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Unlocking Digital Financial Inclusion on Economic Growth: Cross-country study using panel data

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Abstract:
The present research explores the evolving trend of Digital Financial Inclusion indicators among both men and women in the Top 5 countries by GDP, covering the United States, China, Japan, Germany, and India, for 2014, 2017 and 2021, collected in the global Findex database. This paper examines the relation between DFI among both men and women and GDP growth. Panel least squares (LS), Two-stage least Squares (2SLS) and generalised method of moments (GMM) regression were utilised to estimate the secondary data. The proportion of both men and women who (i) possess a debit card, (ii) have used a digital payment method, (iii) have received payments digitally, (iv) have used or received a digital payment method and (v) possess a credit card is utilised to measure digital financial inclusion indicators. This trend analysis found a stable increase in the inclusion through digital financial services indicators over the period. Here, A minimal improvement is seen between the years 2014 and 2017, and 2017 and 2021, due to improvements in technology. The regression analysis results indicated a significant positive association exists between GDP economic development and inclusion through digital financial services indicators, excluding the merchant payment indicator, which was observed for both men and women. The results also indicate that digital platform usage has a positive and substantial impact on DFI in the top five nations by GDP.

An increase in fintech-enabled financial inclusion can lead to improved economic prosperity. There is a need for policymakers to promote investment, especially in fintech products and services, and to provide internet facilities and deployment for improved access to digital financial services and GDP economic development for the five largest economies by GDP. Spending money on fintech and improving internet access must be boosted to enhance access to technology-enabled financial services in India. The trend of technology-based financial services for men and women had not been examined previously. The relevance of DFI on GDP development for the top five nations had not been empirically investigated in previous studies. The current study bridges the aforementioned research gaps.

Keywords: *Digital financial inclusion, GDP, Economic development, panel data analysis*

Introduction:

The study develops a robust financial inclusion metric for measuring the DFI level in the leading five countries by GDP. Furthermore, the current research contributes to the influence of DFI on GDP growth by panel data analysis for these countries, covering the United States, China, Japan, Germany and India. This research develops a robust index of financial inclusion to estimate the stage of fintech-based financial services for the top 5 GDP nations.

DFI refers to enhancing fintech-based financial inclusion levels based on the effective adoption of technology. Financial inclusion defines the application of fintech, big tech, blockchain technology, and other online platforms to expand availability and utilise the formal financial

services for the vast majority of the population. (Shen, 2021). Digital financial inclusion remains extremely low in most economies due to digital and financial illiteracy, less awareness of fintech-enabled financial inclusion, and a lower phase of confidence and belief in digital technology for financial purposes. DFI has emerged as an important driver in enhancing economic growth and bringing down inequality in the global economy. Other researchers have investigated a positive interrelation between DFI and GDP growth.

Due to limited digital financial inclusion, revenue disparity and slower economic growth, they observed it (Ozili, 2024).
DFI is a blend of financial and digital inclusion. (Wang, 2023). Thus, we propose a hypothesis that digital financial access has a statistically positive association with GDP economic development. However, these studies did not investigate men's and women's digital-based financial inclusion in the top 5 economies by GDP. This research never provides a critical examination of the emerging patterns in DFI, nor investigates the role of DFI on GDP economic development for the top five countries by GDP. The present research bridges this gap, as identified in the literature survey.

Empirical analysis utilises panel least squares, Two-Stage Least Squares(2SLS), and Generalised Method of Moments (GMM) estimation techniques to mitigate endogeneity issues in the database. The results reveal a strong association between DFI measures and GDP economic development, regardless of whether men or women received digital payment measures.
This research aims to review the literature by focusing on indicators of DFI for both women and men. This research is targeting DFI for women and men in the top 5 countries by GDP. This research also adds to the previous study by connecting digital financial access services to economic development. This research aims to determine whether advancements in digital access to finance will spur the national development of the top 5 GDP nations. The research section 2 deals with a literature survey. Section 3 explains the methodological framework. Section 4 exhibits a discussion of the findings, and Section 5 deals with the final takeaways of the research.

Literature Review:
Some studies have concentrated on the trend and advancement of digital financial inclusion. Researchers have pinpointed the trend and enhancement of digital financial inclusion. Ozili (2018) Illustrated that digitally enabled financial services provide low-cost and convenient financial services for financially vulnerable groups.
Koh et al. (2018) Primarily concentrated on the trend in DFI across Southeast Asia. The researcher analysed the trends and development in digital financial inclusion between 2011 and 2014, using data that was sourced from the Global Findex Database. Researchers explored a significant shift in bank account transfer, availability and usage, as well as further deviations from the growth of banking sector technology infrastructure.
Zhao (2024) Assessed the influence of DFI on provincial and national transformation and shared affluence in China. The researcher evaluated the influence of DFI employing a structural equation modelling approach. The researcher concluded that digital financial inclusion has a favourable outcome on shared wealth among Eastern Chinese territories. He also discovered that regional innovation levels moderate the consequences of DFI on China's shared wealth. Furthermore, the researcher ultimately concluded that attempts should be undertaken to

enhance DFI and advancement driven at the regional level to promote economic development in China. Further research analysed the effect of DFI on GDP economic development.

Ahmad (2021) Studied the drastic improvement in DFI throughout China and was concerned with whether this growth has a considerable favourable consequence on economic development across China. He assessed how DFI and labour capabilities play a significant role in economic development within China. The research findings suggest that DFI and human resources exert a significant impact on GDP economic development across China. According to prior research, Xun et al. (2020) Investigated whether internet-driven digital finance contributes to promoting economic development throughout China. Researchers developed a DFI list and assessed, assuming that DFI enhance sustainable development and household income.

Across countries, Ozturk (2022) was engaged in establishing whether DFI has been a driver of economic development and environmental quality. He explored the influence of DFI on GDP, economic development and ecological conservation in OBRI nations between 2007 and 2019. The methodology utilised in the research was estimated by Ordinary Least Squares (OLS), Two-Stage Least Squares (2S LS) and Generalised Method of Moments (GMM) estimation techniques. Researchers showed that DFI boosted GDP economic development, yet reduced ecological quality by reducing CO2 emissions. Although this research investigates the interaction between DFI and a nation's improvement, this study has not widely analysed the interaction between GDP economic development and DFI among men and women from the highest 5 GDP countries. The previous studies have also not analysed the interplay between economic development and men's or women's DFI for the top five GDP economies. This literature review will bridge the gap.

Methodology:

The top 5 GDP countries' annual digital financial inclusion indicators were obtained based on the World Bank's Global Findex database. Sustainable economic development facts were obtained based on the World Bank of the World Development Indicators (WDIs). The time frame ranges only for the years 2014, 2017 and 2021.

Results:

Table 1 Pearson correlation of the variables

Correlation (p-Value)	GDPR	DC	CC	MP	MR	MRP
GDPR	1.000					
DC	-0.761	1.000				
CC	-0.816	0.902	1.000			
MP	-0.716	0.978	0.914	1.000		
MR	-0.796	0.919	0.945	0.929	1.000	
MRP	-0.726	0.984	0.929	0.996	0.945	1.000

Note: *indicates significance at the 10% level. CC = Men and Women who possess a credit card, male & female (% age 15+), DC = Men and Women who possess a debit card, male & female (% age 15+), MRP = Men and Women who made or received a digital payment transactions, female and male(% age 15+), MP = Men and Women who made a digital payment services, male & female (% age 15+), MR = Men and Women who received digital payment, female & male (% age 15+), GDPR = Real GDP growth.

Source: Author's calculation

Interpretation: The data were estimated using the panel Least Squares (LS) and the Arellano-Bond first-difference Generalised Methods of Moments (GMM) regression. These techniques were utilised to mitigate endogeneity challenges in the dataset. Table 1 represents the Pearson correlation coefficient between DFI and a nation's development. This table exhibits the correlation among both male and female engaged in digital payment (MP), received a digital payment (MR), who made or received a digital payment (MRP) transaction, possess a debit card (DD), possess a credit card (CC) and GDP economic development (GDPR). P-values are denoted in parentheses. The correlation matrix represented in Table 1 highlights a strong positive correlation between DC and MP (0.98), suggesting that debit card possession is highly associated with making digital payments. The result also indicates a strong positive correlation between DC and MRP (0.98), suggesting that debit card possession is highly associated with making financial transactions.

Alternatively, the GDP growth and DC factors have a negative Pearson correlation of -0.761. It suggests a strong inverse correlation between GDP growth and DC. It suggests that DC possession is not dealt with in the higher nations' development. Moreover, the Pearson correlation coefficient between GDPR and MP factors has a strong inverse relationship of -0.716. It suggests a strong inverse correlation between the GDP growth and the MP. It suggests that a high level of digital payments has no significant relationship with a nation's development.

Discussion:

4.1 Trend analysis of the DFI indicators and GDP Growth

The following figures illustrate the trends for DFI and GDP Economic development for the top 5 GDP economies during the years 2014, 2017, and 2021, respectively.

Regarding DFI indicators and China's GDP development rates for the years 2014, 2017, and 202, there is a marginal rise in the DFI indicators and GDP growth. There is a minimal rise in GDP compared to digital financial inclusion indicators. Policy makers focus on improving data protection regulations as the digital finance sector advances rapidly.

Regarding digital financial inclusion measures and Germany's GDP growth rates in 2014, 2017, and 2021, there is a slight increase in the usage of credit and debit cards, and the GDP growth rate is higher compared to other countries. There is a development of banking infrastructure in comparison to emerging economies.

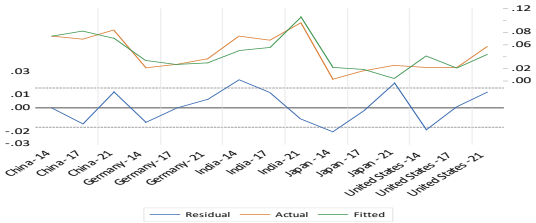
In terms of digital financial inclusion measures and India's GDP growth rate for the years 2014, 2017, and 2021. The use of debit cards has decreased due to the advancement of mobile-based transactions. Credit card usage is low, indicating that financial inclusion is still debit-based and driven by digital payments.

Regarding digital financial inclusion indicators and GDP development rate in Japan over the years 2014, 2017 and 2021. There are higher digital financial inclusion indicators, indicating a well-established digital finance system. There is an advanced banking infrastructure and a long-established history of financial inclusion.

With respect to digital financial inclusion measures and GDP development rates in the rates in United States in 2014, 2017 and 2021. There is an accelerated development in DFI indicators and GDP economic development. There is no federal data protection law.

4.2 Regression analysis of the contribution of digital financial inclusion to economic growth

4.2.1 Least square estimation: The study explains the significant relationship between the GDP growth of the top 5 countries, such as the United States, China, Japan, Germany and India, with digital financial inclusion for the years 2014, 2017 and 2021 based on the panel least square regression method.



Source(s): Global Findex and WDI

Table 2: Impact of digital financial inclusion on economic growth

Coefficient (p-value)	GDPR	GDPR	GDPR	GDPR	GDPR
DC	-0.281				
CC		-0.113			
MP			-0.182		
MR				-0.103	
MRP					0.553
t-statistic	-3.045	-2.331	-1.103	2.239	2.101
Prob (t-statistic)	0.014	0.045	0.299	0.120	0.052

Source(s): Author's computation

4.2.2 Two-Stage Least Squares (2SLS) estimation: Here, there is the immediate influence of DFI on the GDP economic development of the top 5 countries, such as the United States, China, Japan, Germany and India, during 2014, 2017, and 2021, is examined with the help of the two-stage least squares regression technique. Two-stage least squares regression evaluation is employed to remove any endogeneity from the data.

Table 3: Economic growth impacts of digital financial inclusion: Two-stage least squares (2SLS) regression

Coefficient (p-value)	GDPR	GDPR	GDPR	GDPR	GDPR
CC	-0.161				
DC		-0.321			
MP			-0.476		
MR				-0.1339	
MRP					0.984
t-statistic	-3.213	-3.062	-4.692	-1.979	6.152
Prob (t-statistic)	0.009	0.012	0.001	0.075	0.000

The outcome in Table 3 represents that the MPR variable is positively correlated with the GDP growth in the two-stage least squares estimation. It denotes that an enlarge in the number of men and women making digital payments results in increased economic growth in the top 5 countries by GDP. This indicates that the men and women receiving or making digital payments have a substantial effect on economic progress for the top 5 countries. The study result supports the study, providing documentation that DFI has substantially subsidized to GDP development.

However, the MR has no substantial influence on economic growth, as shown in Table 3, which is based on two-stage least squares estimation. The MR variable does not influence the GDPR variable as indicated by the two-stage least squares estimation in Table 3. The above results are contrary to evidence-based studies that indicate DFI has a substantial influence on GDP growth.

4.2.3 Arellano-Bond GMM estimation: This method investigates the direct effect of DFI on nation's development for the top 5 countries, such as the United States, China, Japan, Germany and India, in the years 2014, 2017 and 2021 using the Arellano-Bond First Difference GMM regression method. This technique also removes the feasible endogeneity problem. The outcome, as shown in Table 4, is that the MRP exhibits a positive coefficient and an insignificant relationship with economic development in the GMM estimation. The MP has a negative factor and depicts a significant relationship with the GDP growth using GMM estimations in Table 4. This suggests that a rise in the percentage of men and women who make digital payments accompanies higher national development in the top 5 countries. This indicates that the men and women who make digital payments are key drivers of economic growth in the top 5 countries. This finding supports the notion that DFI plays a vital role in improving GDP economic growth.

Table 4: Digital financial inclusion and economic growth: Arellano-Bond First Difference GMM

Coefficient (p-value)	GDPR	GDPR	GDPR	GDPR	GDPR
DC	-0.321				
CC		-0.161			
MP			-0.477		
MR				-0.134	
MRP					0.985
t-statistic	-3.062	-3.213	-4.692	-1.979	6.1525
Prob (t-statistic)	0.012	0.009	0.001	0.076	0.000

Conclusion:

The research study assessed the tendency DFI across the top five countries utilising five indicators of digital financial inclusion sourced in the global Findex database, including the percentage of men and women who engaged in digital payment, the rate of men and women

who executed digital payments, the rate of men and women who received digital payments, the percentage of men and women who hold credit cards and the rate of men and women who hold debit cards. The trend was estimated for the years 2014, 2017 and 2021. The study also examined the relations between digital financial inclusion and GDP development.

The trend analysis explained a stable increase in digital financial inclusion indicators during this period. There is a slight increase from 2014 to 2017 and from 2017 to 2021, due to technological improvements. The regression methods indicated a positive correlation between DFI indicators and GDP improvement, excluding the merchant payment indicator for both men and women. The research findings indicate that internet usage and availability positively influence digital financial inclusion in the five largest economies by GDP. The research findings imply that higher digital financial inclusion can expand GDP growth. Policymakers should also recommend improving asset in fintech products and improving internet availability and practice to increase men's and women's DFI and economic development for the top 5 countries by GDP. Moreover, spending money on fintech and improving internet facilities is required in India to improve accessibility for fintech-enabled financial services especially for both men and women, as well as to increase the usage of digital tools for receiving and making payments. Policymakers and practitioners in these countries ought to as well effort collectively to enhance digital financial inclusion.

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