenya (KBA Centre for Research on Financial Markets and Policy Working Paper Series 44), Kenya Bankers Association (KBA), 2020. <https://ideas.repec.org/p/zbw/kbawps/44.html>.
- [4] D. Kanga, C. Oughton, L. Harris, V. Murinde, The diffusion of fintech, financial inclusion and income per capita, Eur. J. Finance (2021), <https://doi.org/10.1080/1351847X.2021.1945646>.
- [5] M. Crowley, Bernardo Bátiz-Lazo, Cash and dash: how ATMs and computers changed banking, in: Oxford: Oxford University Press, vol. 37, Essays in Economic & Business History, 2018, pp. 252–254, 1.
- [6] D.W. Arner, R.P. Buckley, D.A. Zetsche, R. Veidt, Sustainability, Fintech and financial inclusion, Eur. Bus. Organ Law Rev. 21 (1) (2020) 7–35.
- [7] A. Demir, V. Pesqué-Cela, Y. Altunbas, V. Murinde, Fintech, financial inclusion and income inequality: a quantile regression approach, Eur. J. Finance (2020) 1–22, x.
- [8] P.K. Senyo, E.L. Osabutey, Unearthing antecedents to financial inclusion through Fintech innovations, Technovation 98 (2020), 102155.
- [9] M.A. Omar, K. Inaba, Does financial inclusion reduce poverty and income inequality in developing countries? A panel data analysis, J. Econ. Struc. 9 (1) (2020) 1–25.
- [10] D. Ndwiaga, The Effects of Fintechs on Bank Market Power and Risk Taking Behaviour in Kenya, 2019.
- [11] J.M. Liberti, M.A. Petersen, Information: hard and soft, Rev. Corp. Finance Stud. 8 (1) (2019) 1–41.
- [12] M. Carney, The promise of Fintech—something new under the sun, January), in: Speech at Deutsche Bundesbank G20 Conference, Bank of England Governor Mark Carney, January 25th, 2017.
- [13] C.C. Lee, X. Li, C.H. Yu, J. Zhao, Does Fintech innovation improve bank efficiency? Evidence from China's banking industry, Int. Rev. Econ. Finance 74 (2021) 468–483.
- [14] R.T. Ariss, On the implications of market power in banking: evidence from developing countries, J. Bank. Finance 34 (4) (2010) 765–775.
- [15] M.K. Brunnermeier, Deciphering the liquidity and credit crunch 2007–2008, J. Econ. Perspect. 23 (1) (2009) 77–100.
- [16] W.S. Frame, L.J. White, Empirical studies of financial innovation: lots of talk, little action? J. Econ. Lit. 42 (1) (2004) 116–144.
- [17] T. Cavoli, R. Shrestha, The Nature and Landscape of Financial Inclusion in Asia, September, ERIA Discussion Paper Series, 2020, p. 340. Retrieved from, <https://www.eria.org/uploads/media/discussion-papers/1-The-Nature-and-Landscape-of-Financial-Inclusion-in-Asia.pdf>.
- [18] Codebase Technologies. <https://www.codebase.com/>, 2022.
- [19] R. Haq, Pakistan's Fintech Revolution to Promote Financial Inclusion, November 2, 2017. Retrieved from, <http://www.riazhaq.com/2017/11/pakistans-fintech-revolution-to-promote.html>.
- [20] C. Calderón, L. Liu, The direction of causality between financial development and economic growth, J. Dev. Econ. 72 (1) (2003) 321–334.
- [21] A.A. Babajide, F.B. Adegboye, A.E. Omankhanlen, Financial inclusion and economic growth in Nigeria, Int. J. Econ. Financ. Issues 5 (3) (2015) 629–637. Retrieved from, www.econjournals.com.
- [22] T. Chinoda, F. Kwenda, Do Mobile Phones, Economic Growth, Bank Competition and Stability Matter for Financial Inclusion in Africa? Cogent Economics & Finance, 2019.
- [23] S. Ganti, D. Acharya, Financial inclusion fosters growth: simple multiplier and "AK" growth model analysis, Univ. J. Account. Finance 5 (3) (2017) 55–59.
- [24] J.I. Mohammed, L. Mensah, A.G. Dako, Financial inclusion and poverty reduction in sub-saharan africa, Afr. Finance J. 19 (1) (2017) 1–22. Retrieved from: <https://www.researchgate.net/publication/319044622>.
- [25] S. Ghosh, T.N. Sahu, How financially inclusive the Asian's are-an empirical analysis, Rajagiri Manag. J. 14 (1) (2020) 49–69. Retrieved from, <https://www.emerald.com/insight/0972-9968.htm>.
- [26] CGAP, Achieving the sustainable development goals the role of financial inclusion, Retrieved from, https://www.cgap.org/sites/default/files/Working-Paper-Achieving-Sustainable-Development-Goals-Apr-2016_0.pdf, 2016.
- [27] A.L. Ngo, Index of financial inclusion and the determinants: an investigation in Asia, Asian Econ. Financ. Rev. 9 (12) (2019) 1368–1382.
- [28] A.L. Owen, J.M. Pereira, Bank concentration, competition, and financial inclusion, Rev. Dev. Finance 8 (1) (2018) 1–17.
- [29] A.G. Marin, R. Schwabe, Bank Competition and Account Penetration: Evidence from Mexico, Banco de México, Working Papers, 2014.
- [30] X. Vives, 2, Fintech and Banking. Friends or Foes? European Economy: Banks, Regulations and the Real Sector, 3, 2017.
- [31] BIS, Basel Committee on Banking Supervision: Implications of Fintech Developments for Banks and Bank Supervisors, Bank for International Settlements, 2018.
- [32] C.A. Gregorio, Fintech and Entrepreneurial Finance: What's Coming Next? UJI, Universitat Jaume I, 2017.
- [33] A.R. Aleemi, I. Uddin, M. Kashif, Competitive conditions and banking stability in Pakistan: new evidence from market power and charter value, South Asian J. Manag. Sci. 16 (1) (2022).
- [34] A.R. Aleemi, I. Uddin, M. Kashif, Competition and risk taking behavior of banks: new evidence from market power and capital requirements, Pakistan Bus. Rev. 21 (3) (2019) 540–559.
- [35] Y. Tan, C. Floros, Risk, competition and efficiency in banking: evidence from China, Global Finance J. 35 (2018) 223–236.
- [36] J. Forssbaeck, C.T. Shehzad, The conditional effects of market power on bank risk- cross-country evidence, Rev. Finance 19 (5) (2015).
- [37] D.N. Nguyen, Bank Competition and Financial Soundness, Doctoral Dissertation: Western Sydney University, 2020. Available at: <https://researchdirect.westernsydney.edu.au/islandora/object/uws:58075/>.
- [38] K. Dao Bui, E.S. Ume, Credit constraints and labor supply: evidence from bank branching deregulation, Econ. Inq. 58 (1) (2020) 335–360.
- [39] M. Sarma, Index of Financial Inclusion, June, Indian Council for Research on International Economic Relations, 2008.
- [40] C.Y. Park, R. Mercado Jr., Financial inclusion, poverty, and income inequality, Singapore Econ. Rev. 63 (1) (2018) 185–206.
- [41] M. Sarma, J. Pais, Financial Inclusion and Development: A Cross Country Analysis, Indian Council for Research on International Economic Relations, 2008.
- [42] M. Sarma, Index of Financial Inclusion—A Measure of Financial Sector Inclusiveness, Centre for International Trade and Development, School of International Studies Working Paper Jawaharlal Nehru University, Delhi, India, 2012.
- [43] M. Sarma, Measuring financial inclusion for Asian economies, in: Financial Inclusion in Asia, Palgrave Macmillan, London, 2016, pp. 3–34.
- [44] S. Goel, R. Sharma, Developing a financial inclusion index for India, Proc. Comput. Sci. 122 (2017) 949–956.
- [45] C.Y. Park, R.V. Mercado, Financial inclusion: new measurement and cross-country impact assessment 1, in: Financial Inclusion in Asia and beyond, Routledge, 2021, pp. 98–128.
- [46] N. Cámara, D. Tuesta, Measuring financial inclusion: a multidimensional index. BBVA research working papers. <https://www.bis.org/ifc/publ/ifcb47p.pdf>, 2014.
- [47] M.H. Akhtar, I.S. Chaudhry, M.R. Sheikh, Does islamic banking augment financial inclusion in Pakistan? A reinforcement analysis, Rev. Econ. Dev. Stud. 6 (4) (2020) 739–758.
- [48] R. Wang, J. Liu, H. Luo, Fintech development and bank risk taking in China, Eur. J. Finance 24 (4–5) (2021) 397–418, <https://doi.org/10.1080/1351847X.2020.1805782>.
- [49] Q. Wang, i. Yang, Y.-h. Chiu, T.-Y. Lin, The impact of digital finance on financial efficiency, Manag. Decional Econ. 41 (2020) 1225–1236, <https://doi.org/10.1002/mde.3168>.
- [50] D. Kanga, C. Oughton, L. Harris, V. Murinde, The diffusion of Fintech, financial inclusion and income per capita, Eur. J. Finance (2021), <https://doi.org/10.1080/1351847X.2021.1945646>.
- [51] A. Croutzet, A. Dabbous, Do Fintech trigger renewable energy use? Evidence from OECD countries, Renew. Energy 179 (2021) 1608–1617.

- [52] Y. Li, R. Spigt, L. Swinkels, The impact of FinTech start-ups on incumbent retail banks' share prices, *Financ Innov* 3 (2017) 26, <https://doi.org/10.1186/s40854-017-0076-7>.
- [53] A. Demirgüç-Kunt, L. Klapper, D. Singer, S. Ansar, The global Findex database 2021. <https://doi.org/10.1596/978-1-4648-1897-4>, 2022.
- [54] S.A. Asongu, N.M. Odhiambo, Human development thresholds for inclusive mobile banking in developing countries, *Afr. J. Sci., Technol. Innov. Dev.* 10 (6) (2018) 735–744.