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The Evolution Of Digital Payment Systems: India's Leading Role

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Abstract

The rise of digital Payment systems is become a crucial component of contemporary economies, allowing for easier transactions, increasing financial inclusion, and boosting economic growth. This research looks at the growth and effect of digital payment systems in India, comparing it to other rising economies including Chile, Sri Lanka, Chile, etc. Using a panel regression statistical analysis, we investigate the causes and impacts of digital payment uptake in these nations. The report shows India's pioneering position in the digital payment sector, which is fuelled by strong government regulations, technology breakthroughs, and creative financial solutions. Key results show that India's digital payment ecosystem outperforms its competitors in a number of areas, including user adoption rates, transaction volumes, and the integration of digital platforms into everyday business. Countries in our list display diverse patterns and obstacles in their digital payment development, determined by their respective socioeconomic situations. This comprehensive comparative study highlights the crucial elements influencing the viability and constraints of digital payments systems in emerging economies, providing valuable information for decision-makers in government, business, and technology improve global digital financial infrastructure.

Keywords: Digital payment systems, Panel data regression, Economic growth, Central Bank Digital Currency, Online payments.

Introduction

Digital payments have just captured a sizable portion of India's payments business, which is experiencing significant transformation. The shift from an economy dependent on cash to one that uses less paper money has begun. (Singh, 2022) The objective of a Reserve Bank of India is one that its affiliated institutions are actively pursuing digitized India. India today boasts one of the world's biggest and most rapidly growing digital payment ecosystems, due to about A billion cards and over two billion personal payment instruments (PPI)—including online wallets, smartphone applications, e-wallets, and other the use of electronic payments systems—are in circulation. In reality, the exponential growth of the internet's infrastructure fuelled e-commerce. UPI stands for Unified Payment Interface widely regarded as an innovative payment method for simplifying retail digital transactions.

One important component of a nation's financial and economic structure is payments and settlement systems. A method of payment is a clearing, settlement, or payment service that facilitates payment between two parties, a player and a payee (Kshetri, 2022). According to Humphrey and Setsuya (Humphrey, 1995), To save expenses and boost productivity, the payment system has to be updated and switched from a paper-based to an electronic one. Based on the authors' estimation, the payment system cost for any country might amount to around 3 percent of its GDP. In addition to guaranteeing optimal use of scarce resources, an effective payment system reduces systemic risks and facilitates faster liquidity movement in the economy. Similar to other aspirational

economies, India has seen rapid advancements in information technology, legislative framework modifications, and the establishment List recently established institutions. These factors have helped bring new payment methods to the fore methods, goods, and delivery routes for both small and big value, urgent payments with the growing prevalence of e-commerce in the nation's economic endeavors, a number of significant changes to the payment system will occur more quickly. (Roy & Sahoo, 2016)

Debit, credit, and prepaid cards, QR codes, E-wallets, and UPI payments are all methods of making cashless digital payments. among other methods. (Bhide, 2019) Online payment transactions. Technological advancements made it possible for digital payment options to expand. According to the Indian Reserve Bank, Indians possessed 944 million debit cards that may be used for electronic payments as of June 2018. Increased investments in fintech have had a favourable influence in all sectors, including digital payments, the smartphone technology industry, Internet adoption, and poor data accessibility. E-commerce companies indicate that 61 percent of their clients pay using debit cards. That obviously demonstrates that using debit cards for purposes other than ATM withdrawals is easy, and many online shops require debit card payment for high-value purchases, allowing e-tailers to access a wider audience.

Digital India is a government-led program to assist the nation in adopting digital technologies. Initiatives aim to reduce bureaucratic procedures, reduce corruption, and expedite public service delivery. Citizens of the nation. (Hebbar, 2020) Digital India is expected to provide long-term economic benefits for India. The Digital India Scheme focuses on technology-driven activities. The Digital India initiative focuses on the agricultural, industrial, and service sectors, which drive economic development. The program prioritizes three crucial aspects offering as a utility digital infrastructure for all residents, empowering individuals via digital means, and providing on-demand services and governance. Linking is the goal of the Digital India initiative. e-kranti, public access to the internet, mobile connection, broadband roads, early harvest initiatives, electronic manufacturing, information services for everyone, and IT for employment have connected 2.5 lakh villages around India. The effort is supported by these nine pillars.

According to industry analysts, digital payment will be a watershed moment in the domestic e- commerce business, with the existing trend of cash-on-payment domination being reversed over the next five years. (Narendra Kumar et al., 2020) According to a Google India and BCG analysis, increased expenditure by women and new Internet users from smaller cities is estimated to exceed $100 million by 2020. It is projected that the Reserve Bank of India would transform the game by implementing the Unified Payments Interface (UPI).1The near- universal availability of mobile technology, as well as the fast increasing usage of P2P payments by mobile users, are driving the worldwide rise of mobile payment services that are available internationally. The decision by the government to provide the non-tax NEFT services seven days a week, twenty-four hours a day has facilitated digital transactions.

Despite its sophistication, every country's payment system is vulnerable to hazards such as bank failures, fraud, and counter-party failures. Errors may lead to disruption and mistrust in the payment system. If a major payment transaction is not cleared, it might disrupt subsequent transactions, causing institutions to collapse and disrupt the nation's method of payment. A systematic and cascading failure of the payment system might impair monetary policy effectiveness and undermine financial system trust. Minimizing systemic risk is a significant task for regulators. The central bank of any nation takes efforts to eliminate systemic risks and promote a stable and efficient payment system. India is the top most country in digital payments. India launched so many schemes which undergoes digital payments.

Factors Behind India in Being Top on Digital Payment List

In barely a decade, (Jangid et al., 2020) With 10 times its current size, it is anticipated that the National Payment Corporation of India (NPCI) would accomplish its aim of 100 million transactions every day. The Reserve Bank of India and the Indian Banks Association (IBA) launched a combined campaign with the goal of becoming the finest. The company aims to provide payment services to all Indians via its worldwide network. The Indian Banks' Association (IBA) and NPCI was founded in 2008 by the Reserve Bank of India (RBI) with the goal of becoming the "best payments network globally" and providing payment services to all Indians. The government envisioned NPCI as a key component of India's payment and settlement infrastructure, addressing the requirement for a strong 'backbone' to digitize the economy. Stakeholders supported an entity that best suited this purpose.

The important organization that facilitates financial transactions and provides numerous services. (Kumar &

Menon Suseela, 2020) There are 10 banks that promote. controlling National Payment Corporation's activities in India. The banks that are the promoters are: SBI, Canara Bank, Bank of Baroda, ICICI Bank, Citibank, HDFC Bank, HSB, Punjab National Bank, Union Bank of India, and Bank of India etc. The National Payments Corporation in India's primary services are the Unified Payment Interface, also known as UPI, and national Bharat Bill Payment System. Payment requests and collection are made easier with UPI products. Furthermore, it facilitates non-financial services including question raising, PIN creation, one-time password creation, and mobile banking setup.

Mobile payment systems have the potential to promote financial inclusion in emerging countries. poor-income nations are distinguished by factors such as price sensitivity, poor digital penetration, and high Mobile payment use is also influenced by the risk of failure and competition in developing regions. (Sobti, 2019) study model identifies contextual facilitators (e.g. price advantage, network externalities, trust, habit) and barriers (e.g. risk, absence of enabling circumstances, operational restrictions) that influence mobile payment use intentions. Evaluating the elements that influence users' desire to continue using mobile payments is crucial for evaluating the technology's impact on financial inclusion and sustainability.

The RuPay Card has transformed India's payment environment by offering a safe and affordable substitute for traditional payment methods. The Indian payment sector has seen tremendous upheaval in the previous decade, owing mostly to the expansion of digital payments. (George, George, & Baskar, 2023) Redefining the payment landscape in India has been made possible in large part by the RuPay card. The RuPay card was created in 2012 as an alternative to popular international payment systems like Visa and Master Card. The RuPaycard is one example of a payment solution that has transformed the Indian payments environment. The Indian National Payments Corporation (NPCI) made available the RuPaycard, a domestic payment card, in 2012. The card was established with the goal of offering a low-cost, safe, and locally sourced alternative to international payment cards like Visa and MasterCard. The NPCI is a non-profit organization established up The Reserve Bank of India (RBI) oversees the nation's transactions and payment processes. The RuPay card was created with the assistance of the RBI, who required that all Indian banks give RuPay cards to their clients.

In the midst of the COVID-19 outbreak, online banking plays a crucial role in offering safe, low-cost, and contactless financial instruments to consumers and governments. Pradhan Mantri Increased access to financial institutions like banking is the goal of the Jan Dhan Yojana, a National Mission towards Financial Equality. (Somasundaram, 2020) Accounts for savings and deposits, payments, credit, insurance, and pensions plans are all available at reasonable rates. Since the start of PMJDY, women have accounted for 56% of all bank accounts. According to Finance Minister Nirmala Sitharaman, 46 crore bank accounts totaling Rs 1.74 lakh crore in deposits have been opened under the PMJDY. The initiative now covers 56% of women and 67% of rural or semi-rural regions have Jan Dhan accounts.

India has over 4.9 million street sellers, who make up A large fraction of the work force in the unorganized sector in the nation. (Mir & Wani, 2023) The increasing The increasing use of mobile payment systems including m-wallets like as Paytm, Bhim, Google Pay, PhonePe, and others might be linked to India's emphasis on the online economy and its policies promoting digital transactions. This is also true for street sellers, and seeing It's common to see street vendors accepting payments using QR codes. QR barcode stickers were often posted on street sellers' carts in Kashmir to facilitate online purchases. Meanwhile, retailers were mostly unaware about these mobile payment apps. Due to their limited language skills, they have to depend on family members or acquaintances who are literate to confirm transactions or handle administrative problems. New opportunities for digital payments were made possible by the widespread use of these smartphone apps for m-wallet or m-payment The Unified Payments Interface (UPI) (Vishnoi, 2022) A new payment method that enables quick and safe money transfers is available in India. Users may pay bills, receive payments, and make payments all on one platform. In India, UPI has completely changed the way people make payments, making them faster and simpler. Additionally, the UPI system offers various advantages, including simplicity, security, cost-effectiveness, and more. (George, George, Baskar, et al., 2023) several issues with UPI implementation exist, such as consumers' lack of knowledge regarding security and system concerns. Notwithstanding these challenges, UPI is able to transform the Indian digital payment landscape. It may provide organizations with new ways to reach out to clients more effectively. An overview of India's Unified System will be given in this article.

Many people's everyday lives revolve on smartphones. Smartphones have evolved into gadgets that allow with

software placed on their smartphones, digital users may make payments or perform financial transactions. (Apanasevic, 2013) A digital wallet is an electronic device that allows users to do business transactions, including payments. The platform is in the form of software, and all personal information is encrypted for security considerations. As the world moves towards digitization, Today's society is expected to become cashless with the introduction of the digital wallet. Individuals and smartphones have become best friends and inseparable; it is extremely simple using digital wallets and making digital payments is popular. Digital wallet, often known as E-wallets are among the burgeoning subjects in E-commerce platforms.

To limit social interaction and address concerns about the new coronavirus spreading via currency notes and ATMs, Indian Bank has urged that its clients utilise Digital Banking Service (DBS). Dr. Ellen Foxman of the Department of Laboratory Medicine said that COVID-19 spreads by minute water droplets discharged into the air when an infected person coughs or sneezes. (Kaur & Kushwaha, 2021) It is also conveyed via the surfaces with which we come into touch in our everyday lives, which is why we encourage people to avoid using conventional methods of payment for items. The National Payments Corporation of India is promoting digital payment systems such as UPI, NEFT, and mobile banking as a protection against the coronavirus pandemic. Amazon, a popular e-commerce site, has ceased taking cash purchases and instead encouraged users to make digital payments. Swiggy and Zomato, the online food delivery applications, have also pushed their clients to switch to digital payments. Prime Minister Narendra Modi's aggressive initiatives have contributed significantly to India's rise to the top of the worldwide digital payment systems rankings. Under his leadership, the government has initiated and supported a number of projects, including the acceptance of the Digital Currency and the UPI, which is the Unified Payments Interface. India program, which have which have transformed the financial sector. These measures have permitted broad use of digital payments, increased financial inclusion, and propelled India to the forefront of digital financial innovation. As a consequence, India's digital payment ecosystem serves as a model for other nations, demonstrating how government assistance and technical breakthroughs may alter financial institutions. (Sharma, 2023)

In 2014, Russia's annexation of Crimea and the resulting geopolitical tensions and sanctions highlighted the vulnerabilities of foreign technology dependence. This prompted India to accelerate its digital innovation efforts, focusing on self-reliance through initiatives like "Make in India" and "Digital India." The Indian government and RBI supported the development of domestic payment systems, with NPCI playing a crucial role. The crisis also underscored the importance of cybersecurity, leading to increased investments. Geopolitical shifts encouraged Indian tech companies to explore new markets and diversify partnerships, catalysing India's journey toward becoming a global digital powerhouse. During the Russia-Ukraine crisis, Russia faced international sanctions aimed at defusing the situation. Despite being meant to harm Russia, the sanctions imposed on it had a catastrophic impact on the worldwide economy.

Especially by disrupting global supply chains. (Kakran, 2022) Even though India had declared itself neutral, there is no hope of escape the horrors of such a large fight. India can cover its deficit by increasing wheat exports, since Russia and Ukraine have affected global wheat supplies. They are the two largest wheat exporters in the world. Consider exporting mustard oil from Rajasthan and Uttar Pradesh. The absence of SWIFT has created a hole in the market. The UPI system in India can handle this (Unified Payments Interface). UPI enables digital payments even when the user does not have internet connectivity.

Literature review

This study examines India's payment systems and compares them to those in other emerging and established nations. Following an introduction to payment and settlement systems, this work is divided into three sections. (Roy & Sahoo, 2016) The first segment highlights India's difficulties and prospects. The second section provides a review of payment methods in general, established nations (USA, UK, Europe, Japan), emerging countries (China), and India. The third section compares India's payment systems to those of selected emerging and developed nations, benchmarking them against BIS key principles.

Lamberte (Lamberte, 2001) Examining the effectiveness of the present system of payments in the Philippines, researchers found that it has been rapidly evolving lately due to persistent efforts by the Bankers' Association of the Philippines with the Federal Reserve of the Philippines to increase their effectiveness and reduce its susceptibility to systemic hazards. The newly proposed Real-Time Gross Settlement (RTGS) solution in MIPS2 (Multi-Transaction Interbank Payment solution) addresses some of the major issues with big value transfers that might lead to systemic hazards.

Sangsubhan (Hapter, 2011) noted that Thailand's payment system has undergone continuous improvement to bring it up to par with international standards. The clearing system, various e-payment systems, and its BAHTNET (Bank of Thailand Automated High Value Transfer Network) are all undergoing improvements. In order to maintain a secure environment that complies with international requirements and to take the necessary steps to join international money transfer systems, it is necessary to improve the monitoring and effectiveness of this payment system.

(Murphy, 2004) Murphy analysed payment systems within the US and concluded that operational risks are a concern for bank regulators. Concentration risk is a consequence of network providers gradually integrating with one another may lead to concerns with price, service quality, and product innovation. Bank regulators are not directly responsible for addressing this problem.

The more than 660 million news items covered by LexisNexis News & Business resulted in the (Wang et al., 2022) creation of two new indices to gauge interest in and uncertainty about Central Bank Digital Currency (CBDC) (CBDCAI). Following news on digital currency and CBDC, both indices rose. In contrast to cryptocurrencies, foreign currency, bonds, VIX, and gold, which have positive correlations with CBDC volatility, the MSCI World Banks Index, USEPU, & FTSE All-World Index have negative correlations with CBDC volatility. The financial markets are more impacted by CBDC uncertainty than by CBDC attention.

(Banerjee & Sinha, 2023) This research will showcase CBDC's Central Bank Digital Currency potential to improve monetary participation. In order to evaluate the impact of CBDC deployment on financial inclusion, formal regression modeling is being used to identify potential drivers of banking industry stability and efficiency. With payment system visibility, the CBDC should be constructed using a structural vector auto-regression model. taken into account. The suggested research may assist identify bottlenecks in India's financial inclusion efforts and construct CBDC. The suggested research may also identify the role of policymakers in optimizing consumer advantages. The paper outlines the RBI's possible involvement in ensuring the seamless implementation of CBDC. The report identifies a payment system trend in India that opens the door to beneficial CBDC implementation and customer welfare. (Raimee et al., 2021) This research by recommending and offering some implications on how service providers should enhance their product and service to guarantee alignment with students. His research technique is qualitative. A focus group interview will be done with undergraduate students. The survey found that device compatibility, convenience, simplicity of use, cashback, and rewards all had a substantial effect on digital wallet use. Use the digital wallet. Preferences with the usage of digital wallets gradually increasing in the nation, it is undoubtedly fascinating to witness the beneficial influence it has on the user and the general growth of the country's GDP in the globe.

(Civelek et al., 2021) Digital local currencies have a substantial impact on the economic situations of disadvantaged areas, choosing respondents with at least ten years of experience in disadvantaged region enterprises allows this article to meet the research objectives. The researchers have previous information about this issue, which is another argument for using this sample strategy. This study exemplifies descriptive research, as the researchers collected qualitative as well as quantitative information for it. Simply stated, the researchers' method of reporting the findings was to list the answers survey respondents gave to open-ended questions after assembling them in Microsoft Excel. All businesses want to use virtual currencies and are open to accepting transactions in these currencies, according to the data. Companies are willing to provide incentives as well as bonuses to their clients and staff in an effort to encourage the use of digital money. These findings may provide compelling evidence in favor of establishing a virtual local currency in a disadvantaged area during the Covid-19 pandemic community.

Research Gap

Research in the evolution of digital payment systems, particularly focusing on India's leading role compared to other emerging economies like Brazil, Russia, and Turkey, identifies several gaps that merit further investigation. First, while existing studies highlight India's impressive strides in digital payment adoption, there is a need for deeper analysis into the specific regulatory frameworks and policy interventions that have contributed most significantly to its success. Understanding these mechanisms could provide valuable lessons for policymakers in other developing nations aiming to replicate or adapt India's approach. Second, there are not enough thorough comparison studies that methodically examine the technological infrastructures and innovations driving digital payment systems across these countries. Such comparative analyses could shed light on transferable best practices and innovative solutions that could enhance digital financial inclusion globally.

Third, while the study acknowledges the socioeconomic contexts influencing digital payment adoption in Brazil, Russia, and Turkey, more research is needed to explore how cultural, institutional, and economic factors interact to shape digital payment ecosystems uniquely in each country. Addressing these gaps could offer nuanced insights and practical recommendations for fostering sustainable and inclusive digital payment ecosystems in diverse global contexts.

Objectives
- Examine India's Digital Payment Growth
- Compare International Digital Payment Systems
- Identify Key Drivers and Barriers

Methodology Data collection

Source: https://www.nationmaster.com/nmx/ranking/number-of-e-money-payments

The data collection for this study on digital payments in India, Brazil, Turkey, and Russia sourced from Nation Master spans the period from 2013 to 2019. Utilizing secondary data from Nation Master's rankings and statistical compilations, specific metrics such as the number of e- money payments were extracted and analyzed. The dataset captures trends and variations in digital payment adoption across these countries over the specified timeframe, providing a comprehensive overview of their respective trajectories in embracing electronic payment methods. The data collection process involved accessing and compiling publicly available statistical information from reliable sources to ensure consistency and accuracy in comparative analysis. This dataset serves as a foundational basis for conducting panel regression analysis to explore the factors influencing digital payment uptake and its impact on economic growth and financial inclusion in India, Brazil, Turkey, and Russia.

Panel regression

Panel regression is a statistical technique for data analysis that is often referred to as longitudinally or fixed effects regression where observations are made on the same entities—individuals, businesses, and nations—over a number of time periods. Panel data is distinct from cross-sectional data, which records an image at a certain moment in time. allows researchers to examine how variables change over time within each entity and across entities. Panel regression models take into account both the individual-specific characteristics (fixed effects) and time-specific variations (time effects), providing a more thorough comprehension of the connections between variables and permitting the control of unobserved heterogeneity and potential biases that could arise in cross-sectional or time-series analyses alone. This method is particularly useful in studying economic, social, and policy-related phenomena where both time-series dynamics and individual-specific effects play crucial roles in shaping outcomes.

In a panel regression analysis where the number of digital payments represents the year as the independent variable, the dependent variable, and the fundamental formula may be expressed as follows:

Digital Payments$_{it}$ $\quad$ $\quad$ $\quad$ β_1 Year$_{it}$ $\quad$ $\quad$ β_2 CountryDummy$_{it}$ $\quad$ u_{it}

where:
- Digital Payments$_{it}$ is the number of digital payments in country i at time t.
- a is the intercept term.
- β_1 the coefficient for the year, representing the trend over time.
- Year is the time variable for country i at time t.
- β_2 represents the coefficients for the country dummy variables (India, Srilanka, Chile, with India as the baseline).
- CountryDummy$_{it}$ are dummy variables for the different countries (e.g., India, Srilanka, Chile).

u_{it} is the error term, capturing the unobserved factors affecting the number of digital payments.

In this model, β_1 indicates how the number of digital payments changes over time across all countries in the study, while the dummy variables account for country-specific effects.

Regression analysis

Panel data regression is a kind of longitudinal data that tracks variables observed for many entities across time. Panel data may be processed using pooled ordinary least squares, albeit the results may not be optimal. Similar to the fixed impact and random variables models, panel data regression models may include developed as a result of The constant or random variable's ability to record variations in time and cross-sections. Furthermore, panel data is more efficient at drawing conclusions since it generates a higher number of observations therefore

degrees of freedom and has a larger number of variables. Furthermore, panel data generally reduces autocorrelation and multicolinearity problems in comparison to time series analysis, improving the accuracy of econometric calculations.

Table 1 Regression model

Source	SS	df	MS	Number of obs	=141	
				F(1, 139)	=13.42	
Model	3.11E+11	1	3.11E+11	Prob > F	=0.0004	
Residual	3.22E+12	139	2.32E+10	R-squared	=0.088	
				Adj R-squared	=0.0815	
Total	3.53E+12	140	2.52E+10	Root MSE	=150000	
noofdigita~s	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
id	16312.7	4453.68	3.66	0.000	7506.975	25118.42
_cons	-55487	27742.3	-2	0.047	-110338.5	-635.4397

The regression analysis findings, together with a statistical overview of the model that was employed, are displayed in the table. A sample of 141 observations was used for the analysis. The F-statistic indicates that the predictive value is statistically significant value of 13.42 and the accompanying p-value (Prob > F) of 0.0004.

Total sum of squares (SS) for the model is 3.53E+12, which is divided into the residual sum of squares (3.22E+12) and the model sum of squares (3.11E+11). The model's mean squares (MS) are 2.32E+10 for the residual and 3.11E+11 for the model, respectively, based on 139 degrees of freedom for the residual and 1 degree of freedom (df) for the regression. Approximately 8.8% of the diversity in the dependent variable can be explained by the model, with an R-squared of 0.088. variable. At 0.0815, the adjusted R-squared value, which takes the number of predictors within the model into account, is marginally less. The standard deviation for the residuals is represented by the Root Mean Squared Error (Root MSE), which is 150,000.

Additionally, the table gives the predictors' coefficients, p-values, t-values, standard errors, and 95% confidence ranges. The predictor 'id' has a t-value of 3.66 with a highly significant p-value of 0.000, based on its coefficient of 16,312.7 and standard error of 4,453.68. This shows that one of the dependent variable's important predictors is 'id'. The 'id' coefficient has a confidence interval that spans from 7,506.975 to 25,118.42. The constant term (_cons) is similarly statistically significant, with a confidence interval spanning from -110,338.5 to -635.4397. Its coefficient is -55,487 with a standard error of 27,742.3, a t-value of -2, and a p-value of 0.047.

FEM and REM, Hausman test results:

Fixed Effect Model

A commonly used model in panel data analysis is the Fixed Effects Model (FEM). Technique used to account for factors that change over time but vary between entities (people, businesses, nations, etc.). It makes the assumption that the independent factors and individual-specific effects are associated. FEM focuses on capturing the influence of elements that vary over time within an entity by removing the effect from time-invariant features. FEM's ability to handle unobserved heterogeneity is its main advantage, especially when it is persistent across time and correlated with the variables that are not independent.

Table 2:Fixed Effect results

Fixed-effects (within) regression	Number of obs	=	141
Group variable: id	Number of groups	=	10
R-sq: within = 0.0856	Obs per group:min =		14
between = 0.0012	avg =		14.1

overall = 0.0620				max =	15	
F(1,130)	=	12.17				
corr(u_i, Xb)	= -0.0020			Prob > F	=	0.0007
noofdigita~s	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
_cons	-1.96E+07	5624838	3.48	0.001	-3.07E+07	-8462125
sigma_u	87077.57					
sigma_e	134568.78					
F test that all u_i=0: F(9, 130) = 5.86				Prob > F = 0.0000		

The table displays the outcomes of a fixed effects regression analysis, with a specific emphasis on the variable "noofdigits". The constant term (_cons) has a coefficient of -1.96E+07, with a standard error of 5,624,838. This shows a result that is statistically significant (p < 0.001). This suggests a detrimental starting point for the dependent variable while all other factors remain consistent. The confidence interval for this constant extends from -3.07E+07 to -8,462,125, providing more evidence of the significance of this estimate.

In addition, the table presents the estimated values for each of the variance components, with sigma_u being 87,077.57 and sigma_e being 134,568.78. These estimates offer valuable information on the range of differences inside and among entities in the dataset. This information is crucial for comprehending the degree to which the facts and the model match fundamental structure of the data. In summary, the findings provide a strong model that accurately considers fixed effects in the study.

Random Effect Model:

The Random Affects Model (REM), which uses panel data similarly to the FEM, makes distinct assumptions about the effects that are particular to each person. REM makes the assumption that the entity-specific consequences are random and uncorrelated with the independent variables. It makes sense when variation in various aspects is taken to be random without any connection to the predictors. REM is more efficient than FEM if the assumptions it makes about within-entity and between-entity variances are true.

Table 3: Random Effect

Fixed-effects (within) regression		**Number of obs**	=	141		
Group variable: id		**Number of groups** =		10		
R-sq: within = 0.0856		**Obs per group: min =**		14		
between = 0.0012		**avg =**	14.1			
overall = 0.0620		**max =**	15			
		Wald chi2(1)	=	12.25		
corr(u_i, Xb) = -0.0020		**Prob > chi2**	=	0.0005		
noofdigita~s	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95% Conf.**	**Interval]**
_cons	**-1.96E+07**	**5604327**	**3.49**	**0**	**-3.06E+07**	**-8593805**
sigma_u	**84983.436**					
sigma_e	**134568.78**					

The results of the model with random effects are shown in the table, giving the estimated coefficients as well as statistics for the predictor variable, "noofdigita~s." The constant component (_cons) has a coefficient of -1.96E+07, suggesting a statistically significant negative intercept. The coefficient has a robust standard error of 5,604,327 with a z-value of 3.49, resulting in a p-value of 0. This provides compelling information against the hypothesis that is null. The range of confidence for this constant extends from -3.06E+07 to -8,593,805, providing additional evidence of the importance of this value.

In addition, the table presents the standard deviations for the random effects, with sigma_u being 84,983.44 and sigma_e being 134,568.78. These figures represent the fluctuation in the random effects and the remaining errors, respectively. In summary, the table demonstrates a model that fits well, emphasising the significant

contribution of the random effects within capturing unobserved variations in the data.

Hausman Examination:

When deciding whether statistical method—REM or FEM—is better suited for a given panel data set, the test performed by Hausman is used. The null hypothesis for the Hausman test is that REM is the better model, whereas the alternative hypothesis is that FEM is more suitable. The test's objective is to ascertain if repressors and distinct errors are correlated, or individual-specific effects.

Table 4 Hausman Test

Dependent variable	p-value	Chi-square test	Test of summary
noofdigita~s	0.001	0	Fixed effect Test

The table displays the outcomes of The Hausman test is used to assess the coherence of estimators for panel data models, particularly when comparing fixed effects with random effects. The analysed variable is "noofdigits," and its p-value is 0.001, suggesting a statistically important result. Value of the Chi-square test is recorded as 0, indicating a preference for the fixed effects model above the random effects model in this specific dataset. The title "Fixed effect Test" signifies the evaluation of the suitability of the fixed effects technique, which is crucial for providing accurate and valid estimations in the analysis. These results emphasise the significance of model specification with statistical analysis, assisting researchers in choosing the most appropriate strategy for their data.

Comparison between the countries among digital payment using line plot:

Through the use of a line plot, it is possible to efficiently compare digital payments across several nations over time. This is accomplished by presenting the patterns for each country on the same diagram. The quantity of digital payments is shown over the x-axis, while the amount of years is displayed along the y-axis. at the scale. Every line on the plot represents a distinct nation, which makes it possible to make a visual comparison of the increase or decrease in the use of digital payment methods across nations throughout the course of the selected time period. This visualization assists in the identification of patterns, such as which nations have the largest growth rates or if particular countries had dips. Additionally, it emphasizes disparities in the acceptance and use trends of digital payment methods across the countries.
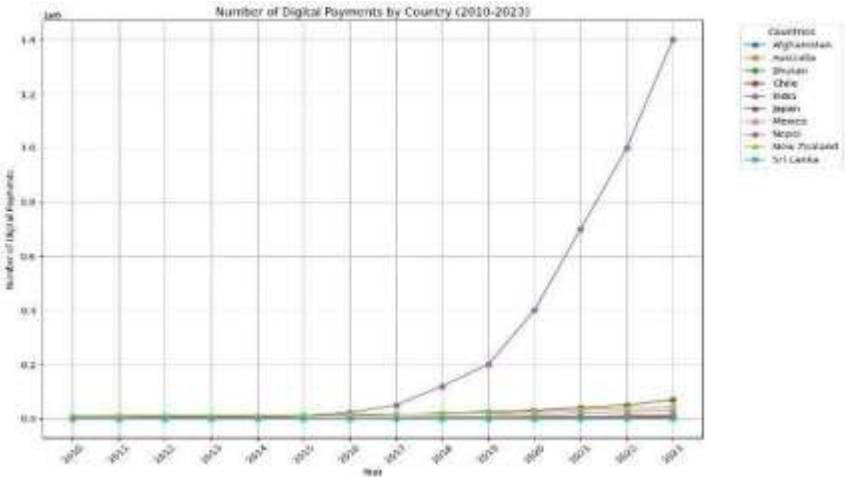
The line graph "Number of Digital Payments by Country (2010-2023)" shows how digital payments have increased over a 13-year period in different nations. The quantity of digital payments is displayed on the y-axis, and the x-axis depicts the years 2010 through 2023. Afghanistan, Australia, Bhutan, Chile, India, Japan, Mexico, Nepal, New Zealand, and Sri Lanka are the nations shown in the graph; each is shown as a distinct coloured line in the legend on the right.

The graph's most striking finding is the exponential growth in digital payments that India has experienced from 2015, when it began to rise sharply and continued to do so until 2023. India will have over 1.4 million digital payment users by 2023. On the other hand, throughout the same time period, digital payments growth in the

other countries is very moderate and consistent. For example, by 2023, Australia and New Zealand—two of the nations with the highest values—will have received about 200,000 and 150,000 digital payments, respectively. Afghanistan, Bhutan, Chile, Japan, Mexico, Nepal, and Sri Lanka are among the other nations with significantly lower figures, typically staying below 100,000 digital payments.

India has experienced substantial development, which is probably due to a combination of factors including increased smartphone penetration, government initiatives, and the widespread use of digital payment platforms. In the meantime, variances in digital infrastructure, adoption rates, and regulatory regimes may be the cause of other countries' steady growth. The graph, taken as a whole, emphasises India's supremacy in the digital payment space throughout the previous ten years.

Discussion

India (shown in purple) exhibits an amazing exponential rise in digital payments beginning about 2016, with a notable uptick starting in 2018. India has significantly outpaced all other nations, with over 1.4 million digital payments made by the year 2023. The government's promotion of digital transactions, demonetization, and the growth of digital payment platforms are some of the causes of this.In contrast to India, the growth rates of Afghanistan, Australia, Bhutan, Chile, Japan, Mexico, Nepal, New Zealand, and Sri Lanka have been far more moderate. Digital payments have gradually increased in several nations, although none have reached the size of India, New Zealand, Australia, and Japan (shown in orange, brown, and yellow, respectively) all exhibit modest rising trends, suggesting a gradual but steady uptake of digital payments. Between 2010 and about 2015–2016, the amount of digital payments for several countries was virtually unchanged. This implies that early in the past ten years, the adoption of digital payments was rather sluggish.

Conclusion

Notably, India stands out for its exponential increase, particularly from 2018 onwards, demonstrating the important role that government regulations, growing internet penetration, and technology improvements play in promoting the adoption of online payments. However, in contrast, more progressive expansion has been demonstrated by Afghanistan, Australia, Bhutan, Chile, Japan, Mexico, Nepal, New Zealand, and Sri Lanka. This implies that although various countries are adopting digital payments, the rate and scope of adoption differ significantly. Though at varying rates, the patterns shown in this graph suggest that digital payments are becoming more and more important on a global scale. India's explosive economic expansion is a prime example of how smart policies and better infrastructure can greatly increase e-commerce. It is anticipated that the amount of digital payments would increase internationally as measures are put in place and technology keeps developing, which will lessen the need for cash and improve financial inclusion. Numerous reasons have helped to cause a considerable increase in digital payments, particularly in India. The government's efforts to promote a cashless economy, including the 2016 demonetization that compelled many people to transition to electronic payment methods, have been one of the key components. Furthermore, the Unified Payments Interface (UPI), which offers a smooth, quick, and secure platform for digital payments, has completely changed The manner in which transactions are completed since its inception and widespread use.

Furthermore, the development in digital payments has been greatly aided by The pervasiveness of smartphone use and the affordable internet availability. Higher usage rates result from lowering adoption barriers for digital payments as more individuals have access to these technologies. This is especially the case with India, where internet connectivity and smartphone adoption have had expanded throughout the previous 10 years.

Conversely, a number of variables, such as varying degrees of internet penetration, technological infrastructure, legal frameworks, and consumer behaviour, could account for the slower growth rates in other nations. For example, the shift to digital payments is happening gradually in nations like Japan, which has historically had a robust cash-based economy. Comparably, in less developed nations, a not being able to obtain financial services and technology may impede the quick uptake of digital payments.

Moreover, adoption rates are significantly influenced by cultural variables and confidence in digital payment systems. People who live in some areas could still prefer cash because they don't trust digital services or are worried about cybersecurity. The adoption of digital payments is probably going to pick up speed when these issues are resolved with improved security and greater knowledge.

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