FINANCIAL TECHNOLOGY INNOVATION AS A DRIVER OF PRIVATE INVESTMENT IN ZIMBABWE

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ABSTRACT

Over the past few decades, the global financial sector has undergone significant transition. Developments such as increased use of financial instruments, capital inflows, new regulations, deregulation, and innovations have influenced the financial sector, private investment, and the broader economy. Financial technology (FinTech) has brought major changes to financial services, reshaping economies. While much is known about FinTech's global impact, little research has examined its effect on private investment in developing nations such as Zimbabwe. This study examines how financial technology influences private-sector investment in Zimbabwe. The study is motivated by the introduction of new financial products—such as mobile money, real- time gross settlement systems, remittances, and internet banking—especially during periods of low private investment. The analysis uses Fully Modified Ordinary Least Squares and Canonical Cointegration Regression (CCR) models. Results show that financial technology has a positive and significant long-run impact on private investment in Zimbabwe. The findings also reveal a negative relationship between private investment and exchange rates. The study recommends that authorities, investors, and development agencies leverage digital financial innovation to support sustainable private sector investment. However, growth of the money supply alone is insufficient; sound economic management is also necessary for effective private investment.

Keywords: Digital Finance, Financial Technology, Private Sector Investment, Zimbabwe.

1. INTRODUCTION AND BACKGROUND

In the past thirty years, global digitalisation has transformed the financial sector. There has been a notable rise in the number of financial institutions, capital inflows, new regulations, deregulation, and innovations in financial instruments. These changes affect financial sector performance, private investment, and the overall economy. With globalisation and technology, financial deepening and widening now help deliver financial services efficiently. FinTech, short for financial technology, refers to companies and innovations that apply advanced technology—such as software, mobile applications, and data analytics—to improve, automate, or deliver financial services. This includes payment platforms, digital banking, lending solutions, and investment tools. FinTech includes more than just traditional banking systems—it introduces new, efficient methods for delivering financial services. Technology increases the reach, speed, efficiency, and cost-effectiveness of financial services compared to traditional banks. FinTech sits at the crossroads of inclusive finance, technological advancement, and innovation. However, it is still unclear whether FinTech actually promotes investment growth.

1.2 Background of the study

The digital revolution has increased access to financial services worldwide. This is true in developing countries and has changed how people pay, borrow, and save. For example, as of 2024, 79% of adults globally have bank or mobile money accounts—up from 74% in 2021. In developing economies, electronic payments rose from 35% of adults in 2014 to 57% by2021, in part because people wanted to avoid physical cash. In low- and middle-income countries, financial account ownership increased by 6%, and by 2024, 75% of adults had an account, a rise from 2021. Many adults who receive digital payments also use them and tend to save or borrow money.

The internet and mobile phones are rapidly changing FinTech, especially in Africa. The leading African FinTech countries are Nigeria, Kenya, South Africa, and Egypt. The FinTech market in Africa is expected to reach

$882.30 billion by 2030 and is already creating jobs and expanding access to financial services. FinTech companies often partner with banks, mobile network operators, and other stakeholders to develop payment solutions for consumers and small businesses. As the fastest-growing startup sector in Africa, FinTech raised over $1.3 billion in 2021. Its growth is driven by more smartphone ownership, lower internet costs, expanded network coverage, and a young, growing population.

African FinTech fosters financial inclusion and supports daily life, with mobile money, blockchain, and digital banking narrowing the gap for the unbanked. Companies like Flutterwave, Paystack, Ecocash, and M-Pesa are global leaders.

In 2021, one-third of adults in Sub-Saharan Africa had a mobile money account, the largest share of any region in the world and over three times the global average of 10%. Mobile money is increasingly becoming an integral part of the financial ecosystem in Sub-Saharan Africa. Statistics have shown that 40% of adults in Sub-Saharan Africa had a mobile money account as of 2024, up from 27% in 2021[2]; [7]. Beyond payments, mobile money accounts have also become an important way to save in Sub- Saharan Africa, including Zimbabwe.

Looking specifically at Zimbabwe, the Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ) indicates that the FinTech industry is set for significant growth with the introduction of Fifth Generation (5G) technology by mobile telecommunications, the arrival of global low-earth-orbit satellite service leader Starlink and the increasing adoption of emerging technologies like artificial intelligence (AI) and machine learning (ML).

As of July 2019, Zimbabwe had 50 FinTech companies, with an average age of three years [8]. The majority of these companies operate in the payments sector, followed by remittances. The following table presents the number, types, and average age of FinTech companies.

Table 1
SUMMARY OF FINTECH COMPANIES

Type of fintech	Number of fintechs	Average age (Years)	Type of fintech	Number of fintechs	Average age (Years)
Payments	17	2.9	Marketplace	2	3.0
Remittances	11	4.0	Insurance	2	1.5
Lending	2	3.5	Cryptocurrency	3	2.3
Infrastructure	3	2.7	Various	10	3.2

Source: RBZ 2023

To date, FinTech in Zimbabwe has been a largely successful story of digital payments, building on both global and regional digitalisation efforts. These are payments made through real-time gross settlement (RTGS), point-of-sale (POS) machines, automated teller machines (ATMs), mobile banking, and internet banking. Driven by a range of factors, including the macroeconomic situation, cash shortages and aggressive marketing by Econet, the volume of digital payments grew from 38 million in 2012 to 367 million in 2016, and then accelerated to 1.96 billion in 2018[8]. As shown in Figure 1.

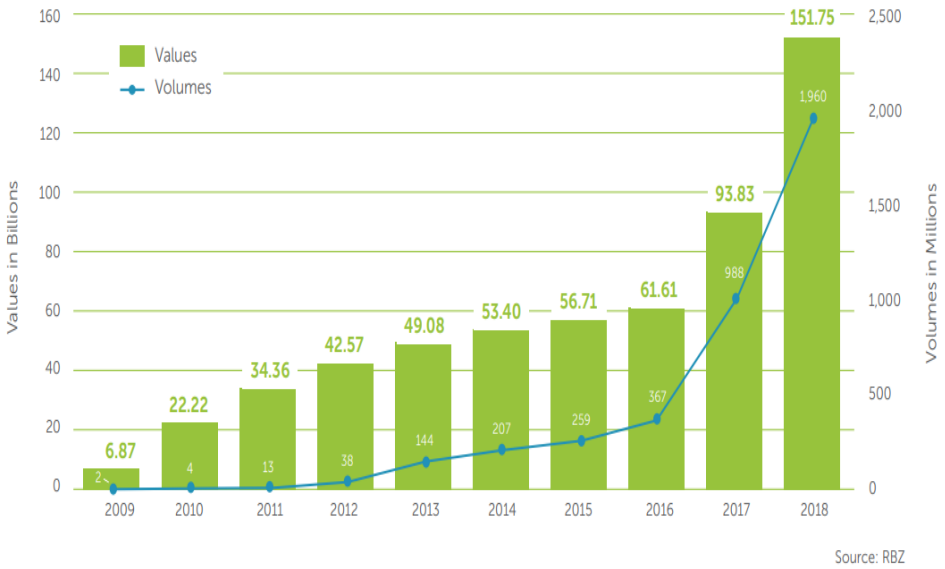

FIGURE 1
GROWTH OF DIGITAL PAYMENTS IN ZIMBABWE

Seventy per cent of adult Zimbabweans have a transaction platform or account that allows them to transact digitally through a bank or mobile money account [2]. The value of electronic transactions processed through the national payment systems infrastructure during the fourth quarter, ending December 31, 2024, increased by 53.96% from USD 13.9 billion in the third quarter of 2014 to USD 21.4 billion. Transaction volumes also increased by 240.69% to 188.64 million from 55.37 million during the same period [6].

The RTGS settlement system (generally used by larger entities and individuals for higher-value transactions) accounts for the highest-value payments; however, mobile money transactions are catching up fast. Between 2016 and 2018, while the aggregate value of RTGS transactions increased by 72%, the total value of mobile money transactions increased by 628% [6].

Econet and its subsidiaries dominate the digital payment space in Zimbabwe. EcoCash has a near-monopoly position in mobile money, according to the Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ). The sector recorded a 0.64% increase in active mobile subscriptions from 14,739,613 in the first quarter to 14,834,345 in the quarter under review.

Mobile penetration increased from 96.14% in the first quarter to 96.76% in the second quarter of 2024 [5]. Cassava, Econet's FinTech spin-off, aims to offer a bundle of tech-based products that emulate Tencent's full-service offering in China. Econet offers FinTech products, including small-ticket digital loans, through its subsidiaries, Steward Bank and Zimloan.

Zimbabwe's FinTech industry is vibrant and rapidly growing, with numerous firms engaging in financial technology and developing specialized solutions. Most entities are registered as Authorised Dealers with Limited Authorities, allowing them to conduct various transfer services, including cash-to-cash, international wire, international mobile, Automated Clearing House (ACH), and mobile companion prepaid card transfers. Pay it up, a notable FinTech company founded in 2017, joins others such as Zimswitch, InnBucks MicroBank, among others. Currently, Pay it up supports MultiChoice's DStv service and is expanding to provide loans, investments, and insurance products to unbanked and underbanked populations, aligning with SDG 1.

Additionally, Zimbabwe's economy significantly depends on remittances, supported by a diaspora of over four million Zimbabweans [6]. Despite this, remittance fees remain high, averaging 9.81%. Prominent participants in the corridor include Hello-Paisa, World Remit, exchange4free.com, FNB (South Africa), Mama Money, Mukuru, MoneyGram, Western Union, ABSA, Standard Bank, and Nedbank. FinTech firms such as Shumba Money and Simukai Financial Services are actively working to reduce transaction costs [6].

FinTech enhances entrepreneurship and job creation by facilitating access to capital through digital loans and crowdfunding, aligning with SDG 8. Expanding digital access to financial services reduces poverty and inequality by streamlining business processes and providing people with a secure way to build and protect their wealth. It also catalyses economic growth by facilitating access to credit to support small businesses and smooth consumer spending [9]. On the other hand, increased access to financial services raises essential questions about the role of regulatory oversight and the need for financial education to protect vulnerable populations from exploitation.

In addition to expediting payments and broadening public access to credit, FinTech is also democratising and liberalising investing. It is doing so by bringing new tools and services that appeal to – and are affordable for– a broader range of investors [10]. Furthermore, low-cost passive investments, such as exchange-traded funds (ETFs), have experienced enormous growth in recent years. Easily accessible via digital platforms, these products offer quick and diversified access to various asset classes, geographies, and sectors.

FinTech can help further simplify the investment process. For example, some applications automatically invest users' spare money from purchases into a diversified portfolio of Exchange Traded Funds (ETFs). Ro-bo-advisors, meanwhile, make trades on an investor's behalf using survey responses and algorithms.[9]

Then again, low private investment is one of the main economic problems bedeviling Zimbabwe's economy. Private investment is, in fact, an essential ingredient for sustainable economic growth and a powerful enabler of development, especially in developing countries like Zimbabwe. Developing the private sector as an alternative development strategy to stimulate economic growth, create employment, and ultimately reduce poverty has gained significant credibility and substance in Zimbabwe. Still, private investment levels in Zimbabwe remain low, by international standards (15%-20% of GDP), even when compared with several other African countries. Such low levels of private investment imply that the economy's productive capacity will not increase. This, in turn, subsequently leads to lower rates of economic growth and job creation, and fewer opportunities for people with low incomes to improve their livelihoods [9].

The response of private investment to various macroeconomic factors has received little attention in the analysis of investment behaviour in Zimbabwe. However, it is widely accepted, especially among economists and policymakers, that private investment expansion is the primary catalyst of long-run economic growth in developing countries like Zimbabwe. In fact, the revival of growth in Zimbabwe urgently needs, among other things, an increase in investment, which should primarily emanate from the private sector if growth is to be efficient and sustained. Therefore, to bridge the investment gap in Zimbabwe's economy, policy-makers need to attract more private capital. Regrettably, in Zimbabwe, the much-awaited role of the private sector as an engine of growth has yet to materialise. There is an urgent need for the Zimbabwean government to address the investment bottlenecks amid stagnating economic growth.

Public investment is often driven by political motives rather than an economic rationale. Private investment, on the other hand, can mobilise resources and make wise decisions, enhancing economic efficiency. In developing countries like Zimbabwe, there is a shift towards private-sector-led growth strategies that emphasise market forces and reduce public-sector involvement. Public investment lowers production costs, particularly for infrastructure development, making private investment the "fuel" for growth.

Private investment in Zimbabwe has been significantly low for the past three decades [11]. Yet, the performance of Zimbabwe's economy, like that of any other economy, relies on investment, specifically private

investment. The government of Zimbabwe aims to reverse the period of stagnation and decline, transforming the country into an upper-middle-income nation by 2030. To meet this objective, as outlined in the National Development Strategy-1 (NDS1) for 2021–2025, the government aims to create 760,000 formal jobs, for which the private sector plays a crucial role. Achieving this objective will require both finding practical solutions to a range of bottlenecks that constrain growth and taking full advantage of the country's comparative strengths [6]

Continuous macroeconomic challenges, resulting in a lack of a predictable, transparent, and non-discriminatory business climate, high levels of uncertainty, and struggling capital markets that limit access to long-term finance, have led to limited investment in the country. Zimbabwe lags behind its aspirational peers, such as the Arab Republic of Egypt, Indonesia, and Türkiye, in attracting foreign direct investment. After picking up in 2018 to $718 million, mainly reflecting one-off investments in the mining sector, FDI inflows to Zimbabwe dropped to $341 million in 2022 [6]

Since financial technology has contributed significantly to the development of new securities and the financial market, it has also helped make the financial sector more accessible to ordinary people. Research in this area indicates that the development of a viable financial sector is crucial for both economic growth and poverty reduction [12]. Bara, Mugano [13] postulated that advancements in financial innovation are a driving force for broad economic growth.

Against this background, the level of financial innovation in developing countries, including Zimbabwe, has been tremendous. Conversely, low private investment is one of the main problems bedevilling Zimbabwe's economy[6]. Yet it is an essential ingredient for sustainable economic growth and a powerful development enabler, especially in developing countries like Zimbabwe. Developing the private sector as an alternative development strategy to stimulate economic growth, create employment, and ultimately reduce poverty has gained significant credibility and substance in Zimbabwe. However, most existing literature generalises about FinTech's macroeconomic effects without deeply exploring its role in shaping private investment decisions at the country-specific level, particularly in Zimbabwe [10, 12, 13]. Moreover, the review uncovered that extensive research into various aspects of fintech and financial inclusion, bank performance, blockchain adoption, and the expansion of financial services has received significant attention [14-17]. Hence, the motivation for this study stems from the increased rollout of new financial products, such as mobile money, real-time gross settlements, remittances, and internet banking, in Zimbabwe, yet the economy grapples with low private investment [11]. While these innovations have contributed to financial inclusion, there remains a limited empirical assessment of how these developments directly affect the investment behaviour of private actors, especially in an environment marked by hyperinflation, currency volatility, and regulatory uncertainty. Therefore, the study aims to assist policymakers in developing policies that promote increased private investment in Zimbabwe, as financial innovation rises. Hence, the study investigates the effects of financial technology on private investment in Zimbabwe.

This article proceeds as follows: a review of the relevant theoretical and empirical literature; the research methodology, which outlines the data sources, variables, and data analysis procedures employed; the research findings and discussion; a conclusion and policy recommendations; and, finally, research limitations and future research directions.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Theoretical Literature

The study is grounded in two theories and a model: the innovation diffusion theory, the technology acceptance model, and the behavioural finance theory. The critical analysis of the theories and the model sheds light on the mechanisms by which financial technology adoption occurs and how it translates into savings that flow into private investment.

Innovation Diffusion Theory (Everett Rogers)

Innovation Diffusion Theory (IDT), developed by Everett Rogers, is a framework that explains how, why, and at what rate new ideas and technologies spread through cultures and social systems. Introduced in his 1962 book "Diffusion of Innovations", the theory identifies key factors influencing the adoption of innovations. In the context of FinTech, it helps us understand the adoption of tools such as mobile banking, digital wallets, cryptocurrencies, robo-advisors, and others [18, 19]. Rogers, Singhal [19] identified the channels through which technology diffusion occurs in a society. Diffusion occurs through technology adopters, including early adopters, innovators, early majority, late majority, and laggards. On the extreme sides, some early adopters are opinion leaders. In the Zimbabwean case, big organisations like Econet promoted African Telecoms and the FinTech space, and through its subsidiaries, it rolled out digital technologies that enhanced the uptake of mobile banking and digital savings and loans as early as the 1990s. Laggards are traditional users who resist change and are typically the last to adopt. They always stick with conventional banking and adopt innovations last. Usually, these adopters are coerced into adopting a technology owing to external push factors, for instance, in Zimbabwe, the macroeconomic crisis, such as cash shortages, whereas in some cases it could be aggressive marketing from pioneering organisations.

Rogers designed five factors which influence the adoption of technology. Which is Relative Advantage: Faster, cheaper, more accessible services than traditional banks, Compatibility: Must align with users' financial habits and trust concerns, Complexity: Simple, intuitive design is essential for adoption, Trialability: Free trials and demo accounts help lower entry barriers and Observability: Visible use by peers (e.g. Venmo, Apple Pay, Ecocash) drives uptake. This theory offers a roadmap for how FinTech companies can better strategise product rollouts, target users, and overcome resistance to new financial technologies. By applying IDT to financial innovation, stakeholders can better understand the dynamics of adoption, identify barriers, and develop strategies to facilitate the widespread adoption of new financial technologies. However, the theory fails to provide an organised set of steps for adopting a technology; instead, it names adopters and assumes early and late adopters. Again, the theory ignored institutional factors that may also affect the adoption of a new technology.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a theory that explains how users come to accept and use a technology. It was originally developed by Fred Davis in 1986 and later refined in his 1989 doctoral thesis [20]. The TAM theory proposes two main factors that influence technology acceptance: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). The submissions predict that, if adopters believe that a technology would enhance job performance, it will ultimately drive acceptance of that technology. The same applies if users believe that a technology is easy and us-er-friendly; this positively influences their acceptance of the technology. Similarly, [19] identified factors that influence the adoption of a technology as relative advantages that a technology brings in comparison with the traditional way of carrying out the same task. Also, pointed out the complexity, which is the same as the ease of use, that aligns a behaviour towards a particular technology.

The TAM offers a theoretical framework for understanding user acceptance of information systems and technologies. Within the FinTech sector, which encompasses innovations such as mobile banking, digital wallets, robo-advisors, blockchain applications, and peer-to-peer lending platforms, TAM provides valuable insights into the behavioural drivers behind technology adoption among both consumers and financial professionals. TAM serves as a robust foundational model for understanding us-er behaviour in the FinTech industry. However, given the complexity and regulatory sensitivity of financial services, TAM must often be augmented with additional constructs to capture trust, perceived risk, and external influences. As FinTech continues to evolve, TAM-based frameworks offer both theoretical and practical value in designing user-centred financial technologies.

Behavioural Finance Theory

Behavioural Finance Theory blends psychology and traditional eco-nomic theory to understand how psychological influences and biases affect the decisions of investors and financial markets. Traditional finance assumes that all investors are rational and that markets are efficient, meaning that all available information is always

reflected in asset prices. However, Behavioural Finance challenges these assumptions by recognising that humans often make irrational decisions due to cognitive biases and emotions. The theory is fundamental in the development and adoption of financial technology [21]. According to the theory, there are several mediating biases between behavioural finance and the adoption of FinTech. The decision to adopt and accept a FinTech is linked to psychological biases such as overconfidence, loss aversion, and herd behaviour. Herd behaviour, in the case of FinTech, is equated with the fast adoption of a technology associated with mob psychology, where individuals blindly follow the crowd. Whilst loss aversion, a common bias that results in investors fearing loss more than the value of the gains, drives individuals to adopt FinTech, as they want to reduce the risk of loss, such as through the adoption of a robo-advisor. The overconfidence bias occurs when individuals are overly confident in their ability to make informed decisions that may even outperform those of traditional investors. Adoption of crypto platforms, trading applications; however, overconfidence may lead to risky investment decisions. In addition, behavioural data is being used to redefine creditworthiness beyond traditional credit scores, offering more inclusive financial services. By understanding human behaviour, FinTech products are designed to keep users engaged through gamification, notifications, and automatic features that make financial management easier.

FinTech apps use behavioural nudges, gamification, and design to encourage saving, investing, or borrowing. Integrating Behavioural Fi-nance into FinTech yields a more user-friendly, personalised, and efficient financial ecosystem, where understanding human behaviour is crucial for delivering better financial products and services. Nevertheless, the theory cannot universally explain human behaviour in finance, as it fails to predict behaviour compared to traditional models that provide quantifiable tools for portfolio management.

2.1.2 Empirical Review

Over the past three decades, financial technology (FinTech) has emerged as a transformative force in sub-Saharan Africa, reshaping the financial services landscape and influencing private investment behaviour. Studies across the region highlight how mobile money, digital banking, and alternative lending platforms have improved access to finance for small and medium enterprises (SMEs) and unbanked populations [22, 23]. However, most existing literature generalises about FinTech's macroeconomic effects without deeply exploring its role in shaping private investment decisions at the country level, particularly in Zimbabwe.

FinTech's capacity to expand financial access is well-documented. In sub-Saharan Africa, Coffie, Yeboah [24] found that mobile money systems significantly improved financial inclusion, facilitating access to credit and enhancing entrepreneurial activity.

Similarly, Boloupremo and Ogege [25] demonstrated that in Nigeria, FinTech innovations led to measurable reductions in poverty and increased financial participation by underserved populations. In India, [26] emphasised that FinTech revolutionised banking by enabling better customer targeting and increasing digital transaction volumes, supporting investment in underbanked communities.

Focusing on Fintech’s ability to alleviate financing constraints, Lyu and Ji [27], [28] found that financing constraints reduce information asymmetries and transaction costs. Whilst Ye, Zhou [29], and Huang [30] extended this finding by showing that FinTech improves information transparency and eases resource allocation constraints, especially in SMEs.From a Zimbabwean perspective, studies by Chitimira and Torerai [31] explored Zimbabwe’s FinTech landscape, noting the rise of platforms like EcoCash and One Money as vital in reducing transactional friction and bypassing traditional banking constraints. Similarly, [32] provides a conceptual framework linking FinTech adoption to SME growth but stops short of quantifying its impact on private capital formation or on investors' risk perceptions.

Studies also link FinTech to improved investment efficiency [8, 33], observing that FinTech facilitates better investment decisions, curbs over- and under-investment, and strengthens internal governance through data transparency. According to Ye, Zhou [29], easing financing constraints and enhancing disclosure quality are key

channels through which FinTech improves investment efficiency. This is relevant to Zimbabwe, where inefficient investment has historically undermined economic growth.

Recent literature also highlights the role of FinTech in green finance. Bhuiyan, Rahman [34] and Zhu and Huang [35] demonstrate that FinTech adoption in banking enhances employee efficiency and promotes environmental sustainability through green lending and investment platforms. Ye, Zhou [29] found that FinTech development is more effective in firms that disclose ESG information and in technologically advanced regions. Given its climate vulnerabilities, Zimbabwe could benefit from integrating FinTech with environmental finance.

Further analysis of macroeconomic fundamentals and Fintech was conducted by Kassner [36], who confirmed that macroeconomic variables significantly influence capital allocation into FinTech firms, with real estate yield-bond gaps having adverse effects. Whereas Peltomäki (2025) analysed FinTech stock returns and the business service sector, finding that FinTech aligns more closely with business services than traditional finance. This suggests that FinTech firms are more inclined to partner with service providers than to utilise technology in expanding investment portfolio applications. Conversely, Lai, Yue [37] demonstrated that FinTech helps reduce corporate overleverage, a chronic issue in developing economies.

Despite the absence of extensive Zimbabwe-specific studies, evidence from comparable economies suggests significant potential for FinTech to drive private investment. Zimbabwe's own experience with EcoCash and Zipit illustrates the transformative power of digital platforms. Furthermore, insights from Asia and Europe highlight FinTech's role in reducing leverage, increasing investment quality, and opening new capital avenues. However, regulatory uncertainty and infrastructure challenges remain key barriers [28, 29, 38-41].

Across the literature, there is growing recognition that FinTech can lower barriers to investment by improving credit access, reducing transaction costs, and enhancing financial transparency [8]. Yet, in the context of Zimbabwe, a gap remains in understanding the extent to which FinTech tools influence actual private investment flows. While these innovations have contributed to financial inclusion, there remains a limited empirical assessment of how these developments directly affect the investment behaviour of private actors, especially in an environment marked by hyperinflation, currency volatility, and regulatory uncertainty. Furthermore, there is a lack of analysis of how FinTech intersects with macroeconomic instability, institutional trust, and investor confidence — critical factors in fragile economies.

This review underscores the necessity for a country-specific, data-driven assessment of FinTech's impact on private investment in Zimbabwe. Such research could illuminate context-specific dynamics that broader regional studies may overlook and inform targeted policy interventions to harness FinTech for sustainable economic growth.

The hypothesis that guides this work is as follows:

H_1: *Financial technology has no significant effect on private investment in the Zimbabwean economy.*

H_2: *Macroeconomic instability weakens the effect of financial technology on the private sector of Zimbabwe.*

3. MATERIALS AND METHODS

To investigate how FinTech adoption and infrastructure realities interact to influence the private sector's investment, the study used time series data from 1990 to 2023, sourced from the World Bank database [42]. The study period was chosen based on data availability; some variables that measure FinTech were excluded due to data gaps in the 1990-2000 period, when FinTech was still in its early stages of development. The primary explanatory variable of the study is FinTech, an index calculated using Principal Component Analysis (CPA) of mobile money indicators[43] , internet access and remittances [44].The primary response variable is domestic credit to the private sector (% of GDP) sourced from the World Bank(WDI)[42], which captures the dynamics of private investment. For data analysis, the author employed the Fully Modified Ordinary Least Squares (FMOLS) and the Cointegration

Correlation Regression (CCR) methods to estimate the long-run parameters. The advantages of using FMOLS and CCR lie in the estimation method's ability to correct endogeneity and serial correlation biases in cointegrated time series models. A model adopted from [44] who explored the dual relationship between fintech and financial inclusion in developing countries and their impact on economic growth, and modified as follows;

$$PSI_t = \propto + \beta Fintech_t + \gamma Controls_t + \varepsilon_t \qquad equation1$$

$$PSI_t = \propto + \beta FinTech_t + \gamma EXR_t + \Phi BM\_GDP_t + \delta\, FDI\_GDP_t + \varepsilon_t \qquad equation2$$

Where PSI_t is the private sector investment proxy for domestic credit to the private sector as %GDP and Fintech_t is the financial technology index calculated using PCA and control variables (FDI_GDP-foreign direct investment as a percentage of GDP, EXR- exchange rate and BM_GDP-broad money as a percentage of GDP, measuring financial development).

Dependent Variable

Private sector investment is the dependent variable for the study and is measured by the domestic credit to the private sector (% of GDP), and the monetary sector credit to the private sector (% of GDP) is used in the robustness model. The study uses domestic credit as % of GDP because it reflects source of credit flow for investment especially in developing countries. The study follows the measures used by several scholars, such as [45-47].

Independent Variable

Financial technology is used as the primary explanatory variable of this study. Building on the approaches of [28, 43, 44]. The study calculated a FinTech index using Principal Component Analysis (PCA), and the following measures were included: Individuals using the Internet, as % of the population, mobile cellular subscriptions, Personal remittances received (% of GDP), personal remittances paid (current US$), and Mobile cellular subscriptions (per 100 people). However, the variables could have been used, such as ATMs and POS density, value of electronic payment (%GDP), and number of digital payments per capita, but data constraints affected our choice of the possible close proxies. Hence, including internet usage and paid and received remittances would strengthen Zimbabwe's financial technology proxy. The study expects a positive association between private sector investment and financial technology.

Control Variables

Broad Money as a percentage of GDP indicates Zimbabwe's financial development. This was drawn from the empirical works of [46, 47] which investigated the effect of financial development on private sector investment. The data variable was sourced from the World Development Indicators database of the World Bank. The study expects the financial development variable to strengthen the private sector investment. The rest of the variables are outlined in Table 2.

Table 2
DATA TYPE, DESCRIPTION AND SOURCE

Variable	Role	Description	Source
DC_PVT_GDP	Response Variable	Domestic credit to private sector (% of GDP)	[48]
DCPB_GDP	Response Variable	Domestic credit to private sector (% of GDP)	[48]
MSP	Response Variable	Monetary Sector credit to private sector (% GDP)	[48]
FINTECH	Explanatory	Financial Technology Index calculated using principal	Author's

		component analysis	computations
INT_POP(%)	Explanatory	Individual using the Internet (% of population)	[48]
MOBCEL_SUB	Explanatory	Mobile cellular subscriptions	[48]
MOB_CEL_SUB(100)P	Explanatory	Mobile cellular subscriptions (per 100 people)	[48]
P_REMIT%_GDP	Explanatory	Personal remittances, received (% of GDP)	[48]
BM_GDP	Control	Broad money (% of GDP)	[48]
EXR	Control	Real effective exchange rate index (2010=100)	[48]
FDI_GDP	Control	FDI (net inflows % of GDP)	[48]

Source: *Author's computations*

4. RESULTS

This section presents the study's findings and interpretations of the results from the assessment of the relationship between FinTech and private-sector investment in Zimbabwe for the period 1990-2023. The section proceeds as follows: a summary of descriptive statistics results, followed by the results of pre-diagnostic tests and FMOLS, CCR, and DOLS models, robustness check results, and interpretations. Finally, the post-estimation and validation.

Table 3
DESCRIPTIVE STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
LDC_PVT_GDP	33	18.87293	15.01872	5.237706	84.81197
LBM_GDP	33	28.58913	25.16348	12.21126	151.5489
LEXR	33	2.04e+08	1.17e+09	0.003625	6.72e+09
FDI_GDP	33	1.258789	1.244312	0.032292	6.940053
FINTECH	33	-5.14e-17	1.531958	-2.846845	4.413474

Source: *Author's computations*

The results in Table 3 indicate overall mean and standard deviation values over a thirty-three-year period of fintech development. The domestic credit to the private sector as a percentage of GDP (DC_PVT_GDP) averaged 18.87% against a standard deviation of 15%. This suggests that, overall, credit to the private sector has been relatively low for the past thirty-three years, as compared to developed countries, where it records 50% or more. A standard deviation of 15% indicates that, generally, credit provision to the private sector is not stable. The FinTech index of -5.4 also indicates limited fintech development, with a standard deviation of 1.5, suggesting stable growth of FinTech, albeit within a constrained technology ecosystem with a maximum of 4. Still, FinTech advancement remained low compared to stronger economies. Again, during the same period, on average, broad money as a percentage of GDP (BM_GDP) was 28.5% and had a standard deviation of 25%. The result imply that, during the period, there were phases of significant financial deepening coupled with instabilities and variabilities largely because of hyperinflationary and exchange volatilities characterising the study period. Table 4 shows the pairwise correlation matrix results.

Table 4
PAIR-WISE CORRELATIONS RESULTS

Variables	(1)	(2)	(3)	(4)	(5)
(1) LDC_PVT_GDP	1.000000	0.773819	-0.422823	0.036099	-0.506787
(2) LBM_GDP	0.773819	1.000000	-0.511991	-0.139175	-0.357729
(3) LEXR	-0.422823	-0.151991	1.000000	0.036348	0.410384

(4) FDI_GDP	0.036099	-0.139175	0.036348	1.000000	0.264673
(5) FINTECH INDEX	-0.506787	-0.357729	0.410384	0.264763	1000000

Source: *Author's Computations*

The pairwise correlation matrix results are shown in Table 4. If the absolute pairwise coefficient is greater than 0.8, it suggests multicollinearity. A slightly positive coefficient of 0.77 is depicted between Domestic credit to private sector (% of GDP) and Broad money (% of GDP). To further address multicollinearity, the study employed principal component analysis to mitigate it and constructed the FinTech index. See Appendix A. 1. The study justifies the use of principal component analysis to calculate the FinTech index, a Kaiser-Meyer-Olkin measure of sampling adequacy probability greater than 0.6.

Table 5
STATIONARITY TESTS USING ADF AND PHILIPS PERRON

Variable	Test	Statistics	P-Value	Order of integration
LBM_GDP	ADF	-5.459171	0.0001***	1(1) Stationary
	PP	-6.856897	0.0000***	1(1) Stationary
LDCPB_GDP	ADF	-4.693108	0.0007***	1(1) Stationary
	PP	-5.192932	0.0001***	1(1) Stationary
LREMIT_%GDP	ADF	-5.491224	0.0001***	1(1) Stationary
	PP	-4.620056	0.0008***	1(1) Stationary
LDCP_GDP	ADF	-4.995962	0.0003***	1(1) Stationary
	PP	-5.300106	0,0001***	1(1) Stationary
LINT_POP(%)	ADF	-4.230970	0.0000***	1(1) Stationary
	PP	-4.253364	0.0022***	1(1) Stationary
MSPS	ADF	-4.995962	0.0003***	1(1) Stationary
	PP	-5.301558	0.0001***	1(1) Stationary
MOBCEL_SUB	ADF	-3.860645	0.0060***	1(1) Stationary
	PP	-3.881660	0.0057***	1(1) Stationary
MOBCEL-SUB_POP	ADF	-3.763856	0.0007***	1(1) Stationary
	PP	-3.779219	0.0057***	1(1) Stationary
FDI_%GDP	ADF	-4.642994	0.0007***	1(0) Stationary
	PP	-4.642994	0.0007***	1(1) Stationary
LEXR	ADF	-7.509777	0.0000***	1(1) Stationary
	PP	-8.504459	0.0000***	1(1) Stationary
LPREMIT_P	ADF	-5.491224	0.0001***	1(1) Stationary
	PP	-5.491594	0.0001***	1(1) Stationary
FinTech_index	ADF	-4.758822	0.0006***	1(1) Stationary
	PP	-4.766112	0.0006***	1(1) Stationary

To ensure the validity and robustness of the study results, a set of pre-diagnostic tests was conducted, which included the stationarity test using the Augmented Dickey-Fuller Test and the Phillips-Perron test. According to Table 5, multiple variables in the study are non-stationary in levels, except for Foreign Direct Investment as a percentage of GDP, which becomes stationary in levels. Hence, the variables exhibit a long-run relationship, indicating cointegration among the variables under investigation. The order of integration of variables also indicates the appropriate estimation technique; in this case, it suggests adopting Fully Modified, Canonical Cointegration, and Dynamic Ordinary Least Squares for the long-run estimation, free from serial correlation and endogeneity.

Table 6
COINTEGRATION TEST USING JOHANSEN COINTEGRATION TEST

Hypothesised no. of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Probability
C ≤ 0	0.979894	377.3736	197.3709	0.0000***
C ≤ 1	0.926909	252.3573	159.5297	0.0000***
C ≤ 2	0.751518	168.6437	125.6154	0.0000***
C ≤ 3	0.709172	124.0874	95.75366	0.0002***
C ≤ 4	0.602210	84.56661	69.81889	0.0021***
C ≤ 5	0.556221	55.06798	47.85613	0.0091***
C ≤ 6	0.408267	29.07026	29.79707	0.0605
C ≤ 7	0.315285	12.27984	15.49471	0.1440
C ≤ 8	0.004979	0.159738	3.841466	0.6894

Authors' computations using EVIEWS, Note */**/***

Table 7
UNRESTRICTED VAR OPTIMUM LAG SELECTION CRITERIA

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-885.1362	NA	2.42e+14	55.82101	56.18745	55.94247
1	-651.8987	335.2788	6.97e+09	45.24367	48.54158*	46.33683
2	-562.2142	84.07924*	3.26e+09*	43.63839*	49.86777	45.70325*

Authors' computations using EVIEWS 14. Note * represents lag selection using different information criteria

Tables 6 and 7 present the cointegration tests and lag selection results. According to Table 6, a Johansen cointegration test indicates a long-run equilibrium relationship. Five cointegrating equations are confirmed from the less than 0.05% probabilities, hence accepting the null hypothesis of one cointegrating relationship among variables. Checking for cointegration is a pre-estimation diagnostic that must be met before estimating any long-run relationship between variables. The results confirm a long-run relationship among the investigated variables, qualifying the FMOLS, CCR and DOLS models. On the other hand, the optimal lag selection is shown in Table 7. The unrestricted VAR model was selected using the Akaike Information Criterion (AIC), which indicates the least statistics at two lags, suggesting that the past two years' values provide the most meaningful explanation for the present variable, while losing the minimum information. Table 8 indicates the FMOLS, CCR and DOLS models.

Table 8
INDICATES THE FMOLS, CCR AND DOLS MODELS

Variables	**FMOLS**	**CCR**	**DOLS**
LBM_GDP	0.879660***	0.907649***	1.009931***
	[0.062223]	[0.071705]	[0.156143]
LEXR	-0.072089***	-0.097437***	-0.238182***
	[0.006951]	[0.009193]	[0.048973]
LFDI_GDP	0.03437	0.040769	0.119677
	[0.024042]	[0.028679]	[0.087462]

LFINTECH INDEX	0.230290***	0.357728***	0.955321***
	[0.023794]	[0.036632]	[0.196009]
Constant	-0.109237	-0.225071	-0.792295
	[0.210593]	[0.243683]	[0.540877]
R_squared	0.611333	0.416303	0.916608
Adjusted_R squared	0.551538	0.326504	0.805418
Jarque_Bera	0.4656	0.4656	0.4656
Durbin-Watson stat	1.584116	2.071736	1.652379

Sources: Author's computation using EViews 14; Note: Values in parentheses are the P-values and ***, ** & * represents statistically significant at 1, 5 & 10% levels respectively

Table 9
ROBUSTNESS TEST DEPENDENT VARIABLE: MONETARY SECTOR CREDIT TO PRIVATE SECTOR (% GDP) LM_SEC_PVT_SEC FMOLS AND DOLS

Variables	**FMOSL**	**DOLS**
LBM_GDP	0.883202*** [0.063099]	1.079862*** [0.150775]
LEXR	-0.072239*** [0.007049]	-0.192229*** [0.045857]
LFDI_GDP	0.034863 [0.024380]	0.134682 [0.100422]
FINTECH INDEX	0.230101*** [0.024129]	0.784630*** [0.186764]
Constant	-0.122434 [0.213558]	-1.018200* [0.560013]
R_squared	0.612363	0.917670
Adjusted_R squared	0.552726	0.807898
Jarque_Bera	0.4656	0.4656
Durbin-Watson stat	1.582035	1.612443

Sources: Author's computation using EViews 14; Note: Values in parentheses are the P-values and ***, ** & * represents statistically significant at 1, 5 & 10% levels respectively.

5. DISCUSSION

According to Table 8, the results show that Financial Technology adoption has a positive and statistically significant effect on the private sector of Zimbabwe in the long run, with coefficients (23%,95% and 35%) respectively. FinTech emerged as the key driver of credit expansion and promotion of credit access to the private sector. FMOLS, DOLS, and CCR models consistently confirm the positive link between digital innovation and the private sector of a developing country, consistent with findings by [33], Qi, and Ouyang [41], who highlighted that FinTech has a more noticeable impact on the productivity of corporate investments in less developed locations. Besides, a positive effect of FinTech was noted in the reduction of financing constraints, which cumulatively

expands the liquidity stock and reduces excess leverage on private enterprises [37]. Similar findings also confirmed that FinTech enhances investment efficiency across both local SMEs and listed companies in China, as prior studies have established [30, 33]. Remarkably, both studies confirmed that FinTech alleviates financing constraints and information asymmetry that characterised traditional banks, thus supporting FinTech's inclusiveness [29]. Additionally, FinTech promotes investment efficiency by preventing overinvestment and underinvestment in the private sector [28].

The results confirm the theoretical predictions of the study's chosen theoretical framework. According to the innovation diffusion theory, the spread of FinTech has made the unbanked, SMEs, and the private sector more visible, enabling their participation in funding initiatives that traditional banks could not fully support. In another dimension, the Technology Acceptance Model also supports the study's findings, suggesting that a positive link exists between FinTech and the private sector, with adopters' perceptions playing a crucial role. As the private sector gradually migrates to FinTech platforms, funds flow into the sector efficiently, thereby enhancing investment opportunities.

As evidenced in Table 8, broad money expansion is positively and consistently enabling the private sector in Zimbabwe, with coefficients for FMOLS, DOLS and CCR (87%, 100%,90%), respectively. This implies that increased liquidity and credit growth are robust enablers of private sector investment. However, the effectiveness of the metrics in confirming the channelling of credit growth to private-sector productivity could be weakened by the persistent exchange rate depreciation that characterised the period under study. The study reliably confirmed a statistically significant negative effect of exchange rate depreciation on private sector investment. According to Table 8 in the FMOLS, DOLS and CCR models confirmed the following impacts (-0.7%, -23% -0.9%) respectively. Hence, this confirms that even if broad money shows a positive trend, efforts to boost productivity in the private sector could easily be undermined by exchange rate instability, discouraging the private sector from making long-term investments. A vast body of empirical evidence [46] [47]; confirms similar findings, underscoring that macroeconomic instability erodes confidence and fuels uncertainties in the financial system.

Conversely, foreign direct investment as a percentage of GDP is statistically insignificant in explaining variations in private- sector investment in Zimbabwe, as shown in Table 8. This implies that FDI flows into Zimbabwe cannot be sustained in the long run, leading to a lack of visible, enhanced private-sector investment. The crowding, in effect, does not change the investment in Zimbabwe. Findings elsewhere are mixed and vary by region, and the crowding-in effect is also confirmed in Asia, Africa, and Europe in the empirical work of [49-51]. However, the FDI crowding-out effect is also confirmed in the same regions [52-54], leaving the debate inconclusive and requiring further investigation that includes other macroeconomic variables that may vary across countries, e.g., governance and human capital development.

Table 9 illustrates the robustness of the model's results, which were obtained using the dependent variable, domestic credit to the private sector by banks. The variable excludes non-bank financial institutions, such as pension funds, insurers, and microfinance institutions, thus focusing on the narrow effect of digital financial adoption within the monetary sector. The findings reinforce the first model's findings, which broadly measured private-sector investment. Accordingly, financial technology exhibited a positive and statistically significant effect on private sector credit by banks, as shown in the following metrics in FMOLS and DOLS models, respectively (0.23%, 0.78%). The variable measures the effect of macroeconomic instability (-0.07% and -0.19%). Again, consistent results confirmed that exchange rates weaken private-sector investment in Zimbabwe.

Table 10 POST DIAGNOSTIC TEST RESULTS			
Test	Test used	P-value	Conclusion
Normality test	Skewness/Kurtosis tests	0.4656	Residuals are normally distributed
Heteroscedasticity	Breusch-Pagan / Cook-Weisberg test	0.5929	Residuals are homoscedastic
Heteroscedasticity	White Test	0.5018	Residuals are homoscedastic

Source: *Author's Computations*

To assess the reliability and validity of the study's models, a heteroscedasticity test is crucial to determine whether the error variance remains constant across all observations. Table 10 presents the results of the Normality and heteroscedasticity tests. According to the results, the models are free of heteroscedasticity, as indicated by the p-values of both the White and Breusch-Pagan Tests; we accept the null hypothesis of no heteroscedasticity, thus confirming homoscedastic residuals. Also, the residuals are normally distributed as the study acknowledges the null hypothesis. The Jarque-Bera test was employed. The skewness and kurtosis tests are critical in both large and small samples. Significant non-normality may impact the reliability of sample inferences in FMOLS estimation for small samples.

6. CONCLUSION AND POLICY IMPLICATIONS

FinTech presents a compelling opportunity to catalyse private investment in Zimbabwe by reducing financing constraints, improving capital allocation, and promoting `inclusive growth. Nevertheless, a nuanced, Zimbabwe-specific body of research is essential to fully realise its potential. The study examined the impact of FinTech on private-sector investment and the role of macroeconomic stability in achieving the collective goal of growing and expanding the private sector through digital innovation. A long-run relationship exists between financial technology and private sector investment in Zimbabwe, supporting the idea that recent developments in digital finance are driving a positive narrative that surpasses traditional banking systems.

Moreover, the study concludes that Broad Money plays a significant role in enhancing private-sector investment; however, its effectiveness depends on a stable macroeconomic environment. As such, Zimbabwe has historically been known for a weak financial system, as highlighted in the research findings, which show that the exchange rate negatively impacts private-sector investment. Therefore, no matter how broad money could increase (financial development), the impact of the increase is weakened by an unstable exchange rate.

The findings have several policy implications for the Zimbabwean economy. First, monetary authorities are cautioned that a growing money supply can only effectively promote private investment when coupled with a stable macroeconomic environment. The study recommends that monetary authorities, investors, and development agencies leverage digital financial innovation to drive long-term, sustainable growth in private-sector investment. Macroeconomic instability cannot guarantee private sector investment growth, even with a high broad money supply. In addition, a long-run link exists between FinTech and the private sector, suggesting that policymakers should promote digital financial innovation, such as internet and mobile banking, and subsidise infrastructure enablers of digital finance. Lastly, policymakers are advised to foster a stable macroeconomic environment and a digital, innovation-driven financial system to stimulate private-sector investment.

7. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

The study contributes to ongoing debates in a new dimension by exploring the influence of FinTech on Zimbabwe's private sector. The study created a FinTech index spanning from 1990 to 2022, utilizing available data and principal component analysis. In addition, the study reveals how digitalisation has levelled the playing field, enabling investment and mechanisms that achieve efficiency, thereby lowering operating costs and enhancing risk

management possibilities. Institutional trust and investor confidence are critical factors that further research can dive into in fragile economies. However, the study falls short by investigating only the long-run aspect. Nevertheless, examining the short-term effect of FinTech on investment could equip policymakers to craft effective short-term policies, as FinTech is still evolving and is particularly underdeveloped in Zimbabwe's capital markets. Also, the study used domestic credit to private sector as %GDP as the proxy for private investment with an assumption that credit is a channel of investment. Again, the results may exclude the rural economy, as most measures of FinTech tend to focus on urban areas, creating a false impression of financial technology in Zimbabwe. Further studies could also explore FinTech's impact on social progress in Zimbabwe's economy.

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