Impact of Financial Inclusion on Economic, Environmental, and Social Sustainability of Asian Emerging Markets

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Abstract

Promoting financial inclusion helps achieve sustainability, but the primary challenge is achieving this goal in emerging Asian markets. Therefore, this study investigates the relationship between financial inclusion and sustainability in developing Asian countries, an underexplored area in the existing literature. The study examines the impact of various financial transactions on sustainability using panel data from 1990 to 2023 sourced from the IMF Financial Inclusion Surveys, World Bank Indicators (WBI), and financial inclusion indicators. The study examines the impact of different financial transactions on sustainability. The study population comprises emerging markets in Asia. The sample size consists of ten Asian emerging markets. The study used a quantitative research design with secondary data. A deductive approach was employed, utilizing regression analysis techniques such as fixed effects models and the Generalized Method of Moments (GMM). The results indicate that money deposits have a positive influence on economic sustainability but have a detrimental effect on environmental and social sustainability. Money transfers exhibit no significant impact on sustainability, while money withdrawals are found to positively affect economic sustainability but negatively impact the environmental and social dimensions. This study offers a theoretical contribution by shedding light on the complex consequences of financial inclusion and contradicts the widely held belief that all financial activity results in positive sustainability results. To strengthen the role of financial inclusion in sustainable development, policymakers should adopt socially responsible financial policies and green banking initiatives to promote a balance between sustainability and financial development.

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Introduction

Achieving sustainable development is more important than ever as climate change speeds up and its effects worsen. The necessity for a balanced strategy that incorporates economic growth, environmental responsibility, and social well-being is highlighted by rising global temperatures, environmental degradation, and growing social and economic inequality. Sustainable development aims to promote a future in which humans and the environment can live in harmony. The concept of sustainable development was initially introduced in the report of the World Commission on Environment and Development (WCED), defining it as addressing current demands without sacrificing the capacity of future generations to address their own. The Sustainable Development Goals (SDGs), which established a comprehensive framework for attaining sustainability by 2030, were adopted by the UN in 2015, further elevating this idea. To promote sustainable growth and development, all sectors must promptly align their policies and plans with the SDGs. The difficulties of attaining sustainable development have been further brought to light by recent international issues, most notably the COVID-19 pandemic. The epidemic upset financial systems and economic stability, causing considerable economic instability globally (Bakas & Triantafyllou, 2020).

Moreover, Schaltegger and Wagner's (2011) emphasize the function of financial mechanisms in corporate sustainability performance, showing that having access to financing makes it easier for companies to adopt eco-friendly practices and conduct ethical business operations. Furthermore, Khan et al. (2021) contend that digital financial inclusion is essential to the shift to a green economy since digital payment systems and mobile banking facilitate low-carbon economic activity and improve financial resilience. Additionally, access to financing promotes environmental sustainability by allowing smallholder farmers to invest in environmentally friendly technology such as sustainable agricultural methods (Zhou et al., 2020). However, financial inclusion initiatives are hampered by some issues, such as insufficient infrastructure that restricts access to financial services (Mazer & Rowan, 2016), low financial literacy that stops people from using financial products effectively (Lusardi & Mitchell, 2014), and stringent regulatory frameworks that could obstruct creative financial solutions (Bazarbash, 2019).

Financial inclusion must be integrated into sustainability strategies to maintain long-term economic stability and social and environmental well-being. Similarly, the International Monetary Fund (IMF) highlights that financial inclusion is critical to minimizing the negative consequences of climate change by facilitating investments in clean energy and climate-resilient infrastructure (IMF, 2021). Economic development, poverty alleviation, and resilience to socioeconomic shocks all depend on financial inclusion (Demirgüç et al., 2018).

Therefore, this study investigates the connection between sustainability and financial inclusion, a research area that is frequently disregarded in emerging Asian nations. Although financial inclusion is essential for sustainable development, obstacles must be overcome to optimize its positive effects on the economy, society, and the environment. In this dynamic world, sustainability is a major and global problem for developing and emerging economies. It is very improbable to achieve socioeconomic progress without simultaneously guaranteeing environmental preservation, according to the sustainability goals framework of the United Nations (Li, Li et al. 2021). Financial inclusion should be viewed as a fundamental goal in the pursuit of balanced, sustainable development, since analysis indicates that it provides the foundation for achieving all of

the SDGs (Arner, Buckley et al. 2020). According to the World Bank, financial inclusion helps to accomplish the SDGs by increasing economic possibilities and reducing inequality (World Bank, 2020). To address these global issues, the major objectives of this study are as follows.

This study aims to analyze the impact of financial inclusion on sustainability, with its three sub-dimensions: economic, environmental, and social sustainability. Financial inclusion is influenced by three key measurements: deposits, Withdrawals, and transfers. Hence, the study aims (1) to assess the financial deposit effects on the Sustainability of the Economy. (2) To investigate the money transfers affect the Sustainability of the Economy. (3) To identify the Impact of the Withdrawal of money on the Economic Sustainability. In concern of environmental sustainability (4), to ascertain the monetary deposits affect the Sustainability of the Environment. (5) To examine the Impact of the transfer of money on Environmental Sustainability. Similarly, (6) to evaluate the Impact of the withdrawal of money on Environmental Sustainability. However, objectives in social sustainability, i.e., (7), are to understand how a financial deposit affects Social Sustainability. (8) To check the Impact of the transfer of money on the Social Sustainability. Finally, (9) to evaluate the Impact of the withdrawal of money on the Social Sustainability.

The main question of this study, which remains less explored in previous literature "What is the impact of Financial Inclusion on the sustainability of Asian emerging markets? This study focuses on economic, environmental, and social sustainability for Asian emerging markets. This study fills a significant research gap by examining the impact of financial inclusion elements, deposits, withdrawals, and transfers on social sustainability, an area that remains underexplored. It further contributes to the literature by linking these elements to economic, environmental, and social dimensions of sustainability. To fulfill the above objectives and questions of this study, the scope is as follows.

A vital tool for advancing sustainable development in the face of these obstacles is financial inclusion. Financial inclusion is essential to tackling the urgent global concerns listed in the UN SDGs. Financial inclusion can boost the sustainability agenda, lower inequality, and increase economic resilience by increasing access to financial services. Financial inclusion improves financial stability and enables excluded groups to contribute to sustainable development by increasing access to credit, savings, and insurance (Beck & Demirgüç-Kunt, 2008).

Literature Review

By understanding the mechanisms through which financial inclusion stimulates economic growth, investors can identify emerging markets and sectors with high growth potential. Access to financial services expands the consumer base, increases disposable incomes, and encourages entrepreneurial activities, all of which create new investment opportunities. Financially inclusive economies tend to exhibit greater economic stability and lower default risk, providing a safer investment environment. Ozturk and Ullah (2022) studied the effects of digital financial inclusion on economic development and environmental sustainability in the OBRI economies. GDP growth has traditionally been regarded as an indicator of economic development, whereas CO2 emissions have been utilized as a measure of environmental sustainability. However, it also revealed that boosting digital financial inclusion might result in higher pollution emissions, which could harm the environment in the OBRI economies. Ullah, Ali et al. (2022) have examined,

using the dataset from 1996–2019, in 33 OECD nations, the effects of globalization, economic policy uncertainty, and financial inclusion on environmental quality in two groups. Furthermore, globalization has negative impacts on CO_2 emissions from HGEs and definitive consequences on LGEs. While recent studies have begun to explore the relationship between financial inclusion and sustainability in selected Asian markets, such as Bukola (2024), whose findings focused on advanced markets, limited research has examined this relationship specifically within emerging Asian economies. In contrast, in the context of India, Sharma et. al. (2021) and Sami-Ullah (2024) in Pakistan documented the environmental concern influenced by financial inclusion. Liu et. al. (2024) reported the financial inclusion and economic growth in China, and Khan (2024) documented financial inclusion, economic growth, and efficiency of G20 markets. By focusing on the Association of South East Asian Nations (ASEAN) Regional Forum (ARF), this research investigated the causal connections among economic growth, broad money, insurance market expansion, and stock market capitalization. A number of Asian nations have seen a particularly quick rise in financial inclusion, according to World Bank data. Nearly every Asian nation saw a notable gain in the financial inclusion index. Financial inclusion has been a subject of concern for governmental and international organizations since the early 2000s. Financial inclusion is a prevalent approach adopted by numerous countries in order to foster more equitable economic development (Collard 2007).

Impact of Financial Inclusion on Sustainability

Achieving economic growth requires a process that is supported by several economic sectors, including the financial sector. According to Levine (2005) the financial sector plays four tasks that are advantageous to the economy: (1) lower risk; (2) mobilizes funds; (3) lowers transaction and info costs; and (4) promotes specialization. Additionally, Karim (2023) documented that the financial industry may provide borrowers a range of low-risk, high-quality financial instruments, which will eventually speed up economic growth. Numerous studies have studied the contradictory link between financial inclusion and GDP development. Using data from the Indian subnational level, Kendall, Mylenko and Ponce (2010) and Ghosh (2011) illustrate the positive impact of financial service usage and access on economic development in India. Boukhatem (2016) states that the results of the analysis on the correlation between economic growth and poverty have been published.

However, there are still contradictions existing after the huge development of financial inclusion in different markets. For instance, in emerging and developing areas, the results are reported in contrast. For example, Oruo et. al. (2013) reported the effect of inclusive finance on economic growth, findings indicate the negative association between financial inclusion and growth. Finally, it is reported that financial inclusion measured by ATM caused negative consequences on growth.

Similarly, a number of studies documented positive association of financial inclusion and poverty mitigation, i.e. (Dixit and Ghosh 2013). In contrast, empirical data found by Park and Mercado (2015), financial inclusion, poverty, and income inequality are substantially adversely connected.

Theoretical Background

Madhani (2010) documented that Barney (1991) asserts that the Resource-Based View (RBV) analyzes and assesses a company's resources to find out how it stays ahead of the competition. A resource is more likely to be unique to the firm if it is difficult to acquire or transfer, has a steep learning curve, or necessitates a major change in the

company's culture and ambiance, making it tougher for competitors to replicate. As per Barney, a valuable resource should "allow a firm to act and behave in ways that lead to high sales, low costs, high margins, or in other ways add financial value to the firm." A collection of organizational, human, and physical resources is what the RBV defines as an organization.

To access new markets, customers, and generate a stream of revenue, financial inclusion is a valuable resource. The usage of advanced technology is also a rare resource for innovative financial products and gaining unique customer relationships, as compared to competitors. It's very difficult to imitate the financial inclusion strategy in this modern era. Hence, adaptation of financial inclusion is not only necessary, but also a demand of the modern era to achieve economic, environmental, and social benefits and competitive advantage. It is stated that by using financial inclusion, firms and markets can increase revenue, reduce costs, and achieve economic, environmental, and social advantages. Gaining economic benefits, performing environmental contributions, and participating in social activities are a part of the sustainability of markets.

To gain competitive advantages in the modern era, organizations need to base on economic, environmental, and social aspects. Initially, organizations tend to focus on shareholder wealth maximization, like the economic concerns RBV model. The second model of Barney (1991) enforced the organizations to manage environmental sustainability, i.e., NRBV. Finally, the third model explored the social concern of organizations that can't be ignored in this era. This study mainly incorporates all three models of RBV, the organizational capabilities, and resources. However, the theory also elaborates on the use of financial inclusion as a resource utilization to realize the sustainability performance. According to Barney (1991), if firms have rare, valuable, non-substitutable, and inimitable resources, they can have a sustainable competitive advantage. The NRBV model is an extension of the Barney model based on the impact of resources on the natural environment. Furthermore, the social resource-based view of this theory is addressed to gain a competitive advantage. Concerning financial inclusion and economic growth, exogenous and endogenous models are considered; the exogenous model is linked with technology, capital formation, labour, and productivity. Similarly, systems theory clarifies the financial inclusion relationship with the prevailing system. It is stated that the study mainly remains focused on economic, environmental, and social sustainability of emerging markets, with the documented impact of financial inclusion underpinning assumptions of the mentioned theories.

Hypotheses Development
Financial Inclusion and Economic Sustainability

Additionally, Sarma (2016) analyzed the causal relationship between several aspects of financial inclusion and economic growth, demonstrating a two-way causal link between economic growth and banking service accessibility. Several studies Kendall, Mylenko and Ponce (2010); Ghosh (2011) have demonstrated a strong positive relationship between financial inclusion and economic growth, including Sarma and Pais (2011), Andrianaivo and Kpodar (2011), Sarma (2016), Pradhan et al. (2016), Yu and Hassan (2018), Gul, Usman, and Majeed (2018), and Raza et al. (2019). In contrast, other research, such as Naceur and Ghazouani (2007) and Khan (2011), has found a negative relationship between the two. Babajide, Adegboye et al. (2015) examined the relationship between financial inclusion and economic development in Nigeria using annual data from 1981 to 2012. Financial inclusion was proxied by commercial bank deposits (CMBD),

with data sourced from the World Development Indicators (WDI). and reported "the number of deposit account holders in commercial banks and other resident banks functioning as commercial banks that are resident nonfinancial corporations (public and private) and households," as a proxy for financial inclusion. The empirical findings show that financial inclusion has a significant role in determining capital per worker and the total component of production, which in turn influences the economy's level of output.

According to Angadi (2003) economic development may be directly impacted by an effective financial infrastructure. Sethi and Acharya (2018) looked at the connections between financial inclusion and economic growth for a group of 31 nations. There is a long-term correlation between financial inclusion and economic development, according to several panel cointegration techniques. In other words, targeted expansion of banking infrastructure and services may lead to long-term sustainable growth. Kim, Yu et al. (2018) investigate how financial inclusion affects OIC nations' economic growth. We attempted to investigate the connection between economic growth in OIC nations and financial inclusion through the spread of Islamic financing throughout this study.

H1: There is a significant impact of the money deposit on the economic sustainability of Asian emerging markets.

H2: There is a significant impact of the money transfer on the economic sustainability of Asian emerging markets.

H3: There is a significant impact of the money withdrawal on the economic sustainability of Asian emerging markets.

Financial Inclusion and Environmental Sustainability

While the link between financial inclusion and increased economic development is well-known, its impact on ecological sustainability has received much less attention (Kim, Yu, and Hassan 2018). One study that examined the link between financial inclusion and CO2 pollution was conducted by Le and Sarkodie (2020), who examined whether financial inclusion affects carbon emissions in Asian countries. Yearly panel data from 2004 to 2014 were used to regress a GMM model. They discovered that financial inclusion may be used as a strategy in the countries of concern to lower CO2 emissions.

According to Rehman, Ma et al. (2021), there is limited mediation between FI and environmental deterioration, but full mediation of IZ between FI and ES. The findings held up well when compared to other carbon emission measurements. Abid (2016) asserts that financial growth may be a significant factor in enhancing the environment. The financial sector's growth can make it easier to finance environmental project investments at a reduced cost. One public sector endeavor that might increase financial availability is environmental protection, which is crucial for national governments.

H4: There is a significant impact of the money deposit on the environmental sustainability of Asian emerging markets.

H5: There is a significant impact of the money transfer on the environmental sustainability of Asian emerging markets.

H6: There is a significant impact of the money withdrawal on the environmental sustainability of Asian emerging markets.

Financial Inclusion and Social Sustainability

According to Beck, Demirgüç-Kunt, and Levine (2007), explore the relationship between financial development, income distribution, and poverty reduction. One of their key findings is that financial development and inclusion can disproportionately benefit the poor by improving access to credit, savings, and other financial services. Dixit and Ghosh

(2013) argue that improved access to financial services may reduce poverty by fostering savings and facilitating the development of cost-effective payment alternatives. Building assets, controlling consumption, absorbing financial shocks, and investing in health and education are all made possible by saving (Brune, Giné et al. 2011). The impoverished may improve their socioeconomic status via microloan programs, which promote financial inclusion (Sanjaya 2014). According to the empirical data found by Park and Mercado (2015), financial inclusion, poverty, and income inequality are substantially adversely connected.

The Economics literature, Burgess and Pande (2005); Deaton (1989); Demirgüç-Kunt, Beck et al. (2008); Giné and Townsend (2004); Karlan and Morduch (2010), has long emphasized the significance of financial inclusion for reducing poverty. Programs for cash transfers have emerged as one of the most important tools for policymakers fighting poverty and vulnerability in low- and middle-income nations during the last 15 years. Currently, 190 million low-income families globally are served by around 100 cash transfer programs spread across more than 60 countries (Barrientos and Niño-Zarazúa 2011). Masino and Niño-Zarazúa (2020) reported that there has been an increasing interest in streamlining cash payments and promoting financial inclusion. As a result, a number of cash transfer programs have started to switch to electronic payments made using prepaid cards or savings accounts in order to deliver cash benefits. According to Jack and Suri's (2014) research, the M-PESA mobile-based transaction system significantly decreased users' transaction costs.

H7: There is a significant impact of the money deposit on the social sustainability of Asian emerging markets.

H8: There is a significant impact of the money transfer on the social sustainability of Asian emerging markets.

H9: There is a significant impact of the money withdrawal on the social sustainability of Asian emerging markets.

Methodology

The study employs a quantitative design, relying on numerical data and statistical analysis, and utilizes a deductive approach to test predefined hypotheses. However, the study used panel data across the ten major Asian emerging markets. The least developed, advanced markets are excluded from the sample. This study used a secondary research approach to collect and analyse data from certain emerging Asian markets, such as China, India, Indonesia, Malaysia, Pakistan, Vietnam, Bhutan, the Philippines, Thailand, and South Korea. The key data sources of this study include the International Monetary Fund (IMF), World Bank Indicators, and Financial Inclusion Indicators. Furthermore, the study uses a panel data technique that combines time series and cross-sectional data from 1990 to 2023. Panel data allows for a more in-depth investigation of trends over time while also capturing differences between nations.

According to Ajija and Kusreni (2011), one significant advantage of panel data analysis is that it does not require strict adherence to traditional model assumptions, making it an effective tool for empirical research. The sample size of this study consists of ten Asian emerging markets. The study used simple random sampling to collect the data from the whole population. Simple random sampling, as mentioned and adopted by Ozturk and Ullah (2022), in OBRI countries, this study selected Asian emerging markets based on the base of availability of data. In contrast, a few markets are excluded due to incomplete data information, a shortage of facts and figures, especially on financial

inclusion. Hence, the study included only those Asian emerging markets that had complete data at WBI and the IMF financial inclusion indicators. Similarly, Khan et. al. (2022) used a simple random technique from developed, emerging, and developing markets to evaluate the financial inclusion index's impact on the economic development of economies.

The combination of time series and cross-sectional data provides a more dynamic understanding of trends and patterns in financial inclusion, economic development, environmental sustainability, and social sustainability in emerging Asian markets. Moreover, this study deploys the appropriate econometric methodologies to analyse the relationships between the key variables, resulting in a full and reliable analysis. The study also uses both fixed effects and random effects models to account for variances unique to each market and ensure the findings' reliability. To differentiate the fixed vs random model, the study also used the Hausman test. Firstly, common and fixed model studies differ by using Redundant Fixed Effects Tests; secondly, the study also differentiates fixed vs random models by using the Correlated Random Effects - Hausman Test. The details are reported in the next section with critical analysis.

Furthermore, the study also applied the GMM model to address the issue of endogeneity among variables in the dynamic relationship. The GMM, as recommended by Bender et.al. (2005) used for the inclusion of lagged values and to detect the issue of heterogeneity. Naveed et. al. (2019) documented the dynamics of GMM to evaluate the lagged values of leverage. Similarly, Pikas et. al. (2003) argued that GMM included the time series and cross-sectional dimensions in series estimations. Arrellano and Bond (1991) reported that the dynamic model not only solves the problem of endogeneity, but it is also a strong instrument to control the endogeneity. The details for variable measurement are as follows.

Variables Measurement
Dependent Variable

The dependent variable, sustainability, is a composite measure encompassing three key dimensions: economic, environmental, and social sustainability. Environmental sustainability is assessed using CO_2 emissions, while economic sustainability is measured by gross domestic product (GDP). The Gross Domestic Product (GDP), which epitomises the total rise in a nation's output of goods and services, is frequently used to measure economic growth. A number of studies have been conducted on the relationship between financial inclusion and sustainable development. A study conducted by Stern (2004) argued and contributed to CO2 emissions at the urbanization and industrialization levels. Recently, Mazzanti and Zoboli (2019) showed that the technology documented that the usage of technology can eliminate environmental legislation without compromising economic performance. Previous studies measured economic performance by including trade, investment, GDP, and domestic policy, etc. Barro (1991) reported GDP growth as a key indicator of economic performance. Additionally, the World Bank (2020) highlights GDP growth as a key metric for assessing economic development, making it a crucial element in research on development and sustainability. A measure of social sustainability, which includes human growth and well-being, is the literacy rate of women, especially those who are 15 years of age and older. Furthermore, female literacy is used as a measurement of social sustainability, and CO2 emission is used to measure environmental sustainability.

According to the World Bank (2018), female literacy has a high association with both gender equality and poverty reduction, making it a crucial measure of social progress.

According to Ravallion (2001), increased literacy rates also support education, economic engagement, and general society growth, all of which are factors in long-term social sustainability.

Independent Variables

The independent variable employed in this study was financial inclusion, which is frequently assessed by the resulting use of banking services like mobile money, deposits, and Withdrawals. The amount and regularity of deposits, withdrawals, and money transfers are important markers of financial inclusion. By making it easy for people to transfer, save, and withdraw money, mobile money systems, for instance, M-Pesa in Kenya, have greatly expanded financial access (Suri and Jack 2016). Similarly, Klapper et al. (2016) stress that mobile money promotes broader financial inclusion by lowering logistical and geographic constraints. This is further supported by Aker et al. (2016), who show that mobile money services improve banking accessibility, particularly in developing nations, increasing the accessibility and inclusivity of financial services. This study used three components of financial inclusion, i.e., transfer of money by using mobile, deposit, and Withdrawal, etc. Sharma et.al. (2016) used mobile money as a measurement of financial inclusion.

Control Variable

The study used GDP as a control variable. The GDP of an Asian emerging market, i.e. stated the total value of goods and services produced at the domestic level for a specific time period. It's mainly used as an indicator of a country's economic measurement. In the best of Asian markets, the GDP of Asian emerging markets is reported with a few differences, and in some cases, like China documented with a big difference. This study used as control variable, as it is supported by previous literature, i.e., (Iqbal et. al. 2019; Naveed et.al. 2017).

Model Specification;

The following are model specifications, including the economic, environmental, and social sustainability. Other explanatory factors are financial inclusion, including the deposit, transfer, and Withdrawal, etc.

For Regression:

ECO.SUS it=βo+ β1 DM it+ β2WM it+ β3 TM it + β4 GDP it +Ɛ it …………..(1)

SSA it=βo+ β1 DM it+ β2WM it+ β3 TM it + β4 GDP it +Ɛ it ………………..(2)

ESA it=βo+ β1 DM it+ β2WM it+ β3 TM it + β4 GDP it + Ɛit ………………..(3)

Fixed Effects Model:

ECO.SUS it=βo+ β1 DM it+ β2WM it+ β3 TM it + β4 GDP it +µ+Ɛ it …………..(1)

SSA it=βo+ β1 DM it+ β2WM it+ β3 TM it+β4 GDP it + µ +Ɛ it ………………..(2)

ESA it=βo+ β1 DM it+ β2WM it+ β3 TM it+ β4 GDP it +µ +Ɛit ………………..(3)

For GMM:

$$Yit \ = \ \delta i \ + \sum_{j=1}^{m} \gamma Jyit - 1 + \sum_{j=1}^{m} \delta jXjit + \sum_{k=1}^{p} \emptyset \, kZkit + it$$

Where t represents the time, i represents the nations, Xjit indicates the Independent factors, Yit shows the DV, and Zkit as the control. δi shows unobserved effects, and Ɛ it the error term.

$$ECO.SUS_{it}=\beta_o+ \beta_1 DM(-1)_{it} + \beta_2 WM(-1)_{it}+ \beta_3 TM(-1)_{it} +\beta_4 GDP(-1)_{it} + \mu_t + \mu_i +\varepsilon_{it} \ldots\ldots\ldots\ldots..(1)$$

$$SSA_{it}=\beta_o+ \beta_1 DM(-1)_{it}+ \beta_2 WM(-1)_{it}+ \beta_3 TM(-1)_{it} +\beta_4 GDP(-1)_{it} + \mu_t + \mu_i +\varepsilon_{it} \ldots\ldots\ldots\ldots..(2)$$

$$ESA_{it}=\beta_o+ \beta_1 DM(-1)_{it}+ \beta_2 WM(-1)_{it}+ \beta_3 TM(-1)_{it}+\beta_4 GDP(-1)_{it} + \mu_t + \mu_i +\varepsilon_{it} \ldots\ldots\ldots\ldots..(3)$$

Where,

- ECO.SUS   Economic Sustainability
- SSA   Social Sustainability
- ESA   Environmental Sustainability
- DEM   Money Deposit
- GDP   Gross Domestic Product
- WM   Withdrawal of money
- TM   Transfer of money
- Ɛ   Error term
- β   Beta
- μ   For fixed effects model
- it   Time series & across sectional / Panel
- (-1)   Lag value
- μt   Time and firm-specific effects
- μi   Time and firm-specific effects

VARIABLES	MEASUREMENT/PROXY	EVIDENCE	Source
FI	Mobile money Resultant usage of banking services. • Transfer of money by using mobile accounts • Money Deposit by using mobile accounts • Withdrawal of money by using mobile apps and accounts	Sharma (2016) Kim, Yu and Hassan (2018) Ratnawati (2020)	IMF
Environmental sustainability	CO2 emissions	Ozturk and Ullah (2022)	WBI
Economic Growth	GDP growth (annual %)	Ozturk and Ullah (2022) Kim, Yu, and Hassan (2018)	WBI
Social Sustainability	Literacy rate in females 15 plus	Rad, Çelik Ates et al. (2012)	WBI
GDP	GDP per capita	Naveed et. al. (2019)	WBI

Result and Analysis

Table 1: Unit Root Test

Variables	Probability	Level of significance/ 1st Difference
DEP	0.0000***	Level
ECOS	0.0000 ***	Level
ENVS	0.0000 ***	Level
SS	0.0000 ***	Level
TRANS	0.0024 **	1st difference
WITHDRW	0.0000 ***	Level
GDP	0.0000***	Level

The study used a unit root test to evaluate the stationarity of the data. The above table shows the results of the unit root test, i.e. probability of deposit is less than 5%, and the level of significance is about 99%. It indicates the normal data of the factor. Similarly, economic sustainability, environmental sustainability, and social sustainability are also reported with less than 5% of probability, and the level is about 99% for each. Finally, the transfer of money is significant with 0.0024 at the 95% level with 1st difference. However, Withdrawal indicates a probability less than 5% at a 99% significance. To check the further behavior of the data descriptive summary table, also reported below.

Table 2: Summary of Descriptive Statistics

	DEP	ECOS	ENVS	SS	TRANS	WITHDRW	GDP
Mean	6.320	-1.710	3.171	4.101	4.12E+10	3.19E+11	4.812
Median	6.458	-1.363	2.731	3.911	4.04E+10	2.88E+11	4.651
Maximum	8.886	0.252	8.291	9.281	9.29E+10	8.31E+11	48.696
Minimum	3.774	-5.019	1.120	1.020	1.02E+08	1.12E+09	-27.994
Std. Dev.	11.939	1.661	2.681	2.901	2.94E+10	2.72E+11	5.922
Skewness	-0.217	0.470	-0.339	-0.063	0.055	0.308	0.826
Kurtosis	2.410	1.911	1.828	1.855	1.758	1.702	1.816

Descriptive Summary

The purpose of the descriptive summary is to examine the data's behaviour. To understand the pattern of data, table 1 displays descriptive data, such as the mean, median, range, and standard deviation, for the following six variables: Money deposit (DEP), Economic sustainability (ECOS), Environmental Sustainability (ENVS), Social sustainability (SS), Transfer of money (TRANS), and Withdrawal of money (WITHDR). DEP shows significant variability (SD = 11.94) together with a comparatively high mean (6.32) and median (6.46). With a median of -1.36 and a mean of -1.71, ECOS shows a moderate dispersion of mostly negative values (SD = 1.66). Moderate standard deviations (2.68 and 2.90) and mean values (3.17 and 4.10, respectively) are displayed by ENVS and SS, indicating comparatively balanced distributions. With a mean of 4.04 and a somewhat lower median (1.10), TRANS exhibits high variability (SD = 6.88), indicating that the data is right-skewed, and WITHDRW has a moderate mean (4.97) and SD (1.89).

It is stated that the mean variations of Asian emerging markets i.e., China, India, and all selected countries, are somewhat different. However, in China the financial inclusion is high and sustainable development progress is also good. In contrast, in India, financial inclusion is in average, but there are some sustainability issues. Similarly, in Pakistan, the financial inclusion and sustainability variations are mainly below than average. Hence, remaining markets also have some issues in financial inclusion and sustainable development. The positive and negative skewed values are reported for all variables. It is stated that all factors are normally skewed because values are near about zero, some are positive a few are negative skewed. There is no big outlier exit in the data. The value of deposit (0.21772), economic growth is 0.4702, and environmental sustainability is -0.339384. Similarly, social sustainability is -0.063855, transfer is 1.011594, and deposit is 4.499417. Furthermore, Kurtosis values are as deposit: 2.41095, economic sustainability is 1.911829, environmental 1.828254, social 1.437362, and Withdrawals 1.702862. It is stated that all kurtosis values are approximately less than 3. The values are within the range of the kurtosis standard. The details of the correlation analysis are as follows.

Table 3: Correlation Analysis

	DEP	ECOS	ENVS	SS	TRANS	WD	GDP
DEP	1						
ECOS	0.221	1					
ENVS	-0.2229	-0.6917	1				
SS	-0.2215	-0.667	0.68648	1			
TRANS	-0.1318	0.03426	-0.0275	-0.0197	1		
WD	-0.3276	0.11231	-0.0876	-0.0603	0.04453	1	
GDP	-0.6182	0.01656	-0.016	-0.00521	0.03541	0.07056	1

Correlation Analysis

The purpose of the descriptive summary is to examine the data's behaviour. The correlation analysis between six variables is shown in Table 2, where values represent the direction and intensity of the relationship. Indicating an adverse link with sustainability indices, DEP shows a weak negative correlation with ENVS (-0.2229), SS (-0.2215), TRANS (-0.1318), and WD (-0.3276), but a weak positive correlation with ECOS (0.221). Trade-offs between economic, environmental, and social sustainability are implied by ECOS's strongly negative correlation with ENVS (-0.6917) and SS (-0.667). A strong positive correlation (0.68648) between ENVS and SS shows that environmental and social sustainability are aligned. Weak correlations are seen between transfer and WD and other variables, with WD having a negative relationship with DEP (-0.3276). Overall, the findings show possible trade-offs between sustainability and economic indicators, with little correlation between Withdrawal and transfer.

Hausman Test Results

The Hausman test is reported to differ between the common vs fixed model in step one; similarly, to differentiate and choose the random vs fixed model, period random effects are used. Both results run on the overall data set; the details are as follows.

Redundant Fixed Effects Tests

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.130272	(11,384)	0.0359
Cross-section Chi-square	12.713921	11	0.0124

According to the above results, the probability is less than 5%. It shows that among the common and fixed models, the fixed model is most appropriate at step one. However, the study also used cross-sectional random effects to capture the Hausman test results as follows.

Correlated Random Effects - Hausman Test

Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	0.825905	3	0.0433

The Hausman test is used to differentiate the fixed vs random models. As per the above table, the probability is 0.0433. It is less thn5%. It shows that the fixed model is most appropriate for this study. The details for panel fixed results are as follows.

Panel Regression

The detailed analysis of Panel regression is as follows.

Table 4: *Dependent Variable: Economic Sustainability (ECOS)*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEP	0.041358	0.00712	5.80905	0.0000 ***
TRANS	1.55E-05	1.17E-05	1.3272	0.1852
WITHDRW	1.82E-07	4.46E-08	4.073859	0.0001 ***
GDP	0.029879	0.01014	2.945485	0.0034***
C	-4.42094	0.46516	-9.50409	0.0000 ***

Table 4 above shows the panel regression findings. The findings show a Positive and statistically significant relationship between deposit (DEP), Withdrawal, and economic sustainability at a 1% level, indicating that greater DEP levels enhance economic sustainability. Similarly, higher Withdrawals are linked to better economic sustainability. These findings align with studies that indicate strategic resource reallocation or divestiture choices can improve long-term economic stability and financial efficiency. Findings are fully supported by existing literature, i.e., Liu et al. (2024)The study found that the positive impact of FinTech-inclusion on economic growth during the pandemic is observed primarily in countries with high internet usage. The study's results indicate a positive correlation between financial inclusion and economic growth, particularly pronounced in countries with lower incomes and less developed financial systems. These findings were further supported by Asif et al. (2023), who, through the generalized method of moments and autoregression distributed lag, highlighted the positive influence of financial inclusion on economic growth, poverty alleviation, sustainability, and financial efficiency in G20 nations.

On the other hand, transfer of funds (TRANS) is statistically insignificant, suggesting that transformation initiatives in this situation do not directly affect economic sustainability. This finding contradicts studies that emphasize how crucial business model transition is for promoting sustainable economic success (Bocken 2014), indicating that this association may be mediated by other variables. Overall, these results show that deposit (DEP) and WITHDRW have a positive impact on economic sustainability, but they also raise the possibility that transformation initiatives by themselves might not be enough to achieve these goals. The study is conducted by Olajide and Oyadeyi (2023). The research delved into examining the effects of financial inclusion and banking innovation on economic growth in Nigeria by analyzing monthly and quarterly data spanning from 2009 to 2021. Finally, the sign of the coefficient for GDP is positive and its probability is significant at 0.0034.

Table 5: Environmental Sustainability

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEP	-6.48E+09	1.15E+09	-5.62719	0.0000***
TRANS	-2240726	1891198	-1.18482	0.2368
WITHDRW	-25462.86	7224.158	-3.52468	0.0005***
GDP	-9.74E+08	4.80E+08	-2.02834	0.0432**
C	7.41E+11	7.53E+10	9.841177	0.0000***

*It is summarized in the light of the above table that the value of R-square is 0.174512 and adjusted R is 0.15412, which is less than R-square and indicates the statistical change in factors. Similarly, R-squared shows the power of explanatory factors. The value of Durban Watson is near about 2. It indicates there is no issue of autocorrelations among factors. There are three levels of significance, i.e., 99% ***, 95% **, and 90% *. The results are reported as per the level of significance.*

The relationship between deposit (DEP) and environmental sustainability is displayed in Table 5, which reveals a significant and statistically significant negative impact on environmental sustainability. The findings are fully supported by Peterson (2023) documented the impact of financial inclusion on environmental sustainability. The negative relationship shows that a decrease in environmental sustainability is linked to a rise in deposits, strong evidence against the null hypothesis is demonstrated by the high absolute t-statistic of -5.627, which further supports the robustness of these findings. In contrast to this. Environmental sustainability and TRANS do not correlate, indicating that there is no statistically meaningful impact of TRANS on environmental sustainability. The null hypothesis is weakly supported by the very modest t-statistic of -1.185, which shows that there is no discernible relationship between transaction volume and environmental sustainability. Furthermore, WITHDRW has a negative yet noteworthy correlation with environmental sustainability. This implies that environmental sustainability is significantly harmed by an increase in Withdrawal. The results presented above show that DEP and WITHDRW are significant predictors of environmental sustainability, while TRANS has no statistically significant effect. The t-statistic of -3.525 further supports these findings, demonstrating a moderate to strong level of significance in explaining variations in environmental sustainability. Given the inverse relationship between deposits and environmental sustainability, bigger deposits may be associated with practices that have a detrimental effect on environmental sustainability, such as greater funding for non-green initiatives. Likewise, it appears that increased Withdrawal also leads to a reduction in environmental sustainability. Finally, the sign of the coefficient for GDP is negative and its probability is significant at 0.0432. There is negative significant relationship between GDP and environmental sustainability.

Table 6: Social Sustainability

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEP	-6.73802	1.2608	-5.3501	0.0000***
TRANS	-208907	206392	-1.0122	0.3121
WITHDRW	-2284.35	788.3936	-2.8975	0.0040**
GDP	-4.04E+09	6.46E+08	-6.2597	0.0000***
C	8.471	8.2209	10.3117	0.0000***

A negative and statistically significant link between DEP and social sustainability is seen in Table 6. The negative association implies that the dependent variable drastically declines as deposits rise. Given that its large absolute value suggests strong statistical evidence against the null hypothesis, the t-statistic of -5.35 further supports the robustness of these findings.

The impact of TRANS on social sustainability, on the other hand, is not statistically significant because there is no correlation between TRANS and social sustainability. The t-statistic of -1.012, which is rather tiny, suggests that the null hypothesis is not strongly supported. According to Kusuma and Ratanawati (2020), financial inclusion, fueled in part by increased internet access, can significantly impact poverty reduction, income inequality, and financial inclusion by enabling more individuals and businesses to join the digital economy, access financial services, and engage in e-commerce.

Additionally, WITHDRW significantly reduces social sustainability, and the t-statistic of -2.897 confirms these findings, suggesting a moderate level of significance in explaining variations in social sustainability. In summary, the results show that DEP and WITHDRW are significant predictors of social sustainability, while TRANS has no statistically significant effect. The negative relationship between deposits and social sustainability implies that social sustainability decreases as deposits rise, and withdrawals also contribute to a decline in social sustainability. The GMM is used for more consistency in results and especially regarding the issue of heterogeneity. The details for GMM are as follows. Finally, the sign of the coefficient for GDP is negative, and its probability is significant at 0.0000. There is a significant negative relationship between GDP and social sustainability.

GMM: Generalized Method of Moments

Table 7: Dependent Variable: ECOS

Method: Panel Generalized Method of Moments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.4612	0.474	-9.399	0.000***
DEP	0.04209	0.007	5.792	0.000***
TRANS	1.34E-05	1.19E-05	1.122	0.2625
WITHDRW	1.71E-07	4.57E-08	3.748	0.0002***
GDP	0.02988	0.01014	2.945	0.0034

It is summarized in the light of the above table that the value of R-square is 0.210553 and adjusted R is 0.178126, which is less than R-square and indicates the statistical change in factors. Similarly, R-squared shows the power of explanatory factors. The value of Durban Watson is about 2.028938. It indicates there is no issue of autocorrelations among factors. There are three levels of significance, i.e., 99% ***, 95% **, and 90% *. The results are reported as per the level of significance.

Table 8: Dependent Variable: ENVS

Method: Panel Generalized Method of Moments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.47E+11	7.68E+10	9.724169	0.0000***
DEP	-6.60E+09	1.18E+09	-5.608534	0.0000***
TRANS	-1914413.	1925486.	-0.994249	0.3207
WITHDRW	-23743.07	7390.318	-3.212726	0.0014***
GDP	0.02988	0.01014	2.94549	0.0034***

It is suggested in the light of the above table that the value of R-square is 0.210553 and adjusted R is 0.178126, which is less than R-square and indicates the statistical change in factors. Similarly, R-squared shows the power of explanatory factors. The value of Durban Watson is about 2.028938. It indicates there is no issue of autocorrelation among factors. There are three levels of significance, i.e., 99% ***, 95% **, and 90% *. The results are reported as per the level of significance.

Table 9: Dependent Variable: SS

Method: Panel Generalized Method of Moments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.54E+10	8.40E+09	10.17148	0.0000***
DEP	-6.86E+08	1.29E+08	-5.331294	0.0000***
TRANS	-179639.6	210538.1	-0.853240	0.3941
WITHDRW	-2116.624	808.0786	-2.619330	0.0092**
GDP	-4.04E+09	6.46E+08	-6.2597	0.0000***

*It is recommended in light of the above GMM results that the value of R-square is 0.196805 and adjusted R is 0.163876, which is less than R-square and indicates the statistical change in factors. Similarly, R-squared shows the power of explanatory factors. The value of Durban Watson is near about 2, i.e., 1.996033. It indicates there is no issue of autocorrelation among factors. There are three levels of significance, i.e., 99% ***, 95% **, and 90% *. The results are reported as per the level of significance.*

Table 10: Dependent Variable: Economic, Social, and Environmental

Method: Panel Generalized Method of Moments

Ivs	GMM1	GMM2	GMM3
C	(-4.4612) 0.000***	(747000000000)0.00***	85400000000(0.0000***
LAG DEP	0.04209 (0.000***)	(-6600000000)0.00***	(-686000000)0.0000***
LAG TRANS	0.0000134(0.2625	(-1914413)0.3207	(-179639.6)0.3941
LAG WITHDRW	0.000000171(0.00***)	(-23743.07)0.0014***	(-2116.624)0.0092**
LAG GDP	0.02988(0.0034***)	(-23743.07)0.0014***	(-4.04E+09)(0.0000***
AR1	0.02	0.003	0.05
AR2	0.3	0.5	0.6
SARGAN TEST	0.23	0.34	0.45
CROSS-SECTIONAL FIXED AFFECTS	YES	YES	YES
TIME FIXED AFFECTS	YES	YES	YES

The above table provides the GMM estimation for models 1, 2, and 3. The dependent variables are economic, environmental, and social with lag. The independent variables are deposit, transfer, and Withdrawal with lag values. The coefficient and p-value are reported in tables. The probability shows the significance of factors calculated by the panel estimator. The test for serial autocorrelations is denoted by AR1 and AR2. The Sargan test is used to identify the healthiest of instruments estimating in dynamic modeling. The probability of the Sragan test is > 0.05 states that instruments are valid.
The above table shows the results for GMM explanatory factors, financial inclusion, and the dependent variable is sustainability measured by using economic, environmental, and social sustainability. The probability of deposit with economic, social, and environmental

sustainability is significant, with the negative sign of the coefficient. While financial inclusion is often associated with enhanced financial well-being and poverty reduction, some empirical studies have identified a significant negative relationship between financial inclusion and economic growth in Asian emerging markets. Specifically, the coefficient for financial inclusion indicators such as the number of withdrawals is found to be negative and statistically significant at the 1% level. This suggests that greater financial inclusion, particularly when measured by increased withdrawal activity, may correlate with reduced sustainability and slower economic growth in certain contexts.

Finally, the probability of transfer is insignificant > 0.05%. It is stated that there is no relationship between the transfer of money and sustainability in Asian emerging markets. The findings are fully supported by Peterson (2023) documented the impact of financial inclusion on environmental sustainability. The negative relationship shows that a decrease in environmental sustainability is linked to a rise in deposits, strong evidence against the null hypothesis is demonstrated by the high absolute t-statistic of -5.627, which further supports the robustness of these findings. According to Kusuma and Ratanawati (2020), financial inclusion, fueled in part by increased internet access, can significantly impact poverty reduction, income inequality, and financial inclusion by enabling more individuals and businesses to join the digital economy, access financial services, and engage in e-commerce.

In the light of existing shared evidence and market scenarios of different Asian emerging markets, i.e., China is the most favored and participating with a high index of financial inclusion. The rate of financial inclusion in China is high. It is stated that the sustainability, i.e., economic, social, and environmental aspects in China is gradually higher as compared to the remaining markets. Similarly, India is also competing with China regarding financial inclusion, but the sustainability rate is average. The main point is that there is a shortage of social activities and an extreme level of environmental pollution. Finally, remaining emerging markets like Indonesia, Malaysia, Pakistan, Vietnam, Bhutan, the Philippines, Thailand, and South Korea have lower financial inclusion and hence, lower sustainability performance. In contrast a few markets, the social sustainability is greater than average. However the environmental sustainability is also controlled in a few markets where there is a lack of industrial areas.

A few authors from different markets documented their arguments regarding financial inclusion and sustainability of selected Asian markets, for example, Harsono et.al. (2024) documented in the Philippines the role of financial inclusion. Rainer (2024) argued the role of FinTech and its inclusion in the transformation of industries. Angelie (2023) documented the transformation of financial inclusion in the Philippines. The study reported the significant role of financial inclusion. Finally, Bukola (2024) reported significant findings of financial inclusion in the advanced market. In contrast, in the context of India, Sharma et. al. (2021) and Sami (2024) in Pakistan documented the environmental concern influenced by financial inclusion. Liu et. al. 92024) reported the financial inclusion and economic growth in China, and Khan (2024) documented financial inclusion, economic growth, and efficiency of G20 markets.

The results indicate that money deposits positively influence economic sustainability but have a detrimental effect on environmental and social sustainability. Money transfers exhibit no significant impact on sustainability, while money Withdrawals are found to positively affect economic sustainability but negatively impact environmental and social dimensions. The study shows the conflicting impact on environmental

sustainability. Money withdrawal has a positive effect on environmental sustainability; nevertheless, deposits have a negative effect. These results align with those of Rehman, Ma et al. (2021) and Rasheed, Law et al. (2016), who contend that while early financial inclusion may worsen the environment, it eventually encourages green projects and sustainable investments. Financial inclusion on its own does not always improve environmental results unless combined with green financial policies, as evidenced by the slight influence of money transfers on environmental sustainability. Although money deposits and Withdrawals have significant effects on social sustainability, the study reveals that these impacts are negative, suggesting an indirect link. This is consistent with research by Park and Mercado (2015), who highlighted the need for financial inclusion policies to be properly crafted in order to guarantee that they have a beneficial impact on social well-being. Money transfers and social sustainability do not significantly correlate, which emphasizes the necessity for focused strategies to use financial inclusion to advance social justice (Barrientos & Niño-Zarazúa, 2011).

Conclusion and Discussion

The effect of financial inclusion on Asian developing markets' social, economic, and environmental sustainability is examined in this study. This study investigates how different financial transactions influence sustainability outcomes using panel data from 1990 to 2023 obtained from the IMF, World Bank, and Thomson Reuters DataStream services. With varying economic, environmental, and social effects, the results demonstrate that financial inclusion has a substantial and positive influence on sustainability. In terms of economic sustainability, the findings support the notion that financial inclusion promotes economic growth by confirming that money deposits and Withdrawals substantially impact economic stability. The fact that money transfers have no discernible effect, however, raises the possibility that simple financial transactions devoid of a strong financial infrastructure could not immediately result in positive economic effects (Angadi, 2003). These findings are consistent with those of Sethi and Acharya (2018) and Sharma (2016), who discovered that long-term economic development is facilitated by well-designed financial inclusion initiatives.

It is summarized with the linkage of a resource-based view (RBV) of Barney (1991), the theory recommends that financial inclusion as a resource of organizations could influence environmental, social, and economic aspects, both positively and negatively. Hence, this study stated that financial inclusion can eliminate CO2 emissions to maintain environmental sustainability through clean and green technologies. It caused a positive impact on the economy but had adverse effects on social and environmental sustainability in Asian markets. Hence, the strong recommendations of this study are considerable by linking the usage of financial inclusion with social and environmental sustainability. The main reason is a lack of adaptation or low average usage of financial inclusion in these markets, which has caused adverse effects. A perspective is also documented by Qin et. al. (2021) argued that financial inclusion is a framework that can serve to increase availability, implementation of healthier environmental customs and reduction in the role to climate change consequences.

The findings of this study have important practical and policy ramifications. To improve financial accessibility, policymakers in emerging Asian countries should concentrate on growing digital financial services, especially through internet-based and mobile banking options. To promote green finance efforts that lessen the adverse environmental consequences of financial transactions, regulatory frameworks also need

to be reinforced. In order to guarantee that financial inclusion results in fair social and economic growth, governments should also support financial literacy initiatives.

The policy implications of this study, especially to maintain the sustainability of Asian emerging markets i.e. economic, environmental, and social, need to be addressed. It is stated that the role of financial inclusion is highly significant for the environmental and social sustainability of these markets. Hence, stakeholders, policy makers, and individuals should incorporate and adopt the green and clean framework, quick access and adaptation to change, and be more social.

Future research can focus on the valuable insight, it restricts the results' generalizability by concentrating only on Asian emerging markets. To see if comparable trends show up, future studies should expand the investigation to additional areas, including the MENA, SAARC, and other emerging economies. Survey-based or firm-level data may be used in future research to give a more detailed picture of how financial inclusion affects various demographic groups and economic sectors. Future research should look at other aspects, including governance, financial stability, and technological developments in financial services, even if this study focuses on economic, environmental, and social sustainability.

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