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FINTECH ADOPTION, FINANCIAL INCLUSION, AND BANKING SECTOR EFFICIENCY: A DECADAL ASSESSMENT OF PAKISTAN'S DIGITAL MACROECONOMIC TRANSITION

Muhammad Kashif[1]
PhD Scholar
Department of Economics
University of Karachi, Karachi.
Kashifdewan@hotmail.com

Prof. Dr. Nooreen Mujahid[2]
Director, Applied Economics Research Centre
University of Karachi, Karachi.
nooreenmujahid111@yahoo.com

ABSTRACT

The aim of this study is to determine if digital infrastructure, macroeconomic growth and physical branch expansion can account for the banking sector performance in Pakistan, which is undergoing a rapid transition from a branch-centric to a digital banking system. A time series of annual data for Pakistan for the period 2015-2025 (n = 11) is analysed using Ordinary Least Squares (OLS) regression. The performance of the banking sector is fitted to real GDP growth, Internet penetration and the number of bank branches. Model adequacy tests include Augmented Dickey–Fuller (ADF) unit-root tests and the Jarque–Bera, Breusch–Pagan and Breusch–Godfrey tests. The model explains 93.5% of the variation in banking performance (adjusted $R^2 = 0.907$; $F = 33.35$, $p = 0.0002$). The only predictor that is significant at the 5% level is Internet penetration ($\beta = 0.089$, $p = 0.008$). GDP growth is positive and significant only at the 10% level ($\beta = 0.087$, $p = 0.098$), while bank branches are negative and insignificant ($\beta = -0.237$, $p = 0.637$). The residuals are normally distributed, homoskedastic and have no first order serial correlation. The stationarity tests performed by the ADF, however, do not yield the result of stationarity at level or first difference, and therefore the estimates are interpreted as associations instead of long run causal effects. There are some limits in this research, such as the short annual sample and the non-stationarity of the dependent series; in the future, quarterly or bank-level panel data should be used with cointegration or ARDL methods. Pakistan's policymakers and bank managers need to focus on enhancing the digital aspect of the sector's operations rather than continuing to expand their branch network for better sector performance. This study provides recent country-level evidence (2015–2025) on the relationship between digital infrastructure and banking performance in an emerging economy, using the Technology Acceptance Model, Diffusion of Innovations theory and Resource-Based View.

Keywords: Digital banking; Internet penetration; Banking sector performance; Economic growth; Pakistan

JEL classification: G21, O33, C22

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INTRODUCTION

The banking sector plays a key role in economic development by raising the savings, channelling credit and facilitating payments (Schumpeter, 1934; King & Levine, 1993; Levine, 1997). In the past 10 years, the manner in which banks add value has evolved. The number of transactions conducted on the Internet and via mobile devices is increasing, and electronic distribution is more cost efficient than distributing online through physical branches (DeYoung et al., 2007; Hernando & Nieto, 2007; Gomber et al., 2017).

Pakistan provides a helpful context in which to examine this transformation. In 2021, the State Bank of Pakistan (SBP) introduced the Raast instant payment system, and in 2022, it released a licensing and regulatory framework for digital banks (State Bank of Pakistan, 2022). Meanwhile, internet connectivity has expanded, and the economy has experienced turbulent growth and contraction in 2020 and stabilisation in 2022-2023. While people have gone online, banks have continued to open new branches.

Problem Statement

Pakistan's banks are faced with a dilemma between making investments in physical outlets and investments in digital outlets, and evidence of which is correlated with better performance of the banks in the sector at country level is scarce and old. Research undertaken in other countries has revealed that the use of Internet banking can yield profit benefits, but the impact of this varies by country and time (Furst et al., 2002; Ciciretti et al., 2009). The bulk of the evidence for Pakistan actually dates back before the digital payments boom after 2020. So it is hard to say what has been driving banking performance—in terms of growth, digital infrastructure or branch expansion. In their absence, policymakers might be misled in focusing financial-inclusion policies on the wrong location, and financial institutions might be over-committing resources on branches that are generating declining benefits.

Research Objectives

- To analyse the correlation of the performance of the banking sector with GDP Growth in Pakistan (2015-2025).
- To test the relationship between penetration of the internet and the performance of the banking sector.
- To test the relationship between bank branch expansion and the performance of the banking sector.

Macroeconomic Growth and Banking Performance

In the finance–growth literature, banking and the real economy are found to support one another (King & Levine, 1993; Levine, 1997, 2005). A strengthening of the economy increases the demand for loans, increases the ability of borrowers to repay and reduces credit risk, thereby boosting bank income. Demirgüç-Kunt and Huizinga (1999) have discovered that macroeconomic conditions affect bank margins and

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profitability in 80 countries. Athanasoglou et al. (2008) showed that the business cycle has a positive, asymmetric effect on Greek bank profitability. Dietrich and Wanzenried (2011) found a positive correlation between the growth of GDP and Swiss bank profitability before and during the global financial crisis.

H_1: There is a positive and significant relationship between GDP growth and the performance of the banking sector in Pakistan.

Digital Infrastructure & Banking Performance

Digital infrastructure can help banks to provide services at a lower unit cost and to extend the reach of service provision beyond the branch network. Furst et al. (2002) have found that the U.S. national banks that provided Internet banking services were more profitable. DeYoung et al. (2007) demonstrated that higher levels of Internet use had a positive effect on the profitability of U.S. community banks via increased deposit-service income. Hernando and Nieto (2007) discovered that the internet channel for Spanish banks decreased overhead costs and increased profits, but only after some time. Ciciretti et al. (2009) correlated better performance and stock returns of Italian banks to internet activities. In general, Berger (2003) and Scott et al. (2017) demonstrated that technological advancement and digital network adoption lead to sustained improvements in bank performance. Digital finance enhances financial inclusion and access in emerging markets, thereby expanding the customer base (Ozili, 2018). Pupil perceptions of usefulness and ease of use are the determinants for adoption (Shaikh & Karjaluoto, 2015).

$H_{2:}$ The relationship between Internet penetration and performance of the banking sector in Pakistan is positive and significant.

Branch Networks and Banking Performance.

The traditional means of mobilisation and relationship lending for deposits have been through the branches. However, branches are expensive and as customers move to digital, the marginal value of the branch can be reduced. Hernando & Nieto (2007) noted that internet banking complemented branches and reduced costs, and Hasan et al. (2012) demonstrated that it is payment technology, and not physical scale, that is responsible for the returns of retail banking. Consequently, there is mixed evidence regarding expansion and access: on the one hand, good, on the other, there is a risk of reducing the efficiency of the system.

H_3: The contribution of bank branches to the performance of the banking sector in Pakistan is remarkable.

Research Gap

Most of the above studies have been based on information obtained from the years before 2015 for developed countries and on bank indicators instead of country indicators. There are very few studies that empirically test the macroeconomic, digital and physical channel determinants of Pakistan within a common framework that includes the impact of the COVID-19 shock and the launch of Raast and digital-bank licensing. This study aims to fill that void.

THEORETICAL FRAMEWORK

The model is based on three theories that complement each other.

Finance–Growth Theory. Innovation is the engine of development, and banks are the key providers of finance for innovation, according to Schumpeter (1934). The two-way relationship between financial depth and growth has since been formalised by King and Levine (1993) and Levine (1997, 2005). This view is consistent with GDP growth being a measure of the performance of the bank (H1).

The theory of the Technology Acceptance Model (TAM) and Diffusion of Innovations (DOI). TAM is that perceived usefulness and perceived ease of use facilitate technology adoption (Davis, 1989). The spread of innovation over time through a population is explained using the concept of adopter categories (Rogers, 2003), as explained in the following. Internet penetration is the infrastructure condition that enables these adoptions to take place at scale; as more people go online, more of them become customers of digital banking and transaction volumes increase, as do cost reductions (H2).

Resource-Based View (RBV). Barney (1991) contended that firms possess a comparative advantage over resources that are valuable, rare, inimitable and non-substitutable. Historically, branch networks have been such a resource. The distinctiveness of branches is being eroded, and digital resources are becoming the more strategic resource (H3).

CONCEPTUAL FRAMEWORK

The conceptual framework is composed of three independent variables that are based on the theories mentioned earlier (Figure 1). Growth (H1, H2) will be positively impacted by GDP growth and internet penetration. The direction of the branch effect is ambiguous (H3), as branches can increase access, but can also incur fixed costs.

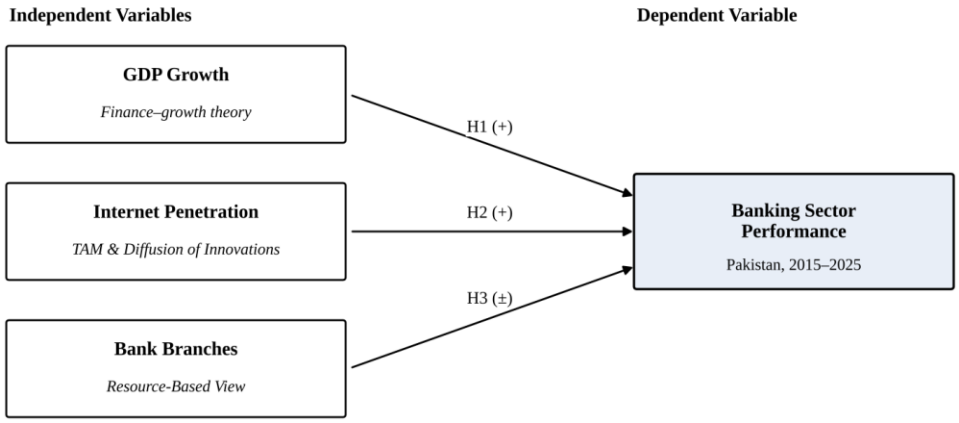


Figure 1: Conceptual framework of the study

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RESEARCH METHODOLOGY

Data Collection and Management

This study is based on positivist philosophy, deductive, quantitative and explanatory design. Secondary time-series data are used to test hypotheses based on theory.

Data and Sample

It is a time series of 11 annual observations of Pakistan between 2015 and 2025. The data are collected from reliable and authentic national and international sources such as the State Bank of Pakistan (banking indicators and number of banking branches), Pakistan Bureau of Statistics (GDP growth), World Bank (World Development Indicators) and Pakistan Telecommunication Authority (internet penetration).

Variables and Measurement

Table 1: Identifies the sources of variables, measurements and data.

Areas of Interest	Variable	Type	Measurement
Banking Sector Performance (BSP)	Dependent	[Specify, e.g., banking sector ROA, %]	State Bank of Pakistan
Growth of real GDP (GDPG)	Independent	Real GDP growth, % (annual)	PBS; World Bank
Internet Penetration (INT)	Independent	Internet users, % of population	World Bank; PTA
State Bank of Pakistan (SBP)	Independent	Scheduled Bank branches [unit]	Bank Branches (BR)

Note. PBS = Pakistan Bureau of Statistics, PTA = Pakistan Telecommunication Authority.

Model Specification

$$BSPt = \beta_o + \beta_1 GDPGt + \beta_2 INTt + \beta_3 BRt + \varepsilon t \quad (1)$$

where t = 2015, …, 2025; the β_0 is the intercept; the β_1, β_2 and β_3 are the slope coefficients; and the ε_t is the error term.

Estimation and Diagnostic Procedure, 6.5

There were four steps to the analysis:

The non-stationary properties of the series were tested by using the Augmented Dickey–Fuller (ADF) test at level and first difference (Dickey & Fuller, 1979), as regressing such series can lead to spurious results (Granger & Newbold, 1974).

Coefficient significance was tested by t-test, and overall fit by R^2, adjusted R^2 and the F-test (Gujarati & Porter, 2009) was used for OLS estimation.

The residual diagnostics used are: Jarque–Bera for normality (Jarque & Bera, 1980), Breusch–Pagan for heteroskedasticity (Breusch & Pagan, 1979), Breusch–Godfrey LM for serial correlation (Breusch, 1978; Godfrey, 1978) supported by the Durbin–Watson statistic (Durbin & Watson, 1951).

Interpretation at the 5% level of significance; 10% indicated as weak evidence.

ANALYSIS AND INTERPRETATION

Regression Results

Table 2: OLS regression results for banking sector performance (2015-2025) in Pakistan

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant (C)	−0.291	4.927	−0.059	0.954
GDP Growth	0.087	0.046	1.905	0.098
Internet Penetration	0.089	0.024	3.655	0.008
Bank Branches	−0.237	0.481	−0.493	0.637
R-squared	0.935			
Adjusted R-squared	0.907			
F-statistic	33.35			0.0002
Durbin–Watson statistic	1.691			

Note. The dependent variable is the performance of the banking sector, and there are 11 annual observations analyzing the dependent variable, with a residual df = 7. Estimated by OLS. Estimated from the verified observations for Pakistan.

Interpretation of Table 2. The model is an appropriate fit for the data. The three predictors together account for 93.5% of the variance in the banking sector performance ($R^2 = 0.935$). The power of the model is still strong when compared to the number of predictors (adjusted $R^2 = 0.907$). The F-statistic value of 33.35 with a p-value of 0.0002 implies that the null hypothesis that all slope coefficients are zero should be rejected, which means that the model is jointly significant.

GDP growth. The coefficient is positive ($\beta = 0.087$, $t = 1.905$, $p = 0.098$). Other factors being equal, the banking performance increases by 0.087 units when there is a 1% rise in GDP growth. The effect is statistically significant at the 10% level but not at the 5% level, meaning that it provides only weak support for H1. The 95% confidence interval [−0.022, 0.196] includes zero.

Internet penetration. The coefficient is positive and significant ($\beta = 0.089$, $t = 3.655$, $p = 0.008$). Internet penetration is found to have a positive effect on banking

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performance, with each additional percentage point of internet penetration corresponding to an increase of 0.089 points in the banking performance index. The 95% confidence interval for the proportion is (0.032, 0.146), which is entirely above zero. H2 is supported. The model suggests that Internet penetration is the strongest and only statistically reliable predictor.

Bank branches. The coefficient is negative but insignificant ($\beta = -0.237$, $t = -0.493$, $p = 0.637$). The wide 95% confidence interval [−1.375, 0.901] suggests that there is no discernible association between branch expansion and banking performance in the period. H3 is not available.

Constant. The intercept (−0.291, $p = 0.954$) is not significant, and so has no substantive meaning as values of all predictors are zero outside the range of data.

Durbin–Watson. The DW statistic of 1.691 is close to 2. The number of regressors, $n = 3$, puts it in the inconclusive zone of the Durbin–Watson bounds; therefore, the Breusch–Godfrey test is considered formally to test for serial correlation, as shown in Table 3.

Diagnostic and Stationarity Tests

Table 3: Diagnostic and stationary test results (Pakistan: 2015-2025)

P-value	<0.05	<5%	Reject the null hypothesis.
ADF (level)	0.695	0.990	Non-stationary not rejected
ADF (first difference)	−1.778	0.392	Stationarity not established
Bera–Rojas	3.053	2.965	Normality not rejected
Breusch–Pagan	3.788	0.285	Heteroskedasticity not detected
Breusch–Godfrey (1 lag)	0.308	0.579	Serial correlation not detected.

Note. ADF test is used to identify the presence of a unit root in the series. Jarque–Bera null: Residuals are normal. Breusch–Pagan test: F test statistic=0.000.Breusch–Pagan test: Prob>F = 1.000. Breusch–Godfrey null: Accept. Source: authors' estimation.

The OLS assumptions are supported by the residual diagnostics. The Jarque–Bera statistic (0.661, $p = 0.719$) would not reject normality, so the t- and F-tests are appropriate in this small sample. The Breusch – Pagan statistic (3.788, $p = 0.285$) indicates that there is no heteroskedasticity, and therefore standard errors are valid. Compared to the inconclusive Durbin–Godfrey result at first order, the Breusch–Godfrey test (0.308 and $p = 0.579$) shows no first-order serial correlation and thus supports the hypothesis of independent errors.

The stationarity results are recommended with caution. The ADF statistic at level (0.695, $p = 0.990$) and at first difference (−1.778, $p = 0.392$) do not reject the unit-root null. Even after differencing, stationarity of the series is not achieved; when the series are not stationary, regression can result in spurious relationships (Granger &

Newbold, 1974). There are two mitigating factors to this worry. First, the Granger–Newbold rule of thumb indicates that a spurious regression occurs if the R^2 is greater than the Durbin–Watson statistic, and in this case R^2 (0.935) is less than DW (1.691). Secondly, there is no autocorrelation in the residuals. Despite this, since there are only 11 observations, the estimates for the coefficients are not strongly supported by the ADF test and should be interpreted as short-run associations, rather than long-run causal effects.

DISCUSSION

The primary reason behind the improvement in banking performance in Pakistan during 2015-2025 was the penetration of the internet. This result confirms that Internet delivery is profitable for banks, as it has been documented to increase bank fee income while decreasing costs (Furst et al., 2002; DeYoung et al., 2007; Hernando & Nieto, 2007; Ciciretti et al., 2009). It also supports TAM and DOI: the more connected people are, the more they will find digital banking useful and easy to use, and adoption of digital banking will shift from early adopters to the majority (Davis, 1989; Rogers, 2003). Policy measures like Raast and digital-bank licensing may have had a similar impact in Pakistan—providing payment rails that were easily accessible at low cost to connected users (State Bank of Pakistan, 2022).

GDP growth was slightly and positively linked. The direction is in line with finance–growth literature and with the work of Athanasoglou et al. (2008) and Dietrich & Wanzenried (2011), which correlates the business cycle with bank profitability. The weak significance is probably due to the small sample and the volatile growth of Pakistan, which experienced a downturn in 2020 when banks continued to make money from government securities instead of private lending.

Bank branches were not significantly associated with performance, and the sign was negative. This reinforces the RBV thesis of the diminishing strategic importance of branch networks stemming from the replacement of branches by digital channels in recent years (Barney, 1991). This aligns with the notion that returns in retail banking are not necessarily tied to physical size, but rather to technology (Hasan et al., 2012; Scott et al., 2017). Additional branches can result in additional fixed costs without corresponding return.

The non-stationarity of the series qualifies these conclusions. It is best to interpret the relations as fairly strong short-run associations with good residual diagnostics, rather than as strong long-run causal effects.

CONCLUSION

This study empirically examined whether GDP growth, internet penetration and bank branches can explain the performance of the banking sector in Pakistan during 2015-2025. All of the normality, heteroskedasticity and serial correlation tests were passed, and the OLS model accounted for 93.5% of the variation in performance. The extent of internet penetration proved to have a positive and significant effect ($p = 0.008$), while GDP growth proved to have a positive effect significant only at the 10% level ($p = 0.098$), and bank branches did not prove to have a significant effect ($p = 0.637$). The results show that a key determinant of the performance of banks in

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Pakistan's recent history is not their physical growth but digital infrastructure. Due to lack of stationarity, the results are interpreted as associations.

RECOMMENDATIONS

For State Bank of Pakistan and policymakers

- To further grow digital payment infrastructure as a means to improve sector performance and financial inclusion, such as Raast adoption and digital-bank licensing.
- Collaborate with the Pakistan Telecommunication Authority for the extension of affordable broadband and mobile internet, particularly in rural areas.
- Improve cybersecurity and consumer-protection regulations to ensure that the broader use of digital does not increase operational risk.

For banks

- Reduce new branch investments and focus more on mobile apps, internet banking and digital onboarding.
- Prune or convert poor-performing branches to advisory and/or digital-assisted service points.
- Invest in digital literacy campaigns to increase perceptions of usefulness and ease-of-use of new users.

For researchers

- Re-estimate the model using quarterly or bank-level panel data and use cointegration ARDL or panel methods.

SIGNIFICANCE OF THE STUDY

- **Theoretical:** The study combines finance–growth theory, TAM, DOI and RBV in one country-level model and demonstrates the superiority of the digital-adoption mechanism over the physical-resource mechanism for an emerging economy.
- **Practical:** It provides banks with confirmation on reallocating investment from the branch to digital channels.
- **Policy**: It offers recent data relating to the COVID-19 period and the launch of Raast, which will form the basis for the SBP's digital-finance agenda.

LIMITATIONS AND FUTURE RESEARCH

- Small sample. Eleven annual observations mean that there are only seven degrees of freedom to measure, which limits the power of the analysis and may help explain why the significance of GDP growth has been marginal.

- Non-stationarity. There is a risk of spurious association, as the ADF tests were not stationary at level and first difference. Future studies should utilize longer time series, structural-break tests (e.g., 2020) and data cointegration (Engle & Granger, 1987) or the ARDL bounds approach (Pesaran et al., 2001).

- Omitted variables. Interest rates, inflation, and bank-specific factors were not accounted for and could affect the estimates, in addition to mobile-money use.

- Aggregate measure. It is important to note that one sector-level performance indicator is not sufficient to differentiate between conventional, Islamic and digital banks.

- Single country. Results might not be generalizable beyond the context of Pakistan, and external validity can be tested by comparing with other South Asian panels.

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