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Navigating Adoption of Financial Derivatives: Dynamics of Complexity and Regulatory System

Ruva Tunze University of Dar es Salaam, Tanzania, e-mail: ruvtunze@yahoo.co.uk
Evelyn Richard University of Dar es Salaam, Tanzania, e-mail: mbwamboneema18@gmail.com
Eric Mkwizu University of Dar es Salaam, Tanzania, e-mail: ericmkwizu@gmail.com

SUMMARY

This study examines the intention of financial institutions to adopt financial derivatives in less developed markets. Integrating key innovation attributes, complexity and regulatory system as a moderator. The theoretical framework uses complexity theory and financial innovation theory to provide a robust explanation of adoption behaviour. Data were collected from 142 financial institutions in Tanzania. Using Structural Equation Modelling (SEM).

The results demonstrate that complexity and the responsive regulatory system significantly influence the intention to adopt financial derivatives, and the regulatory system significantly moderated the adverse effect of complexity. Theoretically, this study contributes to the financial innovation literature by integrating complexity theory in adoption models, offering empirical validation in a developing market context. These findings provide practical insights for derivative designers, financial educators, and regulatory authorities.

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1. INTRODUCTION

Financial derivatives have developed into an important innovation within the contemporary economic landscape. As of 2023, the notional value of global derivatives markets surpasses $600 trillion, highlighting their pivotal role in modern financial intermediation (BIS, 2023). Derivatives significantly improve market liquidity, optimise capital efficiency, and facilitate risk distribution, thereby fostering more dynamic and adaptable financial systems. The growing prevalence of unconventional financial structures such as credit-linked notes, synthetic securitisation, and tailored swap agreements has concurrently introduced considerable complexity (Rahman, 2015). Studies show that innovator use complexity as strategic asset that gives them monopoly rent for their innovations. To others, the complexity involved has created challenging for institutions to evaluate risks precisely (Fabozzi, 2025).

The complex innovative derivatives operating in complex financial markets create a complex financial system (Wang et al., 2020). Many regard it as an impediment to entry; organisations may exhibit reluctance in embracing complex derivatives (Schammo, 2021). This happens especially when their internal capabilities and oversight frameworks are insufficient (Al Janabi, 2024). The complexity of this challenge is further exacerbated by the entrenched nature and inflexibility of conventional regulatory frameworks (Battiston, Farmer, et al., 2016). Throughout history, the realm of regulation has often found itself lagging behind the rapid advancements in financial innovation. Silber (1975) and Financial Innovation Theory (1983) showed the link between financial innovation and regulatory systems.

The 2008 Global Financial Crisis revealed the profound inadequacies in the regulation of Over the Counter (OTC) derivatives as opposed to Derivative exchange platform derivatives. The OTC derivative, particularly credit default swaps,

and their potential to exacerbate systemic shocks (Zakheos, 2022). In the aftermath of the crisis, there was an avalanche of regulations from Basel III requirements to Dodd-Frank in 2010 (Yazlyuk et al., 2018). However, disjointed supervision, transnational regulatory exploitation, and unclear definitions continue to exist, especially in developing markets where regulatory capabilities and technological frameworks are constrained (Jarvis, 2017).

One of the effective regulatory systems is a responsive regulatory system. It highlights the importance of graduated enforcement (Braithwaite, 2011), behavioural monitoring, and real-time data analytics as essential instruments for enhanced oversight (Arner et al., 2016). It operates as a pyramid structure where, at the lowest level, knowledge, support, and clarity are based. At the high level, a few non-compliant investors are being punished. Instead of perceiving regulations as an external limitation, this perspective positions regulatory responsiveness as a strategic facilitator—one that influences whether complexity acts as an obstacle or a driving force for institutional innovation, hence moderating the effect of complexity.

Previous studies have shown the relationship between complexity and its influence on adoption in various contexts, such as financial derivatives and non-financial derivatives. These studies found the negative influence on the complexity in reporting of financial derivatives. Regulatory system effectiveness influence has also been investigated with different results (Bag et al., 2023; Schaupp et al., 2022; Allen, 2019) and the responsiveness of the regulatory system was not examined while it influences the financial system. Therefore, there remains a significant gap in understanding how regulatory responsiveness could moderate the influence of the relationship between complexity and adoption intention, which this study aimed to fill.

Accordingly, the implications of the above work are multiple. Besides the extensive studies on the financial derivative complexity, it also fills the empirical gap specifically on the responsive regulatory system. Second, it enhances the theoretical gap by synthesising Silber's Financial Innovation Theory with Complexity Theory. Third, our research offers practical insights for regulators and policymakers, highlighting the importance of responsiveness in the regulatory system for developing financial derivatives markets. This has effects for both developed and developing financial markets. The rest of the paper is section as follows, theoretical and empirical reviews, methodology, findings and discussion, conclusion and recommendations.

2. LITERATURE REVIEWS

2.1. Theoretical Literature Reviews

This research is based on two complementary theoretical perspectives: financial innovation theory and complexity theory. These perspectives offer a strong foundation for comprehending the relationship between the complexity of financial instruments, the intentions of institutional adoption, and the responsiveness of regulatory mechanisms. The combination informs the central proposition of this study of these theories: the responsiveness of the regulatory environment is a determining factor in the relationship between derivative complexity and institutional adoption intentions. In highly responsive systems, complexity may be perceived as manageable and value-generating.

Complexity Theory, which has its roots in systems science (Simon, 2012), in the context of financial innovation, complexity is defined as the structural opacity, multivariate risk profiles, Valuation challenges and information asymmetries (Turner & Baker, 2019). In financial markets, the diffusion of highly customised derivatives (especially in OTC environments) amplifies institutional uncertainty and implementation barriers — particularly for entities lacking analytical capacity (Battiston, Caldarelli, et al., 2016). Therefore, complexity may act as a barrier rather than a strategic advantage in such settings. Complexity Theory thereby elucidates the nonlinear connection between institutional adoption and innovation sophistication, particularly in environments with restricted analytical or regulatory capabilities (Gai et al., 2011).

In addition, Financial Innovation Theory Silber (1975) conceptualises innovation as a mechanism by which financial institutions respond to and surmount constraints, including regulatory, institutional, and economic ones. This logic is exemplified by derivatives, which allow firms to circumvent capital controls, manage illiquid exposures, or customise risk-transfer solutions. Innovations like swaps or credit derivatives historically emerged to evade capital controls, enable bespoke risk-sharing, and adapt to institutional constraints. However, FIT also highlights a paradox: as institutions innovate to bypass barriers, they often create new regulatory gaps and systemic risks. In this sense, regulatory friction both stimulates innovation and requires adaptive oversight (Frame & White, 2014). Consequently, Financial Innovation Theory offers a framework for comprehending the reasons why institutions pursue complexity in financial innovations.

Both theories communicate to explain adoption intentions, while Financial Innovation Theory FIT explains *why* institutions seek innovation (even complex ones), and CT explains *why* they may hesitate to adopt them. These theories converge on the idea that responsive regulation can bridge this gap by reducing institutional uncertainty.

2.2. Empirical Literature Reviews

To ensure conceptual clarity, this literature review includes core studies that focus directly on financial derivative adoption, especially in emerging markets; Adjacent literature explores financial technologies (FinTech) that share institutional and regulatory dynamics with derivatives; Peripheral research covers broader innovation adoption contexts, offering pattern-based insights rather than direct causality.

2.2.1. Influence of complexity on the adoption intention of financial derivatives

Complexity is the perceived difficulty of understanding, using, or implementing an innovation (Rogers, 2003). The relationship between complexity and adoption intention has been widely examined across product categories. In derivatives, complexity manifests through: tailor-made financial engineered Over The Counter OTC structures, which implies that financial derivative trading platforms also have room for complexity. In the other platform, Organised Derivative Exchanges ODE financial derivatives are standardised (Lewandowska, 2020). The complexity of financial derivatives is the result of tailored solutions specific to the needs of clients, but can also cause ambiguity, valuation challenges, accounting friction, and behavioural hesitation, discouraging the adoption, particularly for institutions with limited analytical or regulatory capacity (Hirsa, 2024). Furthermore, network complexity results from institutions establishing multilayer financial networks, increasing contagion risk where one institution's default becomes a challenge to the system (Battiston, Caldarelli, et al., 2016).

Complexity is increasingly seen as a key factor in the adoption of financial derivatives (Verma, 2024) — a challenge in Accounting and reporting (Malaquias & Zambra, 2020). With numerous reporting requirements discouraging derivative adoption (Gope, 2017; Gope & Mitra, 2018; Hairston et al., 2019; Hairston et al., 2023; Malaquias & Zambra, 2020; Tunze et al., 2025). Furthermore, Complexity inhibits adoption across financial and technological domains from cloud systems to big data (Albayati et al., 2020; Sun et al., 2021), Institutions with limited technical/regulatory capacity are disproportionately affected (Gope, 2017; Hairston et al., 2023). While some exceptions exist Al-Okaily et al. (2024) , the consensus supports that increased complexity leads to reduced adoption intent.

Therefore, from the complexity theory and previous literature, the study postulates that:

H1: Complexity has a significant negative influence on the intention to adopt financial derivatives.

2.2.2. Influence of Responsive Regulatory System on the adoption intention of financial derivatives

Financial innovation theory posits that regulatory systems function as critical external catalysts that either facilitate or hinder financial innovation (Silber, 1983). The structure of regulatory systems impacts adoption intentions directly through their structural design (Drahos, 2017). The regulatory system is defined as a combination of institutions, laws, and processes that give a government control over the operating and investment decisions. Thus, it comprises regulations, regulators and regulated persons. Regulation establishes boundaries for the conduct of participants in financial markets to safeguard against socially harmful outcomes (Barak-Corren & Kariv-Teitelbaum, 2021).

Globally, financial derivatives markets are shaped by transnational regulatory regimes led by bodies such as the Basel Committee on Banking Supervision, the International Organisation of Securities Commissions (IOSCO), and the Financial Stability Board (FSB) (Donnelly, 2019). These institutions have coordinated post-crisis regulatory reforms aimed at enhancing transparency, mandating central clearing for standardised OTC contracts, and improving counterparty risk management (Servais, 2020). The evolving characteristics of financial derivatives necessitate adaptive, responsive regulation that fosters innovation while preventing their systemic risks (Awrey, 2015). Therefore, responsive regulatory systems that are acknowledged for their dynamic and flexible enforcement strategies become paramount (Braithwaite, 2016).

Financial Innovation Theory positions the regulatory system in the aspect of regulation as a key environmental factor that constrains innovation via compliance burdens, or enables adoption via safety nets and trust-building (Silber, 1983; Barak-Corren & Kariv-Teitelbaum, 2021). Uncoordinated frameworks promote arbitrage (Henkel, 2019), but responsive models (like sandboxes and graduated enforcement) promote safe experimentation (Braithwaite, 2016). In developing markets, fragmented oversight and limited capacity hinder uptake (Jarvis, 2017; Хоменко et al., 2024; Njoroge et al., 2013). Nevertheless, innovations like central counterparties (CCPs) demonstrate how regulation can reduce risk perception and enhance trust (Chance, 2017; Thomadakis & Lannoo, 2021).

While complexity typically deters adoption, regulatory responsiveness can reduce this negative effect. Responsive regulation includes: Real-time monitoring (Arner et al., 2016), behavioural insights (Barak-Corren & Kariv-Teitelbaum, 2021), dynamic enforcement hierarchies (Braithwaite, 2011). Such frameworks build institutional trust, offering interpretive flexibility that offsets perceived complexity. (Ranchordas & Vinci, 2024)

Research in fintech adoption supports this moderating role — where adaptive policy design improved adoption in sectors like food safety, AI, and green finance (Fernando et al., 2015; Li et al., 2019; Ullah et al., 2024).

The critical role of responsive regulatory regimes is to moderate the perceived complexity of financial derivatives by acting as interventions. There are many interventions after a crisis, such as the establishment of Central Counterparties (CCPs). CCP introduction used to mitigate counterparty risk, and the contagion results through centralised netting (Chance, 2017). Thomadakis and Lannoo (2021) show that Central Counterparties (CCPs) have facilitated the heightened usage of derivatives, also evidenced by Bank for International Settlements (BIS) data.

Previous studies on the influence of the regulatory system on adoption and complexity have been positive and negative for others. Hee and Song (2017) discovered that both regulatory frameworks in Korean insurance companies have a positive influence on adoption. Conversely, Thinh et al. (2020) recognised legal ambiguities as impediments to adoption in Vietnam, paralleling the conclusions of Al-Slehat et al. (2018) in Jordan and Bhadra and Singh (2024) in India, where regulatory friction and taxation deterred derivative use. Similarly, China (Hao et al., 2022) shows the same results. Emerging markets encounter distinct challenges that have hindered the adoption of derivatives (Хоменко et al., 2024; Kobilarev & Živanović, 2019). Njoroge et al. (2013) highlighted that Kenya's disjointed regulatory framework hindered market efficiency and the advancement of intermediaries. The clarity and scale of regulations were crucial for enterprises' engagement with complicated derivatives.

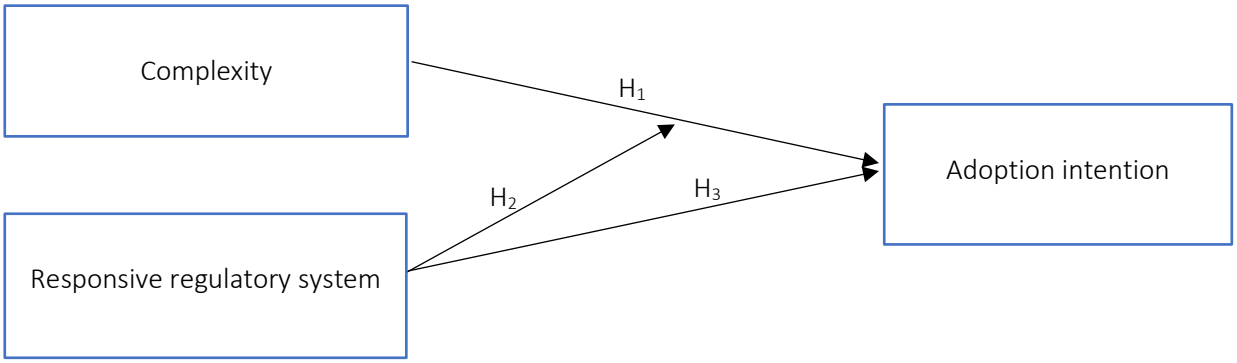
From Financial Innovation Theory (Silber, 1975), firms innovate to bypass regulatory barriers but may delay adoption if regulatory frameworks are rigid (Awrey & Macey, 2022). Responsive regulation reduces information asymmetry and institutional uncertainty (Braithwaite, 2011)

Therefore, this study proposed that:

H2: Responsive Regulatory System positively influences the adoption intention of financial derivatives

H3: A Responsive Regulatory system moderates the influence of complexity on Adoption Intention

The proposed framework is graphically presented in Figure 1.



Source: Literature review

Figure 1: The conceptual framework of the adoption intention of financial derivatives

3. METHODOLOGY

3.1. Research Methods and Population

A quantitative research design was utilised to empirically investigate the moderating effect of responsive regulatory regimes on the link between the complexity of financial derivatives and institutional adoption intention. This method was chosen for its effectiveness in objectively analysing structured data and detecting statistically significant correlations among latent dimensions (King et al., 2021). Primary data were obtained using a standardised questionnaire addressed to senior executives of financial institutions in Tanzania. The unit of analysis was financial institutions. The target respondents or unit of inquiry were finance and risk management department heads, recognised as pivotal decision-makers having a direct impact on the institutional and department adoption of financial derivatives. These persons generally possess the

strategic authority to analyse derivative instruments, analyse regulatory restrictions, and promote their adoption at the board level (Lien, 2022). The research population comprised departments in commercial banks, insurance firms, pension funds, and mutual funds, predominantly located in Dar es Salaam and Dodoma, where the density of regulated financial institutions is highest. A sampling of 158 intended participants. A total of 142 completed replies were received, resulting in an 89.8% response rate, adequate for subsequent statistical analysis employing Structural Equation Modelling (Hair et al., 2021).

3.2. Data Collection Instrument

The questionnaire was modified from recognised, published sources in order to guarantee content validity and coherence with the study's conceptual framework. Items were adjusted according to expert recommendations (Amirzadeh et al., 2024). All constructs were assessed using a five-point Likert scale, from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). The survey tool encompassed the complexity constructs, which is the extent to which financial derivatives are regarded as technically or operationally challenging to implement. Measurement items were sourced from Davis (1989) and Rogers (2003), encompassing factors such as reporting difficulty, usage difficulty, and learning duration. Responsive Regulatory System (Moderator): Derived by modifying indicators from Braithwaite, (2016) and Drahos, (2017), containing elements of the regulatory pyramid. This encompasses the clarity of regulation, knowledge, complexity, changes needed, and Adoption Intention: Metrics were derived from Teo et al. (2003), Davis et al. (1989), encompassing adoption planning, recommendation willingness, risk-benefit assessment, and preference for alternative tools.

3.3. Data Analysis Method

The gathered data were examined via Partial Least Squares Structural Equation Modelling (PLS-SEM) through SmartPLS 4. This method was selected for its appropriateness in models that incorporate both reflecting constructs and moderating effects. It enables concurrent estimation of measurement and structural models, facilitating rigorous route coefficient analysis and hypothesis testing (Hair et al., 2021). The model underwent evaluation for reliability, convergent validity (utilising Average Variance Extracted and factor loadings), and discriminant validity (via Fornell-Larcker and HTMT criteria). The moderating influence of the responsive regulatory system on the complexity–adoption link was evaluated using an interaction term approach, assessing if the intensity and direction of this relationship varied significantly across different levels of regulatory responsiveness.

4. RESEARCH FINDINGS

4.1. Analysis of Respondents

This study examined the distribution of respondents amongst various types of financial institutions—banks, insurance firms, pension funds, and mutual funds—to ensure a comprehensive grasp of institutional viewpoints. The categories were chosen due to their strategic significance in financial markets and their differing exposure to derivative instruments (Kidwell et al., 2016). A total of 142 respondents provided data. Banks were the predominant portion, with 60.6% of the sample. Insurance firms constituted 35.2% of the total respondents. The residual segment of the sample comprised pension funds and mutual funds, together representing 4.2%. This distribution illustrates the paramount influence of commercial banks and insurance companies on Tanzania's financial markets.

4.2. Descriptive Analysis of Constructs Using SPSS

The study explores the means, standard deviations, skewness, and kurtosis of the constructs studied, and a descriptive statistical analysis was performed. The results for all constructs are shown in Table 1. In general, the mean of constructs reflected the level of respondents' perceptions of the construct.

Table 1

Descriptive analysis of constructs using SPSS

Constructs	Mean	Std. Deviation	Skewness	Kurtosis
Complexity	3.2312	0.74426	0.185	-0.982
Responsive Regulatory System	4.135	0.43122	-0.358	-0.67
Adoption Intention	3.9915	0.58872	0.159	-1.315
Average	3.78	0.58		

Source: Smart PLS

Descriptive statistics illustrate institutional views on financial derivative usage, complexity, and regulatory system. Complexity scores averaged 3.23 (SD = 0.74), indicating significant difficulty using financial derivatives. The positive skewness of 0.185 shows that a minority of respondents thought derivatives were more complex than average, reflecting financial sophistication or institutional capabilities. A flatter distribution with a negative kurtosis of -0.982 suggests institutional complexity varies.

Responsive Regulatory system scores averaged 4.14 (SD = 0.43), showing institutional confidence in the regulatory system. The negative skewness of-0.358 indicates that most respondents rated the regulatory system positively, while the negative kurtosis of-0.670 indicates an even distribution around the mean. The findings indicate that respondents saw the regulatory system as helpful and responsive, which may boost institutions' willingness to offer financial products. Institutions were likely to implement financial derivatives, as the mean adoption intention was 3.99 (SD = 0.59). A little positive skew of 0.159 shows stronger adoption readiness, while a negative kurtosis of-1.315 predicts a wider response dispersion.

4.3. Measurement Model Assessment with Smart PLS4

To assess the measurement model's reliability and validity for the constructs, various test was done, such as indicator reliability, internal consistency reliability, convergent validity, and discriminant validity using Smart PLS 4. The results show that the model passed all the specified psychometric standards. Item loadings exceeded the minimum threshold of 0.50, ranging from 0.696 to 0.908; the item that had a lower loading was eliminated, indicating that each remaining observed indicator makes a significant contribution to its corresponding latent construct. Internal consistency reliability was determined using composite reliability (CR) values ranging from 0.841 to 0.939 and Cronbach's alpha scores ranging from 0.754 to 0.918. The middle Rho values range from 0.764 to 0.920. Both outperform the suggested cut-off values, indicating good internal consistency and reliable construct measurements.

Convergent validity was further supported by the average variance extracted (AVE) values for all constructs, which were above the 0.50 threshold, showing that each construct explains a significant percentage of the variance in its indicators. Discriminant validity was proven using several criteria. First, the Fornell-Larcker condition was met because the square root of each construct's AVE outperformed its correlations with other constructs. Second, the heterotrait-monotrait ratio (HTMT) values were all less than the conservative threshold of 0.85, indicating that the conceptions are conceptual and statistically distinct. Furthermore, cross-loading analysis demonstrated that each item loaded more strongly on its assigned concept than on other constructs, hence supporting discriminant validity. Table 2 presents a condensed overview of the measurement model data, as well as a graphical depiction of the measurement model to aid interpretation. Figure 2 shows pictorial presentation of the measurement model assessment.

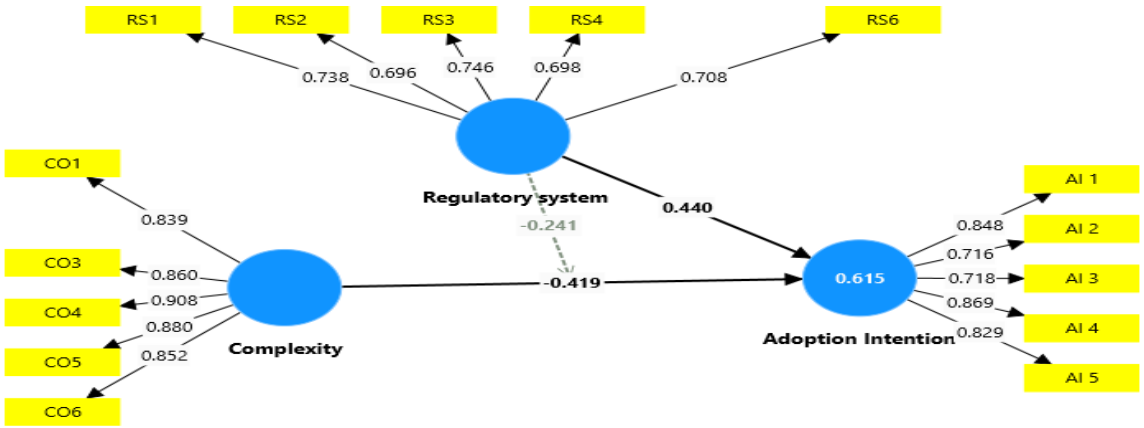
Table 2

Measurement Model Assessment

Constructs	Indicators	Reliability			Validity		
		IR	ICR			CV	DV
		Loadings	CR α	ρ_a	ρ_c	AVE	HTMT
		> 0.5	> 0.7	CRα > 0.7 < ρ_c	> 0.7	> 0.5	< 0.85
Complexity	CO1	0.839	0.918	0.92	0.939	0.754	0.658
	CO3	0.860					
	CO4	0.908					
	CO5	0.880					
	CO6	0.852					
Responsive Regulatory system	RS1	0.738	0.751	0.752	0.834	0.514	0.737
	RS2	0.696					
	RS3	0.746					
	RS4	0.698					
	RS6	0.708					
Adoption Intention	AI1	0.847	0.857	0.87	0.897	0.638	
	AI2	0.722					
	AI3	0.717					
	AI4	0.869					
	AI5	0.826					

Source. Smart PLS

Overall, the results show that the measurement model has high psychometric qualities, including indicator reliability, internal consistency, convergent validity, and discriminant validity.



Source: Smart PLS4 (2025)

Figure 2: Measurement Model

4.4. Structural Model Assessments with Smart PLS 4

Following a successful review of the measurement model, the assessment of the structural model evaluated the relationships between constructs. Assessing collinearity statistics (VIF), path coefficients (β), coefficient for

determinations(r^2), effect sizes (f^2), t-statistics, and p-values is essential for determining the strength, significance, and practical relevance of proposed correlations. Non-parametric bootstrapping with 5,000 subsamples was employed to estimate path coefficients, as recommended in PLS-SEM due to its robust inference capabilities and absence of normality assumptions. Based on the directed study hypotheses, which posit that regulatory systems positively influence adoption intention while complexity negatively impacts it, one-tailed hypothesis testing was employed. One-tailed tests enhance statistical power when the direction of the association is hypothesised.

4.4.1. Variance Inflation Factor (VIF)

Variance Inflation Factor (VIF) is used to assess the level of multicollinearity in a model (Hair et al., 2021). Multicollinearity arises when independent variables are highly correlated, distorting coefficient estimates and reducing the model's interpretability. The criterion of the VIF value is VIF ≤ 3.3. the no collinearity problem (Kock, 2015). In this study, as per Table 3, all VIF values are less than 3, indicating that there is no substantial multicollinearity among the independent variables(Hair et al., 2021). The greatest VIF is for regulatory system 1.855, which is still well within safe limits.

4.4.2. Path coefficient, F-squared, T statistic and P value

Other structural model findings in terms of the proposed hypothesis are shown in the table. The first hypothesis (H1), which investigated the influence of Complexity on Adoption Intention, was validated. The path coefficient was negative and statistically significant (β =-0.419, t = 7.075, p < 0.001), indicating that increased perceived complexity diminishes the propensity to embrace financial derivatives. The effect size magnitude was moderate (f^2 = 0.322), affirming its practical significance.

The second hypothesis (H2), which evaluated the impact of the Regulatory System on Adoption Intention, was also substantiated. The findings indicated a positive and substantial correlation (β = 0.440, t = 6.989, p < 0.001), illustrating that strong regulatory frameworks enhance adoption intention. The effect size was moderate (f^2 = 0.352), underscoring the significance of institutional contexts in influencing adoption behaviour.

Table 3

Summary of Structural Model Assessments

Hypothesis Relationship	VIF	F-square	Path coefficient	T statistic	P values	Significant	Negative/ Positive
H1: Complexity -> Adoption Intention	1.418	0.322	-0.419	7.075	0.000	Yes	Negative
H2: Regulatory system -> Adoption Intention	1.430	0.352	0.440	6.989	0.000	Yes	Positive
H3: Regulatory system x Complexity -> Adoption Intention	1.012	0.081	-0.241	3.488	0.000	Yes	Negative

Source: Smart-PLS4 (2025).

The third hypothesis (H3) assessed the moderating influence of the Regulatory System on the link between Complexity and Adoption Intention. The interaction term was significant (β =-0.241, t = 3.488, p < 0.001) with a small to moderate effect size (f^2 = 0.081). This suggests that a robust regulatory framework alleviates the adverse effects of complexity, therefore promoting adoption despite perceived obstacles. The study model accounted for 61.5% of the variation (R^2 = 0.615) in Adoption Intention, indicating significant explanatory strength and highlighting the framework's robustness.

4.4.3. Moderation Analysis of Regulatory System

Complexity demonstrated a notable negative impact on adoption intention (β =-0.408, t = 6.771, p < 0.001; f^2 = 0.283), suggesting that increased perceived complexity diminishes individuals' readiness or capacity to adopt new systems. The introduction of the moderator (interaction term) Regulatory System resulted in an increase in the model's explanatory power from R^2 = 0.584 to R^2 = 0.615, indicating an additional 3.1% variance in adoption intention. The interaction effect demonstrated statistical significance (β =-0.241, t = 3.488, p < 0.001) and practical relevance (f^2 = 0.081), albeit with a

smaller effect size compared to the direct effects. This negative interaction indicates that the beneficial impact of a supportive regulatory environment diminishes in contexts characterised by high complexity.

Table 4a

Before Moderation

Relationships	VIF	Path coefficient	f-square	T statistics	P values
Complexity -> Adoption Intention	1.414	-0.408	0.283	6.771	0.001
Regulatory system -> Adoption Intention	1.414	0.463	0.364	7.605	0.001

Source. Smart PLS4

Table 4b

After Moderations

	VIF	Path coefficient	F-square	T statistics	P values
Regulatory system x Complexity -> Adoption Intention	1.012	-0.241	0.081	3.488	0.001

Source. Smart PLS4

Table 4c

Coefficient for determinations (R-square)

Adoption Intentions	R^2
Before Moderation	0.584
After Moderations	0.615

Source. Smart PLS4

The comparison of models pre- and post-moderation from Table 4a and Table 4b demonstrates that regulation serves as an effective mechanism for promoting adoption, though its impact is not definitive. The effectiveness is influenced by the level of complexity, which may either enhance or diminish it. These insights are crucial for policy design in developing countries, where regulatory structures and implemented systems frequently demonstrate significant complexity. Developing straightforward, clear, and contextually relevant regulations is essential for maintaining elevated adoption rates in these environments. Moreover, Prior to moderation, the R^2 as on Table 4c score was 0.584, (58.4%) of the variance in adoption intention. Post-moderation, the R^2 ascended to 0.615, (61.5%) of the variation. The 3.1% increase indicates that the moderator(s) introduced significant interaction effects that improve the model's predictive ability.

5. DISCUSSION OF THE FINDINGS

The main objective of this study is to examine the influence of complexity and the responsive regulatory system on adoption intentions. Moreover, the study aims at to examine the moderating influence of the responsive regulatory system. These objectives were transformed into hypotheses, and they were tested statistically using PLS SEM with smart PLS as a data analysis tool. The study tested the relationship between complexity and the regulatory system with adoption intentions. Also, the study tested the moderating effect of the regulatory system on the relationship between the complexity of and adoption intentions of financial derivatives.

The examination of the relationship indicates that complexity has a substantial adverse effect on adoption intention (β =-0.408, t = 6.771, p = 0.001;<0.05). This suggests that as derivatives become increasingly complex, the likelihood of investor adoption diminishes. The significant adverse effect of complexity on adoption intention highlights a broader systemic issue: in underdeveloped financial ecosystems, complexity represents technical difficulty and institutional fragility. This finding validates the Complexity Theory (Turner & Baker, 2019), also corroborates previous research

indicating that financial products characterised by high complexity impede diffusion adoption (Wang et al., 2016; Chen et al., 2021). The result closely reflects the concerns raised by Chiu (2023) when linking complexity, regulation and the financial market.

In contrast, the regulatory variable exhibited a substantial positive impact on adoption intention (β = 0.463, t = 7.605, p = 0.001;<0.05). This indicates that a well-organised and responsive regulatory framework fosters adoption by instilling confidence in market actors. The positive relationship affirms key propositions in the Responsive regulatory strategy literature. In contexts where regulation is perceived as adaptive, participatory, and risk-sensitive, institutions gain confidence to engage with complex financial instruments. This study's findings suggest that responsive regulatory environments act as institutional enablers, reducing perceived uncertainty and enhancing interpretive clarity. Similarly, Chiu (2023) argue that adaptive regulation, particularly through sandbox frameworks and iterative rule-making, improves innovation adoption by reducing institutional uncertainty and compliance risk. The outcome aligns with findings from Hee and Song (2017), which highlight the facilitative function of regulation in promoting financial innovation. However, opposing results on Thinh et al. (2020), Al-Slehat et al. (2018) and Bhadra and Singh (2024) in India, Hao et al. (2022) , Хоменко et al.(2024); Kobilarev and Živanović (2019) and Njoroge et al. (2013). Where they show the negative influence of the regulatory system.

The incorporation of the responsive regulatory system's moderating influence greatly enhanced the model. The interaction between responsive regulatory systems and complexity was statistically significant (β =-0.241, t = 3.488, p < 0.001), This corresponds with previous studies Fernando et al., (2015), Ngisau & Ibrahim, (2020), Li et al., (2019), Ullah et al., (2024) and the responsive regulatory system. There is a decrease in the negative effect of complexity from-0.408 to-0.241, suggesting that the responsive regulatory systems mitigate the adverse influence of complexity on adoption intention but do not eliminate all the adverse influence. This suggests many reasons, such as the speed of complexity that results from more innovative financial derivatives that goes higher compared to the knowledge of the regulator, that was explained in regulatory dialectic theory. Regulatory system in this context functions as a partial buffer, creating room for experimentation.

The result also directly supports Chiu (2023), who caution on responsive regulation in the absence of organisational preparedness. Adoption decisions remain bounded by knowledge, risk aversion, and capacity limitations. This interaction pattern underlines the importance of pairing responsive regulation with capacity-building measures, such as training, decision-support tools, and tailored compliance pathways. This pattern resonates with Awrey's (2015) claim that financial innovation often outpaces interpretive capacity, making adoption difficult even when regulation is enabling. Complexity operates at multiple levels—technical, cognitive, and institutional (Poutanen et al., 2016). As Braithwaite (2011) emphasises, responsive regulation must be dialogic and continuous to build compliance capacity. In summary, while complexity hinders adoption, a robust regulatory framework mitigates this negative impact, facilitating acceptance even in challenging product situations.

The model's explanatory power was enhanced following the inclusion of the moderator. Before moderation, the model accounted for 58.4% (R^2 = 0.584) of the variance in adoption intention. Upon incorporating the moderating impact, the explained variation rose to 61.5% (R^2 = 0.615). This enhancement illustrates that the regulatory framework is essential in augmenting the model's prediction precision by mitigating the adverse effects of complexity while bolstering the beneficial impact of regulation. The findings indicate that clear, accessible, and user-oriented regulations can minimise complexity, enhance trust, and promote adoption, even in systems regarded as difficult. The findings empirically support the notion that responsive regulatory frameworks enhance adoption directly and diminish the perceived burden of complexity, thereby rendering complex systems more approachable and adoptable.

6. CONCLUSIONS

A progressive, prudential, and risk-sensitive regulatory framework is needed to develop derivatives in developing markets like Tanzania. Clear eligibility rules and asset allocation constraints for institutional participants like banks, pension funds, and insurance corporations are needed to restrain speculative excesses in shallow and growing markets. These policies should provide enough flexibility for appropriate hedging and long-term investments that build the real sector. Developing markets may aggressively attract qualified domestic institutional investors to increase participation and market breadth. We must carefully sequence this growth, backed by compliance readiness evaluations and capacity-building initiatives, to guarantee good governance and informed risk management for all participants. Tanzania must also foresee and overcome regulatory obstacles, notably supervisory capacity, learning from developed financial markets. To manage a developing and complicated market, the Capital Markets and Securities Authority (CMSA) needs specialised training, derivatives expertise, and regulatory technology.

For high-leverage participants like hedge funds and international institutional investors, market liberalisation must be staged carefully. Developing markets like Tanzania must have strong macroprudential controls, including capital adequacy, exposure limitations, and stress-testing procedures, before allowing these actors. With enhanced market transparency

and accountability, Tanzania could reconsider investing limitations on collective investment schemes (CIS) like unit trusts and enable regulated exposure to low-risk derivatives such as government bond futures. Tanzania should create risk-aligned pay frameworks for investment managers to prioritise long-term stability over short-term rewards. Misaligned incentive structures have caused excessive tail risk and herding in established derivatives markets. The Bank of Tanzania and CMSA should work with industry players to define incentive rules. Macroprudential regulation from the start is necessary due to the country's sensitivity to global market volatility and external shocks. Finally, Tanzania should seek regional regulatory harmonisation through SADC venues like CISNA, using cross-border learning from established markets. A well-planned, institutionally grounded, and regionally linked approach would help Tanzania avoid premature liberalisation and develop a derivatives market that boosts financial resilience and investment.

Regulators and key stakeholders should support standardised derivative contracts and derivatives exchanges to improve openness, accessibility, and confidence. Regulations should be adaptable and responsive, using regulatory sandboxes for safe experimentation and oversight. A responsive, regulatory system where stakeholders shape rules is essential. Collaboration keeps rules in line with institutional goals and market realities. Shariah-compliant derivative products would increase inclusivity and uptake in specialist industries like Islamic finance. The Bank of Tanzania, other regulatory organisations, and private institutions, the study recommend the collaboration in derivative training programs to enhance knowledge and technical expertise. Continuous professional development from the Tanzania National Board of Accountants and Auditors should cover derivative pricing, IFRS compliance, and risk management. Tax rebates or derivative position capital relief could encourage responsible adoption. Develop real-time market surveillance systems to monitor exposures, liquidity concerns, and systemic links. To prevent regulatory arbitrage and promote cross-border involvement, the East African Community (EAC) should harmonise derivatives legislation.

Author contributions

Ruva G. Tunze: Conceptualization, Formal analysis, Funding acquisition, Writing – original draft all 100%.

Evelyn M. Richard, Supervision 50%; Validation100%:

Eric Mkwizu: Supervision 50%, Writing – review & editing 100%

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