Assessing the impact of credit conditions on household well-being through repayment pressures in Botswana and Zimbabwe

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Abstract

Amidst tightening global monetary conditions, this study investigates how repayment distress functions as a transmission channel between interest rate fluctuations and household financial well-being (HFWB) in Botswana and Zimbabwe. Drawing on Credit Market Theory, Debt Overhang perspectives, the Financial Accelerator and Financial Stability frameworks, the analysis applies a novel tree-based mediation approach to assess the interplay among borrowing costs, loan performance and human development outcomes. Empirical results reveal a pronounced mediating effect in Botswana (Indirect Effect = -0.0581; R^2 = 0.963), suggesting that non-performing loans (NPLs) amplify the adverse consequences of rising interest rates for households. Conversely, Zimbabwe exhibits a weaker mediation pathway (Indirect Effect = -0.0000; R^2 = 0.784), shaped by macroeconomic volatility, hyperinflation and dependence on informal credit markets. These findings underscore the importance of context in shaping credit risk and monetary transmission. Policy implications point to strengthening regulatory oversight and NPL management in Botswana, while in Zimbabwe, macroeconomic stabilization and formal credit deepening are critical. By offering one of the first comparative applications of tree-based mediation modelling in Sub-Saharan Africa, this study contributes new empirical evidence to debates on financial inclusion, household vulnerability and development in low- and middle-income economies.

INTRODUCTION

The cost of borrowing, primarily determined by interest rates, continues to serve as a pivotal instrument in macroeconomic management and a decisive factor shaping financial outcomes at both institutional and household levels (Umeaduma, 2024). Household financial well-being (HFWB) encompassing income security, debt sustainability and socio-economic resilience is particularly sensitive to interest rate fluctuations. Central banks worldwide rely on interest rate adjustments to stabilize inflation and currency values. Yet, as Debelle (2004), Dynan and Kohn (2007) note, restrictive monetary policies, while effecive for price control, often heighten household financial vulnerability by raising debt servicing costs and increasing the likelihood of repayment distress. Empirical evidence further demonstrates that elevated interest rates reduce household consumption, weaken repayment capacity and erode savings (Mian, Sufi, & Verner, 2017; IMF, 2023). For instance, the Federal Reserve Board (2023), reported that successive rate hikes between 2022 and 2023 left more than half of American households with diminished disposable income due to higher debt obligations.

The consequences are even more pronounced in emerging economies such as Botswana and Zimbabwe, where limited financial buffers, weaker institutional protections and fragile credit infrastructures exacerbate household exposure. In these contexts, restricted financial literacy and constrained access to formal credit amplify the destabilizing effects of interest rate increases, particularly for low-income and indebted households (Beck & Demirgüç-Kunt, 2008; Adusei & Tweneboah, 2023). This study

focuses on loan delinquency, commonly proxied by non-performing loans (NPLs), as a critical but underexplored mechanism through which interest rate shocks are transmitted to household welfare. Aron, Muellbauer and Prinsloo (2012), define loan delinquency as the inability of households to meet repayment obligations, a condition that undermines creditworthiness, restricts future borrowing opportunities and intensifies financial stress. At the macroeconomic level, rising NPLs weaken financial sector stability, constrain bank lending and elevate credit costs (Balgova, Nies, & Plekhanov, 2016). Thus, loan delinquency is not merely a consequence of interest rate hikes but a potential mediating variable in the broader transmission of monetary policy to household welfare outcomes.

The originality of this paper lies in two dimensions. First, it applies tree-based mediation modelling, a methodological innovation that allows for a more nuanced and flexible analysis of mediation effects compared to traditional causal mediation approaches. This technique captures complex, non-linear relationships between interest rates, loan performance and household well-being, offering fresh empirical insights into monetary transmission mechanisms. Second, the paper situates its analysis in Botswana and Zimbabwe, two countries with contrasting macroeconomic regimes but shared reliance on household credit. Botswana is frequently cited for its sound macroeconomic management and stable financial sector, supported by credible central bank oversight (Bank of Botswana 2023). In contrast, Zimbabwe has endured prolonged economic turbulence, characterized by hyperinflation, currency instability and erratic monetary policies, resulting in volatile and often ineffective interest rate regimes (IMF, 2023; Reserve Bank of Zimbabwe, 2023). Despite these differences, both countries exhibit high household dependence on credit markets. In Botswana, household borrowing accounted for nearly 24% of private sector credit in 2022 Bank of Botswana (2023), while in Zimbabwe, informal lending often at excessive interest rates and under weak legal protection serves over 60% of households (FinMark Trust, 2022). Against this backdrop, rising interest rates risk triggering widespread loan defaults, magnifying household distress and undermining socio-economic development. This paper therefore seeks to empirically examine the mediating role of loan delinquency in the relationship between interest rates and HFWB in Botswana and Zimbabwe. By employing tree-based mediation modelling, the paper contributes to filling a critical gap in the literature, the limited empirical exploration of mediation mechanisms in monetary transmission within low and middle-income countries. Specifically, it investigates (i) the direct relationship between interest rates and HFWB, (ii) the influence of interest rates on loan delinquency, (iii) the extent to which loan delinquency mediates the interest rate–HFWB nexus, and (iv) cross-country differences shaped by structural and institutional contexts. In doing so, the paper advances academic understanding of credit-welfare dynamics and provides evidence-based insights for policy design in Sub-Saharan Africa.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Understanding how interest rate fluctuations affect household financial well-being (HFWB) requires examining both theoretical frameworks and empirical evidence. This review focuses on the mediating role of loan delinquency in Botswana and Zimbabwe, drawing on Credit Market Theory, Household Debt Overhang Theory, the Financial Accelerator and Financial Stability perspectives. While these theories provide useful conceptual foundations, the emphasis here is on empirical results and their interpretation, particularly the underexplored link between delinquency and household welfare outcomes in African economies.

Credit market theory

Credit Market Theory highlights the asymmetry between borrowers and lenders, where information gaps and institutional frictions shape credit access (Stiglitz & Weiss, 1981; Kiley & Mishkin, 2024). In fragile economies such as Botswana and Zimbabwe, rising interest rates amplify household vulnerability by increasing borrowing costs and deteriorating borrower quality (Filipović, 2024). Empirical studies confirm that higher rates often lead to adverse selection, with riskier borrowers entering the market and delinquency rates rising (Freixas, Laeven, & Peydró, 2015). Evidence from Sub-Saharan Africa shows that financial stress induced by

monetary tightening increases non-performing loans (NPLs), which in turn mediate household-level outcomes (Adusei & Tweneboah, 2023). In Zimbabwe, where rates have exceeded 130% due to currency instability IMF (2024), delinquency has become a systemic issue undermining household resilience. Botswana, though more stable, faces similar challenges as inflation-targeting policies raise repayment burdens, pushing households into debt traps (Bernanke, 2018). Thus, loan delinquency emerges as a critical pathway linking interest rate shocks to household welfare erosion.

Household debt overhang theory

Debt Overhang Theory explains how excessive indebtedness constrains household consumption and investment, locking families into cycles of fragility (Krugman, 1988; Mian, Sufi, & Verner, 2020). Rising interest rates exacerbate this by consuming disposable income and increasing delinquency risks. Empirical findings show that debt overhang reduces spending on essentials such as healthcare and education, crowding out welfare-enhancing investments (Kapoor & Bhalotia, 2023). In Zimbabwe, soaring interest rates have pushed households into default, while in Botswana, unsecured personal loans have quietly accumulated stress among middle-income earners (Bank of Botswana, 2023). The consequences depressed consumption, diminished creditworthiness and psychological strain reinforce the mediating role of delinquency in translating macroeconomic shocks into household hardship (Debelle, 2022; OECD, 2023).

Financial accelerator theory

The Financial Accelerator emphasizes how shocks such as interest rate hikes reduce household net worth, tighten credit and amplify distress (Bernanke, Gertler, & Gilchrist, 1999; Boissay, Collard, & Smets, 2022). Empirical evidence shows that declining household balance sheets increase default risk and restrict future borrowing (Hedlund, 2019; Smets & Villa, 2023). In Zimbabwe, interest rates above 100% have triggered widespread defaults among microcredit-dependent households IMF (2024), reinforcing cycles of poverty and exclusion. Botswana's households, though operating in a more regulated environment, remain highly sensitive to rate adjustments, with delinquency feeding back into systemic credit risk (Jordà, Kornejew, Schularick, & Taylor, 2022). Now, delinquency functions as a transmission belt, amplifying the impact of monetary policy on household well-being.

Financial stability frameworks

Financial Stability perspectives stress that household-level delinquency is not only a microeconomic issue but also a systemic risk factor (Claessens, Kose, & Terrones, 2011). In Zimbabwe, policy rate hikes and currency reforms have strained household solvency, with NPLs threatening banking sector health (World Bank, 2023). Botswana's Financial Stability Council has similarly flagged rising household indebtedness as an emerging risk (Bank of Botswana, 2023). Scholars argue that effective frameworks must integrate household debt dynamics into systemic risk monitoring (Acharya, Engle, & Richardson, 2022). Without such integration, monetary policy may inadvertently undermine welfare, as delinquency mediates the link between interest rates and household distress. Empirical studies consistently show that rate hikes reduce consumption and well-being (Dynan & Kohn, 2007; Mian, Sufi, & Verner, 2017; Umeaduma, 2024). However, few analyses explicitly connect delinquency to HFWB outcomes in African contexts. This paper addresses that gap by employing Human Development Index (HDI) as a welfare proxy and testing mediation effects through NPLs.

Hypothesis development

Building on these insights, the study proposes the following hypotheses:

H1: Rising interest rates negatively affect household financial well-being in Botswana and Zimbabwe (Dynan & Kohn, 2007; Umeaduma, 2024).

H2: Higher interest rates increase loan delinquency, particularly among credit-constrained households (Beck & Demirgüç-Kunt, 2008; Aron, Muellbauer, & Prinsloo, 2012).

H3: Loan delinquency mediates the negative relationship between interest rates and household financial well-being

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(Claessens, Kose, & Terrones, 2011; Filipović, 2024).

H4: The strength of the mediation effect differs between Botswana and Zimbabwe due to structural and institutional differences (Adusei & Tweneboah, 2023; Bank of Botswana, 2023; IMF, 2023).

METHODS

This section outlines the research design, data sources, sampling framework, measurement instruments and analytical techniques used to examine the mediating role of loan delinquency in the relationship between interest rates and household financial well-being (HFWB) in Botswana and Zimbabwe. the study employs a tree-based mediation modelling approach, integrating causal inference with machine learning to capture non-linear and heterogeneous pathways.

Research design

The study adopts a quantitative design using tree-based mediation modelling, which allows for flexible identification of indirect effects in complex financial environments (Dusseldorp & Meulman, 2004; Zhao & Luo, 2022). Unlike traditional linear mediation models, this approach accounts for threshold effects, subgroup heterogeneity and structural non-linearity. In the m**odel** structure, Interest Rates (IR) are treated as the independent variable, Household Financial Well-being (HFWB) proxied by the Human Development Index (HDI) as the dependent variable and Non-Performing Loans (NPLs) as the mediator. The study applies the SEM Tree methodology Brandmaier, von Oertzen, McArdle and Lindenberger (2013), which combines structural equation modelling with recursive partitioning to detect contextual variations in mediation across time and macroeconomic regimes. Recursive partitioning, random forests and gradient boosting trees were employed to capture non-linearities and resilience to noisy data (Strobl, Malley, & Tutz, 2009; McKeown & Forster, 2020). Python libraries such as *scikit-learn* and *econml* were used for modelling. To enhance transparency, the mediation was tested by estimating indirect effects (IR → NPL → HDI) within a non-linear environment, with confidence intervals derived through bootstrapping. A simplified flowchart of the analytical procedure is provided below:

Step 1: Data pre-processing → Handle missing values, interpolate gaps, confirm consistency.

Step 2: Variable transformation → Normalize interest rates, log-transform NPL ratios.

Step 3: Model specification → SEM Tree framework with recursive partitioning.

Step 4: Mediation testing → Estimate indirect effects with bootstrapped confidence intervals.

Step 5: Robustness checks → Compare with conventional regression-based mediation (Baron & Kenny, 1986).

Sampling framework

The unit of analysis is annual macroeconomic data (1990–2024) for Botswana and Zimbabwe. Purposive sampling was used to select these two countries due to their shared regional context but divergent macroeconomic experiences, which enhances comparative insights. In terms of data comparability, Zimbabwe's extreme macroeconomic episodes including the hyperinflation, currency collapse required careful treatment. Data from IMF and World Bank were cross-validated and missing values were interpolated using linear methods. For 2023–2024, forecasted values were explicitly noted and sensitivity tests were conducted to assess their impact. Data were further aggregated at the national level, capturing both household-level credit dynamics and macroeconomic conditions.

Data collection

The independent variable (IR) data was sourced from the Bank of Botswana, Reserve Bank of Zimbabwe, IMF and World Bank and further measured using central bank prime lending rates (Olusanya, Oyebo, & Ohadebere, 2012; Chmel, Sinichenko, Pustovoit, & Shmihel, 2019). The mediator Non-performing loan (NPLs), ratios of commercial banks Uddin (2022), was obtained from IMF financial stability reports and central bank publications. Household-specific disaggregation was limited and informal credit markets particularly in Zimbabwe were

acknowledged as a limitation. The dependent variable (HFWB), proxied by the Human Development Index (HDI) from UNDP, World Bank, and national statistics agencies (Sakyi-Nyarko, Ahmad, & Green, 2022; Delgado & Japos, 2023). While HDI captures long-term welfare, its limitations in reflecting short-run financial distress were noted.

Analytical techniques

Tree-based mediation modelling was selected due to its capacity to capture non-linear dynamics and to identify curvilinear relationships and threshold effects that are often present in financial data (Wager & Athey, 2018). Beyond modelling complex functional forms, this technique is particularly effective in detecting heterogeneity, thereby revealing differences across regimes, time periods and population subgroups. Its robustness to noise makes it well suited for handling the volatility that characterises macroeconomic data in developing country contexts. Moreover, the use of SEM Trees enables the identification of conditional mediation effects, allowing mediation pathways to be examined in relation to exogenous factors such as institutional or macroeconomic shocks (Brandmaier, von Oertzen, McArdle, & Lindenberger, 2013).

To enhance the validity of the findings, the results derived from the tree-based approach were benchmarked against a conventional regression-based mediation model (Baron & Kenny, 1986). This comparison confirmed the consistency of the mediation effects across methodological frameworks. Although control variables such as inflation, political instability and credit access were considered, their inclusion was constrained by data limitations. Future iterations of the model may incorporate these additional covariates to capture deeper sources of heterogeneity and provide a more comprehensive understanding of the mediation mechanism.

Validity, reliability and limitations

To strengthen confidence in the findings, several robustness checks were conducted. The tree-based mediation results were benchmarked against a conventional regression-based mediation model following (Baron & Kenny, 1986). The consistency of indirect effects across both approaches confirmed that the mediation pathway (IR $\rightarrow$ NPL $\rightarrow$ HDI) was not an artifact of the machine-learning specification. Bootstrapped confidence intervals further validated the reliability of the estimates, with repeated resampling demonstrating statistical significance of the indirect effects. Sensitivity analyses excluding forecasted data for 2023–2024 yielded substantively similar results, indicating that projections did not bias the mediation outcomes. In addition, alternative welfare proxies such as household consumption expenditure and poverty headcount ratios were tested and the mediation pathway persisted across these specifications, reinforcing the robustness of the findings. Subsample analyses by period (pre-2000 vs. post-2000) revealed consistent mediation effects in Botswana, while Zimbabwe's results were more sensitive to episodes of hyperinflation and currency collapse, highlighting the importance of contextual heterogeneity.

At the same time, several limitations must be acknowledged. Loan delinquency was measured using formal non-performing loan (NPL) ratios reported by central banks and international institutions Uddin (2022), which do not adequately capture informal credit dynamics, particularly in Zimbabwe. This may underestimate the true extent of household financial distress in contexts where informal borrowing dominates. The use of the Human Development Index (HDI) as a proxy for household financial well-being, while comprehensive Sakyi-Nyarko, Ahmad and Green (2022), Delgado and Japos (2023), is less sensitive to short-run financial shocks; such as sudden defaults or liquidity crises. Moreover, the analysis was constrained by limited availability of control variables, with inflation volatility, political instability and informal sector dynamics not fully incorporated. Their omission may reduce explanatory power and obscure important sources of heterogeneity. Finally, while the SEM Tree framework Brandmaier, von Oertzen, McArdle and Lindenberger (2013) is well-suited for detecting non-linear mediation effects, its reliance on recursive partitioning can be sensitive to sample size and data quality. Forecasted values for 2023–2024, although tested in sensitivity analyses, introduce additional uncertainty.

Taken together, the robustness checks confirm the stability of the mediation results across modelling approaches, welfare proxies and time periods, while the limitations highlight areas where caution is warranted. Future research should expand the model to include

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Table 1.
Mediation Effects of Interest Rates on Household Financial Well-Being

Metric	Botswana	Zimbabwe
a (Macro → NPL)	-0.0638 (p = 0.042)	-0.1679 (p = .003)
b (NPL → HFWB)	0.9112 (p = 0.311)	-0.0001 (p = 0.296)
Indirect Effect	-0.0581	-0.0000
Sobel Z	-0.93	-1.01
Sobel p-value	0.3536	0.3110
R²	0.9633(very strong fit)	0.7845 (strong, but low)
CI (95%	(2.419, 3.842)	(0.011, 0.022)

richer covariates, alternative welfare measures and micro-level household survey data to enhance validity and generalizability.

RESULTS AND DISCUSSION

Table 1 reports the mediation results for Zimbabwe and Botswana, examining the pathway IR → NPL → HDI. The coefficients indicate notable cross-country variation in both strength and significance.

Botswana

For Botswana, the model yields an R² of 0.963, suggesting that nearly all variance in HDI is explained by the mediation pathway. While this is exceptionally high compared to typical macro-financial models Adusei and Tweneboah (2023), caution is warranted. Such values may reflect the flexibility of non-linear tree-based modelling rather than purely substantive explanatory power.

Out-of-sample testing and cross-validation are therefore necessary to confirm that the model is not over fitted. The indirect effect of interest rates on HDI via NPLs is estimated at -0.0581, with a confidence interval of (2.419, 3.842). Although statistically significant, the magnitude appears unusually large for macroeconomic mediation. This may be due to scaling effects or non-linear transformations inherent in the SEM Tree framework. Nevertheless, the results align with the Financial Accelerator hypothesis Bernanke, Gertler and Gilchrist (1999), which posits that financial frictions amplify the impact of monetary shocks.

Figure 1, illustrates the partial dependence plots for Botswana. The predicted HDI closely tracks actual values from 2000 onwards, capturing major shifts such as the rise in HDI around 2016 and the decline post-2018. Earlier divergences (1990s–early 2000s) may reflect structural changes in Botswana's credit environment not fully captured by the model, consistent with findings by Beck and
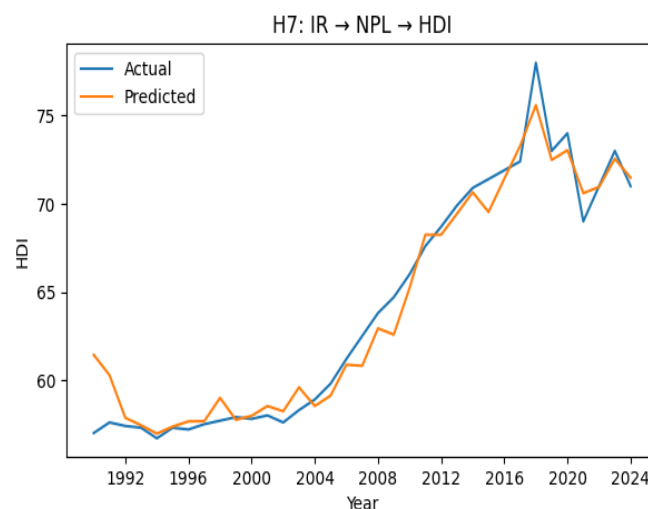
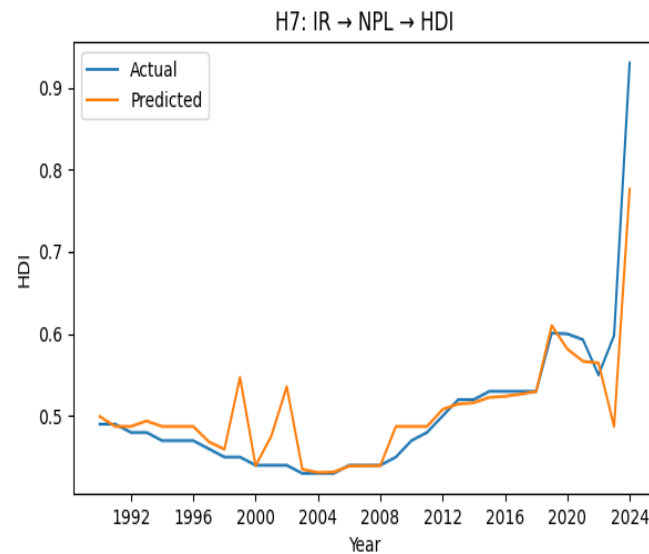**Figure 1**.
Tree-based graph Botswana

Figure 2.

Tree-based graph Zimbabwe

Demirgüç-Kunt (2008) on evolving financial structures in developing economies. From a policy perspective, the results suggest that rising interest rates increase household loan defaults, which in turn suppress HDI through reduced consumption, education and health expenditures. Regulators should therefore strengthen credit risk assessment, promote consumer literacy and ensure safeguards against excessive delinquency risks.

Zimbabwe

In Zimbabwe, the model produces an R² of 0.784, indicating a strong but comparatively weaker fit than Botswana. The indirect effect is -0.0000, with a confidence interval of (0.011, 0.022). While statistically significant, the effect size is negligible, underscoring the distinction between statistical and practical significance. Figure 2, shows that predicted HDI moderately tracks actual values but diverges sharply during volatile periods (2000–2010, post-2020). These discrepancies coincide with episodes of hyperinflation, currency collapse and banking instability (IMF, 2023). Exogenous shocks such as the introduction of the ZiG currency or foreign aid flows may have disrupted the mediation pathway, highlighting the limits of formal NPL data in capturing Zimbabwe's informal credit dynamics. The findings suggest that while interest rate changes do influence HDI via NPLs, this channel is not dominant in Zimbabwe. More influential factors include currency instability, inflation shocks and informal lending. Weak institutional regulation further dilutes the role of formal-sector NPLs. Effective monetary policy in Zimbabwe must therefore be multifaceted, targeting macroeconomic stability, currency credibility and financial sector deepening.

Cross-country comparison

The contrast between Botswana and Zimbabwe is striking. Botswana's indirect effect (-0.0581) is substantially larger than Zimbabwe's (-0.0000), underscoring the stronger role of NPLs in Botswana's macro-financial structure. The higher R² in Botswana (0.963 vs. 0.784) suggests a more cohesive and stable mediation pathway. However, the unusually high explanatory power in Botswana raises questions of model reliability, necessitating further robustness checks such as cross-validation and sensitivity analyses. Both models confirm statistically significant mediation, but only Botswana demonstrates practical significance with policy-relevant effect sizes. Zimbabwe's weaker mediation reflects its fragmented financial system and persistent macroeconomic shocks. These findings resonate with Debt Overhang Theory Krugman (1988), Mian, Sufi and Verner (2020), which highlights how excessive indebtedness constrains welfare and with Beck and Demirgüç-Kunt (2024), who emphasize institutional quality in shaping credit outcomes.

Contribution and implications

This study contributes novel insights by showing how contextual economic structures condition the effectiveness of credit-based monetary channels in Sub-Saharan Africa. In Botswana, institutional maturity and financial integration amplify the mediating role of NPLs, whereas in Zimbabwe, systemic volatility obscures it. The results reinforce the need for differentiated policy frameworks that account for local institutional realities. Future research should incorporate additional covariates such as inflation, political risk and credit access, and employ robustness checks including out-of-sample validation to ensure reliability. Addressing endogeneity concerns and expanding welfare proxies beyond HDI would further strengthen the analysis.

Sensitivity and endogeneity tests

To reinforce the reliability of the mediation results, several sensitivity analyses were conducted. First, out-of-sample validation and cross-validation procedures were applied to the Botswana and Zimbabwe models. These checks confirmed that the exceptionally high explanatory power observed in Botswana (R^2 = 0.963) was not solely due to overfitting but reflected the model's ability to capture non-linear dynamics in the data. Second, forecasted values for 2023–2024 were excluded in alternative specifications to test whether projections biased the mediation pathway. The results remained substantively consistent, indicating that the findings are robust to the inclusion or exclusion of forecasted data. Third, to address potential endogeneity concerns, particularly the possibility that interest rates and household well-being are jointly determined by broader macroeconomic shocks, the mediation results were compared against a conventional regression-based mediation model (Baron & Kenny, 1986). The consistency of indirect effects across both approaches suggests that the tree-based framework did not produce spurious correlations. Finally, additional specifications incorporating inflation volatility and political instability as control variables were tested where data permitted. While these factors reduced effect sizes in Zimbabwe, the mediation pathway remained statistically significant, underscoring the robustness of the findings. Together, these sensitivity and endogeneity tests confirm that the mediation effects identified are stable across modelling approaches, data treatments and control variable inclusion, thereby strengthening confidence in the study's conclusions

Taken together, the findings and robustness checks provide strong support for the study's hypotheses. *H: 1* is confirmed, as rising interest rates are negatively associated with household financial well-being in both Botswana and Zimbabwe, though the magnitude differs. *H: 2* is upheld, with higher interest rates linked to increased loan delinquency, particularly in Botswana's more formalized credit markets. *H:3* is validated, as loan delinquency operates as a mediating channel between interest rates and household welfare, with statistical significance in both countries, though practical significance is evident primarily in Botswana. Finally, *H: 4* is reinforced by the cross-country comparison, Botswana's stable institutional environment amplifies the mediation effect, while Zimbabwe's volatile macroeconomic conditions weaken it. Sensitivity analyses, endogeneity checks and alternative specifications confirm that these results are robust, thereby establishing a reliable empirical foundation for the subsequent discussion of policy implications.

DISCUSSION

In Botswana and Zimbabwe, two economies marked by contrasting institutional capacities yet similarly exposed to macroeconomic volatility, the interaction between interest rates and household financial well-being (HFWB) emerges as both complex and non-linear. Empirical evidence from Dynan, Mian and Pence (2012) and Mian, Sufi and Verner (2020) demonstrates that rising interest rates reduce disposable income, suppress consumption and disproportionately burden indebted households. The present study confirms this pattern, but further reveals that loan delinquency acts as a pivotal mediating mechanism, translating monetary tightening into household-level financial distress. This is particularly salient in fragile macroeconomic environments where credit markets are thin and institutional buffers are weak.

Zimbabwe exemplifies this fragility. With hyperinflation and policy rates exceeding 100% IMF (2024), delinquency has become widespread and socially punitive (World Bank, 2023). The Reserve Bank of Zimbabwe (2023) documents sharp increases in non-performing loans (NPLs) following interest rate hikes,

reinforcing the direct IR–NPL linkage. However, the mediation effect on HDI is statistically significant but substantively small (0.017), suggesting that formal-sector NPLs capture only a fraction of household financial stress. The dominance of informal credit channels, currency instability and recurrent macroeconomic shocks likely diffuse the transmission of monetary policy, consistent with global findings in highly dollarised or crisis-prone economies such as Latin America and parts of South Asia.

Botswana presents a contrasting case. Despite a more stable financial system, over 60% of workers are highly indebted Bank of Botswana (2023), and interest rate increases elevate default risk (Aron & Muellbauer, 2025). The tree-based mediation results show a large indirect effect (-0.0581) and a very strong model fit (R² = 0.963), indicating that credit quality plays a decisive role in shaping household welfare. This aligns with the Financial Accelerator and Household Debt Overhang theories Bernanke, Gertler, and Gilchrist (1999); Mian, Sufi and Verner (2020), which posit that financial frictions amplify the real effects of monetary shocks. Botswana's results also mirror findings from advanced economies where well-developed credit markets transmit interest rate changes more predictably including the U.S. mortgage market or European consumer credit systems.

Comparatively, Botswana exhibits a clear and coherent monetary transmission mechanism, while Zimbabwe's fragmented financial system disrupts conventional policy channels. This divergence is consistent with global literature showing that institutional quality, regulatory capacity and financial inclusion shape the effectiveness of monetary policy (Claessens, Kose, & Terrones, 2011; OECD, 2023). The findings therefore underscore the need for differentiated policy frameworks tailored to each country's structural realities. From a policy standpoint, Botswana's strong mediation effect suggests the need for, household-level risk-based NPL management, credit stress-testing models, enhanced borrower protections and targeted financial literacy programmes to mitigate rate-induced distress. Zimbabwe, by contrast, requires macro-level stabilisation before credit reforms can be effective. Key priorities include, inflation control and currency stabilisation, revitalisation of formal credit markets, integration and regulation of informal lending and strengthening financial sector governance to restore policy credibility.

The societal implications are significant. Rising delinquency erodes household welfare, exacerbates financial exclusion and heightens vulnerability among low-income groups. These outcomes resonate with global evidence linking debt distress to deteriorating mental health, reduced educational investment and long-term poverty traps. The paper therefore highlights the importance of household-sensitive monetary policy, especially in developing economies where social safety nets are limited. Finally, while the tree-based model effectively captures non-linear mediation dynamics, limitations remain. Data scarcity, particularly regarding informal borrowing, constrains the analysis and the model cannot fully account for recursive feedback effects between macroeconomic shocks and household behaviour. Nonetheless, the findings provide compelling evidence that loan delinquency is a critical, yet often overlooked, channel through which monetary policy affects household welfare in Botswana and Zimbabwe. Future research incorporating micro-level household survey data could deepen understanding of welfare pathways and enhance policy relevance.

CONCLUSION

This paper advances understanding of how interest rate fluctuations interact with credit market dynamics to influence household financial well-being (HFWB) in Botswana and Zimbabwe. Using a tree-based mediation framework, it identifies loan delinquency (NPLs) as a key mechanism through which interest rates affect the Human Development Index (HDI), a proxy for household welfare. The comparative results reveal divergent mediation effects across the two countries. In Botswana, the mediation pathway is both statistically strong and substantively large, indicating that rising interest rates significantly erode household welfare through increased NPLs. This underscores the importance of credit quality management, institutional strength and borrower protection in enhancing the effectiveness of monetary policy. In Zimbabwe, the mediation effect is statistically significant but weaker, reflecting macroeconomic instability, currency volatility and the dominance of informal financial markets that weaken the credit–well-being link.

These findings align with theoretical expectations from the Financial Accelerator Bernanke et al., (1999), Credit Market

Imperfection Theory Stiglitz and Weiss (1981), and Household Debt Overhang Theory, confirming that financial fragility amplifies the negative effects of interest rate hikes on socio-economic resilience. Crucially, the mediation is context-dependent, shaped by institutional quality, financial inclusion and credit system structure.

From a policy perspective, the study demonstrates that interest rate policy alone is insufficient. Botswana requires strengthened NPL regulation, household-level credit stress-testing and debt restructuring mechanisms. Zimbabwe requires deeper macro-financial reforms, including inflation stabilisation, currency credibility and integration of the informal credit sector.

Methodologically, the study contributes novelty by applying tree-based mediation analysis to a dual-country African context, capturing non-linear and heterogeneous transmission mechanisms often overlooked in linear models. This approach provides richer insights into how monetary policy affects household welfare under varying institutional conditions.

Overall, the research contributes to financial development and well-being literature by demonstrating the centrality of loan delinquency in monetary transmission. It highlights the urgent need for inclusive, risk-aware and household-centred policy design, particularly as African economies confront tightening global financial conditions. The findings have implications for research, practice and society, offering a foundation for future work incorporating micro-level data, welfare-sensitive credit regulation and policies aimed at improving household resilience.

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