

OTDK-dolgozat

2025

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
FACULTY OF ECONOMIC AND SOCIAL SCIENCES



**INTEGRÁLT ZÖLD PÉNZÜGYEK: ZÖLD PÉNZÜGYEK ÉS PÉNZÜGYI IN-
TEGRÁCIÓ INDIA ÉS MÁR BRICS ORSZÁGOK FELTÖREKVŐ PIACAIN**

**INCLUSIVE GREEN FINANCE: A STUDY OF GREEN FINANCE AND FI-
NANCIAL INCLUSION ON THE EMERGING MARKETS OF INDIA AND
OTHER BRICS COUNTRIES**

KUMAR PAWAN

Konzulens: Dr. Novák Zsuzsanna Éva

Kézirat lezárásának dátuma: 2023. 11. 02

Abstract

Historically, green finance and financial inclusion were considered separate topics. However, this study reveals meaningful insights about them and their usefulness in emerging markets with the help of the Indian market and other BRICS nations. Vulnerable groups targeted for financial inclusion are disproportionately affected by environmental risks and contribute to mitigating environmental change. Thus, a holistic approach is needed, combining green finance and financial inclusion policies into an integrated inclusive green finance (IGF) approach. This recognizes the interdependence of environmental and social factors, empowering marginalized groups to participate in sustainable economic activities and enhancing their resilience. Bridging these concepts fosters a more inclusive and sustainable financial system. The study examines and compares the performance of BRICS countries in the field of financial inclusion and green finance using IMF, World Bank, and Climate Bonds Initiatives statistics between 2017 and 2021 with the help of principal component analysis. The aim of the comparative examination is to give recommendations to policy makers. As best practice a Case study of West Bengal is presented to support the importance of this approach, the combination of social and green perspectives.

Keywords: *Green Finance, Green Bonds, Financial System, Financial Inclusion, Fintech, Emerging Markets, BRICS, India, Global Trends, Environment.*

Table of Contents

1. Introduction.....	5
2. Methodology	9
2.1. Theory of Principal Component Analysis (PCA)	9
2.1.1. Standardization of the Data	10
2.1.2. Calculating Covariance	10
2.1.3. Eigenvectors and Eigenvalues	10
2.1.4. Selecting Principal Components	11
2.1.5. Data Projection	11
2.2. PCA to Study Inclusive Green Finance	11
3. Literature Review	12
3.1. Green Finance	12
3.2. Green Bonds.....	13
3.3. Financial Inclusion.....	14
3.4. FinTech	16
4. Current Situation – Global Trends and BRICS Countries	18
4.1. Current Situation of Green Finance	18
4.2. Current Situation of Green Bonds.....	20
4.3. Current Situation of Financial Inclusion and FinTech.....	23
5. Analysis.....	29
5.1. For the Year 2014	29
5.2. For the Year 2017	30
5.3. For the Year 2021	31
5.4. Variation in Principal Components.....	33
6. West Bengal: A Case of Balancing the Financial Inclusion and Green Finance	34
6.1. Initiatives Implemented in West Bengal	34
6.1.1. Kisan Credit Card.....	34
6.1.2. Financial Support through NABARD	35
6.1.3. Weavers Credit Card (WCC)	35
6.1.4. GOI Scheme	36
6.1.5. Small Finance Banks, NBFC – MFIs, NBFCs, NGO-MFIs	36
6.1.6. Sustainable Transportation Initiative.....	37
6.1.7. Swachh Bharat Mission.....	37
6.1.8. Clean Energy Mission	38
6.1.9. Efficient Energy Resources and Green Buildings	38
6.2. Impacts of the Initiatives.....	38
7. Conclusion	40
8. Limitations and Future Scope	41
8.1. Limitations	41
8.2. Future Scope	41
9. Figures.....	42
10. References.....	52
11. Appendices.....	57
11.1. Correlation Matrix for Year 2014	57
11.2. Correlation Matrix for Year 2017	58
11.3. Correlation Matrix for Year 2021	59
12. Annexures	62
12.1. Year 2014.....	62
12.2. Year 2017.....	63
12.3. Year 2021	64

List of Figures

9.1.	Inclusive Green Finance.....	42
9.2.	Global GVA from Green Financial Services, under NZE2050 scenario.....	42
9.3.	A view of Global Productivity (USD)	42
9.4.	Global Green Index (BRICS Nations)	43
9.5.	Global Green Bonds by Issuers Type (Billions USD)	43
9.6.	Annual Global Green Bonds Issuance compared to SSS Bonds (Bn USD)	43
9.7.	Green Bond Issuance Per Unit GDP (%)	44
9.8.	BRICS Nations' Cumulative Green Bond Issuance	44
9.9.	Total Green Bond Issuance of emerging markets (Bn USD).....	44
9.10.	Local Currency Bond Curve (Sovereign, India)	45
9.11.	Account Ownership Rates (Adults with an account %, 2021).....	45
9.12.	Adults with an account (High Income Vs. Developing Nations), 2014-2021	45
9.13.	Adults having Bank Accounts in BRICS (%).....	46
9.14.	Number of Commercial Bank Branches in BRICS Nations	46
9.15.	Number of ATMs in BRICS Nations.....	46
9.16.	Outstanding Deposits and Loans with Commercial Banks in BRICS (% of GDP).....	47
9.17.	Adults owning Credit and Debit Card (BRICS)	47
9.18.	Mobile Money Account (% , age > 15)	47
9.19.	Internet Access in BRICS	48
9.20.	Digital in-store merchant payment (%).....	48
9.21.	PC1, PC2, and PC3 Matrix for Year 2014.....	48
9.22.	PC1, PC2, and PC3 Matrix for Year 2017	49
9.23.	PC1, PC2, and PC3 Matrix for Year 2021	49
9.24.	Variation of Principal Components.....	50
9.25.	Banks Branch Network in West Bengal	50
9.26.	West Bengal's Credit Flow Trends (Crore, INR)	51

1. INTRODUCTION

Since the 1950s, the ecological and environmental concerns have taken the forefront in the discussions of global economic growth and numerous reports and documents have been released to encourage the growth of the sustainable and green economy. The enormous expense of resources and the environment is the driving force behind the fast expansion of the world economy. The global economy has just entered a period of profound change, and issues including energy scarcity, environmental pollution, and ecological deterioration have steadily surfaced. Aside from doing permanent harm to the ecosystem and ecological balance, indiscriminate economic growth techniques and disregard for nature's rules have also consistently harmed people's physical and mental health while degrading the environment. Among the various elements that encourage the growth of a sustainable and green economy, green finance has a significant role, with green bonds taking precedence. In this paper, the term "green finance" encompasses a broad range of financial activities aimed at facilitating investment in environmentally sustainable initiatives. These financial endeavours leverage innovative instruments to address climate change, bolster environmental conservation, and promote green growth and governance. Major financial institutions from all around the world have taken notice of its invention as a new financial development model that may support economic sustainability.

In order to build a clean, low-carbon, secure, and efficient green development system and to support green economic growth, the core principles of green finance are to put an emphasis on environmental pollution control and eco environmental protection in financial operations. The developing and emerging economies having limited technical development, have chosen the economic benefits at the stake of ecological resources, resulting in environmental degradation. For instance, the majority of BRICS, MINT, and G7 economies are established and intricately connected with substantial environmental degradation. Nevertheless, given the predominant reliance on fossil fuels within their production processes, the prospect of effectively reducing carbon dioxide emissions in these economies appears unfeasible (Emblemsvag, 2022; Alola and Onifade, 2022). However, it is widely considered to balance the economic growth with environmental preservation. It leads to improve funding mechanisms for achieving the financial targets of sustainable green energy projects continue to motivate the activities of BRICS nations among others. Notably, China has made substantial strides in enhancing its green financial system, marked by continuous innovation in green financial products and the attainment of significant outcomes. China's 13th five-year plan (2016–2020) underscores the imperative of constructing a robust green financial system, incorporating green credit and green securities, and establishing a green development fund to further advance these objectives.

The adoption of the "Equator Principles" by Industrial Bank, a forerunner and proponent of green finance in China, was formally declared on October 31, 2008, when it was named the first Equator Bank in the country (Liu Chao, 2022). This accelerated the development of green finance in China.

Another important member of BRICS, India's climate targets for 2030, as submitted under the Paris Agreement, encompass a 45% reduction in its economy's emission intensity relative to 2005 levels. Additionally, these targets involve boosting the proportion of non-fossil fuel-based energy resources to constitute half of the total installed capacity. For financing environmentally friendly initiatives and the shift to a low-carbon economy, green bonds are sustainable financial instruments. In the starting of 2023, India launched the initial portion of its inaugural sovereign green bond, and later the Government of India unveiled its intention to issue a fund, in sovereign green bonds to expanding renewable energy production and reducing its carbon intensity by promoting renewable energy and electrification of transport systems (RBI, 2022).

The green bond market has had rapid expansion since 2015 and, as of 2020, had issued USD 1 trillion worth of bonds cumulatively, although it still makes up a very tiny portion of the global bond market. Green bonds need to win over investors' confidence to ensure market expansion and the availability of funding for the changeover. Greeniums, or premiums for green bonds, indicate investors' trust in and preferences for these financial products.

The US issues considerably more green bonds each year than other nations because of the industry's early inception and stable market structure. China now ranks second in the world for the issuing of green bonds, in part due to the recent popularization of the idea of a green economy and low-carbon environmental protection. However, there are significant disparities between the green bond markets in China and the United States because of the issuer, the issuing process, financial oversight, and other elements. The role of good governance is indispensable in assessing financial progress and advancing sustainable development. Regrettably, it is a frequently overlooked aspect in discussions surrounding environmental quality. Furthermore, the quality of institutions plays a pivotal role in incentivizing the adoption of green energy resources, encouraging green investments, and fostering favourable global trade practices (Lin et al. 2019).

A well-developed and inclusive financial sector carries significant advantages in terms of mitigating information and transaction expenses, consequently shaping the propensity for technological innovation and investment. The concept of financial inclusion is centred on ensuring that suitable and cost-effective financial services and products are accessible to both businesses and individuals. This facilitates their ability to access credit, insurance, engage in financial transactions, facilitate payments, and build savings (Ozturk and Ullah, 2022).

Importantly, the World Bank has identified financial inclusion as a catalyst for achieving the seventh goal among the 17 Sustainable Development Goals (SDGs). Financial inclusion holds the promise of making substantial strides in diminishing income inequality, enhancing the well-being of countless individuals, and alleviating poverty on a global scale. The emergence of Information and Communication Technology (ICT) has notably democratized access to financial inclusion, rendering it more attainable, cost-effective, and convenient for individuals across the world. The development of innovative financial technologies, including mobile banking, digital wallets, and online payment systems, owes its existence to ICT, amplifying the reach of financial services and expanding financial inclusion opportunities (Pradhan et al., 2021). Furthermore, Fintech, a portmanteau of "financial technology," encompasses the innovative technologies applied in the realm of financial services, which have the potential to revolutionize the manner in which financial transactions are executed. This domain introduces novel business models and applications, often provided by online enterprises or financial institutions, leveraging technologies such as the internet, mobile internet, big data, artificial intelligence, and more (Vergara and Agudo, 2021). Fintech is at the forefront of shaping the future of financial interactions and services, offering unprecedented convenience and efficiency in the financial landscape to promote financial inclusion at greater pace (Croutzet and Dabbous, 2021).

The promotion of financial inclusion has unlocked new avenues for small businesses to access credit that was previously inaccessible through conventional financial means. This accessibility, in turn, contributes to heightened productivity and expedites overall development (Lee et al., 2020). Additionally, findings from Ho Chi Minh City in Vietnam underscore that financial constraints represent a substantial obstacle for residents when opting for cleaner household energy solutions (Baulch et al., 2018).

The rapid advancement of digital technology has paved the way for the broader provision of financial services to small and micro-enterprises in rural regions of BRICS nations. Consequently, the remarkable strides in digital financial inclusion can be seen as emblematic of the progress in financial inclusion within China, one of the member states of BRICS (Fungacova and Weill, 2014). This transformation underscores the potential to extend the benefits of financial inclusion to traditionally underserved and remote areas, contributing to the broader economic development of the nation.

Empirical evidence suggests that the expansion of the internet in BRICS nations has served as a catalyst for economic growth and industrial advancement (Lai et al., 2022). However, this growth has been accompanied by a notable adverse impact on energy consumption. The BRICS consortium's shift towards a green financial system receives substantial impetus from the burgeoning fintech sector.

Fintech platforms expedite the mobilization and allocation of funds for environmental projects, streamlining the process. Furthermore, the profitability of fintech enterprises stands to benefit from the backing of green bonds, which also serve as a conduit for sustainable, long-term green development initiatives. This synergy between fintech and green finance has the potential to drive positive environmental and economic outcomes.

Until now, academic and policy literatures have been considering Green Finance and Financial Inclusion as two completely different and immensely unrelated concepts. Similarly, central banks and other financial regulators have majorly deal with green finance and financial inclusion as two separate agendas, with two separate teams working on these issues. However, there are considerable overlaps between green finance and financial inclusion as the major focus groups for financial inclusion leads to be disproportionally exposed to the impacts and risks of the global environmental changes and effectively contributes to mitigating the changes.

The intersection of financial inclusion with green development objectives, the enhancement of the effectiveness of green finance, and the promotion of economic development pose significant challenges that demand thoughtful solutions. These issues are pivotal in realizing sustainable and environmentally friendly economic progress.

This paper helps to understand the concept of Inclusive Green Finance considering two different participants the green finance and financial inclusion majorly focused on BRICS. This paper starts with explaining the green finance, its implications, and global trends in depth. In addition to it, evolution of green bonds, their implications and their tendencies in India and other BRICS are discussed in detail. Furthermore, the other major participants i.e., financial inclusion and FinTech are discussed in detail to understand their executions and reach in BRICS nations. Principal Components Analysis (PCA) helps to identify the relationship between the factors selected from green finance and financial inclusion. The movement of the principal components along the selected time period further add insights to the development of inclusive green finance in BRICS nations. The case study of West Bengal (a state of India) helps us to understand (theoretically) the importance of the green finance and financial inclusion. It tries to exemplify the pragmatic approaches and measures being taken into account for developing financial inclusion and green finance simultaneously to enjoy the synergy named as Inclusive Green Finance.

2. METHODOLOGY

This study is secondary data based. In the course of conducting a comprehensive analysis, this study gathered, cited, and arranged a significant amount of literature in order to develop a thorough understanding of the growth, history and market position of green finance and green bonds at both the national and global levels. It also summarized and organized the pertinent basic insights and the general terminology of green finance and financial inclusion, which improved the theoretical underpinnings of the article.

To underpin the theoretical justification of the importance of these new trends of modern finance, the study collects data from all relevant sources including websites of World Bank, IMF, Climate Bond Initiatives, Global Green Growth Institute, and published reports of Amundi, ARUP, International Finance Corporation, Climate Bond Initiatives, and FINDEX. Data are analysed with the help of Correlation Matrix and Principal Component Analysis (PCA) method. The tools used for analysis are Micro Soft Office (MS Excel) and Gretl. For the analysis, two types of data are used i.e., financial inclusion data set (for instance, number of Banks and number of ATMs in a nation per 1000 km² or 100000 adults, access to debit and credit cards) and green finance data set (for instance, Global Green Index, a holistic green index derived from other green finance factors including issuance of green bonds, Social Inclusion, Natural Capital Protection, Sustainable resources and Green Economic Opportunities).

The emerging markets of BRICS nations (Brazil, China, India, Russia, and South Africa) are playing a significant role in the global economy. Therefore, the study has chosen these nations and analysis majorly focuses on five BRICS nations (Brazil, China, India, Russia, and South Africa).

Due to limited availability of data, this analysis covers the three major years including 2014, 2017 and 2021. For few specific factors, data is available for specific years i.e., 2018 to 2022 and these years' data is used to analyse and comparing the trends in BRICS nations. This study also supports the idea of Inclusive Green Finance with the approach of case study. For conducting the case study analysis, one Indian state with lower ranking in environmental impacts has been selected. Therefore, this case study proves the ideology of IGF and the requirements of its practical implementation as well.

2.1. Theory of Principal Component Analysis (PCA)

Principal Component Analysis, often referred to as PCA, is a valuable technique used in data analysis to simplify and reduce the dimensionality of complex datasets. Its primary objective is to transform a dataset with numerous variables into a smaller set of variables, known as principal components, while preserving the essential patterns and structures in the data.

The process involves several key steps:

2.1.1. Standardization of the Data

To start, PCA centers the data by subtracting the mean from each variable. This step ensures that the new components are uncorrelated and have an average value of zero. The aim of this step is to standardize the range of the continuous initial variables so that each one of them contributes equally to the analysis.

$$Z = \frac{(Value - Mean)}{Standard\ Deviation}$$

Once the standardization is completed, all the variables will be transformed to the same scale.

2.1.2. Calculating Covariance

PCA computes the covariance matrix of the centered data. This matrix captures the relationships and variations among the variables. Diagonal elements represent the variance of individual variables, while off-diagonal elements show the covariances between pairs of variables. The goal of this action is to understand precisely how the variables in the input data set diverge from the mean in relation to each other, or to figure out if there is any connection between them. Because variables are sometimes so highly correlated that they comprise unnecessary data. So, to find these correlations, it becomes important to compute the covariance matrix.

- If covariance is positive, then: the two variables increase or decrease together (correlated)
- If covariance is negative, then: one increases when the other decreases (Inversely correlated).

2.1.3. Eigenvectors and Eigenvalues

The technique proceeds by determining the eigenvectors and eigenvalues of the covariance matrix. Eigenvectors represent the directions along which the data varies the most, while eigenvalues indicate the magnitude of that variance along each eigenvector. Eigen values and eigen vector are calculated to determine the principal components.

Principal components represent novel variables derived as linear combinations of the original variables. The process of creating these combinations ensures that the new variables, known as principal components, are uncorrelated. Additionally, it's designed

to capture and retain most of the vital information from the initial variables, effectively condensing the essential data into the initial principal components.

2.1.4. Selecting Principal Components

The eigenvectors are ranked based on their corresponding eigenvalues in descending order. This ranking helps identify the most significant directions of variance. The top-ranked eigenvectors, the principal components, are selected to form a new feature space with reduced dimensions.

2.1.5. Data Projection

The original data is then projected onto this new feature space defined by the principal components. This projection reduces the dimensionality of the data while retaining the most critical information, as the principal components capture the essential patterns and variances present in the original dataset.

2.2. PCA to Study Inclusive Green Finance

Principal components analysis is a versatile tool. To study the Inclusive Green Finance, there are numerous factors that need to be considered from two major domains i.e., Green Finance and Financial Inclusion. With the help of PCA, these factors are combined and categorised into few principal components for reducing the data complexity, noise, and chaos of handling various factors. The principal components with determined eigen values and eigen vectors help us to understand the loading of the selected factors. These PCs selects few factors from financial inclusion and few from green finance to give us a one common indicator as PC1, PC2 and so on so forth depending on the data coverage. Performing this analysis on different time-period helps to understand the movement of the PCs for selected countries and further helps us to understand the development of inclusive green finance in these countries.

3. LITERATURE REVIEW

3.1. Green Finance

Early scholars and researchers regarded green finance as "environmental finance," "ecological finance," and "sustainable finance" when it was first studied in the 1980s. Green finance is considered as a cutting-edge financial tool for long term economic and social development (Salazar, 1998). It emphasizes ecological growth and environmental conservation more than standard financial tools do. The growth of green finance is essential to achieving economic sustainability because it may successfully encourage the coexistence of the economy and the environment.

The World Bank defines green finance as "financial support for projects that protect the environment, address climate change, and promote sustainable development. This includes investments in renewable energy, energy efficiency, sustainable agriculture, and green infrastructure (World Bank, 2021).

The core of green finance is that sector of the financial industry which, by utilizing financial tools, fosters the green growth of the economy and thereby addresses the environmental issue (Eric Cowan, 1999). It is a type of financing that strives to protect the environment, enhance environmental quality, and reduce environmental risk (Labatt and White, 2002). Green Finance as a financial innovation designed to balance environmental risks and investment rewards. It is built on the idea of environmental conservation. When undertaking manufacturing and operations, green finance can encourage businesses to make the optimal choice by thoroughly evaluating the environmental impact of the operations on the outside world as well as environment. It serves as a significant example of the financial sector's dedication to social and environmental responsibility (Scholtens, 2006).

Green finance should include a green financial system, funding for green policies, investments for environmental conservation, and a thorough explanation of green financial instruments (Lindenberg, 2014). It is a methodical way to involve the financial industry in the transition to a low-carbon and resource-efficient economy that encourages investment in ecological infrastructure and the adoption of energy efficiency and emission reduction technologies (Sounderrajan and Vivek, 2016). Low carbon and green growth can be achieved by lowering environmental pollution, enhancing energy and resource efficiency, and promoting the green transformation of the economic structure. Considering the high risk and poor return features of investments in green energy projects, green finance can be understood as a mix of a green modern assured plan and a tax return from spill overs from the green energy supply (Taghizadeh and Yoshino, 2019).

Distributed ledger technology was utilized to increase the transparency of green money while lowering the risk associated with green finance. This increased a project's profitability and enticed more private capital to engage in the venture. Green finance actively develops a market environment

that try to make a balance between the traditional and green economies (Falcone, 2020). This enables the development of sustainable economies to proceed more quickly. The effect of green financing on environmental quality varies depending on the degree of economic growth (Zhou et al. 2020), Green finance has the potential to considerably enhance the bond between economic growth and environmental quality and to formulate a scenario where both the environment and the economy get benefited.

3.2. Green Bonds

Green bonds have been in existence since the early 2000s and serve as a financial tool to mobilize capital for environmentally beneficial initiatives. In 2007, the European Investment Bank (EIB) issued climate awareness bonds, which designated the beginning of the issuance of green bonds. Subsequently, multilateral banks, which include the World Bank, started issuing green bonds in large quantities. In 2014, the International Capital Markets Association (ICMA) released the Green Bond Principles, which serve as the foundation for the current green label and have sped up the growth of the green bond market. Developed nations have been researching green bonds.

A green bond is a fixed-income financial instrument structured to collect funds for projects associated with climate and environment. These are typically supported by the issuing entities' balance sheet and are often linked to specific assets. therefore, they tend to hold the same credit rating as other debt obligations issued by the entity.

It was analysed that whether the banks follow the Equator Principles. The green bonds are crucial to preserving ecological equilibrium and their issuance had a significant influence on the long-term sustainability of the society (Bert Scholtens and Lammertjan Dam, 2006). There are four major factors that contributed to the immense growth of green bonds on the global capital market. These factors include the issuer's own superior credit rating, favorable prospects for the emergence of investment assignments, the cooperative issuer's solid financial position, and investors' growing eco-and environmental awareness leads to the improved demand for green bonds (Wood and Katie Grace, 2011).

Green bonds are the creative bonds which can be an excellent means for institutional investors to invest towards more stable returns and less correlated to conventional business sector (Christopher Kaminker and Fiorm Stewart, 2012). Furthermore, these are not only helpful for conserving the environment and crucial for creating a world that is sustainable, but they can also help businesses become more successful to form a sustainable and self-reliant economy (John A. Mathews, 2012). There are numerous factors that have contributed towards the developments of green bonds. On the one hand, as a result of the decline in foreign exchange reserves and the implementation of restrictive

measures, public expectations for investments in the oil and gas sector declined, while those in the environmental protection sector rose (Van Renssen, 2014).

Bond issuers, on the other hand, began to work to build a green reputation in the eyes of investors after realizing that the issuing of green bonds would have several good impacts, such as improving the economic reputation of businesses (Van Renssen, 2014). Green bonds are emerging fixed income financial instruments having pricing and rating features equivalent to general or conventional bonds. The major difference is that the issuer is required to use the funds raised on green projects promised to investors and to adhere to strict disclosure requirements (Reboredo, 2018).

A study conducted on nearly 121 European green bonds released in the period of 2013-17 used the propensity matching score method to analyse the differentiation between green and conventional bonds. The study identified that the green bonds have more favourable funding as compared to traditional ones. These have competitive advantages for issuers and still available in the secondary market (Gianfranco and Mattia, 2019). The price of green bonds analysed in relation to financial market with the help of SVAR (Structural Vector Auto Regressive) model and found that there is a solid correlation of green bonds with the money markets (Juan C. Reboredo and Andrea Ugolini, 2020).

There are numerous risks linked to green bonds including default risk, liquidity risk, market risk, operational risk, political risk and so on so forth. It is required to improve the support and standards of the industry to deal with these risks (Jin Jiayu and Han Liyan, 2016). The collected funds (with the help of green bonds) should not only be used in low carbon and climate adaptation projects but also another environmentally friendly projects (Cochu and et al, 2016). The raised concerns about ecological and environmental sustainability improves the demand of the green projects which further leads to the growth of green investments and funding (Goel, 2016). The efficient green financial system can be set up by bringing a structured harmony in ecology and finance by issuing green bonds (Yao and Zi, 2016).

3.3. Financial Inclusion

Financial inclusion, the process of providing affordable and accessible financial services to underserved and marginalized populations, has gained prominence as a pivotal driver of economic development and poverty reduction. Financial inclusion encompasses the provision of a wide range of financial services, including savings, credit, insurance, and payment systems, to individuals and businesses, irrespective of their economic status. It seeks to empower individuals and communities by granting them access to financial resources, thus enabling them to manage their finances, invest, and build assets. Access to financial services fosters entrepreneurship, investment, and consumption, subsequently stimulating overall economic development (Beck, Demirgüç-Kunt, & Levine, 2007).

Moreover, it contributes to financial stability by reducing reliance on informal and risky financial sources. While the benefits of financial inclusion are evident, formidable barriers hinder its realization.

These barriers encompass both demand-side factors, such as limited financial literacy and cultural preferences, and supply-side factors, including lack of infrastructure, high transaction costs, and regulatory constraints. Tackling these barriers is essential for meaningful progress (Cull, Demirgüç-Kunt, & Morduch, 2009). Gender disparities continue to pose a significant challenge in the realm of financial inclusion. Research by Duflo, Karlan, and Osei (2012) emphasizes the importance of gender-sensitive policies and financial products to address disparities and promote equitable access to financial services.

Microfinance institutions have played a pivotal role in promotion of financial inclusion extending financial services to marginalized populations, particularly in developing nations. Research by Morduch and Haley (2002) underscores the substantial impact of microcredit programs, empowering small entrepreneurs, and low-income households by providing access to credit and savings opportunities.

One of the most transformative developments in the financial inclusion landscape is the advent of digital finance and mobile banking. Digital technologies, particularly mobile money, have rapidly expanded access to financial services in regions with limited traditional banking infrastructure (Blumenstock, Eagle, & O'Hanlon, 2018). They enable low-cost, secure, and convenient financial transactions, offering a lifeline to the unbanked. Account holders, whether with a bank or a regulated institution such as a financial cooperative, microfinance institution, or mobile money service provider, can store, deliver, as well as receive money, allowing them to contribute to education, healthcare, and businesses (World Bank, 2021).

Evidence suggests that households and businesses with access to financial services are more resilient to financial shocks than those without (Moore et al., 2019). Low-income women in Chile who joined microfinance institutions and were provided with free savings accounts managed to reduce their dependency on debt and improve their ability to make enough money to survive during an economic crisis (Pomeranz and Kast, 2022).

Numerous data-based studies on financial inclusion have already been done with the help of econometric techniques and methodologies. In a study, it was found that the families headed by a man are more financially inclusive (Grohmann et al., 2018). Financial Inclusion index has been estimated with the help of world bank data and econometric techniques to understand the inclusive financial market in a better manner (Sarma and Pais, 2011). It has been found that there is a

considerable relationship between the financial inclusion and development of the nations (Sarma, 2012).

There are two major factors which makes assessing financial services easy i.e., Level of education and income. These have positive relationship with financial inclusion and development (Demirgüç-Kunt and Klapper, 2013). Banks and financial institutions are reluctant to provide services in rural areas, which is a base of an economic pyramid and rather favouring highly income individuals, corporations and areas having dense population. Such kind of financial system create barrier from demand side which includes volatile income, small earnings, lower lifestyle, illiteracy and so on so forth (Pazarbasioglu et al. 2020). It's also considered that the environmental conditions that ignites the vulnerability to the impact of climate change and degradation also hinder the financial inclusion. Here the usefulness of green finance promotes the financial inclusion.

Digital financial services, such as mobile money, enable users to securely and economically, store funds and transfer them across long distances, resulting in increased remittances and utilization, as well as increased investment. Receiving payments such as salaries and financial support from the government straight away into an account can aid in the attainment of development goals. For example, studies have revealed that workers who received their salaries via direct deposit, a system which encourages account holders to keep the money in the account and take advantage of auto transfers to savings instruments, saved more than workers who were paid in cash (Blumenstock, Callen, and Ghani, 2018).

3.4. FinTech

FinTech abbreviated as Financial Technology. It is defined as a digital innovation that have implemented the technical advancement to transform the financial services and creating new business models, products, and process. It results in decreased transaction cost, improved tracking, and verification for security to create a more reliable business and social environment. It also helps to decrease the fixed costs involved in financial services.

The primary instrument being utilised by FinTech companies are phones. 66.67% adults are without financial services, have access to mobile phones (IFC, 2018). Fintech is poised to play a crucial and leading role in promoting green finance in various Indian states. This will be achieved by harnessing the power of big data analytics (BDA) and artificial intelligence (AI) to facilitate the transition towards green finance, benefiting both individual customers and small and medium-sized enterprises (SMEs) (Wang and Wang, 2020).

More than 1.6 billion people are without reach to financial services and approximately more than 1 billion people who are having bank accounts pay their daily expenses in cash. Moreover, more than 300 million people having access bank accounts get paid in cash and deal in cash (IFC, 2018).

FinTech plays a vital role in the development of Financial Inclusion. The process of making available the financial services to the individuals, households, businesses, and communities by linking them into a formal financial system is called as financial inclusion. This includes financial services and products i.e., credit cards, debit cards, payments, transactions, savings, and insurances (Singh and Singh Kondon, 2011). Since last few years, Financial Inclusion has been transformed as a matter of concern in the domain of monetary policy. There is a need to emphasis on financial inclusion in the developing or least developed nations, which is highly required for the people and organizations to contribute to the country's economy (United Nations, 2019).

Evidence have proved that FinTech decreases the poverty and inequality rates by helping people to manage their expenses, payments, loans, insurance policies (Madar, 2018). In addition to it, it is also facilitating the creation of new innovative companies and development of already present in the market. It improves the level of national savings with the help of creating new jobs (Ajide, 2020). In developing and emerging nations, creation of new jobs, reduction gender discrimination, improvement in literacy rate and financial status are the major concerns. The policy reforms i.e., fiscal, and monetary policy can result into discrimination reduction at financial level and inclusive financial market can help these reforms to bring another level of success (Atkinson and Messy, 2013).

The digitalization promises to reform the traditional economics of inclusive finance. Financial automations extensively decrease the cost involved in monetary transactions and proved to be beneficial for the consumers.

Non-Banking Financial Companies (NBFC) has performed in better manner than the traditional service providers to promote the financial inclusion (Osafo-Kwaako et al., 2018). For instance, mobile service providers (network operators) and the firms dealing with technical know-how using artificial intelligence, big data, machine learning revolutionised the whole financial sector which can never be done with the help of old traditional banking/financial system (Frost et al., 2019).

4. CURRENT SITUATION – GLOBAL TRENDS AND BRICS COUNTRIES

4.1. Current Situation of Green Finance

The way to approach a net-zero economy (a visionary approach that aims to balance greenhouse gas emissions with their removal or offset, ultimately mitigating the impacts of climate change) is hard. But the available market technologies for instance renewable energy, electric vehicles, are capable enough to accomplish this goal by 2030 (United Nations, Paris Agreement). The enormous deployment of these resources and solutions requires immense funding as well. As per IEA (International Energy Agency) identifies the requirement of approximately four trillion USD annual investments by 2030 (Morgan Stanley, 2023). The whole earth is at the stake of changes occurring in climate regularly including temperatures and extremely unpredictable weather events. The most vulnerable ecosystems and biodiversity need to be protected with immediate effect. The approximate cost for climate change adaptation is three hundred and forty billion USD per year by 2030, whereas current investment is less than forty billion USD per year (United Nation Study). This gap can be narrowed down with help public and private sector partnerships in green financing.

The "Net Zero Emissions by 2050 Scenario" (NZE) is an influential and normative scenario developed by the International Energy Agency (IEA), which outlines a comprehensive pathway for the global energy sector to attain net zero carbon dioxide (CO₂) emissions by the year 2050. This scenario encompasses a strategic plan whereby advanced economies would achieve net zero emissions ahead of other regions. It is important to emphasize that the NZE scenario serves as an aspirational goal and an invaluable reference for policymakers, businesses, and society as a whole. However, it necessitates international collaboration, policy coherence, technological advancements, financial support, and public engagement to bring about the profound and necessary changes required to achieve a net zero emissions future by 2050.

The Energy Transitions Commission estimates that financing the transition to Net Zero Emissions by 2050 (NZE2050) requires a capital investment of approximately 1.5% of global GDP (See Figure 9.2). To facilitate this transition, a new green financial services sector is emerging (ETC, 2023). It focuses on delivering investable returns while driving investments in decarbonizing the global energy system through equity and debt instruments.

Financial tools like green bonds and carbon market instruments incentivize carbon-reducing investments and discourage environmentally harmful ones by altering risk perceptions and internalizing environmental externalities. The impact of green finance on the global economy is best assessed by evaluating the outcomes of the investments it facilitates. These outcomes are represented in various green markets, such as clean energy infrastructure and fossil fuel alternatives. In addition

to it, the green finance sector directly participates in global GDP by issuing the green financial products, for instance green bonds, green loans, green investments etc.

As per estimates, the green finance industry is projected to make a direct contribution of \$36 billion to global GDP by 2030. This contribution is hopefully to improve to \$61 billion by 2050. Moreover, the sector's supply chain is quite positive to support an additional \$66 billion of economic activity in the 2030's, with this figure projected to rise to \$90 billion by 2050. These figures underscore the economic significance of green finance, as it drives sustainable investments and generates substantial economic benefits.

A study reveals that the transition to a net zero emissions environment presents aggregate opportunities valued at \$10.3 trillion to global GDP by 2050 (in 2020 prices). This is equivalent to 5.2% of global GDP (ARUP Singapore, 2023). Of this amount, approximately \$4 trillion will be directly captured by enterprises engaged in developing and producing carbon-neutral goods and services i.e., green investment. An additional \$6.3 trillion of value will be generated in the broader supply chains of these industries. Hence, almost two-thirds of the global opportunity is available to a wide range of providers across the global economy.

Moreover, this transition financing will have significant implications for global GDP growth, particularly by mitigating the adverse impacts of climate change on global productivity. Scenario analysis conducted by Oxford Economics indicates that the macroeconomic effects of the clean energy transition depend on its design.

For instance, in the Net Zero Transformation scenario, which assumes substantial technological advancements and more lenient fiscal constraints in climate change mitigation policies, global GDP is projected to increase by over 1% by 2050 compared to a scenario based on existing policies. The growth of green financing can be seen from 21 billion USD to 152 billion USD from 2020 to 2050 (Oxford Economics, 2023) (See Figure 9.3).

This analysis underscores the need for significant technological progress and innovation, equivalent to approximately 0.5% of global GDP by 2050, to offset the negative supply shock resulting from phasing out carbon-intensive capital and higher energy prices. Achieving net zero emissions will require a historically large contribution from advancements in technology to support economic growth while mitigating environmental risks.

Transitioning to a net zero emissions environment presents substantial opportunities valued at \$10.3 trillion to global GDP by 2050. These opportunities extend beyond direct enterprise involvement, with significant value added in the wider supply chains of relevant industries. The transition also offers potential for positive macroeconomic impacts and productivity gains, particularly if supported by green finance instruments for instance, green bonds, green loans etc.

The Green Growth Index serves as a metric for evaluating a country's progress in attaining sustainability objectives, which encompass critical global benchmarks such as the Sustainable Development Goals, the Paris Climate Agreement, and the Aichi Biodiversity Targets. This index assesses performance across four key dimensions of green growth: the efficient and sustainable utilization of resources, the preservation of natural capital, the creation of green economic opportunities, and the promotion of social inclusion. It provides a comprehensive framework to gauge a nation's commitment and success in aligning with these vital sustainability agendas, thereby encouraging environmentally responsible and socially inclusive development (GGGI, 2023). The Global Green Index data of BRICS Countries for the years 2014, 2017, and 2021 (See Figure 9.4) underscores the importance of green finance in driving sustainability within the global economy. China's remarkable progression in its green index stands out, rising from 60.58 in 2014 to an impressive 63.46 in 2021. This consistent growth is indicative of China's unwavering commitment to environmentally conscious practices and investments. Similarly, India has shown a positive trend, with its green index increasing from 45.04 in 2014 to 48.59 in 2021, reflecting the nation's endeavours in green initiatives.

Brazil's consistently high green index, reaching 63.47 in 2021, is a testament to its dedication to sustainability. Although Russia and South Africa experienced slight fluctuations, the overall trend highlights the global shift towards prioritizing ecological sustainability. The data strongly emphasizes the role of green finance in fostering a more environmentally responsible and resilient world economy, where nations are increasingly recognizing the need to balance economic growth with eco-conscious practices.

4.2. Current Situation of Green Bonds

The World Bank has emerged as an important issuer of green bonds and raised substantial sum of \$14.4 billion from 2008 to 2020. These funds have been exercised to support 111 projects around the globe, with a primary focus on renewable energy and efficiency with share of 33%, clean transportation for 27%, and 5% for agriculture and land utilization. The World Bank's implementation of green bonds has made a considerable impact by fostering sustainable development and mitigating greenhouse gas emissions, exemplified by the successful implementation of projects like the Rampur Hydropower Project. This is a notable project launched in northern India, financed through the World Bank's green bond issuances. This initiative focuses to provide environmentally friendly hydroelectric power to the local electricity grid. Green Bonds with the help of this the project of an annual capacity of nearly 2 megawatts, results in the prevention of approximately 1.4 million tons of carbon emissions.

As per data collected by S&P, growth of the green bond issuance showed a regular and consistent growth from 2017 to 2021. But this issuance declined in 2022 from more than 550 billion USD to approximately 450 billion USD, because of the large interest rate environment (See Figure 9.5). Among all the defined issuer categories, Sovereign and Financial Corporations have issued maximum amount of green bonds globally. As of March 2023, the cumulative issuance of green, social, sustainability, and sustainability-linked bonds reached a substantial sum of USD 4.1 trillion (See Figure 9.6). Green bonds account for 64% of this total, indicating their dominant presence in the market. Additionally, emerging market issuances contribute to 15% of the overall amount, highlighting their growing participation in sustainable finance initiatives (World Bank, 2023). This significant milestone demonstrates the increasing popularity and importance of bonds that promote environmental, social, and sustainable objectives. The issuance of such bonds plays a crucial role in mobilizing capital towards projects and initiatives that drive positive change and contribute to a more sustainable future.

Over the period from 2019 to 2022, the data of five major BRICS (See Figure 9.7) nations reveal significant trends in green bond issuance. China stands out as a dominant player, with an impressive surge from 0.2652% of its GDP in 2019 to 0.5535% of its GDP in 2022, showcasing its unwavering commitment to green finance. India showcases steady growth in green bond issuance. In 2019, it issued green bonds valued at 0.1248% of its GDP, and this commitment to sustainability continued through the following years, with issuance reaching 0.164% of its GDP in 2021 and 1.24 billion USD in 2022. India's journey underscores its efforts to attract investment for sustainable projects and align with global environmental goals. Brazil's green bond issuance experienced fluctuations, while Russia steadily expanded from 0.0002% in 2019 to 0.0384% of its GDP in 2022. South Africa notably increased its issuance, reflecting its growing engagement with sustainable investments. These diverse patterns in green bond issuance underscore the global shift towards sustainable finance and the increasing significance of green bonds in financing projects that address environmental concerns and promote a greener future (World Bank, 2023).

The cumulative green bond issuance data for 2021 (See Figure 9.8) tells a compelling story of how green finance initiatives of BRICS nations is making its mark on the global economy. China stands out with a remarkable issuance of 221.3 billion USD, signalling not only its leadership in sustainable initiatives but also its potential to shape global environmental progress. In a similar vein, India, Brazil, and South Africa have issued 17.7 billion USD, 10.2 billion USD, and 2.8 billion USD, respectively, in green bonds, underscoring a rising interest in green finance within emerging economies. Even Russia, with its issuance of 2.6 billion USD, is taking steps toward aligning its financial markets with green principles. This data reinforces the growing consensus on the vital role of green finance in addressing climate change and environmental issues. It demonstrates a worldwide

commitment to directing investments into projects that promote a greener, more sustainable global economy.

For providing more details on individual countries, India for example, India has demonstrated a comprehensive and detailed framework for green bonds, reflecting its commitment to transparency and efficiency in promoting sustainable financing for its green growth strategy. By March 20, 2023, India had successfully issued a total of \$19 billion in green bonds, of which only 13 percent were denominated in the rupee prior to the recent sovereign issuance.

Currently, India ranks fourth after China, South Korea, and Hong Kong among Emerging Market and Developing Economy (EMDE) and developed Asian countries in terms of green bond issuance (See Figure 9.9). However, the recent sovereign issuance has the potential to propel India forward, enabling it to catch up with its peer nations in this domain.

One key factor that could contribute to India's advancement is an increase in the proportion of green bonds denominated in the local currency. India's efforts to promote green bonds and its focus on enhancing domestic issuance can have significant positive implications for the country's sustainable development agenda.

In January 2023, India entered the sovereign green bond market by issuing its first pair of green bonds, joining a growing number of countries utilizing sovereign thematic bonds. The issuance aligns with India's ambitious decarbonization objectives, including targets such as increasing non-fossil electricity capacity to 500 GW and producing 5 million tons of green hydrogen by 2030. This milestone was accompanied by the release of the 2023-24 Annual Union Budget of India, which allocated funds from green bonds to finance various infrastructure projects aimed at decarbonizing electricity generation, carbon-intensive industries, and railways (Reserve Bank of India, 2023).

The debut green bonds issued by the Ministry of Finance were highly successful, not only being oversubscribed but also having a premium and being denominated in the local currency. Through two bond sales, the ministry raised \$1 billion initially, which later increased to \$2 billion following a second sale in February. These bonds were sold with an estimated premium of 5-6 basis points each, and in the secondary market, the average premium for the two bonds reached 9 basis points as of March 20, 2023 (See Figure 9.10). This premium level aligns with the average observed across emerging market sovereign and quasi-sovereign green bonds.

The decision to denominate the bonds in the Indian rupee is significant due to the limited presence of local currency issuances by Emerging Market and Developing Economies (EMDE) in the green bond market, estimated to be less than 3 percent of the global total. By issuing bonds in the local currency, India reduces the risks associated with currency mismatches, where countries hold liabilities in foreign currency while generating investments and revenues in the local currency. This

approach not only enhances the country's decarbonization financing strategy but also promotes the development of green finance within India, fostering a more robust and resilient financial ecosystem aligned with the nation's green growth objectives.

4.3. Current Situation of Financial Inclusion and FinTech

In 2021, a remarkable 76 percent of adults globally possessed an account with a bank or a regulated financial institution, encompassing credit unions, microfinance institutions, and mobile money service providers (See Figure 9.11). This statistic marks a substantial surge in account ownership over the past decade, surging by 50 percent from 2011 to 2021, elevating the percentage of account-holding adults from 51 to 76 percent. Notably, between 2017 and 2021, developing economies exhibited a notable 8-percentage rise in the average rate of account ownership, scaling from 63 percent to 71 percent among adults.

A substantial driver of this expansion in Sub-Saharan Africa is the widespread adoption of mobile money services. What sets this recent growth apart is its global reach, extending across numerous developing economies, a stark contrast to the preceding growth phase between 2011 and 2017, which was primarily concentrated in China and India (World Bank, 2021).

Despite the significant strides, disparities in access to financial services persist, particularly among traditionally underserved populations, such as women, the impoverished, and those with limited education. Encouragingly, progress is evident. For instance, the gender gap in account ownership within developing economies has narrowed to 6 percentage points, down from a long-standing 9 percentage points. These developments underscore the advancing global landscape of financial inclusion, although challenges remain in ensuring equitable access for all segments of the population.

In developing economies, there has been a noteworthy surge in the share of adults engaged in digital payments, escalating from 35 percent in 2014 to 57 percent in 2021 (See Figure 9.12). In high-income economies, digital payments have become nearly universal, with a staggering 95 percent of adults participating. Notably, receiving a payment directly into one's account serves as a crucial gateway to engaging with a broader spectrum of financial services. Indeed, a substantial 83 percent of adults in developing economies who received digital payments have also transitioned into making digital payments themselves, marking a significant increase from 66 percent in 2014 and 70 percent in 2017. Moreover, nearly two-thirds of those who receive digital payments use their accounts for efficient cash management, while approximately 40 percent utilize their accounts for saving purposes. Intriguingly, 40 percent of payment recipients have ventured into formal borrowing through their accounts.

The significance of these findings lies in the fact that the ease of digital payments can pave the way for a more comprehensive adoption of financial services. When it is convenient to leave transferred funds in an account until needed and to make direct payments from the account, individuals are more likely to engage with a range of financial instruments. Similarly, once money finds its way into an account, the propensity to retain it there for savings grows. Notably, receiving payments directly into an account, especially if these payments can serve as a documentation of a regular income stream over time, can simplify and streamline the formal borrowing process. These trends indicate a promising trajectory toward enhanced financial inclusion, offering individuals more accessible and efficient means to manage their finances.

The inception of mobile money services primarily aimed at facilitating domestic remittances within the country, enabling people to send financial support to friends and family residing elsewhere. However, the reach and utility of these services have transcended their original purpose.

The Global Findex survey for 2021 revealed a compelling trend in Sub-Saharan Africa, where approximately three out of four mobile account owners now employ their mobile money accounts for a more diverse range of financial activities, extending beyond person-to-person transactions. These mobile money accounts have not only remained a potent tool for sending domestic remittances but have also evolved into a crucial avenue for savings. In Sub-Saharan Africa, 15 percent of adults, including a remarkable 39 percent of mobile money account holders, have embraced these accounts as a means of saving—a figure that mirrors the share of individuals who use formal savings accounts at banks or other financial institutions.

Additionally, seven percent of adults in Sub-Saharan Africa have ventured into borrowing through their mobile money accounts. This transformation highlights the increasing versatility and significance of mobile money services as an all-encompassing financial tool for individuals in the region, enabling them to manage their financial affairs efficiently and effectively.

In the case of BRICS countries, data presented by world bank (See Figure 9.13), indicating the percentage of individuals aged 15 and above with bank accounts in five diverse BRICS nations—Brazil, China, India, Russia, and South Africa—across the years 2014, 2017, and 2021, offers valuable insights i.e., Increasing Account Ownership, Varying Growth Rates, and Regional Disparities into the accessibility and adoption of formal financial services in these countries.

One striking trend across all five nations is the consistent increase in the percentage of adults holding bank accounts over the observed years. This growth highlights the global trend toward greater financial inclusion, where a growing proportion of the adult population is gaining access to formal banking services. China and Russia notably achieved high levels of account ownership in 2021, showcasing the success of their financial inclusion initiatives.

While the overall trend is positive, there are variations in the growth rates of account ownership. China's consistent increase over the years demonstrates a steady and significant improvement in financial access. India, after a substantial leap from 2014 to 2017, experienced a minor decline in account ownership in 2021. This shift could be attributed to factors such as changes in financial policies or the impact of external events.

Notably, Russia stands out as a nation with consistently high account ownership. Its 2021 figures rival the highest in the group, suggesting a well-established financial infrastructure. Conversely, India, while showing consistent growth, still lags behind other BRICS nations in terms of account ownership.

The data on the number of commercial bank branches (See Figure 9.14) in these BRICS presents a nuanced perspective on the accessibility of banking services through the distribution of commercial banking infrastructure.

Geographic Distribution: When examining the number of commercial banks per 1,000 km², India consistently maintains the lead, signifying a robust and well-distributed banking network. China follows with a notable number of banks, reflecting its effort to ensure accessibility across its vast geography. Meanwhile, Brazil, Russia, and South Africa exhibit varying trends. Brazil's data shows a gradual decline, potentially indicating consolidation in its banking sector, while Russia and South Africa reveal modest reductions in their respective numbers.

Bank Density per 100,000 Adults: Shifting the focus to the number of commercial banks per 100,000 adults, Russia holds the highest numbers across the years, reflecting a significant banking presence concerning its adult population. India follows with steady growth, while Brazil, China, and South Africa display relatively lower numbers in proportion to their adult populations.

These trends underscore the intricate balance between geographic accessibility and banking optimization. China and India prioritize broad geographic coverage, addressing the diverse needs of their populations. In contrast, Brazil, Russia, and South Africa may be engaging in optimization and consolidation strategies, adapting their banking sectors for efficiency. This data underscores the intricate balance required to ensure equitable access to banking services, accounting for geography, demographics, and the unique financial needs of each nation.

The data on the number of ATMs per 1,000 km² and per 100,000 adults in BRICS nations across the years 2014, 2017, and 2021 paints a nuanced picture of ATM distribution and accessibility (See Figure 9.15). When looking at ATMs per 1,000 km², China consistently leads the group, reflecting a robust network of ATMs and widespread accessibility throughout the country. India and Brazil follow, showcasing a significant ATM presence relative to their expansive territories, serving their

vast populations. In contrast, Russia and South Africa display lower figures, indicating a potentially more centralized distribution of ATMs.

Shifting the focus to the number of ATMs per 100,000 adults, Russia maintains a consistent lead, highlighting a substantial ATM presence concerning its adult population. China, India, and South Africa, while exhibiting lower figures, demonstrate steady growth, reflecting their ongoing efforts to expand ATM accessibility. Brazil, on the other hand, shows higher numbers but experiences a gradual decline over the years.

These trends underscore the diverse strategies that nations employ to ensure ATM accessibility. China's extensive network caters to its vast population, while India and Brazil address the banking needs of their populous regions. Russia's high ATM density per adult may reflect a well-established banking infrastructure, while South Africa's consistent growth demonstrates its commitment to expanding financial access. These data collectively emphasize the intricate balance that nations strike between geographic accessibility and optimizing their ATM networks to meet the financial service needs of their populations.

The data on outstanding deposits with commercial banks and outstanding loans from commercial banks as percentages of GDP in BRICS nations across the years 2014, 2017, and 2021, offers a comprehensive view of the financial landscape in these countries (See Figure 9.16). In 2014, China led the group with the highest percentage of outstanding deposits at a remarkable 135.77% of its GDP, reflecting the strong savings culture and trust in the banking system among its citizens.

Over the years, China maintained its lead, reaching 151.94% in 2021. This indicates not only the continuation of these trends but also the expansion of deposit-based financial services in the country. Brazil, while starting with a lower percentage of outstanding deposits at 34.77% in 2014, steadily increased this figure, reaching 40.33% in 2021. India and South Africa also demonstrated consistent growth in deposits as a percentage of GDP, indicating the rise of banking services in these nations.

Conversely, the data on outstanding loans from commercial banks reveals a different narrative. China, which held the highest percentage of outstanding deposits, also exhibited significant growth in outstanding loans, with an increase from 91.30% of GDP in 2014 to 118.33% in 2021. This expansion suggests the availability of credit and the increasing financial engagement of the Chinese population. On the other hand, Brazil maintained a relatively high percentage of outstanding loans, hovering around 40% of GDP. South Africa, despite a decline in this metric, continued to have a substantial share of loans relative to its economic output.

The data showcases the varying financial behaviours and dynamics within these BRICS nations. China, with its high percentages in both deposits and loans, demonstrates a robust and growing financial sector. Brazil, on the other hand, maintains a stable balance between deposits and loans.

The data on credit card and debit card ownership as percentages of the population aged 15 and above in BRICS nations across the years 2014, 2017, and 2021 provides valuable insights into the financial behaviour and payment preferences of individuals in these countries. One of the notable trends observed across these nations is the consistent increase in the percentage of adults owning credit cards. China and Brazil, in particular, have demonstrated remarkable growth in credit card ownership from 2014 to 2021 (See Figure 9.17). China, with its burgeoning middle class and urbanization, saw a substantial increase in credit card adoption, reaching 37.95% in 2021. Brazil's credit card ownership also surged, reflecting a greater reliance on credit as a financial instrument. These trends could indicate an increased appetite for consumer credit and a shift toward cashless transactions. The data on debit card ownership reveals a similar pattern, with substantial growth across all nations. China stands out with a significant rise in debit card ownership, reaching 75.76% in 2021. Debit cards have become a preferred method for conducting day-to-day financial transactions in China. Brazil, Russia, and South Africa have also experienced noticeable growth in debit card ownership, indicating the convenience and accessibility of debit cards for various financial transactions.

India presents an interesting case, with lower percentages of card ownership in comparison to the other BRICS nations (See Figure 9.17). However, the data shows a gradual increase in both credit and debit card ownership, suggesting a changing financial landscape and the potential for further expansion in the future.

The data underscores a global trend of increased card ownership, both credit and debit, as individuals across these nations are increasingly embracing cashless payment methods. This shift has implications for financial services, retail, and payment industries and underscores the need for businesses and financial institutions to adapt to changing consumer preferences. Understanding these trends is crucial for policymakers and businesses seeking to offer financial services that align with the evolving payment landscape.

The data on Mobile Money Account penetration (See Figure 9.18), particularly in Brazil, India, and South Africa, underscores the substantial progress made in fostering financial inclusion in BRICS through FinTech on a global scale (Data is unavailable for China and Russia). In 2014, Brazil exhibited a Mobile Money Account percentage of merely 0.86%, which subsequently surged to an impressive 26.96% by 2021.

India also made noteworthy strides, with a growth from 2.35% in 2014 to 10.44% in 2021, despite experiencing some fluctuations in between. South Africa, on the other hand, continued its steady upward trajectory from 14.43% in 2014 to 36.57% in 2021. These trends emphasize the role of FinTech in expanding financial access, especially in emerging economies. It not only caters to the

unbanked and underbanked populations but also promotes a cashless and inclusive financial ecosystem. As these figures rise, they bring society closer to a more financially inclusive world economy, ensuring that more individuals and businesses have the tools and access they need to participate in the global financial landscape.

The data on Internet access percentages in BRICS highlights the pivotal role of FinTech in driving financial inclusion worldwide (See Figure 9.19). In 2021, Russia stood out with an impressive 92.76% of its population having Internet access, closely followed by China at 82.96%. These nations have harnessed their extensive Internet coverage to boost the growth of FinTech and digital banking, ensuring more widespread access to financial services for their citizens.

However, India had a lower Internet access rate in 2021, with only 27.58%. Despite this, India's thriving FinTech industry has played a vital role in extending financial services to millions of unbanked and underbanked individuals through user-friendly mobile apps and digital platforms. South Africa, with a 64.23% Internet access rate, falls in between, indicating steady progress in advancing financial inclusion. As the world becomes increasingly connected, these statistics emphasize how FinTech can bridge the digital divide and promote financial access, not only in technologically advanced nations but also in regions with more limited Internet infrastructure, contributing to a more financially inclusive global economy.

The data on digital in-store merchant payments (See Figure 9.20) among individuals aged 15 and above in Brazil, China, India, Russia, and South Africa underlines the significant role that FinTech plays in advancing financial inclusion on a global scale. In 2021, China stood out with a substantial 78.68% of its population embracing digital in-store payments, indicating the strong adoption of FinTech solutions. China's advanced mobile payment infrastructure, largely driven by platforms like Alipay and WeChat Pay, has made it easier for both urban and rural populations to access financial services conveniently.

Brazil, with 50.03%, and Russia, with 69.31%, also demonstrate the growing popularity of digital payments, showcasing how FinTech is transforming the financial landscape in these countries. In contrast, India, with 11.39%, and South Africa, with 53.08%, show lower adoption rates, highlighting the existing challenges in promoting digital payments and financial inclusion. These statistics emphasize the need for continued investment in FinTech infrastructure, education, and accessibility to ensure that individuals worldwide, regardless of their location or economic background, can participate in the digital financial ecosystem, thus fostering greater financial inclusion on a global scale.

5. ANALYSIS

5.1. For the Year 2014

For the year 2014, for the identification of principal components the eigen analysis of the correlation matrix yielded 10 eigenvalues from 10 different factors, but only the first four eigenvalues explain a significant portion of the variance in the data. These eigenvalues, in descending order, take a value of 5.5208, 3.2038, 0.8339, and 0.4414.

The first eigenvalue, accounts for 55.21% of the total variance, while the second eigenvalue explains 32.04% and the third one 8.34%. Together, the first three eigenvalues account for 95.59% of the cumulative variance.

Eigenvectors (Component Loadings): The eigenvectors, also known as component loadings, represent the relationship between the original variables and the principal components (PCs). These loadings provide insight into which variables are most strongly associated with each PC. It is important to note that PC1 and PC2 have the highest loadings, indicating that they capture the most variation in the data (See detailed results in Annexure 12.1).

- PC1 is primarily influenced by variables such as "Bank Branches per 1000km²" (loading: 0.370), "Number of ATMs per 1000km²" (loading: 0.356), and "Outstanding deposits with commercial Banks" (loading: 0.227). This component seems to reflect aspects related to density and financial activity.
- PC2 is influenced by "Bank branches per 1000km²" (loading: 0.242), "Number of ATMs per 1000km²" (loading: -0.241), and "Outstanding loans from commercial banks" (loading: -0.486). It appears to capture aspects related to financial transactions and density.
- PC3, with a much smaller proportion of variance (8.34%), is negatively influenced by "Bank branches per 100000 adults" (loading: -0.594) and "Number of ATMs per 100000 adults" (loading: -0.469). This component may represent financial metrics per adult.

Eigenvectors (Component Loadings) after restricting few factors: To make the analysis much focused, three factors are dropped (including deposits with commercial banks, the number of debit and credit cards). The reason for casting off these variables is that they are too strongly correlated with a great number of the other variables (See appendix 11.1 for correlation matrices).

The eigen analysis reveals that there are three principal components (PCs) with eigenvalues greater than 1, which typically indicate significant variability in the data. These components account for different proportions of the total variance (See Figure 9.21):

- PC1 has the highest eigenvalue (3.9883), explaining 56.98% of the total variance. It captures a significant portion of the data's variability.
- PC2 has the second-highest eigenvalue (2.3412), explaining 33.45% of the total variance.

- PC3 has eigenvalue of 0.4832. Although it accounts for less variance individually, when combined with the previous components, they complete the analysis, explaining 97.32% of the cumulative variance.

PC1 is influenced by "Bank branches per1000km2" (loading: -0.413), "Number of ATMs per1000km2" (loading: -0.426), and "Green Index" (loading: 0.429). This component seems to be associated with population density, financial infrastructure, and environmental factors. PC2 is characterized by "Accountage15" (loading: 0.614), "banks per 100000adults" (loading: -0.285), and "Outstanding loans from commercial" (loading: 0.553). It appears to capture demographic and financial variables. PC3 features a strong relationship with "per 100000adults" (loading: 0.603) and "Number of ATMs per 1000km2" (loading: 0.498), suggesting it reflects financial metrics per adult and ATM density.

PC1 and PC2 are the most informative components, highlighting relationships between population density, financial infrastructure, and environmental factors. PC3 provide additional insights into financial metrics and lending. These components can be used for dimensionality reduction and further exploration of the original data.

5.2. For the Year 2017

The eigen analysis identifies four principal components (PCs) with eigenvalues greater than 1, which typically indicate significant variability in the data. These components explain varying proportions of the total variance:

- PC1 has the highest eigenvalue (5.2133) and explains 52.13% of the total variance, making it the dominant component.
- PC2 follows with an eigenvalue of 3.0744, explaining 30.74% of the variance.
- PC3 and PC4 have eigenvalues of 1.3850 and 0.3273, respectively, contributing 13.85% and 3.27% to the cumulative variance.

Eigenvectors (Component Loadings): Eigenvectors, or component loadings, represent the relationships between the original variables and the principal components, shedding light on which variables have the most influence on each PC (See detailed results in Annexure 12.2):

- PC1 is primarily influenced by "Number of ATMs per1000km2" (loading: 0.366) and negatively influenced by "Number of ATMs per100000 adults" (loading: -0.393). This suggests PC1 is associated with ATM density.
- PC2 is characterized by a mix of variables like "outstanding loans with commercial banks" (loading: 0.435) and "Owns a debit card " (loading: 0.494), indicating it may represent aspects of banking and consumer behaviour.

- PC3 shows a strong connection with "Number of commercial Banks per 100000 adults" (loading: -0.494) and "Accounts (percentage)" (loading: -0.594), suggesting it captures aspects of commercial banking and financial lending.

Eigenvectors (Component Loadings) after restricting few factors: To make the analysis much focused, three factors are dropped (including deposits with commercial banks, the number of debit and credit cards). The reason for casting off these variables is that they are too strongly correlated with a great number of the other variables (See appendix 11.2 for correlation matrices). The analysis has identified three principal components (PCs) with eigenvalues greater than 1, signifying their significance in explaining the variance in the data.

These components account for different proportions of the total variance (See Figure 9.22):

- PC1 has the highest eigenvalue (4.0550) and explains 57.93% of the total variance, making it the dominant component.
- PC2 follows with an eigenvalue of 1.5857, explaining 22.65% of the variance.
- PC3 have eigenvalues of 1.1653. Although its individual contribution is smaller, it completes the analysis, explaining 97.23% of the cumulative variance.

PC1 is primarily influenced by "Account (percentage) age 15" (loading: -0.331), "Number of ATMs per 1000km²" (loading: -0.436), and "Green Index" (loading: 0.401). This suggests that PC1 may capture aspects related to demographic factors, ATM density, and environmental metrics. **PC2** is characterized by a mix of variables, including "Number of commercial banks per 1000km²" (loading: -0.442) and "Outstanding loans from commercial banks" (loading: 0.649), possibly reflecting banking infrastructure and financial behaviour. **PC3** shows strong connections with "Number of commercial Banks per 100000 adults" (loading: 0.558) and "Number of ATMs per 100000 adults" (loading: 0.342), indicating it might capture features related to the density of commercial banks and ATMs.

PC1 and PC2 are particularly influential, suggesting a combination of demographic, banking, and environmental factors. PC3 provide additional insights into commercial banking and environmental metrics.

5.3. For the Year 2021

The analysis identifies twelve principal components (PCs), but for conciseness, we will focus on the first four PCs which account for the majority of the data's variance:

- PC1 has the highest eigenvalue (5.4280) and explains 45.23% of the total variance, making it the most significant component.
- PC2 follows closely with an eigenvalue of 4.7231, explaining 39.36% of the variance.

- PC3 and PC4 have eigenvalues of 1.0926 and 0.7563, respectively. They contribute 9.11% and 6.30%, respectively, to the cumulative variance.

Eigenvectors (Component Loadings): Eigenvectors, representing component loadings, indicate the relationships between the original variables and the principal components (See detailed results in Annexure 12.3):

- **PC1** is influenced by " Outstanding deposits with commercial banks " (loading: -0.380), "Out-standing loans from commercial banks" (loading: -0.402), and "Green Bond Issuance Per Unit GDP" (loading: -0.358). This suggests PC1 may capture aspects related to sustainability, and financial behavior.
- **PC2** exhibits a mix of variables, including "Number of commercial banks per 1000km²" (loading: 0.394), Number of ATMs per 1000km² (loading: 0.344) and "Owns a debit card" (loading: -0.310), indicating it may represent features of banking infrastructure and consumer behavior.
- **PC3** is characterized by " Number of commercial Banks per 100000 adults" (loading: 0.586) and "Cumulative Bond issuance per unit GDP" (loading: -0.316), suggesting a focus on bank-ing infrastructure and financial sustainability.

Eigenvectors (Component Loadings) after restricting few factors: To make the analysis much focused, three factors are dropped (including deposits with commercial banks, the number of debit and credit cards). The reason for casting off these variables is that they are too strongly correlated with a great number of the other variables (See Appendix 11.3 for correlation matrices).

These components account for different proportions of the total variance (See Figure 9.23):

- PC1 has the highest eigenvalue (4.2760), explaining 47.51% of the total variance. This component captures the most significant variation in the data.
- PC2 follows with an eigenvalue of 3.2534, explaining 36.15% of the variance.
- PC3 have eigenvalues of 0.9894, contributing 10.99% to the cumulative variance.

Eigenvectors represent the relationships between the original variables and the principal components:

PC1 is influenced by "Number of ATMs per 1000km²" (loading: 0.455), " Number of commercial Banks per 100000adul" (loading: -0.393), and "Cumulative Bond issuance per unit GDP" (loading: 0.437). This suggests PC1 may be associated with aspects related to ATM density, bond issuance, and financial behaviour.

PC2 exhibits influences from "Number of commercial banks per 1000km²" (loading: 0.442), "Green Index" (loading: -0.460), and " Account percentage" (loading: -0.513). PC2 could represent characteristics related to commercial banking and green bond issuance.

PC3 is characterized by "Number of commercial Banks per 100000 adults" (loading: 0.566) and "Green Bond Issuance Per Unit GDP" (loading: -0.413). This suggests a focus on the number of commercial banks and outstanding commercial loans.

PC1 and PC2 reveal insights into ATM density, bond issuance, and banking, while PC3 provides additional perspectives on commercial banking and ATM density. These components can be valuable for reducing dimensionality and exploring underlying patterns in the original dataset.

5.4. Variation in Principal Components

The provided data (See Figure 9.24) represents the scores of five countries (Brazil, China, India, Russia, and South Africa) across three different years (2014, 2017, and 2021) on three principal components (PC1, PC2, and PC3). These principal components are a result of a dimensionality reduction technique, Principal Component Analysis (PCA).

PC1 and PC2 are the most informative components, highlighting relationships between population density, financial infrastructure, and environmental factors. PC3 provide additional insights into financial metrics and lending.

PC1 represents the most substantial source of variance among the countries in the dataset. In 2014, Brazil and Russia exhibited positive scores on PC1, while China, India, and South Africa had negative scores. However, by 2021, these positions had reversed, with China and India obtaining notably positive scores, indicating a shift in their economic or sociopolitical dynamics.

PC2 and PC3 show additional dimensions of variance. PC2 appears to reflect a different dimension of variability, potentially related to a distinct set of economic or social factors. PC3, on the other hand, shows a different pattern of variation, which might represent additional insights into financial metrics and lending changes over time.

In nutshell, the data illustrates changing patterns in the relationships among these BRICS countries over the years, possibly related to various economic, social, environmental, or political developments. India and China are generally showing positive indicators for financial inclusion, but China performs better with commercial bank accessibility. Both countries made a significant progress in green finance as captured by PC1, PC2 in 2014 and 2017, and also PC3 in 2021.

6. WEST BENGAL: A CASE OF BALANCING THE FINANCIAL INCLUSION AND GREEN FINANCE

West Bengal is one of the states of India. West Bengal is one of those first states which implemented the policies for the growth of financial inclusion as well as green finance. It becomes interesting to discuss the case of a state which is promoting the concept of Inclusive Green Finance (Financial Inclusion + Green Finance). This case helps us to understand that what are the major economic reforms, policies and advantages West Bengal have, which helps it to promote financial inclusion and green finance to improve the life of a common man of West Bengal.

The state of West Bengal is served by a total of 37 commercial banks, comprising 12 public sector banks (PSU) and 25 private sector banks. In addition, there are 3 regional rural banks, a state cooperative bank with 17 affiliated district central cooperative banks, and one state cooperative agriculture and rural development bank (SCARDB) with 24 affiliated primary land development banks (PLDBs). This diverse banking network ensures a range of financial services are available to the residents of West Bengal, catering to both urban and rural areas. The growth of the branches can be analysed from the Figure 9.25.

There has been a steady growth in the branch network and the installation of ATMs in West Bengal. The annual compounding growth rate for branches stands at 2.72%, while ATMs have seen a growth rate of 1.17% (See Figure 9.25). This indicates that banking services are becoming more digitized and easily accessible to the people. The average population served per brick-and-mortar branch in West Bengal (excluding co-operatives) is around 9598. This number is quite lower than the national average, which is about 11,000. It means that, on average, each branch in West Bengal serves a relatively smaller population compared to the rest of the country.

6.1. Initiatives Implemented in West Bengal

The State Government of West Bengal (with the support of The Central Government of India) has taken considerable initiatives to promote the financial inclusion and green finance in the state. The major concern of the state is to improve the financial health of the state and its people but not on the stake of environmental impacts. Therefore, they have took such measures which comply with the financial needs of the state and its responsibilities towards the society and environment. There are few notable steps undertook by the state with the help of financial regulatory, economic regulatory and other bodies of the state.

6.1.1. Kisan Credit Card

The Kisan Credit Card (KCC) scheme, introduced in 1999-2000, has been instrumental in ensuring that farmers have access to sufficient and timely credit at affordable rates. Over the years,

the scheme has been modified to meet the evolving credit requirements of farmers and to ensure its widespread coverage among eligible beneficiaries. The primary objective of the KCC scheme is to provide financial support (i.e., financial inclusion) to farmers by offering them a credit card specifically designed for their agricultural needs (i.e., Green Finance) (Reserve Bank of India). This card serves as a single-window facility (inclusive green finance), enabling farmers to avail various financial services and meet their agricultural expenses efficiently.

The scheme's continuous modifications have aimed to address the comprehensive credit requirements of farmers, encompassing diverse aspects of agricultural activities. Considering the average loan amount per KCC, some fluctuations have been observed. In 2020-21, the average loan amount per KCC was Rs. 43,430, which increased to Rs. 59,338 in 2021-22. Since last three annual years, the disbursements were made in 23.73 lakh (2.373 Mn) accounts in 2019-20, 26.08 lakh (2.608 Mn) accounts in 2020-21 and 29.10 lakh (2.901 million) accounts in 2021-22 (SLBC, West Bengal, 2023). These figures reflect the changing financial requirements and varying loan sizes based on the needs of individual farmers.

6.1.2. Financial Support through NABARD

The total financial support provided by NABARD (National Bank for Agriculture and Rural Development) in the state of West Bengal has witnessed a significant increase of approximately 11% over the past two years. In 2019-20, the support amounted to Rs. 12,686.22 crore, which rose to Rs. 14,026.38 crore in 2021-22. It extends financial assistance to various sectors for the development of rural infrastructure and promoting agricultural activities. NABARD provides support through the National Bank for Agriculture and Rural Development Assistance (NIDA) program, which focuses on financing short-term seasonal agricultural operations. The support offered by NABARD encompasses several areas, including assistance to the State Government for the development of rural infrastructure under the Rural Infrastructure Development Fund (RIDF) and Watershed Development Fund (WIF) (NABARD, 2023). This is another contributor to inclusive green finance.

6.1.3. Weavers Credit Card (WCC)

The Weavers' Credit Card Scheme was introduced with the objective of facilitating easy access to credit for weavers and other individuals involved in weaving activities within the handloom sector. However, this scheme has been replaced by the Concessional Credit/Weaver MUDRA Scheme, which offers improved features and benefits to handloom weavers and weaver entrepreneurs nationwide. Under the Concessional Credit/Weaver MUDRA Scheme, weavers and weaver entrepreneurs can avail themselves of margin money assistance, which is set at 20% of the project cost, with a maximum limit of Rs. 10,000 per weaver.

The scheme also provides loans at a reduced interest rate of 6%, enabling them to access affordable credit. Additionally, a Credit Guarantee is extended for a duration of three years, offering further support and security. In the fiscal year 2021-22, a total of 1,338 Weavers' Credit Cards (WCCs) were issued, with commercial banks issuing 458 cards and Regional Rural Banks (RRBs) issuing 880 cards. The cumulative disbursement under the WCC scheme during this period amounted to Rs. 8.05 crore, with commercial banks disbursing Rs. 7.34 crore and RRBs disbursing Rs. 0.71 crore.

The introduction of this new scheme aims to address the specific needs of handloom weavers by providing them with financial assistance, favourable interest rates, and credit guarantees. By doing so, it aims to promote and uplift the handloom sector, empowering weavers to enhance their business operations and improve their livelihoods.

6.1.4. GOI Scheme

Under the Pradhan Mantri Jan Dhan Yojana (PMJDY), a significant number of accounts have been opened in the state, totalling 4.63 crore. Out of these accounts, 2.91 crore are zero balance accounts as of September 2022. To facilitate transactions and financial access, a total of 2.86 crore Rupay cards have been issued as of September 30, 2022 (SLBC, West Bengal). Efforts have also been made to link these accounts with Aadhaar, with successful seeding completed in 3.85 crore accounts. This helps in establishing the unique identification of individuals and facilitates the delivery of all financial services as a part of financial inclusion.

Furthermore, enrolments under the Pradhan Mantri Suraksha Bima Yojana (PMSBY), Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY), and Atal Pension Yojana (APY) have seen significant participation. As of September 30, 2022, there were 187.06 lakh enrolments under PMSBY, 60.11 lakh under PMJJBY, and 34.59 lakh under APY. These figures highlight the success of the PMJDY initiative in promoting financial inclusion and expanding access to various financial services for the people of the state (SLBC, West Bengal)

6.1.5. Small Finance Banks, NBFC – MFIs, NBFCs, NGO-MFIs

In West Bengal, there are currently five Small Finance Banks (SFBs) operating, namely Ujjivan Small Finance Bank Ltd., Utkarsh Small Finance Bank Ltd., Jana Small Finance Bank Ltd., ESAF Small Finance Bank Ltd., and AU Small Finance Bank Ltd. Together, they have established a network of 140 branches in the state. Over the years, these SFBs have witnessed significant growth in deposit mobilization, increasing from INR 83 crore in 2017-18 to INR. 3161 crore in 2021-22, with a compounded annual growth rate (CAGR) of 148%. Similarly, advances or loans extended by SFBs in West Bengal also experienced growth, rising from INR 1273 crore to INR 3232 crore during the same period, with a CAGR of 26%.

Alongside the SFBs, there are 38 Non-Governmental Organization Microfinance Institutions (NGO-MFIs) and Non-Banking Financial Company Microfinance Institutions (NBFC-MFIs) providing financial services in the state. Together with the SFBs, they serve around 85.32 lakh customers and have a total loan portfolio of Rs. 37810.72 crore as of March 31, 2022. These institutions operate through 3234 outlets, contributing to the accessibility and availability of financial services for the people of West Bengal.

In addition to SFBs and NGO-MFIs, three Payment Banks are also present in West Bengal, namely Airtel Payments Bank, India Post Payment Bank, and Fino Payment Bank. These Payment Banks have established a cumulative network of 27 branches in the state, further enhancing the options for financial services. The presence and growth of these institutions reflect the increasing access to financial services and the evolving financial landscape in West Bengal, catering to the diverse needs of customers and contributing to the overall development of the state's economy.

6.1.6. Sustainable Transportation Initiative

Kolkata (city of West Bengal) boasts a diverse and efficient public transport system, including electric trams, railways, metro, buses, three-wheelers, ferries, and private vehicles. It was the first Asian city with electric tram project in 1902. To address the issue of pollution caused by diesel buses, the West Bengal Transport Corporation (WBTC) conducted a feasibility study on the adoption of electric buses. With the support of a USD 250,000 grant from the World Bank's Energy Sector Management Assistance Program (ESMAP), a strategic roadmap was developed for the implementation of electric buses in the city. As a progressive measure, the Government of West Bengal has taken a principled decision to refrain from procuring new diesel buses. Instead, the focus has shifted towards building a robust fleet of 5,000 electric buses in Kolkata by the year 2030. This initiative aims to promote sustainable and eco-friendly transportation options in Kolkata, West Bengal with the help of green funding projects.

6.1.7. Swachh Bharat Mission

The Swachh Bharat Mission (Urban) is a comprehensive national initiative aimed at improving sanitation facilities and achieving Open Defecation Free (ODF) status in urban areas across India. As part of this mission, a project was implemented in Kolkata, West Bengal to enhance the primary and secondary solid waste management systems.

The project, implemented in FY 2018, had a total cost of USD 21.5 million. This initiative is crucial for creating cleaner and healthier urban environments, ensuring proper waste disposal, and promoting the well-being of the urban poor.

6.1.8. Clean Energy Mission

As per a report published by the Ministry of New and Renewable Energy in 2020, the West Bengal was in the lower rank among the 29 states of India. They have started the rooftop solar project to generate 2100 MW energy (as a green financing project) in West Bengal and issued the first regulation about development of the rooftop solar system in the nation.

6.1.9. Efficient Energy Resources and Green Buildings

The Lighting and Electricity Department of the Kolkata Municipal Corporation (KMC) has taken various initiatives to improve energy efficiency in public services within the city. These efforts include utilizing solar power for illuminating advertisement boards and enhancing the operation and maintenance of electric crematoriums along with their air pollution control systems. As part of the Green City Mission, the KMC has plans to replace all 270,000 metal halide lights in the city with LED lights. In the initial phase, they aim to replace 30,000 bulbs, requesting a grant of USD 11.5 million from the state government (Ray, 2018). The available data indicates that the KMC spent USD 2.15 million in FY 2018 and 2019 for this program.

Another program, the Street Lighting National Programme (SLNP), led by the Energy Efficiency Services Limited (EESL), allocated USD 17,000 in FY 2018 and FY 2019 to replace conventional streetlights in Kolkata (West Bengal) with smart and energy-efficient LED streetlights.

Investments in the energy efficiency sector also encompass green building construction, retrofitting, renovation, and modernization of existing buildings. In FY 2018 and FY 2019, these investments amounted to USD 22.14 million and USD 6.69 million, respectively. It is mandatory in West Bengal for commercial buildings with a connected load of 100 kW or greater or a contract demand of 120 kVA or greater to comply with the Energy Conservation Building Code 2017.

6.2. Impacts of the Initiatives

Over the past five years, there can be seen a significant growth due to the initiatives and steps taken by Government of India and West Bengal. There has been a significant increase in total credit disbursement in West Bengal. The disbursement has risen by 297% from Rs. 1,06,599 crore in 2017-18 to Rs. 4,23,725 crore in 2021-22. Within this, Priority Sector advances have also seen a substantial growth of 116%, increasing from Rs. 92,568 crore in 2017-18 to Rs. 2,00,170 crore in 2021-22. Moreover, the flow of Ground Level Credit (GLC) to agriculture and allied activities has witnessed a 77% increase, reaching Rs. 74,690 crore from Rs. 42,232 crore in the same period.

It's worth noting that during this five-year period, the proportion of GLC flow under the Priority Sector has declined from a maximum share of 87% to 47% of the total GLC flow in 2021-22 (See Figure 9.26). This indicates a diversification of credit allocation across various sectors. These figures highlight the substantial growth in credit disbursement, particularly in the Priority Sector and

agriculture-related activities, contributing to the economic development of West Bengal with the help of financial inclusion.

Other than the financial aspects of the state, West Bengal have made limited progress in the national priority of renewable energy development. This can be attributed to the lack of clear mandates in energy governance and a lack of coordination among relevant departments. At the state level, organizations like WBREDA and WBGEDCL need to work together more effectively to drive renewable energy initiatives. Improved coordination and collaboration among these departments played an important role for successful implementation. Similarly, at the city level, the Department of Lighting and Electricity plays a crucial role in renewable energy projects. However, the lack of coordination between different departments has hindered the progress. To overcome the social and environmental challenges and enhance renewable energy efficiency, state has implemented the concept of green building and rooftop solar panels. These initiatives improved the requirement of the green finance and its implementation for the state projects linked to the environmental sustainability and development. This will further help drive greater progress and achieve the national goals in green finance and financial inclusion in West Bengal by promoting inclusive green finance.

7. CONCLUSION

In nutshell, this paper clearly explains the concept of green finance, green bonds, financial inclusion and FinTech with the help of analysing the data from BRICS (Brazil, Russia, India, China, and South Africa). It helps to understand trends of these concepts around the globe with a focus on BRICS nations. With the help of Principal Components Analysis, it demonstrated the relationship between selected factors of green finance and financial inclusion to understand the concept of inclusive green finance. It showed that Inclusive green finance is a financial approach that focuses on combining two vital objectives: environmental sustainability (Green Finance) and social inclusivity (Financial Inclusion) which aims to address environmental challenges, such as climate change, resource depletion, and pollution, while ensuring that the benefits of these efforts are distributed equitably across society. Considering different factors from financial inclusion and green finance for PCA provides the result with specific principal components compacting the characteristics of both concepts. The changing patterns in the relationships among the BRICS countries over the years are possibly related to various economic, social, environmental, or political developments. India and China are generally showing positive indicators for financial inclusion, but China performs better with commercial bank accessibility. Both countries made a significant progress in green finance too.

Overall, the data underscores the changing dynamics among BRICS countries, potentially linked to financial, economic, societal, environmental, and political developments. These evolving relationships provide a compelling case for supporting inclusive green finance, especially in the context of sustainability and sustainable development goals. As these nations continue to evolve, green finance can play a pivotal role in fostering economic growth, environmental protection, and social inclusion across the BRICS bloc, and indeed, the global stage. To give a practical shape to the concept of Inclusive Green Finance, the case study of West Bengal acts as a major tool. This case of West Bengal set an example for other states for promoting green finance along with social and financial inclusivity with the help of modern financial instruments including FinTech services.

8. LIMITATIONS AND FUTURE SCOPE

8.1. Limitations

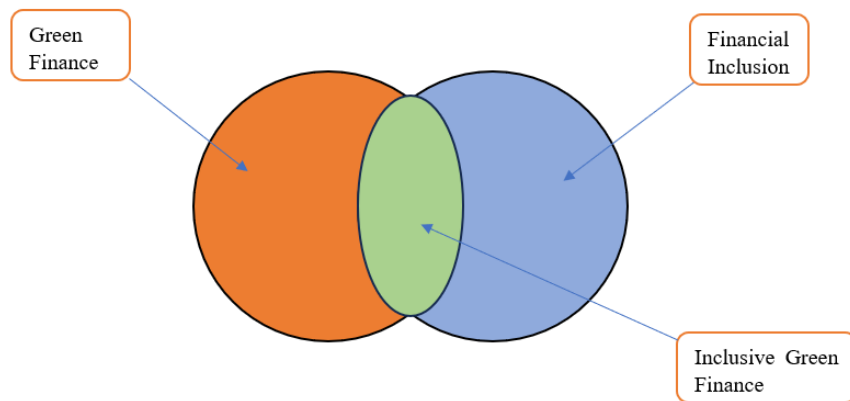
- **Data Availability:** The availability and quality of data may vary across different regions and countries. Incomplete or inconsistent data can impact the accuracy of the analysis.
- **Generalizability:** The findings are based on the BRICS countries, which represent a specific subset of emerging economies. Extending the analysis to a more diverse set of countries can provide a broader perspective.
- **Changing Dynamics:** The paper focused on data from 2014, 2017, and 2021. Economic, social, and environmental dynamics are constantly evolving. A longitudinal study that tracks these changes over a more extended period would offer deeper insights.

8.2. Future Scope

- **Regional Studies:** Future research can delve into the specific green finance and financial inclusion practices of individual BRICS nations, providing a more granular analysis of their strategies and outcomes.
- **Impact Assessment:** Assessing the real-world impact of inclusive green finance initiatives in terms of environmental sustainability and social inclusivity can be a promising area of study. This involves evaluating the effectiveness of green projects in achieving their intended goals.
- **Policy Analysis:** Investigating the role of government policies, regulations, and incentives in promoting green finance and financial inclusion would be valuable. Understanding how these policies influence decision-making and investment choices is crucial.
- **Case Studies:** Conducting in-depth case studies, similar to the one on West Bengal, in different regions or countries can offer practical insights and lessons for policymakers and financial institutions.
- **Long-Term Trends:** Given the urgency of global sustainability challenges, research focusing on long-term trends, especially in the context of climate change, can provide a clearer picture of the effectiveness of inclusive green finance initiatives.

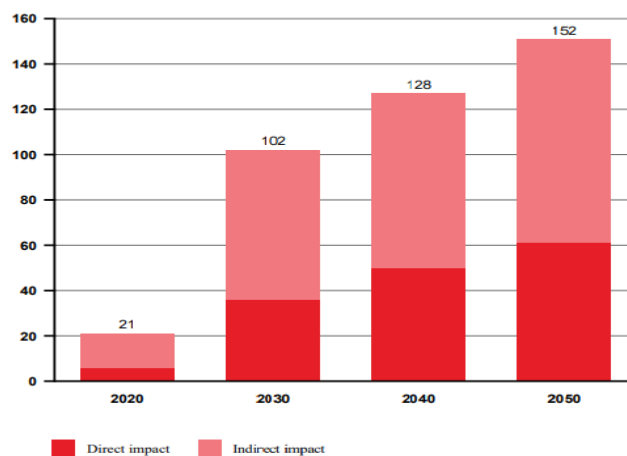
9. FIGURES

9.1. Inclusive Green Finance



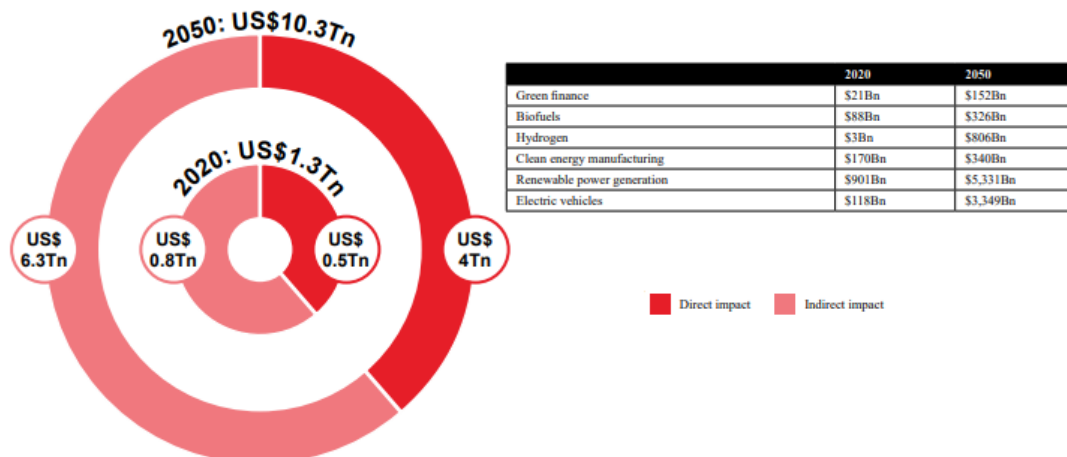
Source: Author's Figure

9.2. Global GVA from Green Financial Services, under NZE2050 scenario



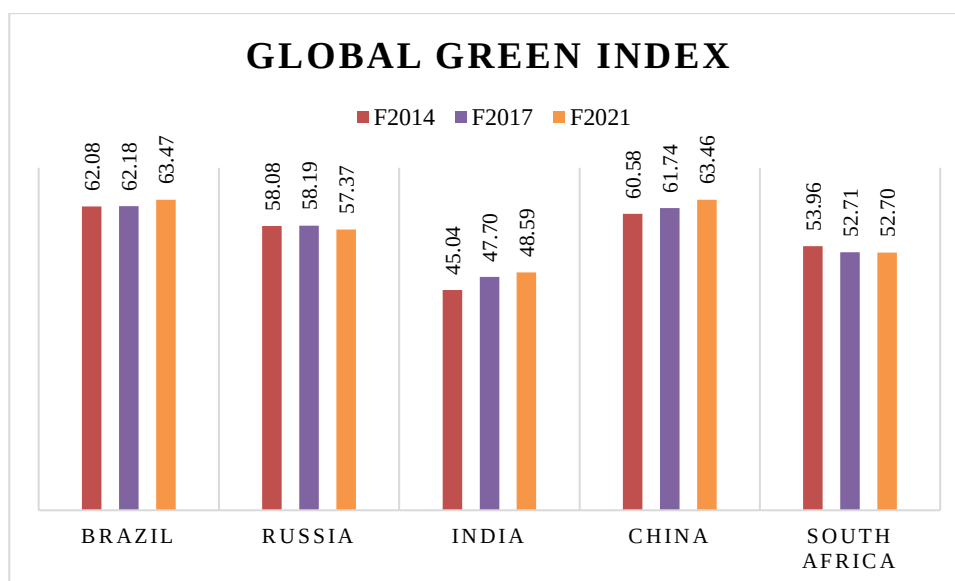
Source: Oxford Economics; ARUP Singapore, 2023

9.3. A view of Global Productivity (USD)



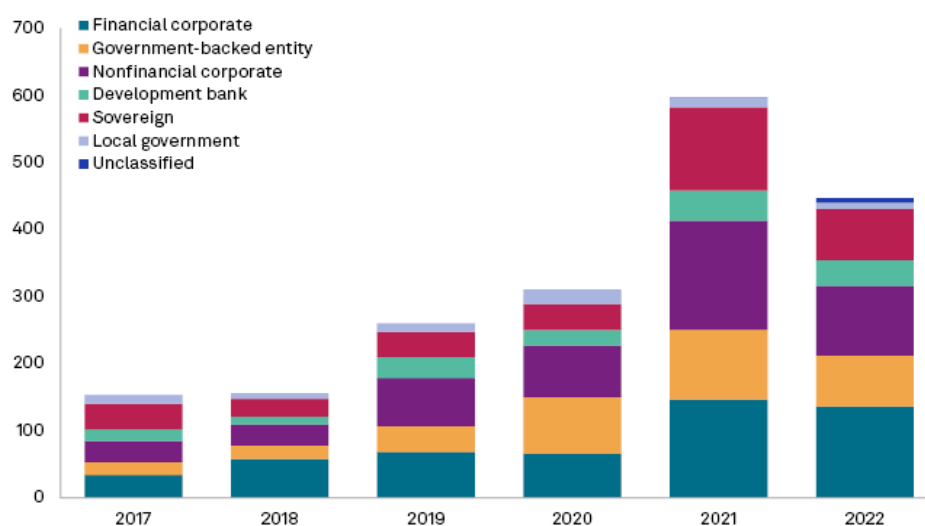
Source: Oxford Economics, ARUP, 2023

9.4. Global Green Index (BRICS Nations)



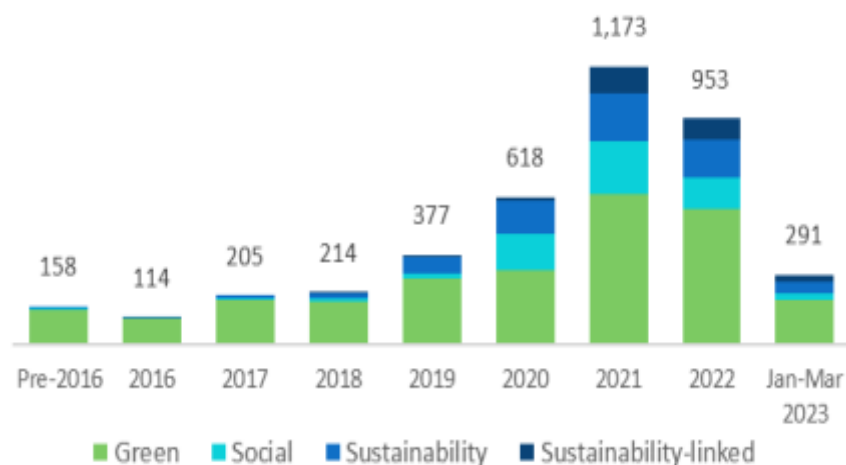
Source: Global Green Growth Institute (GGGI) Database, Author's figure

9.5. Global Green Bonds by Issuers Type (Billions USD)



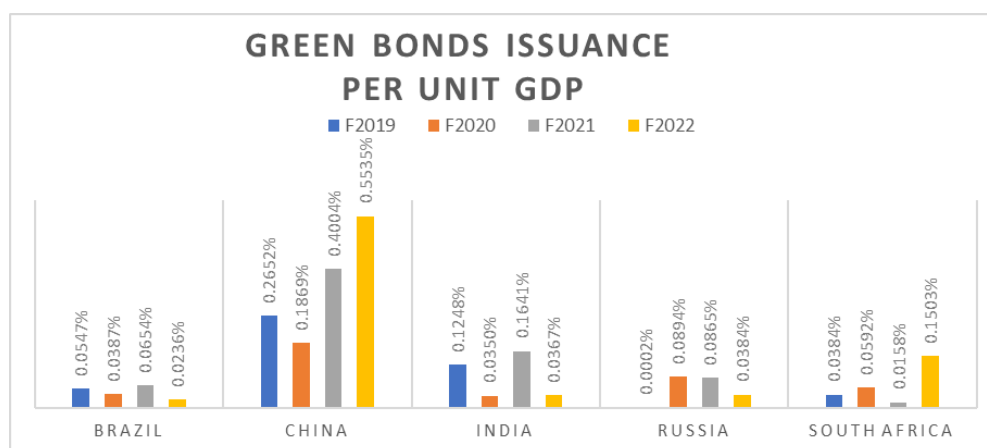
Source: S&P, 2023

9.6. Annual Global Green Bonds Issuance compared to SSS Bonds (Bn USD)



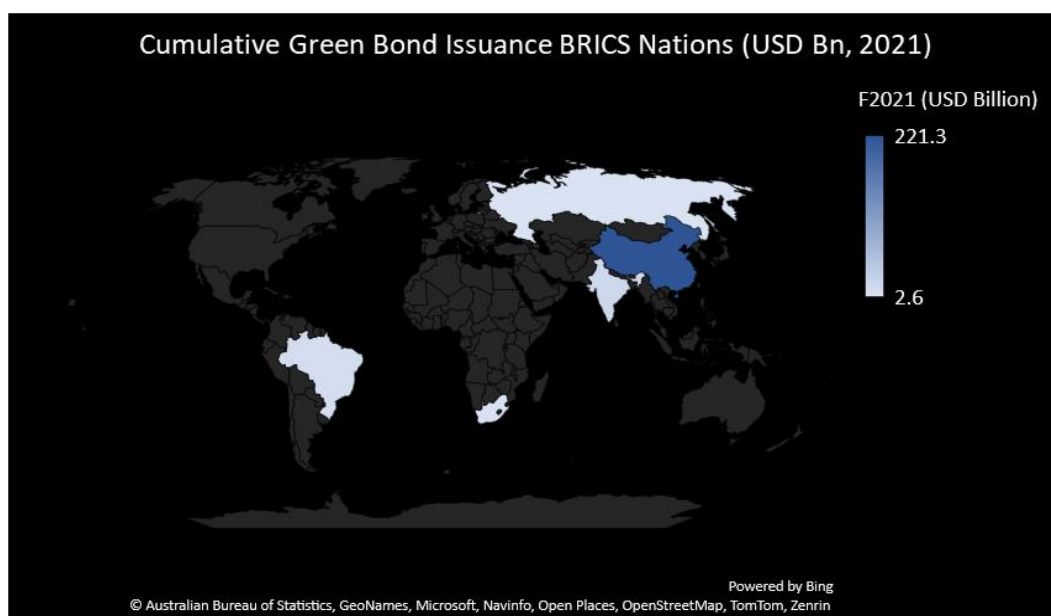
Source: World Bank, 2023

9.7. Green Bond Issuance Per Unit GDP (%)



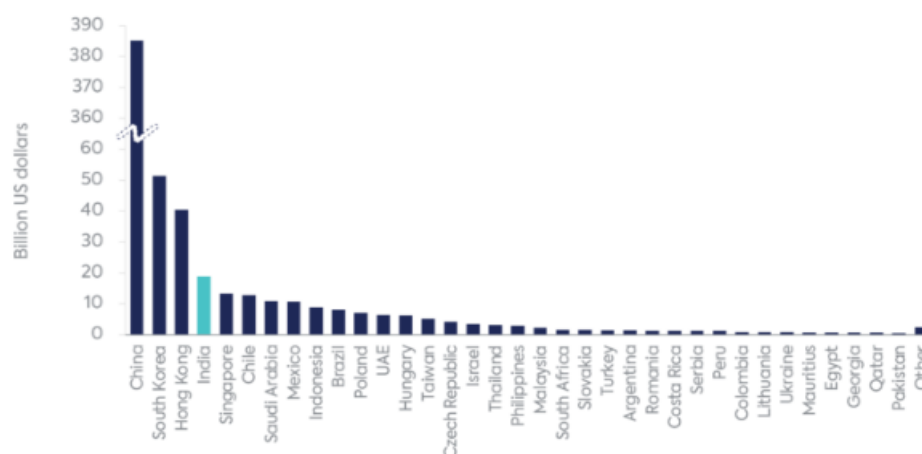
Source: Amundi, Author's Figure

9.8. BRICS Nations' Cumulative Green Bond Issuance



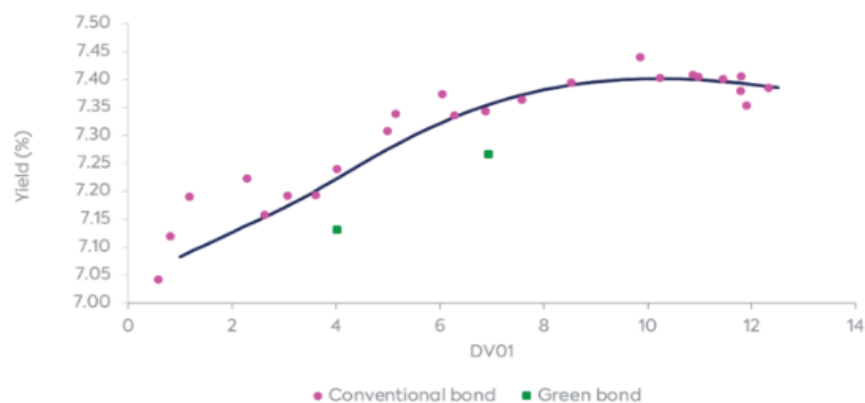
Source: Amundi, Author's Figure

9.9. Total Green Bond Issuance of emerging markets (Bn USD)



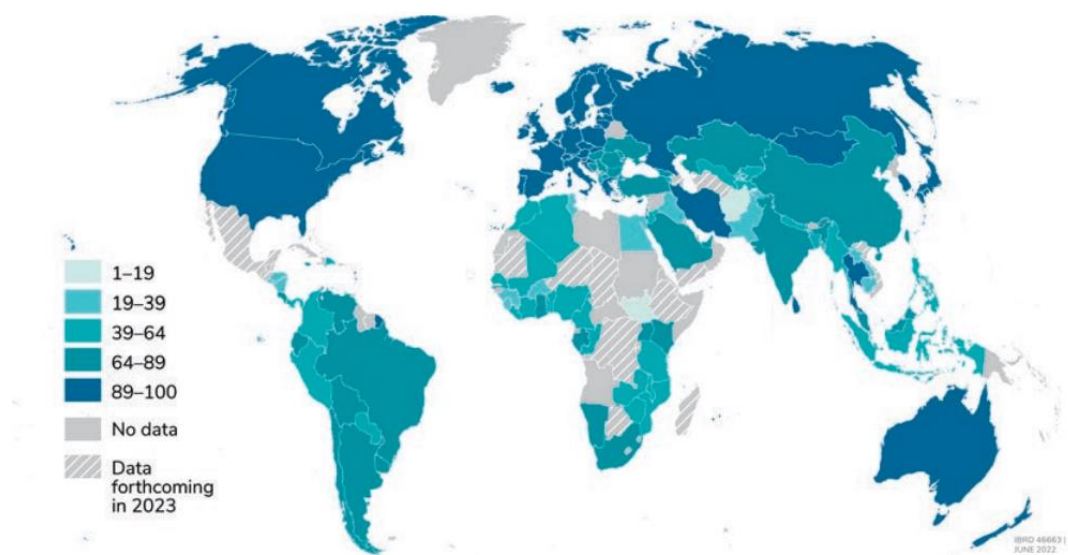
Source: Bloomberg, 2023

9.10. Local Currency Bond Curve (Sovereign, India)



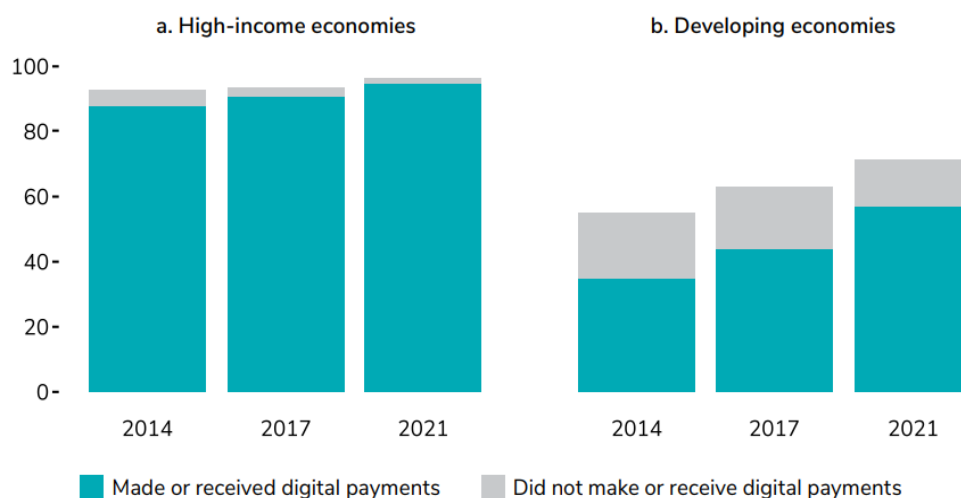
Source: Bloomberg; Center on Global Energy Policy, 2023

9.11. Account Ownership Rates (Adults with an account %, 2021)



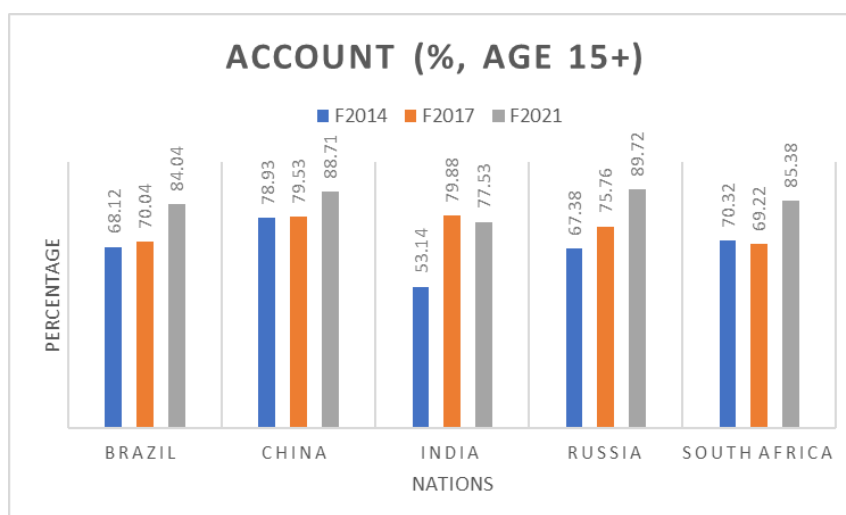
Source: Global Findex Database 2021, Page No. 15

9.12. Adults with an account (High Income Vs. Developing Nations), 2014-2021



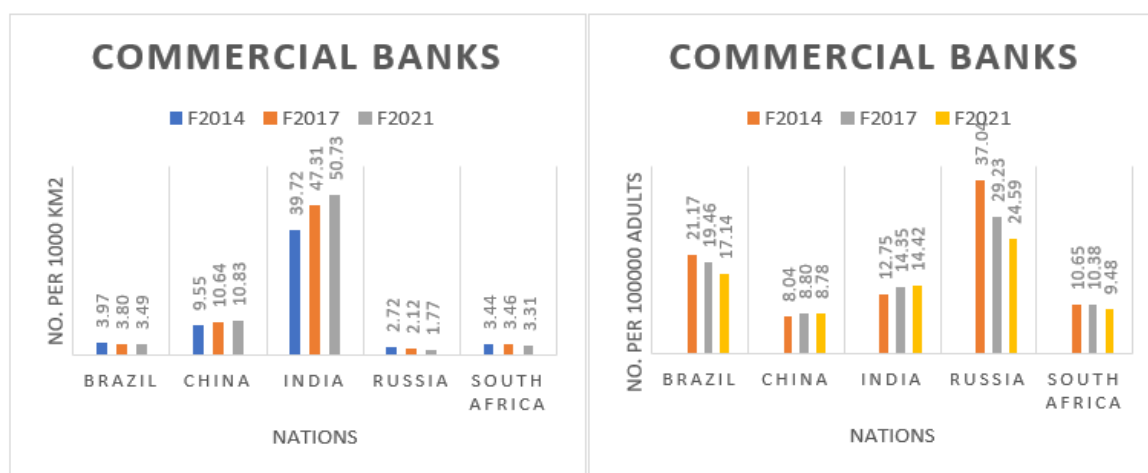
Source: Global Findex Database 2021, Page No. 55

9.13. Adults having Bank Accounts in BRICS (%)



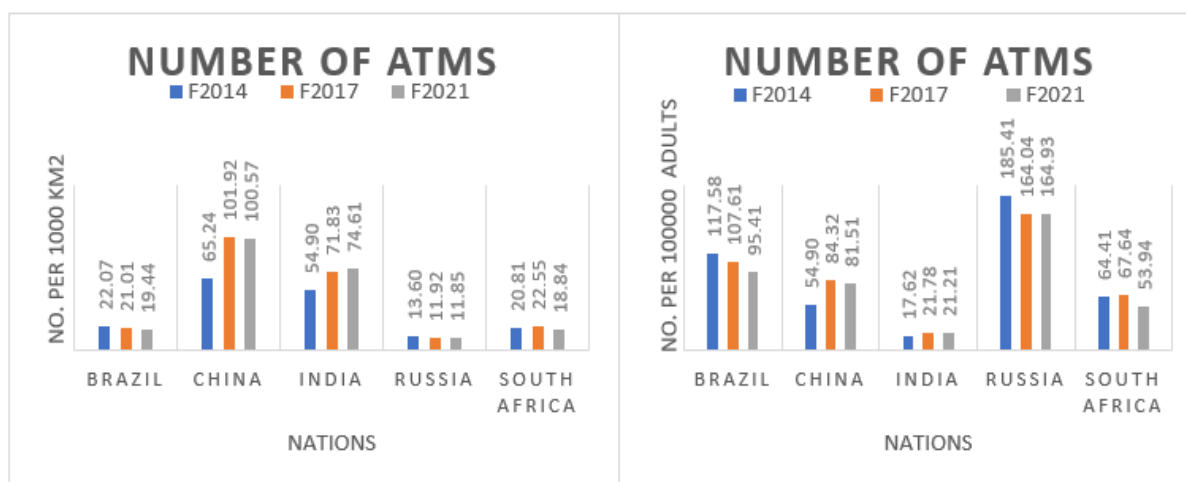
Source: World Bank, Author's figure

9.14. Number of Commercial Bank Branches in BRICS Nations



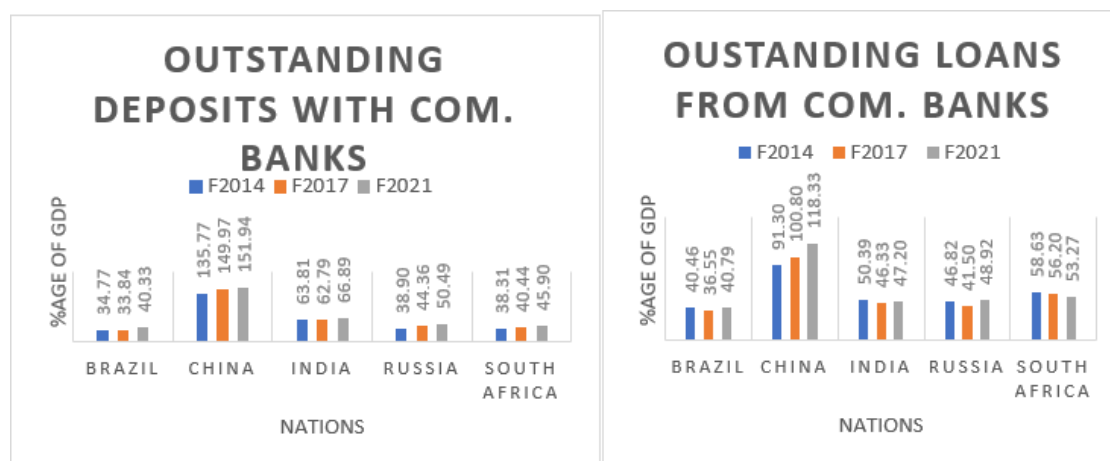
Source: World Bank, Author's Figure

9.15. Number of ATMs in BRICS Nations



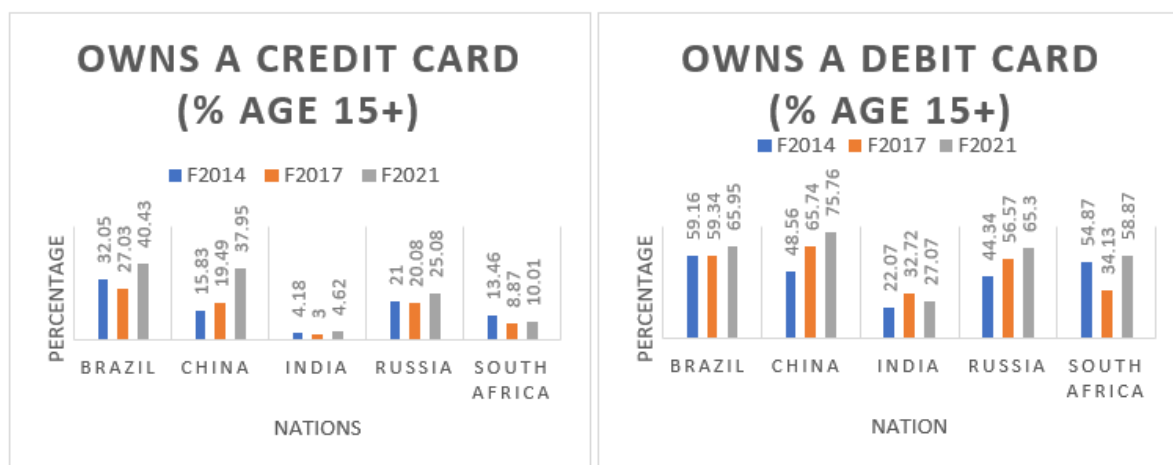
Source: World Bank, Author's Figure

9.16. Outstanding Deposits and Loans with Commercial Banks in BRICS (% of GDP)



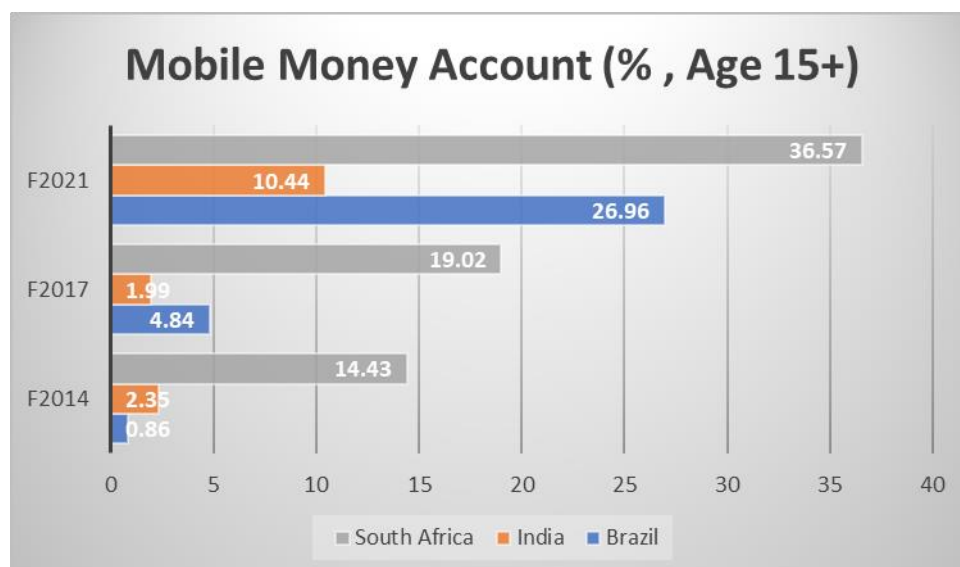
Source: World Bank, Author's Figure

9.17. Adults owning Credit and Debit Card (BRICS)



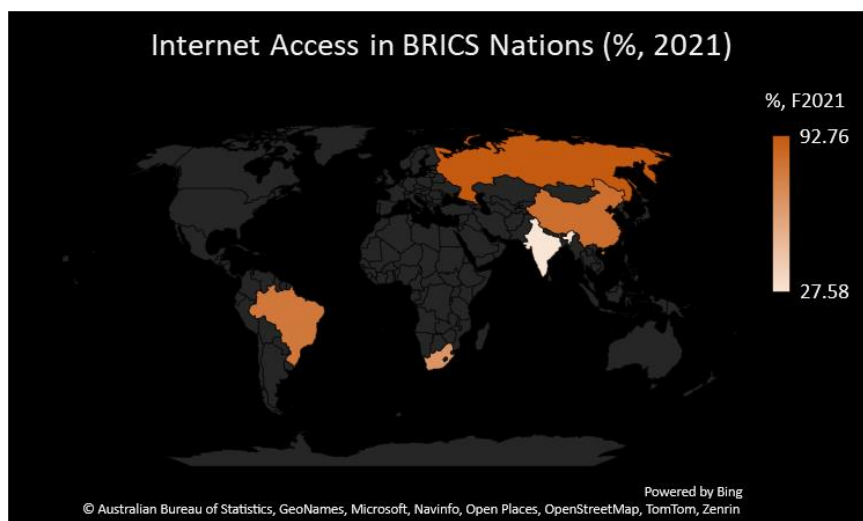
Source: World Bank, Author's Figure

9.18. Mobile Money Account (% , age > 15)



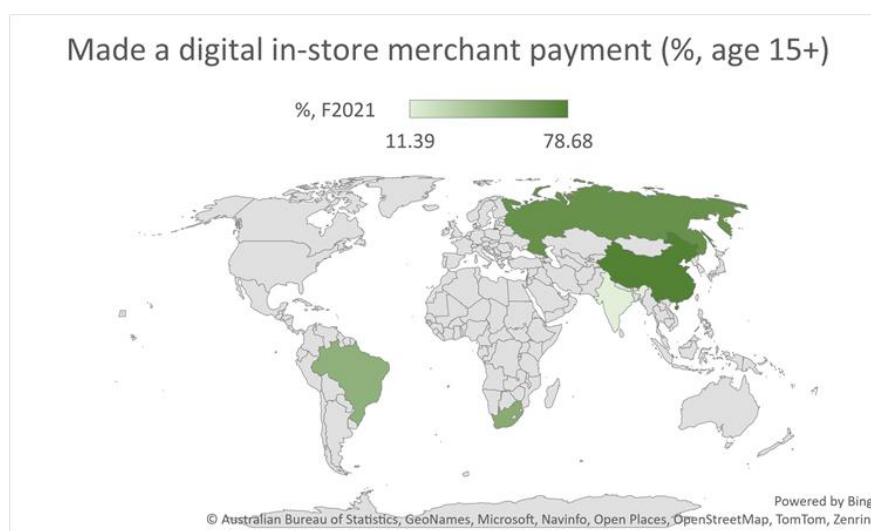
Source: World Bank, Author's Figure

9.19. Internet Access in BRICS



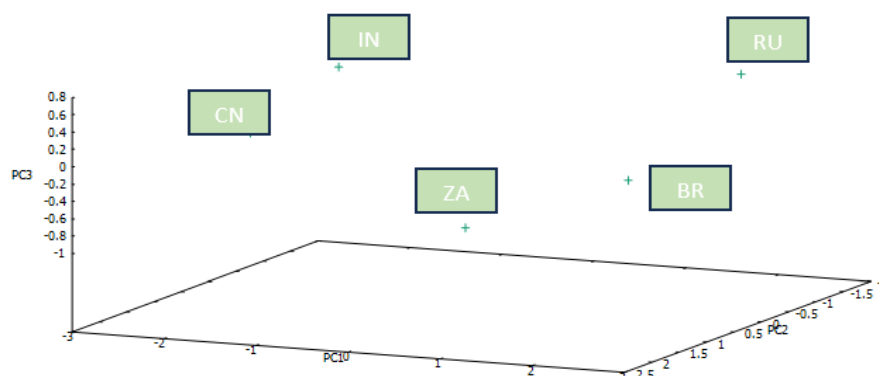
Source: World Bank, Authors' Figure

9.20. Digital in-store merchant payment (%)



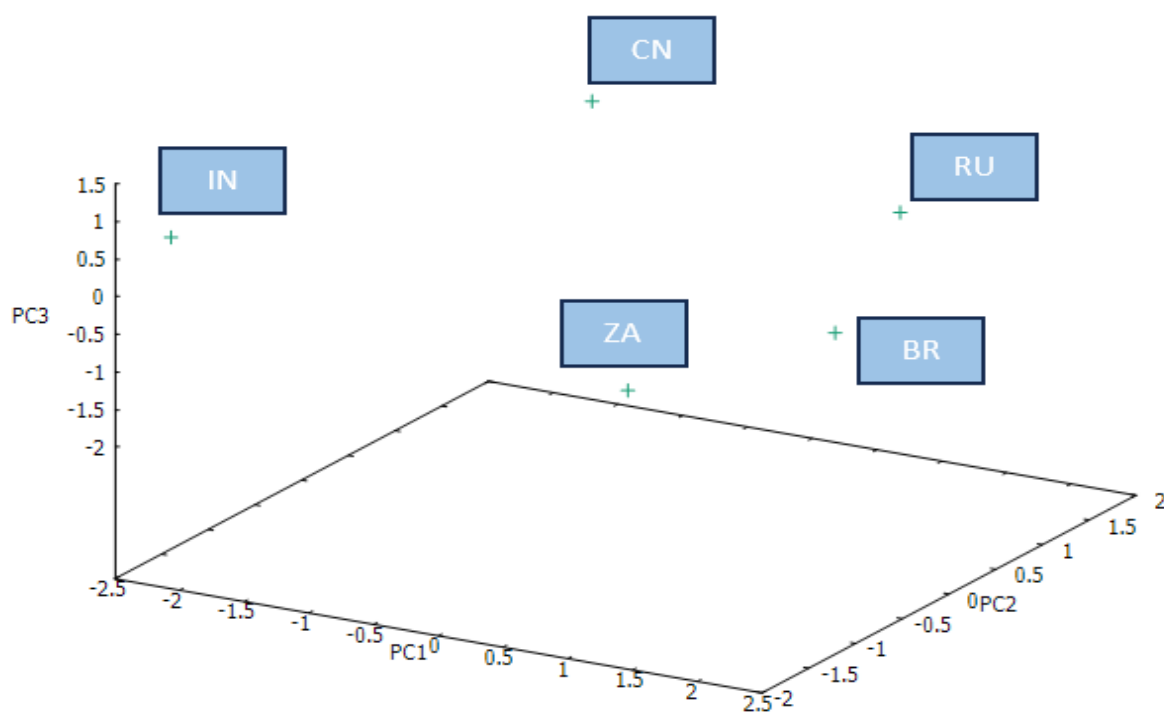
Source: World Bank, Author's Figure

9.21. PC1, PC2, and PC3 Matrix for Year 2014



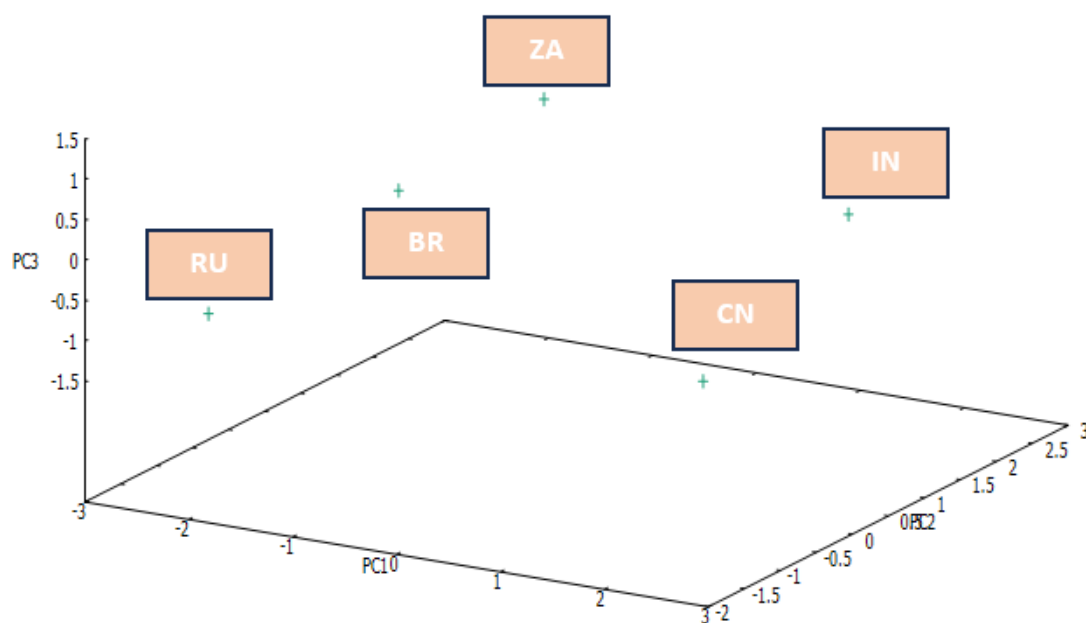
Source: Author's Figure

9.22. PC1, PC2, and PC3 Matrix for Year 2017



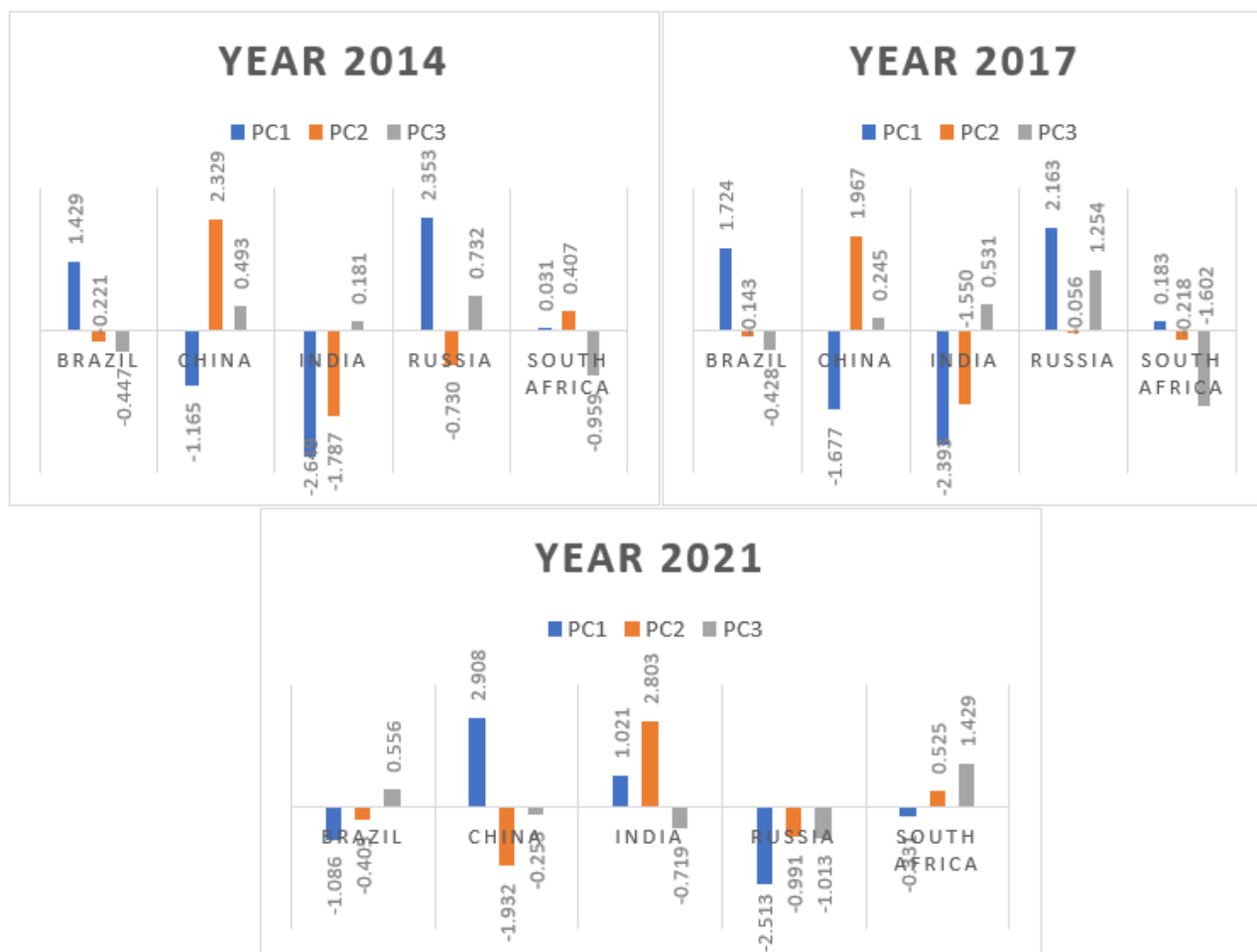
Source: Author's Figure

9.23. PC1, PC2, and PC3 Matrix for Year 2021



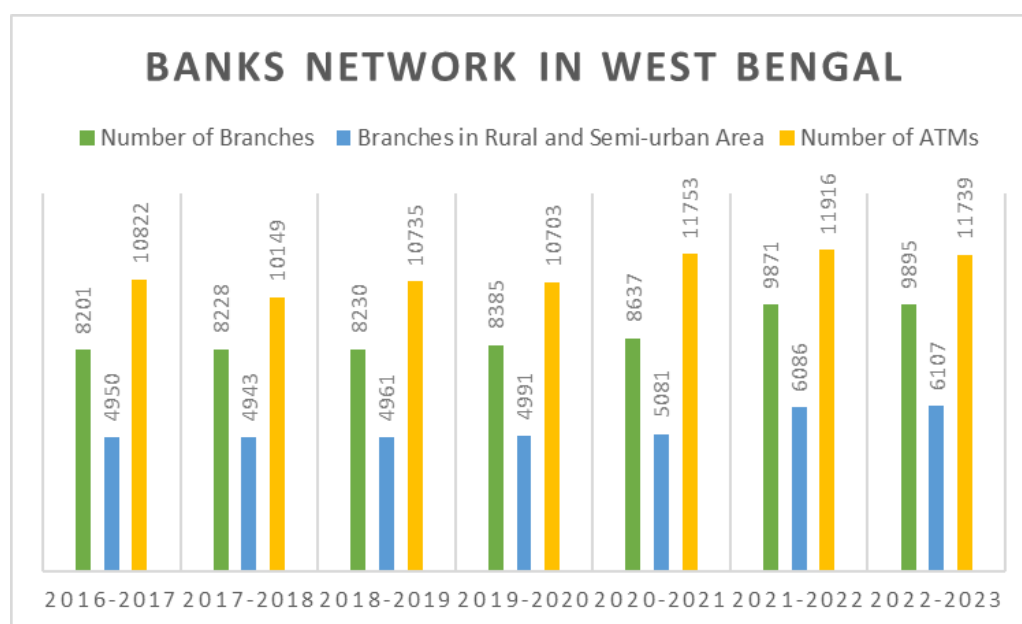
Source: Author's Figure

9.24. Variation of Principal Components



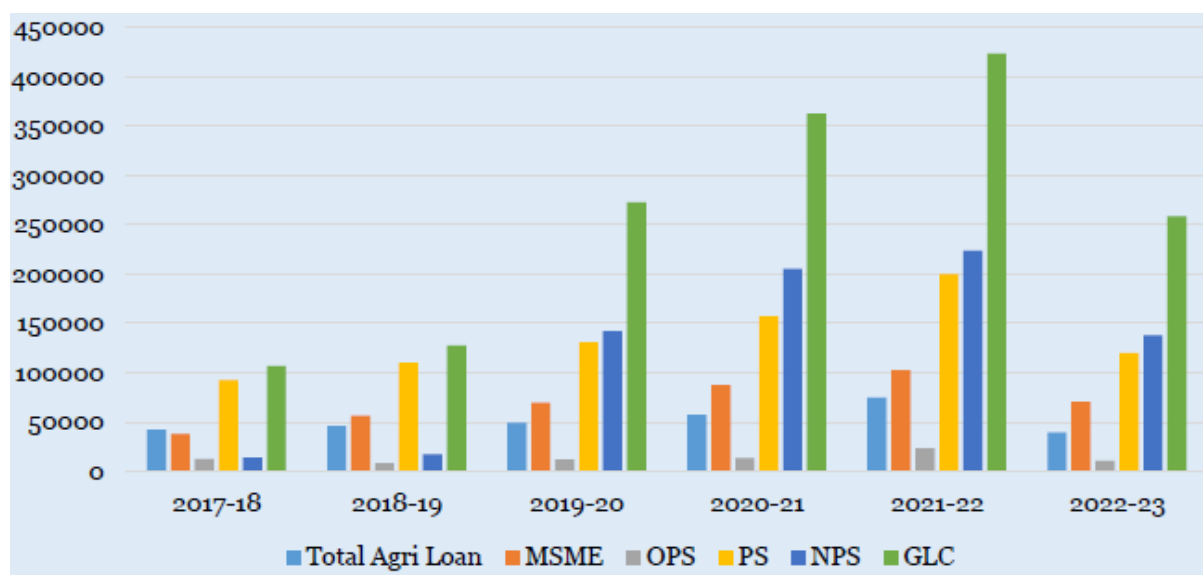
Source: Author's Figure

9.25. Banks Branch Network in West Bengal



Source: SLBC West Bengal 2023, Author's Figure

9.26. West Bengal's Credit Flow Trends (Crore, INR)



Source: SLBC West Bengal, 2023

*Agri Loan = Agriculture Loan, MSME = Micro, Small and Medium Enterprises, OPS = Old Pension Scheme, PS = Priority Sector, NPS = National Pension Scheme, GLC = Ground Level Credit.

10. REFERENCES

- Alola, A.A., & Onifade, S.T. (2022). Energy innovations and pathway to carbon neutrality in Finland, *Sustain. Energy Technol. Assessments*, 52 (2022), Article, <https://doi.org/10.1016/j.seta.2022.102272>
- Ajide, F. M. (2020). Financial inclusion in Africa, does it promote entrepreneurship? *Journal of Financial Economic Policy*, 12(4), 687–706.
- Association of Microfinance Institutions, West Bengal Annual Report 2021-22
- Atkinson, A., & Messy, F. A. (2013). Promoting financial inclusion through financial education, OECD/INFE evidence, policies and practice. *OECD Working Papers on Finance, Insurance and Private Pensions*, 32, 1–54.
- Babu, S. M. & Kumar, A. G. (2022) Outreach of Formal Banking Services and Financial Inclusion by Elayaraja MS, *Economic & Political Weekly* (Vol 57, Issue No. 43, Oct 2022)
- Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality, and poverty: Cross-country evidence. *Journal of Economic Growth*, 12(1), 27-49.
- Baulch B., Do, T.D. & Le, T.H. (2018). Constraints to the uptake of solar home systems in Ho Chi Minh City and some proposals for improvement *Renew. Energy*, 118 (2018), pp. 245-256, 10.1016/j.renene.2017.10.106
- Blumenstock, J. E., Eagle, N., & O'Hanlon, B. (2018). Mobile Divides: Gender, Socioeconomic Status, and Mobile Phone Use in Rwanda. *Information Technologies & International Development*, 14(2), 23-32.
- Blumenstock, J., Callen, M. & Ghani, T. (2018). “Why Do Defaults Affect Behavior? Experimental Evidence from Afghanistan.” *American Economic Review* 108 (10): 2868–901
- Chueca, C. V. & Ferruz, L. A. (2021). Fintech and sustainability: do they affect each other? *Sustainability*, 13 (13), p. 7012
- Croutzet, A. & Dabbous, A. (2021). Do FinTech trigger renewable energy use? Evidence from OECD countries *Renew. Energy*, 179 (2021), pp. 1608-1617
- Centre for Research on Financial Inclusion and Microfinance (CRFIM), BIRD, NABARD, Trend Report on Financial Inclusion in India, <https://birdlucknow.nabard.org/wpcontent/uploads/2022/10/Trend%20Report%20Nov%202022%20FINAL.pdf>
- Climate Bonds Initiative. (2021). 2020 green bond market summary. Retrieved from <https://www.climatebonds.net/resources/reports/2020-green-bond-market-summary>
- Climate Policy Initiatives (2021) Snapshot of Urban Green Finance in Two Indian Cities Case Studies of Hyderabad and Kolkata, https://www.climatepolicyinitiative.org/wp-content/uploads/2021/11/CCFLA-Indian-cities-report_FINAL-1.pdf
- Cochu, A., Glenting, C., Hogg, D., Georgiev, I., Skolina, J., Eisinger, F. & Chowdhury, T. (2016). Study on the potential of green bond finance for resource-efficient investments. European Commission.
- Cochu, A., et al. (2016). Green Bond Portfolios: Diversification Benefits and Performance Drivers. *Journal of Sustainable Finance & Investment*, 6(3), 165-181.
- Cowan, E. (1999). Greening the financial sector. *World Development*, 27(6), 979-987.
- Cui, H., Wang, R., & Wang, H. (2020). An evolutionary analysis of green finance sustainability based on multi-agent game, *J. Clean. Prod.* 269 (2020), <https://doi.org/10.1016/j.jclepro.2020.121799>.
- Cull, R., Demirgüç-Kunt, A., & Morduch, J. (2009). Financial performance and outreach: A global analysis of leading microbanks. *The Economic Journal*, 119(540), 1078-1101.

- Danielle, M., Niazi, Z., Rouse, R., & Kramer, B. (2019). “Building Resilience through Financial Inclusion: A Review of Existing Evidence and Knowledge Gaps.” Financial Inclusion Program, Innovations for Poverty Action, Washington, DC. <https://www.poverty-action.org/publication/building-resilience-through-financial-inclusion-review-existing-evidence-and-knowledge>
- Demirgüç-Kunt, A., & Klapper, L. (2013). Measuring financial inclusion, explaining variation in use of financial services across and within countries. *Brookings Papers on Economic Activity*, 2013(1), 279–340.
- Dhutia, D. L. (2023). “India’s First Green Bond Issue Pulls Local Bidders, Foreigners Aloof—Traders,” *Reuters*, January 26, 2023, <https://www.reuters.com/world/india/india-sells-first-green-bonds-5-6-basis-points-below-sovereign-yields-2023-01-25/>.
- Duflo, E., Karlan, D., & Osei, R. (2012). Savings by and for the Poor: A Research Review and Agenda. *Handbook of Household Finance*, 325–425.
- Emblemståv, J. (2022). Wind energy is not sustainable when balanced by fossil energy *Applied Energy*, 305 (2022), Article 117748, <https://doi.org/10.1016/j.apenergy.2021.117748>
- Erik, F., Frost, J., Gambacorta, L., Natarajan, H., & Saal, M.. 2020. “FinTech And the Digital Transformation of Financial Services: Implications for Market Structure and Public Policy.” *BIS Papers No 117*, July 2021. <https://www.bis.org/publ/bppdf/bispap117.pdf>
- Falcone, P. M. (2020). Green finance as a driver of sustainable economic growth. In *Handbook of Green Finance* (pp. 1–16). Palgrave Macmillan.
- Fungáčová, Z., & Weill, L. (2014). Understanding financial inclusion in China Working Papers of LaRGE Research Center, pp. 196–206
- Frost, J., L. Gambacorta, Y. Huang, H.S. Shin, and P. Zbinden (2019), BigTech and the changing structure of financial intermediation. BIS Working Papers.
- Gianfranco, G., & Mattia, S. (2019). Green Bond Pricing and Trading: Evidence from the European Market. *Journal of Banking & Finance*, 101, 181–200.
- Global Findex Survey (2021). World Bank, <https://www.worldbank.org/en/publication/globalfindex/Report>
- Global Green Growth Institute, https://ggindex-simtool.gggi.org/SimulationDashboard/global_overview
- Global Impact Investing Network. (2021). 2020 annual impact investor survey. Retrieved from <https://thegiin.org/research/publication/2020-annual-impact-investor-survey>
- Goel, D. (2016). Green Bond Investments: The Driver for Sustainable Development. *Energy Policy*, 98, 97–107.
- Goel, P. (2016). Green Finance: A Step towards Sustainable Financial System. *Abhinav International Monthly Refereed Journal of Research in Management & Technology*, Vol(5) No(5), pp.22–31
- Government of India (2023). “Framework for Sovereign Green Bonds,” Department of Economic Affairs, <https://dea.gov.in/sites/default/files/Framework%20for%20Sovereign%20Green%20Bonds.pdf>.
- Grohmann, A., Klühs, T., & Menkhoff, L. (2018). Does financial literacy improve financial inclusion? Cross country evidence. *World Development*, 111, 84–96.
- Hair, J. F. Jr., Anderson, R., Tatham, R., & W. C. (1998). *Multivariate Data Analysis* (fifth edition), Upper Saddle River, New Jersey: Prentice Hall
- IFC. 2018. “Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution.”

- Jain, G. (2020). "Thematic Bonds: Financing Net-Zero Transition in Emerging Market and Developing Economies," Center on Global Energy Policy, Columbia University, December 12, 2022, <https://www.energypolicy.columbia.edu/publications/thematic-bonds-financing-net-zero-transition-emerging-market-and-developing-economies/>.
- Jin, J., & Han, L. (2016). Risk Analysis of Green Bonds. *Journal of Cleaner Production*, 139, 518-527.
- Kaminker, C., & Stewart, F. (2012). The Market for Green Bonds: Development and Outlook. *OECD Journal: Financial Market Trends*, 2012(1), 73-98.
- Kaya, Y., Yamaguchi, M., Geden & O. (2019). Towards net zero CO2 emissions without relying on massive carbon dioxide removal, *Sustain. Sci.*, 14 (6), pp. 1739-1743
- Labatt, S., & White, R. (2002). Building a sustainable future: financial sector approaches to sustainable development. International Institute for Sustainable Development.
- Lai, X., Yue, S., & Chen, H., (2022). Can green credit increase firm value? Evidence from Chinese listed new energy companies *Environ. Sci. Pollut. Res.*, 29 (13) (2022), pp. 18702-18720
- Lee, C.C., Wang, C.W. & Ho, S.J. (2020). Financial inclusion, financial innovation, and firms' sales growth, *Int. Rev. Econ. Finance*, 66, pp. 189-205, <https://doi.org/10.1016/j.iref.2019.11.021>
- Li, C., Sampene, A.K., Agyeman, F.O., Brenya, R., Wiredu, J. (2022), The role of green finance and energy innovation in neutralizing environmental pollution: empirical evidence from the MINT economies *J. Environ. Manag.*, 317 (2022), Article 115500
- Lin, R., Gui, Y., Xie, Z., & Liu, L., (2019), Green governance and international business strategies of emerging economies' multinational enterprises: a multiple-case study of Chinese firms in pollution-intensive industries *Sustainability*, 11 (4) (2019), p. 1013
- Lindenberg, N. (2014). *Green finance and investment in India*. Routledge.
- Mader, P. (2018). Contesting financial inclusion. *Development and Change*, 49(2), 461–483.
- Mathews, J. A. (2012). Financing the Green Transformation. *Nature Climate Change*, 2(12), 805-806.
- Morduch, J., & Haley, B. (2002). Analysis of the effects of microfinance on poverty reduction. NYU Wagner Working Paper No. 1039.
- Morningstar. (2021). Morningstar's latest research finds sustainable funds outperformed traditional funds in 2020. Retrieved from <https://www.morningstar.com/company/press-release/20200423-morningstars-latest-research-finds-sustainable-funds-outperformed-traditional-funds-in-2020>
- NABARD State Focus Paper 2023-24, <https://www.nabard.org/info-centre-state-focus-papers.aspx?cid=512&id=698>
- National Strategy of Financial Inclusion, <https://rbidocs.rbi.org.in/rdocs/content/pdfs/NSFIREPORT100119.pdf>
- Osafo-Kwaako, P., Singer, M., White, O. & Zouaoui, Y. (2018), *Mobile Money in Emerging Markets: The Business Case for Financial Inclusion*. McKinsey & Co.
- Ozturk, I., Ullah, S. (2022). Does digital financial inclusion matter for economic growth and environmental sustainability in OBRI economies? An empirical analysis <https://doi.org/10.1016/j.resconrec.2022.106489>
- Pazarbasioglu, C., Mora, A.G., Uttamchandani, M., Natarajan, H., Feyen, E., & Saal, M. (2020). *Digital Financial Services*. World Bank FCI GP Paper.

- Pomeranz, D., & Felipe, K. (2022). "Savings Accounts to Borrow Less: Experimental Evidence from Chile." *Journal of Human Resources*. Published ahead of print, March 9, 2022. doi:10.3368/jhr.0619-10264R3.
- Pradhan, R.P., Arvin, M.B., Nair, M.S., Hall, J.H. & Bennett, S.E. (2021). Sustainable economic development in India: the dynamics between financial inclusion, ICT development, and economic growth *Technol. Forecast. Soc. Chang.*, 169 (2021), Article 120758
- Principal component analysis of social capital indicators (2019), A methodological paper by Office of National Statistics, United Kingdom,
- Ray, S. (2018). On green mission, KMC to light up city streets with 2.7L LEDs, *The Times of India*,
- Reboredo, J. C. (2018). Green Bond and Stock Market: Evidence from European Financial Markets. *Energy Economics*, 72, 310-324.
- Reboredo, J. C., & Ugolini, A. (2020). Are Green Bonds Priced at a Premium or Discount? A Systematic Review and Meta-Analysis. *Journal of Sustainable Finance & Investment*, 10(2), 139-159.
- Reserve Bank of India (2023). "Underwriting Auction for Sale of Government of India Sovereign Green Bonds for ₹8,000 Crore on January 25, 2023," press release, January 24, 2023, https://www.rbi.org.in/scripts/BS_PressReleaseDisplay.aspx?prid=55100#.
- Salazar, J. J. (1998). Green finance: a tool for environmental management. *Environmental management*, 22(2), 191-201.
- Sarma, M., & Pais, J. (2011). Financial inclusion and development. *Journal of International Development*, 23(5), 613–628.
- Sarma, M. (2012). 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.
- Scholtens, B. (2006). Finance as a driver of corporate social responsibility. *Journal of business ethics*, 68(1), 19-33.
- Scholtens, B. & Lammertjan, D. (2006). Towards Sustainable Investment: An Emerging Bond Market? *Sustainable Development*, 14(3), 143-153.
- Singh, K., & Singh Kondan, A. (2011). Financial inclusion, development and its determinants, an empirical evidence of Indian States. *Asian Economic Review*, 53(1), 115.
- SLBC 158th Meeting Agenda, https://slbcbengal.pnbindia.in/Background_Paper_Quarterly.asp
- Sounderrajan, A., & Vivek, A. (2016). Green finance as a catalyst for low-carbon and resource-efficient development in India. *Sustainable Development*, 24(3), 173-183.
- Taghizadeh-Hesary, F., & Yoshino, N. (2019). Green finance for renewable energy projects: an empirical study from Asia. *Sustainability*, 11(8), 2304.
- The World Bank. (2021). Green Finance. Retrieved from <https://www.worldbank.org/en/topic/financialsector/brief/green-finance>
- United Nations. (n.d.). Paris Agreement. Retrieved from <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>
- United Nations Environment Programme Finance Initiative (UNEP FI). (2021). Sustainable finance. Retrieved from <https://www.unepfi.org/sustainable-finance/>
- Van Renssen, S. (2014). Climate Bonds: Funding the Future. *Nature Climate Change*, 4(1), 4-5.
- Wood, K., & Grace, K. (2011). Green Bonds: The Evolution of Sustainable Finance. *Environmental Finance*, 5(3), 84-89.

- Yao, X., & Zi, Y. (2016). Green Finance and Ecological Economics: A New Framework for a Green Future. *Ecological Economics*, 121, 54-61.
- Yao, W., & Zhi, Q. (2016). The role of green finance in environmental protection: Two aspects of market mechanism and policies. *Energy Procedia*, Vol (104), pp 311 – 316
- Zhou, H., Lei, Y., Zhou, D., & Zheng, H. (2020). Green finance and environmental quality: Evidence from China's provincial panel data. *Energy Economics*, 91, 104994.

11. APPENDICES

11.1. Correlation Matrix for Year 2014

Correlation coefficients, using the observations 1 - 5
5% critical value (two-tailed) = 0.8783 for n = 5

Account (%, age>15)	No. of Bank Branches per1000 km2	Bank Branches per100000 adults	Number of ATMs per 1000km2	Number of ATMs per100000 adults	
1.0000	-0.7735	-0.1362	0.0166	0.2365	Account (%, age>15)
	1.0000	-0.3503	0.6174	-0.6826	Bank Branches per1000 km2
		1.0000	-0.6894	0.9206	Bank Branches per100000 adults
			1.0000	-0.7529	Number of ATMs per 1000km2
				1.0000	Number of ATMs per100000 adults
Outstanding deposits with com. banks 0.4643	Outstanding loans from com. Banks 0.6493	Owens a credit card (age >15) 0.4449	Owens a debit card (age >15) 0.7575	Green Index 0.6612	Account (%, age>15)
0.1875	-0.0426	-0.7410	-0.9163	-0.8937	No. of Bank Branches per1000 km2
-0.5462	-0.6008	0.4748	0.0662	0.4702	No. of Bank Branches per100000 adults
0.8745	0.7106	-0.5498	-0.4938	-0.5422	Number of ATMs per 1000km2
-0.4558	-0.4203	0.6962	0.4301	0.7543	Number of ATMs per100000 adults
1.0000	0.9275	-0.3020	-0.1560	-0.1717	Outstanding deposits with com. banks
	1.0000	-0.3069	0.0522	-0.0982	Outstanding loans from com. banks

1.0000	0.7841	0.9498	Owns a credit card (age >15)
	1.0000	0.8615	Owns a debit card (age >15)
		1.0000	Green Index

11.2. Correlation Matrix for Year 2017

Correlation coefficients, using the observations 1 - 5
5% critical value (two-tailed) = 0.8783 for n = 5

Account (% age>15)	No. of Bank Branches per1000 km2	No. of Bank Branches per100000 adults	Number of ATMs per 1000km2	Number of ATMs per100000 adults	
1.0000	0.6404	-0.0901	0.7718	-0.2457	Account (% age>15)
	1.0000	-0.2571	0.5249	-0.7652	No. of Bank Branches per1000 km2
		1.0000	-0.6586	0.7649	No. of Bank Branches per100000 adults
			1.0000	-0.5511	Number of ATMs per 1000km2
				1.0000	Number of ATMs per100000 adults
Outstanding deposits with com. banks	Outstanding loans from com. Banks	Owns a credit card (age >15)	Owns a debit card (age >15)	Green Index	
0.6734	0.4567	-0.0619	0.1204	-0.4142	Account (% age>15)
0.1263	-0.0520	-0.5874	-0.5429	-0.8093	No. of Bank Branches per1000 km2
-0.5392	-0.6634	0.8621	0.2473	0.5222	No. of Bank Branches per100000 adults
0.8985	0.7959	-0.4958	0.1461	-0.4402	Number of ATMs per 1000km2
-0.1843	-0.1868	0.9699	0.6560	0.8526	Number of ATMs per100000

1.0000	0.9495	-0.1804	0.4584	-0.1144	adults
					Outstanding deposits with com. banks
	1.0000	-0.2448	0.3751	-0.1146	Outstanding loans from com. banks
		1.0000	0.6055	0.7509	Owns a credit card (age >15)
			1.0000	0.8130	Owns a debit card (age >15)
				1.0000	Green Index

11.3. Correlation Matrix for Year 2021

Correlation coefficients, using the observations 1 - 5
5% critical value (two-tailed) = 0.8783 for n = 5

Account (% age>15)	No. of Bank Branches per1000 km2	No. of Bank Branches per100000 adults	Number of ATMs per 1000km2	Number of ATMs per100000 adults	
1.0000	-0.8420	0.1805	-0.2035	0.7920	Account (% age>15)
	1.0000	-0.1535	0.5599	-0.6905	No. of Bank Branches per1000 km2
		1.0000	-0.5733	0.7359	No. of Bank Branches per100000 adults
			1.0000	-0.4872	Number of ATMs per 1000km2
				1.0000	Number of ATMs per100000 adults
Outstanding deposits with com. banks	Outstanding loans from com. Banks	Owns a credit card (age >15)	Owns a debit card (age >15)	Green Index	
0.2849	0.4462	0.5824	0.9021	0.5951	Account (% age>15)
0.1127	-0.0924	-0.5911	-0.8863	-0.6721	No. of Bank Branches per1000 km2
-0.5241	-0.5639	0.1134	-0.0207	0.0823	No. of Bank Branches per100000

0.8777	0.7616	0.0434	-0.1332	-0.0545	adults
					Number of
					ATMs per
					1000km2
-0.1207	-0.0364	0.5428	0.6388	0.5333	Number of
					ATMs
					per100000
					adults
1.0000	0.9733	0.3472	0.3334	0.2651	Outstanding
					deposits with
					com. banks
	1.0000	0.4040	0.4985	0.3471	Outstanding
					loans from
					com. banks
		1.0000	0.8128	0.9894	Owns a
					credit card
					(age >15)
			1.0000	0.8448	Owns a debit
					card (age
					>15)
				1.0000	Green Index
			Green Bond	Cumulative	
			Issuance Per	Bond issu-	
			Unit GDP	ance per unit	
				GDP	
			0.1901	0.0651	Account (%,
					age>15)
			0.2236	0.0381	No. of Bank
					Branches
					per1000 km2
			-0.4136	-0.8568	No. of Bank
					Branches
					per100000
					adults
			0.9109	0.7549	Number of
					ATMs per
					1000km2
			-0.1101	-0.4504	Number of
					ATMs
					per100000
					adults
			0.9790	0.8143	Outstanding
					deposits with
					com. banks
			0.9118	0.8317	Outstanding
					loans from
					com. banks
			0.3721	0.3410	Owns a
					credit card
					(age >15)
			0.2451	0.3176	Owns a debit

		card (age >15)
0.2708	0.3268	Green Index
1.0000	0.7524	Green Bond Issuance Per Unit GDP
	1.0000	Cumulative Bond issu- ance per unit GDP

12. ANNEXURES

12.1. Year 2014

Principal Components Analysis

n = 5

Eigen analysis of the Correlation Matrix

Component	Eigenvalue	Proportion	Cumulative
1	5.5208	0.5521	0.5521
2	3.2038	0.3204	0.8725
3	0.8339	0.0834	0.9559
4	0.4414	0.0441	1.0000
5	0.0000	0.0000	1.0000
6	0.0000	0.0000	1.0000
7	0.0000	0.0000	1.0000
8	0.0000	0.0000	1.0000
9	-0.0000	-0.0000	1.0000
10	-0.0000	-0.0000	1.0000

Eigenvectors (component loadings)

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Account(age>15)	-0.172	-0.504	-0.042	-0.224	-0.081	0.607	-0.285
Bank Branches per1000km2	0.370	0.242	-0.082	0.345	-0.072	-0.111	0.112
Bank Branches per10000adults	-0.290	0.273	-0.594	-0.073	0.389	0.247	0.277
Number of ATMs per 1000km2	0.356	-0.241	-0.212	0.411	-0.473	0.267	0.171
Number of ATMs per 10000adults	-0.376	0.094	-0.469	-0.129	-0.657	-0.331	-0.212
Outstd. Deposits in com. banks	0.227	-0.424	-0.390	0.171	0.240	-0.057	-0.024
Outstd. Loans from com. banks	0.178	-0.486	-0.202	-0.280	0.204	-0.568	0.045
Owns a credit card (age>15)	-0.375	-0.096	0.040	0.663	0.246	-0.162	-0.522
Owns a debit card (age>15)	-0.327	-0.287	0.417	0.016	-0.148	-0.156	0.379
Green Index	-0.388	-0.198	-0.067	0.304	0.000	0.000	0.581
	PC8	PC9	PC10				
Account(age>15)	-0.190	0.402	0.104				
Bank Branches per1000km2	-0.188	0.783	0.025				
Bank Branches per10000adults	-0.211	0.015	-0.386				
Number of ATMs per 1000km2	-0.266	-0.384	-0.242				
Number of ATMs per 10000adults	0.123	0.109	0.006				
Outstd. Deposits in com. Banks	0.712	0.099	-0.098				
Outstd. Loans from com. banks	-0.495	-0.019	0.029				
Owns a credit card (age>15)	-0.196	-0.050	-0.098				
Owns a debit card (age>15)	0.091	0.232	-0.621				
Green Index	0.000	0.000	0.613				

After Casting off 3-factors

Principal Components Analysis

n = 5

Eigen analysis of the Correlation Matrix

Component	Eigenvalue	Proportion	Cumulative
1	3.9883	0.5698	0.5698
2	2.3412	0.3345	0.9042
3	0.4832	0.0690	0.9732
4	0.1873	0.0268	1.0000
5	0.0000	0.0000	1.0000
6	-0.0000	-0.0000	1.0000
7	-0.0000	-0.0000	1.0000

Eigenvectors (component loadings)

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Account(age>15)	0.172	0.614	-0.001	0.080	-0.104	0.305	-0.696
Bank Branches per1000km2	-0.413	-0.339	0.288	-0.222	0.078	0.751	-0.110

Bank Branches per10000adults	0.398	-0.285	0.603	0.132	-0.610	-0.050	-0.070
Number of ATMs per 1000km2	-0.426	0.220	0.498	-0.473	0.073	-0.503	-0.198
Number of ATMs per 10000adults	0.477	-0.063	0.410	0.089	0.768	0.017	-0.036
Outstd. Loans from com. banks	-0.219	0.553	0.365	0.392	-0.036	0.191	0.567
Green Index	0.429	0.264	-0.055	-0.736	-0.118	0.225	0.370

12.2. Year 2017

Principal Components Analysis

n = 5

Eigen analysis of the Correlation Matrix

Component	Eigenvalue	Proportion	Cumulative
1	5.2133	0.5213	0.5213
2	3.0744	0.3074	0.8288
3	1.3850	0.1385	0.9673
4	0.3273	0.0327	1.0000
5	0.0000	0.0000	1.0000
6	0.0000	0.0000	1.0000
7	0.0000	0.0000	1.0000
8	0.0000	0.0000	1.0000
9	-0.0000	-0.0000	1.0000
10	-0.0000	-0.0000	1.0000

Eigenvectors (component loadings)

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Account(age>15)	0.248	0.246	-0.594	0.110	-0.064	0.403	0.126
Bank Branches per1000km2	0.325	-0.195	-0.460	-0.346	-0.287	-0.175	-0.540
Bank Branches per10000adults	-0.354	-0.051	-0.494	0.021	0.354	0.246	0.303
Number of ATMs per 1000km2	0.366	0.300	-0.096	-0.200	0.709	-0.403	0.010
Number of ATMs per 10000adults	-0.393	0.222	-0.105	0.285	0.066	0.145	-0.581
Outstd. Deposits in com. banks	0.250	0.467	0.008	0.108	-0.466	-0.099	0.384
Outstd. Loans from com. banks	0.237	0.435	0.234	0.390	0.147	0.177	-0.330
Owns a credit card (age>15)	-0.370	0.205	-0.306	0.295	-0.161	-0.704	0.032
Owns a debit card (age>15)	-0.179	0.494	0.003	-0.507	-0.126	0.164	-0.076
Green Index	-0.362	0.259	0.150	-0.489	0.000	0.000	0.000

	PC8	PC9	PC10
Account(age>15)	0.516	0.108	0.230
Bank Branches per1000km2	-0.333	0.024	0.093
Bank Branches per10000adults	-0.589	0.036	-0.042
Number of ATMs per 1000km2	0.080	-0.232	-0.039
Number of ATMs per 10000adults	0.086	-0.575	-0.061
Outstd. Deposits in com. banks	-0.347	-0.460	0.028
Outstd. Loans from com. banks	-0.353	0.480	0.175
Owns a credit card (age>15)	0.118	0.323	0.004
Owns a debit card (age>15)	0.055	0.237	-0.600
Green Index	0.000	0.000	0.735

After Casting off 3-factors

Principal Components Analysis

n = 5

Eigen analysis of the Correlation Matrix

Component	Eigenvalue	Proportion	Cumulative
1	4.0550	0.5793	0.5793
2	1.5857	0.2265	0.8058
3	1.1653	0.1665	0.9723
4	0.1939	0.0277	1.0000
5	0.0000	0.0000	1.0000
6	-0.0000	-0.0000	1.0000
7	-0.0000	-0.0000	1.0000

Eigenvectors (component loadings)

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Account(age>15)	-0.331	0.102	0.678	-0.120	-0.359	-0.501	-0.160
Bank Branches per1000km2	-0.383	-0.442	0.259	0.306	0.028	0.558	-0.431
Bank Branches per10000adults	0.371	-0.222	0.558	-0.099	0.684	-0.048	0.147
Number of ATMs per 1000km2	-0.436	0.325	0.180	0.360	0.111	0.210	0.697
Number of ATMs per 10000adults	0.423	0.279	0.342	-0.282	-0.435	0.592	0.082
Outstd. Loans from com. banks	-0.278	0.649	-0.036	-0.306	0.448	0.156	-0.426
Green Index	0.401	0.376	0.102	0.761	-0.012	-0.126	-0.304

12.3. Year 2021

Principal Components Analysis

n = 5

Eigen analysis of the Correlation Matrix

Component	Eigenvalue	Proportion	Cumulative
1	5.4280	0.4523	0.4523
2	4.7231	0.3936	0.8459
3	1.0926	0.0911	0.9370
4	0.7563	0.0630	1.0000
5	0.0000	0.0000	1.0000
6	0.0000	0.0000	1.0000
7	0.0000	0.0000	1.0000
8	-0.0000	-0.0000	1.0000
9	-0.0000	-0.0000	1.0000
10	-0.0000	-0.0000	1.0000
11	-0.0000	-0.0000	1.0000
12	-0.0000	-0.0000	1.0000

Eigenvectors (component loadings)

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Account(age>15)	-0.241	-0.328	0.055	0.481	-0.100	0.243	0.418
Bank Branches per1000km2	0.136	0.394	0.349	-0.207	0.059	0.279	-0.008
Bank Branches per10000adults	0.195	-0.292	0.586	-0.143	0.298	-0.268	0.198
Number of ATMs per 1000km2	-0.258	0.344	0.262	-0.067	-0.009	0.059	0.605
Number of ATMs per 10000adults	-0.059	-0.413	0.381	0.143	0.312	0.080	-0.349
Outstd. Deposits in com. banks	-0.380	0.179	0.218	0.144	0.211	-0.335	-0.059
Outstd. Loans from com. banks	-0.402	0.116	0.078	0.263	-0.179	-0.200	-0.420
Owns a credit card (age>15)	-0.297	-0.252	0.033	-0.541	-0.002	0.547	-0.161
Owns a debit card (age>15)	-0.305	-0.310	-0.180	0.097	0.055	0.159	0.204
Green Index	-0.280	-0.275	-0.091	-0.525	-0.269	-0.532	0.144
Green Bond Issue Per Unit GDP	-0.358	0.189	0.350	-0.019	-0.356	0.147	-0.174
Cumulative Bond issue/ unit GDP	-0.350	0.215	-0.316	-0.111	0.722	0.000	0.000

	PC8	PC9	PC10	PC11	PC12
Account(age>15)	-0.087	0.337	0.386	-0.042	0.290
Bank Branches per1000km2	-0.071	-0.257	0.690	0.180	0.017
Bank Branches per10000adults	0.122	0.136	-0.186	0.456	0.191
Number of ATMs per 1000km2	0.403	-0.113	-0.223	-0.335	-0.186
Number of ATMs per 10000adults	0.065	-0.331	0.065	-0.561	-0.047
Outstd. Deposits in com. banks	-0.464	0.288	0.086	0.031	-0.538
Outstd. Loans from com. banks	0.633	0.039	0.151	0.274	0.040
Owns a credit card (age>15)	0.115	0.401	-0.050	0.068	-0.219
Owns a debit card (age>15)	-0.083	-0.627	-0.065	0.464	-0.283
Green Index	-0.049	-0.128	0.332	-0.182	0.155
Green Bond Issue Per Unit GDP	-0.409	-0.161	-0.372	0.030	0.449
Cumulative Bond issue/ unit GDP	0.000	0.000	0.000	0.000	0.444

After casting off 3-factors

Principal Components Analysis

n = 5

Eigen analysis of the Correlation Matrix

Component	Eigenvalue	Proportion	Cumulative
1	4.2760	0.4751	0.4751
2	3.2534	0.3615	0.8366
3	0.9894	0.1099	0.9465
4	0.4812	0.0535	1.0000
5	0.0000	0.0000	1.0000
6	0.0000	0.0000	1.0000
7	0.0000	0.0000	1.0000
8	-0.0000	-0.0000	1.0000
9	-0.0000	-0.0000	1.0000

Eigenvectors (component loadings)

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Account(age>15)	-0.094	-0.513	-0.018	0.465	-0.012	-0.141	0.561
Bank Branches per1000km2	0.208	0.442	-0.417	-0.118	0.346	-0.505	0.393
Bank Branches per10000adults	-0.393	-0.034	-0.566	-0.203	-0.185	0.516	0.338
Number of ATMs per 1000km2	0.455	0.010	-0.337	-0.041	0.010	0.216	0.058
Number of ATMs per 10000adults	-0.302	-0.389	-0.343	0.064	0.659	-0.111	-0.409
Outstd. Loans from com. banks	0.379	-0.321	-0.115	0.277	-0.208	-0.191	0.053
Green Index	-0.009	-0.460	0.110	-0.787	-0.126	-0.332	0.142
Green Bond Issue Per Unit GDP	0.400	-0.212	-0.413	-0.040	-0.265	0.030	-0.412
Cumulative Bond issue/ unit GDP	0.437	-0.169	0.281	-0.160	0.531	0.502	0.230

	PC8	PC9
Account(age>15)	0.302	0.291
Bank Branches per1000km2	-0.135	0.161
Bank Branches per10000adults	-0.259	-0.037
Number of ATMs per 1000km2	0.642	-0.463
Number of ATMs per 10000adults	0.001	-0.148
Outstd. Loans from com. banks	-0.591	-0.481
Green Index	0.073	-0.069
Green Bond Issue Per Unit GDP	-0.023	0.618
Cumulative Bond issue/ unit GDP	-0.236	0.184