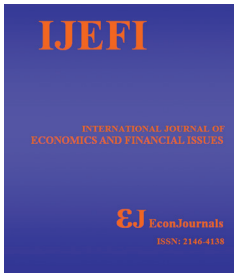

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The Effect of Financial Technology on Capital Inflows in Low- and Middle-Income Countries

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ABSTRACT

This study examines the impact of financial technology on capital inflows and their causal relationship in select low- and middle-income African nations. Secondary data from the World Development Indicator Database (2000-2022) was used, with net financial flows as a proxy for capital inflows. Financial technology indicators included individuals using the internet (IUI), secure internet servers (SIUS), and automated teller machines (ATM). The feasible generalized least squares approach was applied to account for autocorrelation and slope heterogeneity, alongside pre and post estimation tests for robustness. Findings from sixteen low-income African countries indicate that IUI and SIUS positively and significantly affect capital inflows, while ATM has a negative and insignificant impact. In contrast, for sixteen middle-income African countries, only IUI has a positive and significant effect, SIUS shows a positive but negligible link, and ATM has a negative and significant impact on capital inflows. Causality results reveal a unidirectional relationship between ATMs and capital inflows and a bidirectional relationship between IUI and capital inflows in low-income countries, with no causal link for SIUS. In middle-income countries, there is a bidirectional relationship between IUI and capital inflows, a unidirectional link for ATMs, and no causal relationship for SIUS. These findings highlight the need for governments in low- and middle-income African nations to address barriers to financial technology adoption and develop strategies to enhance its role in attracting capital inflows.

Keywords: Financial Technology, Capital, Inflow and Outflow
JEL Classification: G15, O16, F21, F24

1. INTRODUCTION

Financial exchanges that take place between nations for the purposes of commerce, investment, or corporate production are known as capital flows. Governments direct money flows from tax receipts into operations and programs, as well as through currency and trade with other nations. Stocks, bonds, and mutual funds are the investment vehicles of individual investors. While high levels of capital inflow signal an expanding economy, capital outflow typically occurs as a result of economic instability. The development of domestic capital and financial markets is facilitated by capital inflow, which is a major source of funding for middle- and low-income nations.

In early 2020, the COVID-19 pandemic triggered one of the sharpest reversals in portfolio flows to emerging markets on record. Timely capital flow proxies served as early warning indicators, alerting policymakers to the severity of the shock (Koepke and Paetzold, 2020). Additionally, the volume of capital inflow increased in middle- and low-income countries after the 2008 financial crises as a result of increase in the levels of FDI (Nyang`oro, 2017). It has been widely observed that capital inflows to middle- and low-income countries are mainly driven by global liquidity conditions as compared to domestic economic conditions. However, these actions cause surge in capital flow as there are periods when countries receive large capital inflow in a short period of time which fuels domestic economic booms and

asset price inflation. Reasons cited for surges to the economy are increased credit in the domestic economy, exchange rate appreciation, inflationary concerns and the effectiveness of monetary policy (OECD, 2018). Surges are eventually followed by reversals of capital, when credit has to be quickly unwound as well and as such, emerging markets receive timely capital inflow in batches (Gupta, 2016).

The use of technology to enhance financial services is the focus of the financial technology (Fintech) sector. Information technology, policy, regulation, and economic sharing are the main forces behind fintech, a rapidly expanding innovation in the financial services sector. According to various business capacities, fintech can also be defined as concepts that enhance financial services through technological solutions.

Through the use of specialized software and algorithms that are accessible on computers and mobile devices, fintech is a significant force reshaping the global financial services business. Fintech essentially seeks to assist companies, entrepreneurs, and consumers in better managing their everyday operations, procedures, and cash flow. As fintech transforms how we save, borrow, invest, move, and spend money, over US$50 billion has been invested in nearly 2,500 businesses globally since 2010 (Skan et al., 2016). The extensive impact of the COVID-19 pandemic on the economy's growth prompted a move to a remote format of work, increased Internet usage and online payments (Żak and Garcarz, 2020). Increasing capital flows around the world have influenced financial technology alongside domestic macroeconomic policies that guide the activities of the financial and capital market. Growing global markets have made a significant contribution to improved discipline in the area of financial technology, monetary and fiscal policies, punishing bad policies and rewarding good ones. Global financial integration and capital flows are unquestionably growing steadily. Finance markets, however, are among the most poorly functioning in the market economy due to the intertemporal nature of financial transactions and the incompleteness of available tools. Therefore, better information, financial, and capital sector regulation, as well as general prudential macromanagement of financial flows, contribute to a rise in capital inflow and fintech in low- and middle-income nations, which helps the global economy integrate.

Even though most African nations experience large levels of capital inflow, the advent of digitization in the banking industry caused financial sector advancements to skyrocket. However, because the connection between financial technology and capital flow is still a complicated and little-understood topic, its overall development has been unequal throughout the continent. Research has looked at the variables that affect capital flows in Africa, with particular attention to elements like debt levels, financial market growth, and political and economic stability. Moreover, it is widely noted that capital flows directed toward emerging economies are more influenced by global liquidity conditions than by their domestic economic situations. Consequently, emerging markets often experience clusters of capital flows, marked by surges where countries receive substantial capital influxes rapidly, leading to domestic credit expansions and inflation in asset prices. These surges are inevitably succeeded by reversals of capital, requiring a swift unwinding of credit. Consequently, issues of financial stability are intricately intertwined with the cycles of capital flows (Gupta, 2016).

Because it facilitates financial inclusion and makes it easier to access and use funds, financial technology, or Fintech, has a big impact on how the financial industry is shaped and how capital flows (inflows of capital) are improved. However, firms face more difficulties as financial technology services advance in sophistication. Online loan services have caused controversy in communities, including moral hazard, loan defaults, and information asymmetry. The case of money laundering via Bitcoin has also been widely discussed (Suryono et al., 2019). Fintech has a significant impact on capital flows, as competition from Fintech payment providers disrupts the information spillover from banks using payment data to learn about consumers' credit quality, affecting the bank's price for payment services and loan offers (Yang et al., 2023). Nevertheless, little research has explicitly examined how capital flows and financial technology—a necessary component of financial development—affect low- and middle-income African nations. Consequently, the following research questions require responses. First, how does financial technology impact capital inflow and what is the causal relationship between the two in low- and middle-income African nations?

2. LITERATURE REVIEW

2.1. Financial Technology

The term "fintech," or "financial technology," refers to new technology that aims to enhance and automate the provision of financial services. Fundamentally, fintech is used to assist company owners, consumers, and corporations in better managing their financial operations, procedures, and lives. It is made up of certain software and algorithms that are utilized by cellphones and computers. The term "financial technology" is reduced to "fintech." When the term "fintech" first appeared in the 21st century, it was used to describe the technology used in the backend systems of well-known financial organizations like banks. From 2018 or so to 2022, there was a shift to consumer-oriented services. Fintech now includes different sectors and industries such as education, retail banking, fundraising and nonprofit, and investment management, to name a few. Fintech also includes the development and use of cryptocurrencies, such as Bitcoin. While that segment of fintech may see the most headlines, the big money still lies in the traditional global banking industry and its multitrillion-dollar market capitalization. The most talked-about (and most funded) fintech startups share the same characteristic: They aim to outperform and eventually replace established financial services providers by being quick to react, catering to a neglected market, or offering quicker or more efficient service. For instance, the financial business Affirm offers a means for customers to obtain quick, short-term loans for purchases in an effort to disentangle credit card firms from the online shopping process. Although rates may be exorbitant, affirm asserts that it provides a means for customers with bad or no credit to obtain credit and establish a credit history.

Similarly, Better Mortgage seeks to streamline the home mortgage process with a digital-only offering that can reward users with a

verified pre-approval letter within 24 h of applying. GreenSky seeks to link home improvement borrowers with banks by helping consumers avoid lenders and save on interest by offering zero-interest promotional periods. For consumers with poor or no credit, Tala offers consumers in the developing world microloans by doing a deep data dig on their smartphones for their transaction history and seemingly unrelated things, such as what mobile games they play. Tala seeks to give such consumers better options than local banks, unregulated lenders, and other microfinance institutions.

In short, if you have ever wondered why some aspect of your financial life was so unpleasant (such as applying for a mortgage with a traditional lender) or felt like it wasn't quite the right fit, fintech probably has (or seeks to have) a solution for you.

2.1.1. Capital flow

The term capital flows refer to the movement of capital or money for investment in and out of countries. When money for investment goes from one country to another, is a capital flow. All capital flows comprise just money that is a consequence of investment flows. The term does not include money people and businesses use to purchase each other's goods and services.

The movement of funds for company output, trade, or investment is known as capital flow. This takes the shape of investment capital and capital expenditures for operations and R&D within corporations. On a bigger scale, governments use tax revenue to fund operations and programs as well as trade with other countries and currencies. Savings and investment funds are allocated by individual investors to securities like stocks, bonds, and mutual funds.

Capital flows include, for example, the international movement of money into and out of the bond and stock markets. Cross-border mergers and acquisitions are also in this category. Capital flows are made up of all of the money moving between countries as a consequence of investment flows into and out of countries around the world. In this case rather than money flowing between countries to purchase each other's goods and services, we are referring to money flowing into and out of the stock and bond markets of countries around the world, as well as factors such as real estate and cross-border mergers and acquisitions.

According to the Reserve Bank of Australia: "Gross capital flows are one indicator of international financial integration or financial globalization which measure, the pace of overall financial integration increased markedly in the decade before the global financial crisis. Since then, there has been a well-documented decline in cross-border flows of capital, particularly from the banking sector."

2.1.2. Capital flows – the internet

Barriers to foreign investment have drastically decreased since the advent of the Internet, online trading, and e-commerce. The act of purchasing and selling financial products over the Internet is known as online trading. Doing business online, or through the Internet, is referred to as e-commerce. Fund managers and other investors can now take advantage of opportunities around the world much more easily.

If a country's stock market today, for example, is doing particularly well, capital flows will instantly go in its direction. In other words, it will attract investors from other countries immediately. The Internet has changed how investment products respond to market forces. While in the past, local demand and supply were the main drivers of prices, today international factors determine market forces are the market forces which are the forces of supply and demand.

2.1.3. Capital flows – currency values

The value of a nation's currency can be affected by capital flows. The demand for Swiss francs is expected to increase if the Zurich stock market becomes exceptionally appealing in a week. The value of the Swiss franc may increase as a result. If a large corporation acquires another large corporation in a different nation, the same thing may occur. The demand for Swiss francs would rise in tandem with the supply of dollars if the US pharmaceutical giant Pfizer were to purchase the Swiss multinational Novartis. In order to finalize the deal, Pfizer would have to exchange dollars for Swiss francs.

2.1.4. Capital flows explained

At almost every size, including individuals, businesses, and national governments, capital transfers take place. Analysts frequently examine a variety of subsets of capital flows, including movement in asset classes, venture capital, mutual fund, capital outlay budgets, and the federal budget. For analysis, regulatory, and legislative purposes, the federal government and state-level entities in the United States compile capital flows.

Venture capital changes in relation to investments made in start-up companies, while asset-class movements in the financial markets are quantified as capital flows between cash, stocks, bonds, and other financial instruments. The net cash inflows and outflows from various fund types are tracked by mutual fund flows. While federal budgets adhere to government spending plans, capital-spending budgets are reviewed at the company level to track growth objectives. Analyzing such money movements can demonstrate the relative strength or weakness of capital markets, particularly in controlled situations such as the government budget or the stock market. Investors also look at the growth rate of certain capital flows, such as venture capital and capital spending, to find any trends that might indicate future investment opportunities or risks.

As part of standard business operations, companies may look to purchase commercial real estate to house production activities. Additionally, many individuals see the purchase of real estate as an investment that produces rental income. These may classify as investment or business capital flows depending on the analysis.

2.2. Theoretical Review

2.2.1. Technology spillover theory

Technology spillover theory is essential to comprehending how discoveries, information, and technical breakthroughs inadvertently spread throughout different entities, fostering

creativity and economic growth. Technology spillovers are the unintentional transfer of information and technology from one entity to another, according to Griliches (1990). This phenomenon operates through several mechanisms, such as labor mobility, collaboration, and the dissemination of research findings.

At the firm level, technology spillovers occur when a company's innovations unintentionally benefit other firms within the same industry. Jaffe (1986) highlights the significance of firm-specific factors in determining the extent of spillover effects. This dynamic can lead to a more competitive and innovative industry landscape. Industry-level spillovers often manifest in agglomeration effects and regional clusters. Audretsch and Feldman (1996) delve into the geography of innovation and production, exploring how the concentration of related industries fosters technology spillovers. This emphasizes the importance of proximity and shared knowledge environments in facilitating the diffusion of technology.

The international dimension of technology spillovers is addressed by Coe and Helpman (1995), who examine how international trade acts as a conduit for the global transmission of technology. This aspect underscores the interconnectedness of economies and the role of cross-border collaborations in fostering technological progress given the policy implications which arise from the understanding of technology spillovers. Romer (1990) discusses the role of endogenous technological change in economic growth, emphasizing the need for policies that encourage collaboration, knowledge-sharing, and investments in research and development. Policymakers can leverage this knowledge to design initiatives that promote a conducive environment for technology spillovers. However, measuring technology spillovers poses challenges. Mowery and Ziedonis (2002) explore the geographic reach of market and non-market channels of technology transfer, emphasizing the complexities in quantifying spillover effects, particularly through patents. In summary, technology spillover theory illuminates the intricate ways in which knowledge and technology diffuse across firms, industries, and borders, influencing economic development and innovation. These insights are essential for policymakers and businesses seeking to harness the positive externalities of technological advancements.

2.3. Empirical Review

As deduced from the empirical review, several works have been put forth to examine the effects of financial technology on capital inflows in several countries across different regions of the world, notable among such are the works of Majeed et al. (2021) examined the link between FDI and financial development under different country-level characteristics. They found that FDI, trade openness, government consumption, and inflation have significant impacts on financial development; specifically, the first three increased the financial development in Asia, Europe, and Latin America but not in Africa. However, there is need for further verification and improvement in the future research.

Onah et al. (2021) examined the effect of financial technology on cash holding in Nigeria. The study utilized autoregressive distributed lag (ARDL) bounds test approach to cointegration to estimate the long-run relationship between four direct measures of financial technology and findings reveals the presence of long-run negative relationship between cash holding and the four direct measures of financial technology (automated teller machine [ATM], Internet banking [IB], point of sale [POS] and mobile banking [MB]). Nevertheless, the study only takes into consideration a single country but there is a need to assess the effect among different economies.

Irandoust (2021) studied the effect of host countries' financial development on FDI. The findings show unidirectional causality running from financial development to FDI in six of eight countries. Therefore, countries seeking to attract FDI should implement measures to ensure a well-developed financial system. However, the study only focuses on post communists' countries and it also lack detailed discussion on the methodology used.

Demira et al. (2022) investigates the interrelationship between FinTech, financial inclusion and income inequality for a panel of 140 countries using the Global Findex waves of survey data for 2011, 2014 and 2017. Quantile regression analysis was invoked to investigate whether such effects differ across countries with different levels of income inequality and it was found that, financial inclusion is a key channel through which FinTech reduces income inequality. Findings also reveal that while financial inclusion significantly reduces inequality at all quantiles of the inequality distribution, these effects are primarily associated with higher-income countries.

Desbordes and Wei (2017) empirically investigates the various effects that source and destination countries' financial development (SFD and DFD respectively) have on foreign direct investment (FDI). They establish causality by exploiting variations in both country-specific financial development and sector-specific financial vulnerability. This approach is made possible by our use of detailed databases on real manufacturing FDI projects worldwide. Findings reveals that both SFD and DFD have a large positive influence on greenfield, expansion, and mergers and acquisitions FDI, by directly increasing access to external finance and indirectly promoting manufacturing activity. The overall economic impacts of SFD and DFD tend to be similar but their direct and indirect effects vary across margins and types of FDI. However, there is Need for future research to examine the impact of FDI on FD on individual countries to formulate country-specific policies.

Morgan (2022) investigates the developments of financial inclusion and Fintech in the Association of Southeast Asian Nations (ASEAN) member countries and India to identify the ways that Fintech is contributing and can potentially contribute to increased financial inclusion. Empirical analysis shows that financial innovations in products and services delivery from financial technology are significantly closing gaps in financial inclusion. However, the study only focuses only on one methodology thereby need to access using other sophisticated technics.

Tsaurai (2022) examined the nexus between financial sector development, renewable energy usage and unemployment

(UNEMP) in North African countries. The study utilized a panel data from 1992 to 2019 and employed analysis methods such as fixed effects, fully modified ordinary least squares (FMOLS) and pooled ordinary least squares (OLS) were used. Findings reveals that, financial sector development had a significant unemployment reduction influence. Complementarity variables were also noted to have significantly reduced unemployment. The study recommends that, North African countries should therefore craft, develop and implement financial development, renewable energy usage (RENEW) and economic growth enhancement strategies and policies to increase job creation capacity.

Assefa and Mollick (2017) examined financial development and economic growth in Africa 15 African countries from 1995 to 2010 and employ both static and dynamic panel data methods. Findings show that, portfolio flows and Foreign Direct Investment (FDI) have consistently positive effects on economic growth under endogenous stock market capitalization. These findings reinforce the view that African countries should open their equity markets to international investors and encourage FDI. However, this study has become obsolete and there by arising the need to access the impact in the current time period.

Sandri et al. (2022) investigated the impact of economic growth and digitalization on unemployment change, evaluating a modified version of Okun's Law on a balanced panel data set for 58 countries between 2013 and 2019. The results from the estimation of a fixed-effect model show the empirical validity of Okun's law for the sampled countries and a significant contribution of digitalization on unemployment reduction.

Badwan and Awad (2022) investigated the impact of FinTech on Palestinian economic development for the period (2008-2021). In addition, the co-integration was evaluated using a distributed autoregressive approach, and a vector error correction model was used to consider long- and short-term causation. However, the data shows that FinTech products (number of people using the Internet, number of broadband subscriptions, number of mobile cellular subscriptions, number of automated transfer machines, number of branches) contribute to the growth in financial inclusion, which in turn fuels the growth economy in Palestine. However, the study only focuses on fintech and economic development leaving out other important macro-economic problems.

Nenavath and Mishra (2023) investigates the influence of green finance and financial technology on sustainable economic growth. The analysis is based on data from Indian states from 2010 to 2021. The research paper uses the panel regression method to examine the association between fintech, green finance and economic growth by applying a two-step GMM (generalized model of moments) to determine the endogeneity issues of the variables. Findings reveals that green finance widely helps quality economic growth by significantly impacting finance structure, financial effectiveness, and environmental quality protection development. Furthermore, fintech enhances the significant effect of green finance in the finance structure and environmental quality protection while lacking consequences on the association between green finance and economic effectiveness.

Chen et al. (2022) calculates the China's 31 provinces' FinTech indices from 2008 to 2018 and the digital economy development indices from 2012 to 2018 and analyzes the impact of FinTech on the digital economy and its underlying mechanism. The results show that FinTech stimulates the development of the digital economy in China by promoting technological innovation and weakening the financial decentralization of local governments. Further research indicates that local financial regulatory resources have a positive moderating effect on the impact of FinTech in promoting the development of the digital economy. Nevertheless, the study only takes into consideration a single country but there is a need to assess the effect among different economies.

2.3.1. Literature gap

Firstly, most of the studies focuses on single countries such as China's economy, and some developed economies, few on African countries and others while none of the study focuses on the low- and middle-income African countries which this study takes into account. Secondly, the time period from 2000 to 2022 showcases a more recent development on the research topic. Finally, most studies focus attention on the effect of fintech on finanacial inclusion, economic growth, unemployment. This topic seeks to examine the effect of fintech on capital inflow in low- and middle-income African countries.

3. METHODOLOGY

Examining the impact of financial technology on capital inflow in low- and middle-income African nations as well as the causal relationship between financial technology and capital inflow in these nations are the goals of this research.The variable FinTech will be disaggregated to include Automated teller machines (ATMs) (per 100,000 adults) (ATM), Secure Internet servers (per 1 million people) (SIUS) and Individuals using the Internet (% of population) (IUI). The variable for capital inflow is measured using Net financial flows, multilateral (NFL, current US$) obtained from world development indicator (WDI). However, to facilitate sound policy recommendations, exchange rate (EXR) and inflation rate measured by the consumer price index (CPI) obtained from (WDI) were also included in the model to ascertain the role of exchange and purchasing power in determining Fintech effect on capital inflows in middle- and low-income Africa countries. The selected middle-income African countries include Algeria, Angola, Benin, Cameroon, Comoros, Cape Verde, Cote d'Ivoire, Egypt, Ghana, Gambia, Kenya, Lesotho, Morocco, Mauritania, Nigeria and Senegal while the lower income countries comprise of chad, Burkina Faso, Ethiopia, Burundi, Congo rep, Liberia, Madagascar, Mozambique, Niger, Sudan, Somalia, Rwanda, Sierra Leone, Togo, Uganda and Malawi.

3.1. Model A for Objective One

In order to examine effect of financial technology on capital inflow in low-income and middle-income African countries, model A serves as the basis to empirically examine such an effect. It can be written in its implicit form as thus;

$$NFF_{it} = f(ATM_{it}, IUI_{it}, SIUS_{it}, CPI_{it}, EXR_{it}, \mu_{it}) \quad (1)$$

Where, NFF stands for Net financial flows, multilateral (NFL, current US$), a proxy for capital inflows. The variable Fintech will be disaggregated to include Automated teller machines (ATMs) (per 100,000 adults) (ATM), Secure Internet servers (per 1 million people) (SIUS) and Individuals using the Internet (% of population) (IUI). While CPI is Inflation, consumer prices (annual %) EXR is Official exchange rate, obtained from (WDI). The implicit form equation in equation 3.1 above can be written explicitly as;

$$NFF_{it} = \beta_0 + \beta_1 ATM_{it} + \beta_2 IUI_{it} + \beta_3 SIUS_{it} + \beta_4 CPI_{it} + \beta_5 LOGEXR_{it} + \mu_{it} \quad (2)$$

Where, i= 1, 2. N =Selected countries for each group, t = 1, 2. T=23. In equation (2) β_0 denotes the intercept while β_1 ……. β_5 are the parameters or coefficients of the estimated variables; i,t,1 denote the i^{th} country t^{th} refers to time period respectively. The error term is represented by μ which represents uncaptured variables in the model.

3.2. Objective Two

The analysis will use the Pairwise Granger Causality test to investigate the link or causal connection between capital inflow and financial technology performance in low- and middle-income African nations. The criteria used to evaluate this association include determining whether the F-statistics' probability value is greater than a 5% significance level. If so, it suggests that the variables in question do not Granger influence one another to change. The likelihood value may be unidirectional, bi-directional, or non-directional, but if it is less than the 5% confidence level, it indicates that the variables Granger induce changes in each other.

3.3. A Prior Expectation

The apriori expectation involves anticipating the direction and magnitude of parameters, indicating the economic relationships among variables. Based on the study, it is anticipated that the a priori sign for financial technology indicators (ATM, IUI and SIUS) be positive while inflation rate (CPI) be negative and exchange rate indeterminate. Additionally, the anticipated outcome of the result is expected to be greater than zero for $B_1 - B_3$ and less than zero for B_4

$$B_1 - B_3 > 0, B_4 < 0$$

4. RESULTS AND INTERPRETATION

4.1. Summary/Descriptive Statistics on the Effect of Financial Technology on Agricultural Productivity in Western Low-income Africa Countries

A comprehensive summary of sixteen Western low-income African nations is displayed in the Table 1. For this group of low-income people in western Africa, the average observation across all series is 368. According to the results, the NFF dataset is clustered around the mean, with the mean value for the western low-income African countries being 0 and the standard deviation being 1. The observation's values range from a minimum of −5.178 to a maximum of 6.129.

Among the low-income countries in western Africa, the average ATM value is 1.707 with a standard deviation of 2.58. The ATM dataset appears to be dispersed from the mean, based on this. The value of the observation ranges from 0 at the minimum to 12.21 at the greatest. The results also show that the IUI dataset is dispersed from the mean in the western low-income Africa bloc, where the mean value is 4.539 with a standard deviation of 6.621. A value of 0 is the observation's minimum, while 34.984 is its maximum. While the mean value of SIUS is 2.622 and a standard deviation of 7.283, this implies that the dataset is moderately spread away from the mean. The observation has a minimum value of 0 and a maximum value of 80.707. CPI has a mean value of 8.815 and a standard deviation of 22.794, this implies that the dataset is far apart from the mean. CPI also has a minimum value of −8.975 and a maximum of 359.093.

Additionally, EXR has a mean value of 1251.432 and a standard deviation of 3892.799, this indicates that EXR dataset is spread away from the mean. The minimum is 0 and the maximum value is 31558.9.

4.2. Correlation Matrix on the Effect of Financial Technology on Capital Inflows in Western Low-income Africa Countries

The Table 2 displays the results of the correlation matrix on how financial technology affects capital inflows in Western low-income African countries. The dependent variable, NFF, has a positive relationship with itself, as well as with automated teller machines (ATMs), internet users (IUI), and secure internet servers (SUIS). However, it has a negative relationship with inflation (CPI) and the log of exchange rates (LOGEXR). Every relationship shown in the analysis in Table 2 is in line with economic theory. IUI and ATM have the largest positive connection (0.429) in Table 2, whereas NFF and CPI have the

Table 1: Summary/descriptive statistics on the effect of financial technology on capital inflows in Western low-income Africa countries

Variable	Obs	Mean	Standard Deviation	Min	Max
NFF	368	0	1	−5.178	6.129
ATM	368	1.707	2.58	0	12.21
IUI	368	4.539	6.621	0	34.984
SIUS	368	2.262	7.283	0	80.707
CPI	368	8.815	22.794	-8.975	359.093
EXR	368	1251.432	3892.799	0	31558.9

Source: Author's computation (2024)

Table 2: Correlation matrix results on the effect of financial technology on capital inflows in Western low-income Africa countries

Variables	NFF	ATM	IUI	SIUS	CPI	LOGEXR
NFF	1.000					
ATM	0.113	1.000				
IUI	0.280	0.429	1.000			
SIUS	0.210	0.367	0.407	1.000		
CPI	−0.205	−0.030	0.061	−0.023	1.000	
LOGEXR	−0.022	0.091	0.053	0.144	−0.064	1.000

Source: Author's computation (2024)

Table 3: Feasible generalized least square regression output

NFF	Coefficient	Standard error	Z	P>|Z|	[95% coefficient interval]	
ATM	−0.0185	0.0214	−0.87	0.386	−0.0604	0.0233
IUI	0.0404	0.0085	4.76	0.000	0.0238	0.0570
SIUS	0.0169	0.0075	2.24	0.025	0.0021	0.3158
CPI	−0.0098	0.0021	−4.61	0.000	−0.0140	−0.0057
LOGEXR	−0.0266	0.0204	−1.31	0.192	−0.0665	0.0133
C	0.0359	0.1229	0.29	0.770	−0.2049	21.2767

Source: Author's computation (2024)
NFF: Net financial flow, ATM: Automated teller machine per 1000, IUI: Individual using the internet, SIUS: Secure internet server, CPI: Inflation rate, LOGEXR: Log of exchange rate

strongest negative correlation (−0.205). This implies that the model does not have a multicollinearity issue.

4.3. Feasible Generalized Least Square Regression on the Effect of Financial Technology on Capital Inflow in Western Low-Income Countries

The outcome of the feasible generalized least square (FGLS) method on how financial technology affects capital inflows in low-income western nations is shown in the table. In projecting net financial flows (NFF), the estimation's result shows that the number of automated teller machines (ATMs) per 100,000 has a negative and non-statistically significant association. At 5%, there is a positive and statistically significant correlation between NFF and both internet users (IUI) and secure internet servers (SIUS).

The inflation rate (CPI) is negatively related to NFF but statistically significant at 1%, log of exchange rate also has a negative and a non-statistically significant relationship with NFF. The FGLS result conform with prior expectation for all indicator with exception of ATM (Table 3).

According to the empirical results based on the FGLS approach, a unit change in two of the three disaggregated financial technology indicators, IUI and SIUS, is responsible for a 0.0404 and 0.0169 increase in net financial flows (NFF) that is statistically significant at 5%. In contrast, a unit increase in ATM results in a 0.0185 decrease in NFF that is statistically insignificant. Nonetheless, there is a statistically significant 0.0098 drop in NFF for every unit increase in CPI. With a coefficient value of −0.0266, LOGEXR, on the other hand, indicates that a unit increase in LOGEXR will result in a 0.0266 drop in NFF. At this point, it is therefore necessary to conclude that financial technology promotes capital inflows in the sixteen western- low income Africa countries as individuals using the internet (IUI) and secure internet server (SIUS) are factors that promotes financial inclusion which enables easy mobility of funds from one country to another.

4.4. Granger Causality Result on the Effect of Financial Technology on Capital Inflows in Western Low- income Africa Countries

In order to determine the direction of causality among the variables, pairwise granger Causality Tests is conducted, and the result is presented in Table 4. Generally, the estimation test result on the direction of causality reveals there is a bi-directional causal relationship between IUI_NFF1, CPI_NFF, IUI_ATM, SIUS_ATM, CPI_IUI and SIUS_IUI. However, the results show that there exists a unidirectional relationship between CPI_ATM and ATM_CPI and LOGEXR_SIUS and SIUS_LOGEXR. Lastly, the result reveals that there exists a non-directional causal relationship between ATM_NFF and NFF_ATM, SIUS_NFF and NFF_SIUS, LOGEXR_NFF and NFF_LOGEXR, LOGEXR_ATM and ATM_LOGEXR, LOGEXR_IUI and IUI_LOGEXR, CPI_SIUS and SIUS_CPI, LOGEXR_CPI and CPI_LOGEXR. It can be concluded from looking at research goal three that people who use the internet (IUI) have an impact on net financial flows (NFF). The shift in internet users (IUI) is also a result of net financial flows (NFF) granger. It was also discovered during the inquiry that there is no causal connection between ATM and NFF, NFF and ATM and SIUS, and NFF and SIUS.

Table 4: Granger causality result on the effect of financial technology on capital inflow in western low- income Africa countries

Null Hypothesis	Obs	F-Statistic	Prob.
ATM does not Granger Cause NFF	336	1.00797	0.3661
NFF does not Granger Cause ATM		2.62736	0.0738
IUI does not Granger Cause NFF	336	4.11239	0.0172
NFF does not Granger Cause IUI		5.68021	0.0038
SIUS does not Granger Cause NFF	336	0.88024	0.4157
NFF does not Granger Cause SIUS		0.39822	0.6718
CPI does not Granger Cause NFF	336	4.33860	0.0138
NFF does not Granger Cause CPI		4.28722	0.0145
LOGEXR does not Granger Cause NFF	336	0.58675	0.5567
NFF does not Granger Cause LOGEXR		0.23050	0.7943
IUI does not Granger Cause ATM	336	9.23429	0.0001
ATM does not Granger Cause IUI		5.25704	0.0057
SIUS does not Granger Cause ATM	336	37.2980	2.E-15
ATM does not Granger Cause SIUS		9.00711	0.0002
CPI does not Granger Cause ATM	336	0.07804	0.9249
ATM does not Granger Cause CPI		7.46030	0.0007
LOGEXR does not Granger Cause ATM	336	1.05136	0.3506
ATM does not Granger Cause LOGEXR		0.01081	0.9892
SIUS does not Granger Cause IUI	336	47.1040	1.E-18
IUI does not Granger Cause SIUS		3.15685	0.0438
CPI does not Granger Cause IUI	336	4.33209	0.0139
IUI does not Granger Cause CPI		19.9332	7.E-09
LOGEXR does not Granger Cause IUI	336	0.37750	0.6859
IUI does not Granger Cause LOGEXR		1.07365	0.3429
CPI does not Granger Cause SIUS	336	0.18644	0.8300
SIUS does not Granger Cause CPI		0.04877	0.9524
LOGEXR does not Granger Cause SIUS	336	3.67664	0.0263
SIUS does not Granger Cause LOGEXR		1.18352	0.3075
LOGEXR does not Granger Cause CPI	336	2.08279	0.1262
CPI does not Granger Cause LOGEXR		1.43005	0.2408

Source: Author's computation (2024)

4.5. Summary/Descriptive Statistics on the Effect of Financial Technology on Capital Inflow in Western Middle-income Africa Countries

Table 5 shows a detailed summary statistic of sixteen Western middle-income Africa countries. The average observation for this western low-income Africa group is 368 for all the series. The result shows that, the mean value of NFF for the western middle-income Africa countries is 0.456 with a standard deviation of 1.56, this indicates that the NFF dataset are spread away from the mean. The observation has a minimum value of −4.471 and a maximum value of 6.98. The average value of ATM for the western middle-income Africa bloc is 7.318 with a standard deviation of 10.214 This implies that the ATM dataset is spread away from the mean. The observation has a minimum value of 0 and a maximum value of 52.07. The result further reveals that, the mean value of IUI for western middle-income Africa bloc is 16.998 and a standard deviation of 19.443 indicating that the IUI dataset is spread out from the mean. The observation has a minimum value of 0 and a maximum value of 88.13. While the mean value of SIUS is 17.405 and a standard deviation of 60.73, this implies that the dataset is relatively spread away from the mean. The observation's values range from 0 at the least to 523.37 at the greatest. The dataset appears to be distant from the mean, as indicated by the CPI's mean value of 7.936 and standard deviation of 20.791. Additionally, the CPI ranges from a minimum of −16.86 to a maximum of 324.997. Furthermore, the OEXR dataset is moderately dispersed from the mean, as indicated by the EXR's mean value of 211.04 and standard deviation of 232.59. 732.398 is the largest value, and 0 is the minimum.

Table 5: Summary/descriptive statistics on the effect of financial technology on capital inflows in Western middle-income Africa countries

Variable	Obs	Mean	Standard Deviation	Min	Max
NFF	368	0	1	−4.471	6.98
ATM	368	7.318	10.214	0	52.07
IUI	368	16.998	19.433	0	88.13
SIUS	368	17.405	60.73	0	523.37
CPI	368	7.936	20.791	−16.86	324.997
EXR	368	211.04	232.59	0	732.398

Source: Author's computation (2024)

Table 6: Correlation matrix result on the effect of financial technology on capital inflows in Western middle-income Africa countries

Variables	NFF	ATM	IUI	SIUS	CPI	LOGEXR
NFF	1.000					
ATM	0.233	1.000				
IUI	0.443	0.680	1.000			
SIUS	0.245	0.516	0.476	1.000		
CPI	0.016	−0.076	−0.101	−0.050	1.000	
LOGEXR	−0.101	−0.138	−0.114	−0.044	−0.166	1.000

Source: Author's computation (2024)

4.6. Correlation Matrix on the Effect of Financial Technology on Capital Inflows in Western Middle-income Africa Countries

The result of the correlation matrix on the effect of financial technology on capital inflows in Western middle-income Africa countries are shown in the Table below, the dependent variable NFF1 is positively related to itself, it is also positively related to automated teller machine (ATM), individuals using the internet (IUI) and secure internet server (SUIS) and inflation rate (CPI) but negatively related to log of exchange rate (LOGEXR). All the relationship, with the exception of CPI as indicated in the Table 6 analysis is consistent with economic theory. The strongest positive correlation in Table 6 is between ATM and IUI (0.680) and the strongest negative correlation is between CPI and LOGEXR (−0.166). This suggest that there is no issue of multicollinearity present in the model.

4.7. Feasible Generalized Least Square Regression on the Effect of Financial Technology on Capital Inflow in Western Middle-Income Countries

The result in the Table 7 displays the feasible generalized least square (FGLS) approach on the effect of financial technology on capital inflows in western middle- income countries. The result from the estimation reveals that, automated teller machine per 100,000 (ATM) has a negative and statistically significant relationship in predicting net financial flows (NFF1). Individuals using the internet (IUI) has a positive and significant relationship with NFF while secure internet NFF and server (SIUS) have a 5% positive and negative association. Although statistically insignificant, the inflation rate (CPI) has a positive link with NFF, whereas the log of the exchange rate has a negative and non-statistically significant relationship with NFF. For IUI, SIUS, and LOGEXR, the FGLS result is in line with previous expectations. However, CPI and ATM do not meet previous expectations.

According to the empirical conclusion based on the FGLS technique, a unit change in IUI results in a 0.0263 rise in net financial flows (NFF) that is statistically significant at 5%. At the same time, a unit increase in SIUS results in a 0.0014 increase in NFF that is statistically insignificant at 5%. Nonetheless, the outcome demonstrated that a statistically significant decrease in NFF is linked to a 0.0159 increase in ATM. In western low-income nations, there is a statistically negligible increase of 0.0022 in NFF for every unit increase in CPI. LOGEXR, on the other hand, has a coefficient value of −0.2511, which indicates that

Table 7: Feasible generalized least square regression output

NFF	Coefficient	Standard error	Z	P>|Z|	[95% coefficient interval]	
ATM	−0.0159	0.0065	−2.44	0.015	−0.0286	0.0031
IUI	0.0263	0.0033	7.93	0.000	0.0198	0.0328
SIUS	0.0014	0.0009	1.54	0.123	−0.0004	0.0032
CPI	0.0025	0.0023	1.08	0.278	−0.0020	0.0069
LOGEXR	−0.0290	0.0261	−1.11	0.266	−0.0802	0.0222
C	−0.2511	0.1383	−1.82	0.069	−0.5221	0.0199

Source: Author's computation (2024)

NFF will fall by 0.2511 for every unit rise in LOGEXR. Now, it is therefore necessary to conclude that financial technology promotes capital inflows in the sixteen western- middle income Africa countries as individuals using the internet (IUI) are a prominent factor that promotes the use of financial technology which enables easy mobility of funds from one country to another in the western- middle income bloc.

4.8. Granger Causality Result on the Effect of Financial Technology on Capital Inflows in Western Middle- income Africa Countries

In order to determine the direction of causality among the variables, pairwise granger Causality Tests is conducted, and the result is presented in Table 8. Generally, the estimation test result on the direction of causality reveals there is a bi-directional causal relationship between IUI_NFF, IUI_ATM, SIUS_ATM, CPI_IUI, SIUS_IUI and LOGEXR_CPI. However, the results show that there exists a unidirectional relationship between ATM_NFF and NFF_ATM and CPI_NFF and NFF_CPI. Lastly, the result reveals that there exists a non-directional causal relationship between SIUS_NFF and NFF_SIUS, LOGEXR_NFF and NFF_LOGEXR, CPI_ATM and ATM_CPI, LOGEXR_ATM and ATM_LOGEXR, CPI_IUI and IUI_CPI, LOGEXR_IUI and IUI_LOGEXR, CPI_SIUS and CPI_SIUS, LOGEXR_CPI and CPI_LOGEXR. In examining objective three of this study, it can be inferred that, automated teller machine per 100,000 (ATM) does not granger cause a change in net financial flows (NFF). Also, net financial flows (NFF) granger causes a change in automated teller machine per 100,000 (ATM). Individual using the internet (IUI) on the other hand granger cause a change in NFF, also NFF granger cause a change in individuals using the internet (IUI). This result conforms to (Irandoust, 2021) who established that a uni-directional relationship exists. Furthermore, it was found out that no causal link exists between SIUS and NFF likewise NFF and SIUS during this investigation. This result connotes (Irandoust, 2021).

Table 8: Granger causality result on the effect of financial technology on capital inflows in western middle- income Africa countries

Null Hypothesis:	Obs	F-statistic	Prob.
ATM does not Granger Cause NFF	336	0.91434	0.4018
NFF does not Granger Cause ATM		9.32195	0.0001
IUI does not Granger Cause NFF	336	8.16576	0.0003
NFF does not Granger Cause IUI		4.70357	0.0097
SIUS does not Granger Cause NFF	336	0.84658	0.4298
NFF does not Granger Cause SIUS		0.30834	0.7349
CPI does not Granger Cause NFF	336	0.00509	0.9949
NFF does not Granger Cause CPI		3.51615	0.0308
LOGEXR does not Granger Cause NFF	336	0.25697	0.7735
NFF1 does not Granger Cause LOGEXR		1.08721	0.3384
IUI does not Granger Cause ATM	336	17.6123	5.E-08
ATM does not Granger Cause IUI		6.88543	0.0012
SIUS does not Granger Cause ATM	336	40.3244	2.E-16
ATM does not Granger Cause SIUS		18.0884	4.E-08
CPI does not Granger Cause ATM	336	0.18348	0.8324
ATM does not Granger Cause CPI		0.25615	0.7742
LOGEXR does not Granger Cause ATM	336	0.77826	0.4600
ATM does not Granger Cause LOGEXR		0.12261	0.8846
SIUS does not Granger Cause IUI	336	43.8534	1.E-17
IUI does not Granger Cause SIUS		7.61601	0.0006
CPI does not Granger Cause IUI	336	0.56809	0.5672
IUI does not Granger Cause CPI		1.25974	0.2851
LOGEXR does not Granger Cause IUI	336	1.28672	0.2776
IUI does not Granger Cause LOGEXR		0.18916	0.8277
CPI does not Granger Cause SIUS	336	0.13304	0.8755
SIUS does not Granger Cause CPI		1.25924	0.2852
LOGEXR does not Granger Cause SIUS	336	0.16469	0.8482
SIUS does not Granger Cause LOGEXR		0.02767	0.9727
LOGEXR does not Granger Cause CPI	336	5.58406	0.0041
CPI does not Granger Cause LOGEXR		8.71520	0.0002

Source: Author's computation (2024)

5. DISCUSSION OF FINDINGS

In addition to discussing the study's general findings, this part offers economic perspectives on how financial technology affects capital influx into low- and middle-income Western African nations. The correlation matrix, unit root test, and summary statistics are the outcomes of the descriptive statistics. Based on the summary statistics of each subgroup, the series' mean and standard deviation reveal that, although there are comparatively few clusters around the mean, the majority of the data are dispersed from it, indicating diversity among nations. In order to account for cross-sectional dependence, slope heterogeneity, and serial correlation, the feasible generalized least square (FGLS) result will serve as the foundation for this discussion.

The correlation matrix for the effect of financial technology on capital inflows in western-low-income Africa countries indicates that NFF is positively related to automated teller machine (ATM), individuals using the internet (IUI) and secure internet server (SUIS) but negatively related to inflation (CPI) and log of exchange rate (LOGEXR). Also, the correlation matrix on the effect of financial technology on capital inflows in western-middle income Africa countries indicates that NFF is positively related to automated teller machine (ATM), individuals using the internet (IUI) and secure internet server (SUIS) and inflation rate (CPI) but negatively related to log of exchange rate (LOGEXR).

Using the feasible generalized least square (FGLS) estimation approach, the results of the study on the impact of financial technology on capital inflows in western-low income African countries show that there is a negative correlation between the inflation rate (CPI) and the log of exchange rate (LOGEXR) for automated teller machines per 100,000 (ATMs), while there is a positive and significant correlation between net financial flows (NFF) and internet users (IUI) and secure internet servers (SUIS). This implies that secure internet server (SUIS) and individuals using the internet (IUI) are factors that promotes net financial flows (NFF) a proxy for capital inflow. This conforms with (Ya et al., 2023). However, the result on the effect of financial technology on capital inflows in western-middle income Africa countries as presented in the FGLS estimator shows that two out of the three disaggregated financial technology indicators, individual using the internet (IUI) and secure internet server (SIUS) has a positive relationship with net financial flows (NFF) as SIUS is

insignificant while IUI is significant at 5%. This aligned with the study by (Onah et al., 2021; Ya et al., 2023). Automated teller machine (ATM) on the other hand has a negative and statistically significant relationship with NFF. However, Log of exchange rate (LOGEXR) is negative and insignificantly related to net financial flows (NFF) while inflation rate (CPI) is positive and insignificantly related with NFF.

6. CONCLUSION AND RECOMMENDATION

Addressing its initial goals, this study has offered comprehensive insights into how financial technology affects capital inflow in western low- and middle-income African nations. To achieve goal two of this study, a thorough understanding of the causal relationship between financial technology and capital influx is also given. The study came to the following conclusion in light of the findings: First, how financial technology affects capital influx into a few chosen western-low and middle-African nations.

The result on the effect of financial technology on capital inflow in the sixteen western-low income Africa countries as presented in the feasible generalized least square (FGLS) estimator shows that two out of the three disaggregated financial technology indicators, individuals using the internet (IUI) and secure internet server (SIUS) is positive and significantly related to net financial flows (NFF) while automated teller machine per 100,000 (ATM) is negative and statistically insignificant to net financial flow (NFF). However, the result on the effect of financial technology on capital inflow in the sixteen western-middle income Africa countries analyzed as presented in the FGLS estimator shows that one out of the three disaggregated financial technology indicators, individual using the internet (IUI) has positive and significant relationship with net financial flows (NFF). while secure internet server (SIUS) has a positive non- significant relationship with NFF, ATM has a negative and significant relationship with NFF. Given the outcome of the result, it is clear that financial technology plays a part in aiding easy mobility in western-low- and middle-income Africa countries.

Regarding the relationship between capital influx and financial technology in western low- and middle-income African nations. It can be concluded by looking at aim two of this study that people who use the internet (IUI) generate a change in net financial flows (NFF) in western low-income African countries. Additionally, net financial flows (NFF) have a significant impact on the number of internet users (IUI). Additionally, during the inquiry, it was discovered that there is no causal relationship between ATM_ NFF, just as there is no relationship between NFF and ATM and SIUS_ NFF and NFF_ SIUS. Nonetheless, it may be concluded that the number of automated teller machines (ATMs) per 100,000 in Western-low Africa does not significantly alter net financial flows (NFF). Also, net financial flows (NFF) granger causes a change in automated teller machine per 100,000 (ATM). Individual using the internet (IUI) on the other hand granger cause a change in NFF, also NFF granger cause a change in individuals using the internet (IUI). Furthermore, it was found out that no causal link exists between SIUS and NFF likewise NFF and SIUS during this investigation.

From the above findings, it is recommended that Since two out of the three disaggregated financial technology indicators, individuals using the internet (IUI) and secure internet server (SIUS) has a positive and significant relationship with net financial flow (NFF) in western-low income Africa countries, it is highly imperative for the government in western-low income Africa countries to pursue policies that promotes the use of financial technology as a means of aiding an easy mobilization of funds from abroad.

People utilizing the internet (IUI), one of the three disaggregated financial technology indicators, has a strong and positive correlation with net financial flow (NFF) in western-middle-African nations, but ATM has a significant and negative correlation with NFF. This suggests that governments in western-middle-income African nations should eliminate obstacles that make their financial technology difficult to access and direct banks to lower fees for international investors' deposits and savings through monetary policy.

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