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Research article

Threshold effect of non-interest income disaggregates on commercial banks' financial performance in Zimbabwe

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ABSTRACT

Financial performance has become a trending concept in corporate finance and strategic management in recent times especially in the aftermath of the Global Financial Crisis (GFC) of 2007–2009. As an antidote to charter value erosion caused by stiff competition from incumbents in traditional banking activities, banks venture into non-core banking activities as a diversification and survival strategy. The purpose of the study is to determine the optimal threshold levels of non-interest income that stimulate financial performance of ten Zimbabwean commercial banks using non-interest income disaggregates over 2009–2020. Unfortunately, studies that examine the non-interest-income-financial performance nexus of banks involved in intermediation are scant and inconclusive. Furthermore, the use of threshold models to crack this puzzle are conspicuous. The study employed Fully Modified Ordinary Least Squares and Threshold difference Generalized Methods of Moment nonlinear threshold approaches. The aggregated and disentangled non-interest income dynamic optimal thresholds found are 26 %, 17 % and 10 % whereas the average static ones are 35 %, 28 % and 17 %. Compared to aggregated non-interest income, the study reveals that the disaggregates pose a greater positive impact on financial performance of banks in the upper regime than their counterparts in the lower regime. In addition, more banks were found to be operating below the required minimum thresholds. To avert episodes of bank failures and hedging against banking sector fragility, commercial bank managers should come up with well-diversified portfolios of income-generating ventures. Also, central bank regulations must promote non-interest activities, competition, growth and reduce leverage of commercial banks.

1. Introduction

Recently, the interaction between non-interest income and financial performance of commercial banks around the world is receiving much attention from scholars and researchers following the global economic crisis of 2007–2009 and the Covid-19 pandemic. As an antidote to the adverse effects of stiff competition from incumbents in traditional banking activities, banks venture into an off-balance sheet and non-core banking activities which generate non-interest income [1–3]. It is worth mentioning that commercial banks in both developed and developing economies appear to be more focused on non-interest income given that the interest income is highly risk in a fragile economy [4–6]. Traditionally, commercial banks around the world were generating a greater

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proportion of their revenues from collecting interest payments. Following the 2009 Financial Crisis, net interest income margin has started to diminish owing to excessive competition [7]. In this respect, commercial banks have turned to non-interest income coming from non-intermediation activities [8,9].

More interestingly, the digital transformation is accelerating the implementation of a plethora of non-interest income strategies in the banking sector. For example, the Reserve Bank of Zimbabwe (RBZ) [10] third quarter report shows a decline in return on equity (ROE) (fall in performance) from 40 % to 32 % between 2020 and 2021, despite interest income and interest rate spreads increasing from 16 % to 41 % and 4 %–19 %, respectively. This serves as a potential suggestion of usefulness of noninterest income as a greater bank financial performance driver compared to interest income. Also, in September 2021, the Zimbabwean commercial bank income growth was attributed to noninterest income (NI) which accounted for 54 % of total income [10]. The major driver of NI growth was fees and commission (37 %) necessitated by Covid-19 which pushed customers to use digital platforms and plastic money. Foreign exchange intermediation activities contribute a meagre 5 %, portraying it as a potentially untapped source of NI for Zimbabwean commercial banks due to low competition compared to fees and commission NI activities.

The developments in the banking industry related to digital transformation and regulatory frameworks are widely accepted as major drivers of non-interest income. Notably, digital transformation has changed the business models of many commercial banks which necessitated banks to focus on income diversification through the generation of non-interest income [11]. Moreover, many commercial banks have witnessed deregulation which fostered cut-throat competition more than ever before [8,12,13]. To deal with competition, several banks managed to implement new digital technologies that drastically altered their business models and then led to an exponential increase in non-interest income. In the past two decades, the banking sector has witnessed tremendous growth in numerous sources of revenue [5]. Nonetheless, some banks are still focusing on traditional business models [14].

In the case of the United States of America (USA), it is interesting to note that non-interest income accounts for above 40 % of total operating income in commercial banking [15,16]. Given this statistical evidence, it is of great importance to note that many commercial banks in the USA are looking for other lucrative avenues to exploit besides traditional intermediary activities. Admittedly, the chief sources of non-interest income in the banking sector include insurance, fees and commissions, foreign exchange, and service charges. Although many commercial banks are diversifying into non-interest income generation projects in the USA, much of the extant empirical evidence is centered on the interaction between interest income and bank performance. Furthermore, the paucity available studies that have looked at the performance benefit of non-interest income only employed aggregated non-interest income ignoring its disaggregates [2,17–21]. Non-interest income disaggregates like fees and commission and foreign currency market activities might have asymmetric effects on performance of banks in developing economies, Africa included. This situation unmasks the knowledge gap in terms of the interaction between non-interest income especially its disaggregates and financial performance of commercial banks provided that these banks generate a greater portion of their operating income from non-intermediary activities and own the largest market share of African financial systems. In Africa, Zimbabwe included, banks accounts for the bulk of the financial transactions and assets ownership in excess of 60 % [22–24] such that their low performance threatens a country's financial stability and development [25–27]. Therefore, the stability of African financial systems is hinged on their banking sectors' stability since they are major players within the system. Compared to other economies, Africa in general and Sub-Saharan Africa (SSA) in particular, has financial systems whose structures are broadly bank-based [28,29]. As a result, without well-diversified non-interest income portfolios which act as shock absorbers, any systemic bank failures would have serious contagion repercussions across these economies. An under-performing banking sector also has grievous implications on the growth of developing economies. For example, evidence has shown that bank-based financial systems increase private sector funding, especially SMEs and informal economies which drive development more in low-income economies, whereas market-based suit more advanced economies [30–32]. In Zimbabwe, informal economy contributes more than 60 % of GDP [33,34].

In the context of the Indian banking industry, many commercial banks are focusing on non-intermediary activities to diversify their streams of income from traditional interest income. It is within this context that Trivedi [35] highlighted that private and foreign commercial banks are embracing innovation that allows them to rake in non-interest income. This suggests that the shift of commercial banks towards non-interest income such as fee-based income and service charges has permitted them to diversify their sources of income. This shift has been considered a strategic move to lessen the unpredictability of commercial bank's revenues [14].

In the case of Zimbabwe, many developments have taken place in the banking sector. It is within this context that the Zimbabwean banking sector has been liberalized in the pursuit of the Economic Structural Adjustment Program (ESAP) in 1990 [36]. This development has created a fertile ground for competition as indigenous banks penetrated the market. As such, there was a dire need for banks to look for other lucrative avenues such as non-interest income activities to ensure income diversification and survival in the contested market. More interestingly, Zimbabwean commercial banks had invested huge amounts of cash in Automated Teller Machines (ATMs) and Point of Sale (POS), web-based services, debit cards, and master cards [37]. These advanced technologies permit the banks to charge some fees such as ATM fees which are part of non-interest income in this digitalized world. This suggests that the development regarding information and communication technology is increasing the non-interest income of commercial banks in Zimbabwe. But on the other side of the coin, non-banking players such as telecommunication operators have started competing with banks, also offering banking services through mobile money and payments eroding the charter value of banks. This forced banks to aggressively venture into non-interest-generating activities and banking product differentiation.

Moreover, the issue of globalization has forced banks to easily engage in foreign exchange businesses such as currency swaps, options, and forward contracts that contribute to the non-interest income basket of commercial banks. Notably, the widespread closure of banks in Zimbabwe has pressurized banks to come up with alternative methods of raking in revenue besides traditional interest-based activities. For instance, eight banks shut down their operations from 2008 to mid-2014 owing to dwindling operating income in traditional interest activities [38]. With this in mind, the existing commercial banks in Zimbabwe are increasingly focusing on non-interest income activities such as brokerage commissions, fiduciary income, advisory fees, and gains from non-hedging derivatives in an attempt to ensure income diversification. Surprisingly, despite banks venturing into non-interest activities, there is a dearth of literature on the nexus between non-interest income and financial performance of commercial banks in Zimbabwe especially using disaggregated non-interest income activities data. For example, according to ZB Financial Holdings [39], the bank is engaging in non-interest activities like insurance whereby net insurance related earnings rose from ZW$0.11 billion in 2020 to ZW$0.239 billion in 2021 and gross premiums increased by 18.4 % from ZW$0.592 billion in 2020 to ZW$0.701 billion in 2021, whereas there was a 3.1 % decline in insurance related expenses. Also, BancABC launched City Hopper as a domestic remittance service to generate non-interest income [40].

Furthermore, the use of dynamic threshold models to ascertain the optimal threshold levels of non-interest income disaggregates and their effects on bank financial performance is conspicuous in extant literature. Many previous studies around non-interest income and financial performance were conducted in the USA and Asian regions [5,16]. On the other hand, Amoah et al. [41] conducted a study in Ghana on the effect of income diversification on profitability using static threshold effect and they found that diversification of income is connected to higher profitability. In the Zimbabwean context, Kashiri [42] analyzed the effect of non-interest income on bank performance in Zimbabwe using static mixed methods approach. With the aid of ordinary least squares, they observed a positive association between non-interest income and profitability of banks in Zimbabwe.

In addition, the empirical literature debate on the possible drags or accelerators of the effect of aggregated and disentangled non-interest income on bank financial performance is not yet settled. Therefore, this study seeks to contribute to this ongoing debate using Zimbabwe as a laboratory where bank failure and banking crises are more prevalent and a menace. Zimbabwe experienced episodes of bank failures that changed the competitive strategies of many banks [43]. With these gaps in mind, this study attempts to analyze the threshold effect of non-interest income disaggregates on commercial banks' financial performance in Zimbabwe. Consequently, this study answers the question: what is the threshold effect of non-interest income disaggregates on commercial banks' financial performance in Zimbabwe?

The paper is structured as follows. Section two looks at the related theoretical and empirical evidence. Section three covers variables, data and methods. Results and discussion are covered in section four. Lastly, sections five and six covers the conclusion and policy implication, as well as limitations and suggestions for further studies, respectively.

2. Related literature

2.1. Theoretical framework

This part covers the theoretical framework and empirical literature review as follows.

2.1.1. Quiet life hypothesis (QLH)

The quiet life hypothesis was adopted in this study. The hypothesis states that banks with greater market power will engender high profitability quietly, despite the possibility that it could cause inefficiency [44–46]. As such, banks can focus on non-interest income to generate a higher market share which can be transformed into an increase in profitability. In the long term, it could turn high profitability into lower future profitability. The banks with greater market power are more likely to be cost inefficient. This implies that the managers who are poorly monitored by owners of banks will avoid risky but lucrative investments like taking non-interest income projects on board [47]. It is interesting to observe that banks that are engaging in non-interest income projects must strike a balance between optimum efficiency and optimum profitability [44,48]. Accordingly, the theory argues that non-interest income projects by banks are supported by the tenets of the quiet life hypothesis as managers stop shirking and exit their comfort zones due to competition intensity.

2.1.2. Efficient structure hypothesis (ESH)

As propounded by Demsetz [49], the ESH predicts that under the gravity of stiff market competition, efficient organizations outsmart competitors and grow, so that they become even larger, obtain higher market share, and earn extremely higher profits. In the context of banks, the organizations that aim to obtain greater market share by focusing on non-interest income can outsmart competitors and in turn enjoy higher profits [50–53]. Therefore, the theory argues that non-interest income helps banks to improve their efficiency and gain higher market share.

2.1.3. Dynamic capability theory

This theory was propounded by Teece, Pisano, & Shuen [54] to advance the understanding of firm performance in the face of a dynamic operating environment from a strategic management standpoint. They proposed that a firm can gain a competitive advantage in the market if it possesses distinctive processes and assets, a portfolio of difficult-to-imitate complementary assets and knowledge assets and evolution paths. This suggests that income generation in an environment characterized by rapid technological changes relies on the ability of the organization to refine and reconfigure its internal organizational, managerial, and technological processes [54–57]. For an organization to enjoy a competitive advantage in the current dynamic environment, it must possess dynamic capability by keeping competitors off balance and excluding new entries.

Dynamic capability approach supports this study as it explains how commercial banks can achieve and sustain a competitive edge in an environment associated with rapid changes like technological changes. It is within this context that many banks are embracing financial technology (FinTech) to earn non-interest income such as ATM fees from utilizing technological assets. More interestingly, the dynamic capability approach supports the idea of diversification. This means that commercial banks can focus on activities that generate non-interest income as a way of ensuring income diversification.

2.1.4. Markowitz portfolio theory

It was propounded by Markowitz [58] as a theory based on the idea "do not put all your eggs in one basket". This suggests that Markowitz's portfolio theory focuses on elements of returns from alternative investment vehicles and favours efficiently diversified portfolios to be held by organizations [59–61]. Informed with the tenets of this theory, commercial banks must invest in non-interest activities since diversification pays. Consequently, Markowitz's portfolio theory appears to be a firm theoretical foundation that helps commercial banks to build a robust and less-risky portfolio through efficient diversification. To this end, commercial banks are engaging in non-interest activities to diversify their streams of income.

2.2. Banking industry in Zimbabwe

Given the economic turmoil in Zimbabwe, it is deemed necessary to critically interrogate the condition and performance of the Zimbabwean banking sector. It is worth noting that the banks in Zimbabwe play a crucial role when it comes to economic recovery and growth. The Zimbabwean banking sector architecture is comprised of 13 commercial banks, four building societies, and one savings bank. Due to the hard economic conditions prevailing in Zimbabwe, it is not surprising to observe that four banking institutions failed to comply with the minimum capital requirements [62]. Worryingly, the slow pace at which Zimbabwean banks adopt digital technology is leading to a low monthly activity ratio of approximately 15 % [63]. This state of affairs has triggered customer dissatisfaction, poor segmentation, poor customer evaluation, and weak profiling of customers.

Going forward, the pressing issue of non-performing loans has remained problematic in the Zimbabwean banking sector [64]. Statistics revealed that non-performing loans are leading to poor performance of banks which forces them to diversify the sources of income through non-interest activities. Notably, this issue of non-performing loans can be connected to weak monitoring and underwriting mechanisms [65]. To make matters worse, bank failures in Zimbabwe can also be linked to poor credit assessment, liquidity challenges, corporate governance issues, undercapitalization, and insolvency cases [66]. For instance, banks like Renaissance Merchant Bank, Trust Bank Ltd, and Royal Bank Ltd were closed down. It is common knowledge that many banks in Zimbabwe are in survival mode. As such, they are devising robust strategies related to how to generate non-interest income. However, there is limited knowledge related to the threshold effect of non-interest income disaggregates on financial performance, especially in the context of Zimbabwean commercial banks.

2.3. Related empirical evidence

A thorough survey of the earlier empirical studies on the relationship between non-interest income and financial performance reveals that there is no clear conclusion since these studies yielded mixed results. In this regard, Cetin [67] investigated the effect of non-interest income on profitability using Break Regression ordinary least squares (OLS) method on banks from 205 high, medium and low-income countries over the 1999 to 2013 period found positive association in high income countries and no relationship in medium to low-income countries. In the BRICS nations, Sharma & Anand [68] investigated the link between non-interest income and performance using unbalanced panel data over the period 2001–2015. The fixed effects model (FEM) was applied, and their results revealed a positive correlation between income diversification and bank performance. In the Indian context, Trivedi [35] conducted a study on the effect of fee-based income on profitability over the period from 2005 to 2012. They applied multiple regression analysis and found that fee-based income has a positive effect on profitability. In the Jordanian context, Al-Tarawneh et al. [15] investigated the link between non-interest income and financial performance using 13 banks during the period 2000–2015. They found that non-interest income affects bank profitability positively. In Nepal, Shah et al. [69] conducted a study on the influence of non-interest income on bank performance and they observed a positive relationship between non-interest income and bank performance.

In contrast, Al-Khouri & Arouri [70] examined the influence of diversification on risk and return in the banking sector regarding the Gulf Cooperation Council (GCC) conventional and Islamic banking systems. The panel data was generated for the period from 2003 to 2015 using 69 listed banks and they observed a negative effect of income diversification on bank performance. In the African context, Mndeme [71] carried out a study in Tanzania on the relationship between non-interest income and performance of banks using the FEM. A sample of 25 banks was used and data was collected as from 2002 to 2012 and the results revealed that non-interest income negatively affects bank performance. Similarly, evidence from 13 EU countries over the period 2002–2012 [72] and 36 commercial banks in ASEAN region during the period 2008–2020 using Bayesian analysis techniques [73] show negative association between non-interest income and bank performance. On the other hand, some studies yielded no relationship. For example, evidence from Tunisian banks [74], Asian banks [75] and medium and low-income countries [67] support no relationship between non-interest income and profitability.

In the Zimbabwean context, Kashiri [42] analyzed the effect of non-interest income on bank performance in Zimbabwe using a mixed methods approach. With the aid of ordinary least squares (OLS), they observed a positive association between non-interest income and profitability of banks in Zimbabwe. Moreover, Makumbe et al. [76] examined the performance of commercial banks during the multi-currency system in Zimbabwe using a dynamic panel-data model and found that the effect of the multiple currency system on commercial bank performance is weak. Recently, Makurumidze & Rwodzi [77] examined the effect of mobile banking on Zimbabwean commercial bank performance and found that mobile banking enhances performance through easy and cheaper access to services.

3. Variables, data and methods

3.1. Variables and data

A descriptive research design was used with an initial target population comprised of 13 commercial banks out of which 10 were finally selected. The inclusion criterion was sample data availability for at least five consecutive years, forcing three commercial banks with incomplete data to be excluded. Sample representation was ensured by the ratio of total asset of included banks to total asset of commercial banking industry. The included banks own 91 % of the total assets of the Zimbabwean commercial banking industry. Given the Threshold First Difference Generalized Methods of Moments (TFDGMM) method adopted demands a balanced panel without gaps in the data, we selected 10 banks since they have complete annual data for the entire 2009–2020 sample period. The Appendix Table 1A presents the dependent, independent, and threshold variables and their respective data sources. The variables fall into three categories namely bank-specific, industry-wide and macroeconomic. Bank specific variables are ROE (percentage of return to total equity), DR (percentage of debt to total assets ratio), NI (TNI or FCI or FXI as a percent of total operating income), AGE of the bank, and banks' total assets in millions of US$. BSC (Lerner index in percent) is a banking industry-wide measure of competition within the commercial banking market while EP and CPI are macroeconomic indicators. The total number of observations from the strongly balanced panel is 120. The study focusses on commercial banks because their main role is intermediation, which is crucial for growth stimulation through channeling scarce financial resources to sectors of the economy where they are highly productive (allocative efficiency). Allocative efficiency, in the banking sector, refers to efficient allocation of resources so that marginal benefit to society is equal to marginal cost.

3.2. Empirical model

This study used Fully Modified Ordinary Least Squares (FMOLS) and Threshold First Difference Generalized Methods of Moments (TFDGMM) estimation methods. The adapted TFDGMM method is necessitated by the theoretical model proposed by Seo & Shin [78] and Seo et al. [79] and the paucity of application of dynamic panel threshold models to examine the impact of non-interest income disaggregates on bank performance in antecedent literature. Unlike the model of Kremer et al. [80] which cannot split each independent variable into regimes, TFDGMM threshold approaches solve this problem. However, the TFDGMM approach like linear GMM[1], has a weakness.[2] The use of Windmeijer [81] two-step cluster robust standard errors circumvent this problem. As a robustness check, we include static threshold modelling.[3] GMM is among the most crucial and powerful advancements in the last 35 years but surprisingly it has been scantly applied in extant literature [82]. Seo & Shin [78] further allude that TFDGMM unlike linear GMM [79, 80] which are data hungry, too restrictive, and suitable for cases where $N > T$, is not data hungry, unrestricted and most suitable for cases like ours where $N < T$. For these reasons, we adopt TFDGMM estimation technique.

The empirical specification of the static FMOLS model employed is stated as in equation (1).

$$ROE_{it} = \beta_1 NI_{it} + \beta_2 BS_{it} + \beta_3 M_{it} + \beta_4 NI_{it}(BS_{it}) + \gamma_i BD_{it} + \delta t + \alpha_i + \varepsilon_{it} \tag{1}$$

Following Seo & Shin [78] theoretical methodology, the adapted TFDGMM is as expressed by equation (2).

$$ROE_{it} = (\rho_1 ROE_{i,t-1} + \beta_{11} NI_{it} + \beta_{12} BS_{it} + \gamma_{1i} M_{it}) I\{NI_{it} \leq \lambda\} + (\rho_2 ROE_{i,t-1} + \beta_{21} NI_{it} + \beta_{22} BS_{it} + \gamma_{2i} M_{it}) I\{NI_{it} > \lambda\} + \delta t + \alpha_i + \varepsilon_{it} \tag{2}$$

The Hansen [83] dynamic approach is employed only for sensitivity analysis purpose and guaranteeing robustness of results. Equation (3) present the adapted empirical Hansen specification.

$$ROE_{it} = (NI_{it} + \beta_{12} BS_{it} + \gamma_{1i} M_{it}) I\{NI_{it} \leq \lambda\} + (\beta_{21} NI_{it} + \beta_{22} BS_{it} + \gamma_{2i} M_{it}) I\{NI_{it} > \lambda\} + \delta t + \alpha_i + \varepsilon_{it} \tag{3}$$

where NI is a vector of disaggregated and entangled non-interest income measures of focal threshold variable, BS is a vector of other four bank-specific factors other than NI, M is a vector of two macroeconomic variables, BD are bank dummies, $NI(BS)$ represent the interaction term between NI and BS variables, $I\{^\circ\}$ is an indicator threshold function, $\rho_1, \beta_{11}, \beta_{12}, \gamma_{1i}$ and $\rho_2, \beta_{21}, \beta_{22}, \gamma_{2i}$ are the respective lower and upper slope parameters for the two regimes, while λ is the threshold value dividing the observation into two regimes, respectively, α_i are bank effects, t are time effects, and ε are idiosyncratic zero mean random shocks. Similar to Seo & Shin [78], we let the random error ε to be a martingale difference sequence, $E(\varepsilon_{it} | \hbar_{t-1}) = 0$, where: ε_{it} a natural infiltration of bank i at time

[1] The Seo & Shin [78] and Sen et al. [79] model, is also referred to as the threshold first differences generalized method of moment (TFDGMM) since it is an amalgam of Hansen [83] threshold and Arellano & Bond [86] difference GMM dimensions. It is superior to the Hansen [83] approach because it allows the regressors as well as the threshold variable to be endogenous. For a detailed confirmation on the superiority of this recent approach see for example Kremer et al. [80], Seo & Shin [78], Kourtellos et al. [94], Yu & Phillips [156] and Seo et al. [79].

[2] Arellano & Bover [78] and Blundell & Bond [79] theoretically proved that linear First Difference GMM (FDGMM) of Arellano & Bond [86] is asymptotically weak and yields inefficient estimates since it relies on lagged levels of variables which are poor instruments for first-difference equations.

[3] The static threshold will be done using the FMOLS technique due to its superiority over the Hansen [83,84] and Caner & Hansen [157] Fixed Effects procedures which fail to account for endogeneity and omission bias.

Table 1
Descriptive statistics.

Variable	Mean	Standard Deviation	Minimum	Maximum	Observations
ROE	13.612	1.164	−32.821	89.331	120
TNI	10.434	4.765	−3.844	34.489	120
FCI	5.804	0.043	0.000	31.891	120
FXI	1.423	0.015	−0.117	9.697	120
DR	85.748	0.102	9.143	95.778	120
TA	416.334	383.476	61.713	24428.102	120
ALI	88.215	3.254	55.846	95.711	120
CR3	83.381	1.806	61.098	91.723	120
AGE	47.786	37.223	12	125	120
EP	5.550	8.403	−6.249	19.675	120
CPI	75.609	176.898	−2.431	557.202	120

t. To address drawback of Hansen [83],[4] we capture endogeneity by allowing X-regressors and NI-threshold variables to be measurable with respect to $\hbar_{t-1}$, such that $E(\varepsilon_{it}X_{it}) \neq 0$ and $E(\varepsilon_{it}NI_{it}) \neq 0$. The Hansen [83] procedure was only used to address the short comings of Seo & Shin [78] and Seo et al. [79] procedures' inability to determine number of threshold beyond one. FMOLS and TFDGMM models assume only a single threshold whereas the Hansen [83,84] approach assumes at least one. There are paucity financial sector focused studies [85–89] that employed methodologically inferior modified versions of the Hansen [83] threshold technique compared to the Seo & Shin [78] and Seo et al. [79] procedures we adapted in this study.

Preference of FMOLS and TFDGMM is their ability to account for simultaneity and endogeneity bias emanating from 1) bi-directional causality between dependent and independent variables, 2) omitted bias and 3) correlation between bank-specific effects with some of the explanatory variables [78,79,90,91,92]. Therefore, endogeneity problems emanating from either source not accounted for will seriously compromise the consistent and asymptotic properties of estimators possibly resulting in commission of type 1 or 2 errors [93,94,95–99] and leading to wrong policy prescriptions.

The interaction term $NI(BS)$ in equation 1 enables the determination of the mediating effect of each of the four bank specific factors on the performance benefits of each of the three non-interest income measures of Zimbabwean commercial banks.[5] The marginal benefit of BS on bank performance from equation (1) is extracted as reported in equation (4).

$$\partial\widehat{ROE}/_{\partial BS} = \widehat{\beta}_2 + \widehat{\beta}_4 NI \tag{4}$$

Four possibilities arise from equation (4) where mediation of NI acts as either a drag or accelerator of bank performance. First, if both $\widehat{\beta}_2$ and $\widehat{\beta}_4 < 0$, NI disaggregates are a drag to performance since they cascade the negative impact of BS on ROE, indicating negative complementarity effect. Second, $\widehat{\beta}_2 > 0$ and $\widehat{\beta}_4 < 0$ suggest NI acts as a drag which negates the positive impact of BS on ROE, which is a negative substitution effect. Third, $\widehat{\beta}_2 < 0$ and $\widehat{\beta}_4 > 0$ shows that NI acts as an accelerator of performance since it dampens the severity of the negative impact of BS on ROE, which is a positive substitution effect. Fourth, both $\widehat{\beta}_2$ and $\widehat{\beta}_4 > 0$ implies NI acts as a promoter which reinforces the positive impact of BS on ROE, portraying a positive complementarity effect.

In tandem with the antecedent studies [100–107] the optimal threshold at which NI stimulate bank performance from equation (4) is extracted using equation (5).

$$NI = -\widehat{\beta}_2/\widehat{\beta}_4 \tag{5}$$

Principal component analysis (PCA) employed to generate a composite index TNI, an amalgam of FCI and FXI is reported in PCA equation (6).

$$P_j = w_1 FCI + w_2 FXI \tag{6}$$

Where: P_j is the principal component j with $j = 1, 2$ and w represents eigenvectors defining the linear combination of FCI and FXI variables. Following Wold et al. [108], we normalise the weights by making the sum of squared values of variances optimizing weight of equation (6) equal to 1, which we convert to percentage. The detailed PCA results of eigenvalues and eigenvectors are reported in Appendix Tables A2 and A3. From the results in Tables A2, we only select PC1 because it explains the proportion of 93 percent of the variation and its eigenvalue of 2.36 exceeds the mean eigenvalue of 1.33 [109]. From the eigenvectors reported in appendix Table A3, the PC1 we used to generate TNI from FCI and FXI with eigenvectors substituted in equation (6) is reported in equation (7).

$$PC1 = 0.375FCI + 0.664FXI \tag{7}$$

[4] For a detailed exposition of Hansen [83] threshold analysis shortcomings, see for example Caner & Hansen [157], González et al. [158], Fok et al. [159], Seo & Linton [160], Kim et al. [161], Kremer et al. [80], Ramírez-Rondán [162] and Seo et al. [79].

[5] For similar studies that adopt the same approach focusing on various sector of the economy, see for example Hermes & Lensink [100], Gazdar & Cherif [101], Moradbeigi & Law [102], Olagbaju & Akinlo [103], Ehigiamusoe & Lean [104], Olaniyi & Oladeji [105,106] and Ehigiamusoe et al. [107].

The Lerner Index (LI) directly measures bank pricing behaviour by capturing the mark-up in pricing. Size of the divergence between the firm's market price and marginal cost (MC) indicates the level of market power. Higher values of the LI indicate higher mark-ups or lower levels of competition and smaller values signal greater competition. The price and MC will diverge much in less competitive markets and should be equal in perfect competition. Roots of LI's theoretical foundation can be traced from static neoclassical oligopoly theory. In a Cournot quantity-setting model banking industry where homogeneous financial products and services Y are produced at market price P, each bank producing output y_i faces a profit maximization problem given by equation (8).

$$Max_{y_i}[P(Y)y_i - C(y_i, w)] \tag{8}$$

where: y_i is the output of bank i, Y is total banking industry output, that is, $Y = \sum_{i=1}^{n} y_i$ and $P(Y)$ is the market price. $C(y_i, w)$ is bank i's total cost, where w is the vector of input prices of factors of production employed by bank i. This study uses bank level annual data covering the period 2009–2020 to calculate the bank-level LI scores for each selected 10 commercial banks. The LI for each sampled bank was computed as per equation (9).

$$LI_{it} = \frac{P_{it}(Y) - C'_{it}(y_i, w)}{P_{it}(Y)} \tag{9}$$

where: P_{it} is the price of assets and is calculated by dividing each bank's total revenue by total assets of bank i at time t. $C'_{it}(y_i, w)$ is the marginal cost of bank i at time t, derived from the translog total cost function.

4. Results and discussion

4.1. Descriptive statistics

Table 1 presents descriptive statistics of bank-specific, banking sector, and macro-variables. The average TNI, an amalgam from PCA of disaggregates of non-interest income components (FCI and FXI) is 10.4 % of the total operating income with a standard deviation of 4.765, minimum of −3.8 % for ZB bank in 2016, and a maximum of 34.5 % for CBZ bank in 2011. The TNI in 2016 can be attributed to introduction of the bond coins and notes, a surrogate currency treated at par with the US$. High TNI in 2011 might be due to political and economic stability which prevailed during the Government of National Unity (GNU) era of 2009–2013. FCI, the first TNI disaggregate has a mean of 5.8 %, a standard deviation of 0.043, minimum and maximum values of 0 and 31.9 %, for ZB and CBZ banks, respectively. The mean of the last proxy of NI disaggregates, FXI is 1.4 % with a standard deviation of 0.015, respective minimum and maximum values of −0.1 %, and 9.7 % for ZB and CBZ banks. Insights from these three proxies of non-interest income portray large disparities in total aggregated non-interest income TNI than disaggregates FCI and FXI. Thus, Zimbabwean commercial banks seem to focus more on interest income-generating traditional banking activities neglecting non-interest income ventures. Besides its great potential in Zimbabwe, FXI seems to get the least focus from bank managers' non-interest income priorities. Juxtaposing this observation with Table 2 evidence of strong negative linear and monotonic correlation of 68 and 75 percent suggests that a non-interest income portfolio composed of FCI and FXI disaggregates will be well diversified.

Regarding other bank-specific variables, the average performance of Zimbabwean commercial banks proxied by ROE is 13.6 %, standard deviation of 1.164, minimum and maximum values of −32.8 and 89.3 percent suggesting heterogeneity across banks. Bank size proxied by TA has a mean value of $416.33 million, standard deviation of 383.48, maximum and minimum values of $24.43 billion and $61.71 million portray small differences between Zimbabwean banks. The same conclusion of almost bank size homogeneity is derived from DR showing traits of excessive leveraging across banks with a mean ratio of 85.7 percent. A different picture can be observed on the number of years a bank is in operation represented by AGE. On banking sector-specific variables, BSC representing market power as proxied by non-structural measure adjusted Lerner index (ALI) and structural indicator CR3 support traits of a non-competitive banking sector characterized by high concentration and banks with huge market power. Macro-variables show high consumer price index (CPI) and depressed economic performance with high volatilities which possibly hinder income sources and profitable ventures of banks since they pose a systematic risk to the banking sector.

4.2. Diagnostic tests

Tables 2–7 report the results of diagnostic tests done to guarantee the validity, reliability, and robustness of threshold regressions reported in Tables 6 and 7. Relevant diagnostic checks reported include multicollinearity, panel unit root, crossectional dependence, panel cointegration, panel autocorrelation, panel heteroscedasticity, normality, linearity, and instrument validity. Linear and monotonic correlations reported in Table 2 are not in excess of 0.8 [110] and variance inflation factors (VIF) and inverse VIF in Table 3 of less than 4 and 0.25 respectively [111,112] suggest an absence of severe multicollinearity among the explanatory variables.

Except the presence of heteroscedasticity [113] and autocorrelation [96,114,115] across banks, all other diagnostic checks show no evidence of model misspecification, linearity, crossectional dependence, and non-normality. Econometric literature suggests correcting panel autocorrelation and heteroscedasticity in static models using heteroscedasticity and autocorrelation corrected (HAC) technique and use of cluster robust standard errors [116-118]. In the case of dynamic models, it can be corrected using two-step robust-standard errors [81,119].

Table 4 presents Clemente et al. [120], Levin et al. [121], and Herwartz et al. [122,123] panel unit root test results. The nature of

Table 2
Pearson and Spearman Rank Correlation Tests between independent variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) lnTA	1.000 (1.000)								
(2) CPI	−0.198*** (-0.214***)	1.000 (1.000)							
(3) AGE	0.017** (0.104**)	−0.040 (-0.082	1.000 (1.000)						
(4) BSC	−0.244*** (-0.351***)	0.410*** (0.48***)	−0.036** (0.064**)	1.000 (1.000)					
(5) DR	−0.310*** (-0.415***)	0.082** 0.121**	0.111* (0.154*)	0.125*** (0.178***)	1.000 (1.000)				
(6) FCI	0.647** (0.721***)	−0.156** (-0.214**)	0.043*** (0.082***)	0.124*** (0.149***)	−0.046*** (-0.67***)	1.000 (1.000)			
(7) FXI	0.045*** (0.743***)	0.145* (0.231*)	0.344 (0.432)	−0.652*** (-0.686***)	0.131** (0.173**)	−0.680*** (-0.752***)	1.000 (1.000)		
(8) TNI	0.124** (0.186**)	0.362* (0.412*)	0.023* (0.086*)	−0.423*** (-0.46***)	0.462*** (0.524***)	0.326*** (0.423***)	0.561*** (0.581***)	1.000 (1.000)	
(9) EP	0.617*** (0.641***)	−0.456** (-0.512**)	0.093 (0.112)	0.432** (0.465**)	−0.621*** (-0.65***)	0.513*** (0.563***)	0.553*** (0.582***)	0.563*** (0.598***)	1.000 (1.000)

Notes: ***Significant at 1 % level; **significant at 5 % level; *significant at 10 % level. Spearman rank-order correlations are given in parenthesis.

Table 3
Variance inflation factor.

Variable	VIF	1/VIF
LnTA	2.255	0.443
CPI	1.247	0.802
AGE	1.203	0.831
BSC	1.269	0.788
DR	1.288	0.777
FCI	2.085	0.480
FXI	1.273	0.785
TNI	1.487	0.672
EP	0.989	1.011
Mean VIF	1.455	

Table 4
Panel unit root.

Variable	Levin-Lin-Chu (LLC)		Clemente-Montañés-Reyes (CMR)		Herwartz-Maxand-Walle (HMW)	
	Level	1st Difference	Level	1st Difference	Level	1st Difference
ROE	−3.886[a]		−3.787[a]		0.957	6.545[a]
lnTA	1.679	−5.974[a]	−0.353	−8.649[a]	0.785	4.678[a]
CPI	−2.935[a]		−0.294	−5.323[b]	1.002	5.785[a]
AGE	0.258	−6.147[b]	3.632	−4.221[a]	0.543	3.987[b]
BSC	−1.835[c]	−11.958[a]	−5.512[a]		1.456[c]	8.043[a]
DR	−4.894[b]		−3.553[a]		1.874[b]	
FCI	−3.462[a]		−6.458[a]		2.123[b]	
FXI	−6.539[a]		−4.753[a]		1.345	6.894[a]
TNI	0.347	−4.783[a]	0.876	−3.986[a]	0.976	7.654[a]
EP	1.359	−9.654[a]	0.967	−7.391[a]	0.986	7.981[a]

Note.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.

our data demands a battery of robust panel unit root tests since it is plagued with traits of heteroscedasticity and structural breaks possibly emanating from shocks triggered by currency and economic transitions over the sample period. The LLC test assumes homogeneity across panels whereas HMW account for heteroscedasticity observed from the Pagan & Hall [113] test and CMR captures structural breaks in panels when testing for stationarity. Panel unit root tests in Table 4 shows a few variables to be stationary at level and other variables are integrated of order one, justifying the need for cointegration test to determine whether variables are on the same wavelength in the long run. The Pesaran [124] test indicates independence across banks, making Pedroni [125,126] the most suitable cointegration test procedure over Westerlund [127], whose results in Table 6 show a long-run relationship.

Table 5
Hansen [83] static threshold test (fixed-effect panel threshold model).

Threshold	Sum of Squared Residuals	Mean Square Error	F-statistic	Probability value
Total Non-interest Income (TNI)				
Single	0.288	0.053	22.735	0.003
Double	0.275	0.034	4.465	0.678
Total Fees and Commission Income (FCI)				
Single	0.121	0.042	16.5765	0.007
Double	0.162	0.025	3.765	0.8126
Foreign Exchange Income (FXI)				
Single	0.075	0.009	29.959	0.001
Double	0.037	0.005	6.932	0.372

Table 6
Static panel data threshold regression (FMOLS model).

Dependent variable: ROE	(1)	(2)	(3)
	TNI	FCI	FXI
TNI	1.322[a]	1.975[a]	2.173[a]
	(0.177)	(0.371)	(0.444)
FCI	0.521[b]	0.637[b]	0.871[b]
	(0.248)	(0.317)	(0.396)
FXI	2.787[a]	2.897[a]	2.921[a]
	(0.299)	(0.429)	(0.327)
DR	1.241[b]	1.161[b]	1.563[b]
	(0.621)	(0.528)	(0.694)
LnTA	0.889[b]	0.789[c]	0.926[b]
	(0.386)	(0.464)	(0.430)
BSC	−1.327[b]	−1.095[b]	−1.454[a]
	(0.663)	(0.551)	(0.273)
AGE	0.297[c]	0.317	0.354
	(0.176)	(0.255)	(0.346)
EP	1.682[a]	1.177[b]	1.426[b]
	(0.297)	(0.512)	(0.621)
CPI	−1.573[a]	−1.762[b]	−1.894[a]
	(0.252)	(0.882)	(0.223)
DR[c]NI	−3.506[a]	−4.045[b]	−9.304[b]
	(0.516)	(1.734)	(3.944)
LnTA[c]NI	−2.437[a]	−2.458[b]	−4.304[a]
	(0.748)	(1.057)	(0.803)
BSC[c]NI	3.973[b]	5.504[b]	10.141[a]
	(1.760)	(2.347)	(1.720)
AGE[c]NI	−0.868[b]	−1.039[a]	−1.873[b]
	(0.368)	(0.329)	(0.780)
Bank_Dummies	Yes	Yes	Yes
Trend to capture time effects	Yes	Yes	Yes
Non-interest Income Thresholds (Differentiating ROE with respect to DR, lnTA, BSC and AGE			
DR	0.354	0.287	0.168
LnTA	0.365	0.321	0.215
BSC	0.334	0.199	0.143
AGE	0.342	0.305	0.169
Observations	120	120	120
Number of banks	10	10	10
Jarque-Bera test for normality	0.785	0.824	0.936
Wooldridge test for panel autocorrelation	12.58[a]	37.232[a]	31.174[a]
Hall-Pagan test for panel heteroscedasticity	3.404[b]	4.459[b]	5.547[b]
Pesaran test for crossectional dependence	1.256	2.732	2.387
Pedroni Test for panel cointegration	4.148[a]	5.242[a]	6.257[a]
F-Statistic for model significance	39.21[a]	32.14[a]	22.26[a]

Note.
In parenthesis are cluster robust standard errors.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.

Table 7
Dynamic panel data threshold regression results (TFDGMM model).

Dependent variable: ROE	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	TNI	FCI	FXI	DR	lnTA	BSC	AGE
	Lower Regime						
TNI	0.282[a]	0.389[a]	0.432[a]	2.283[a]	0.112[a]	1.790[a]	0.523
	(0.048)	(0.052)	(0.125)	(0.714)	(0.013)	(0.684)	(0.542)
FCI	0.618[b]	0.712[b]	0.916[a]	2.912[b]	0.335[a]	2.175[a]	0.674[b]
	(0.267)	(0.330)	(0.365)	(1.297)	(0.125)	(0.643)	(0.301)
FXI	0.976[a]	1.119[b]	1.265[b]	3.146[a]	0.809[c]	2.478[a]	0.778
	(0.422)	(0.487)	(0.539)	(0.728)	(0.650)	(0.728)	(0.855)
DR	0.454[a]	0.663[b]	0.746[c]	1.834[a]	0.885[b]	0.398[b]	0.283
	(0.124)	(0.653)	(0.421)	(0.342)	(0.383)	(0.200)	(0.486)
LnTA	0.586[a]	0.778[a]	0.836[b]	0.986[a]	0.078[b]	0.086[b]	0.865[c]
	(0.241)	(0.172)	(0.362)	(0.391)	(0.039)	(0.044)	(0.474)
BSC	0.359[b]	0.662[a]	0.999[a]	0.614[a]	0.870[a]	1.873[b]	0.757[c]
	(0.162)	(0.213)	(0.233)	(0.167)	(0.124)	(0.807)	(0.409)
AGE	0.359	0.565	0.575	0.234[c]	0.281	0.698	0.475
	(0.343)	(0.492)	(0.614)	(0.123)	(0.417)	(0.599)	(0.517)
EP	0.316[b]	0.412[a]	0.548[b]	0.871[a]	0.121[a]	0.131[a]	0.141
	(0.137)	(0.178)	(0.237)	(0.252)	(0.019)	(0.016)	(0.485)
CPI	−4.699[b]	−3.506[a]	−1.490[b]	−1.883[a]	−2.989[a]	−5.836[a]	0.509[c]
	(1.239)	(0.537)	(0.641)	(0.727)	(0.671)	(0.869)	(0.290)
	Upper Regime						
TNI	1.785[a]	1.911[a]	2.091[a]	0.086[b]	0.852[b]	0.052[a]	0.186
	(0.192)	(0.218)	(0.351)	(0.039)	(0.431)	(0.019)	(0.356)
FCI	1.952[b]	2.236[b]	2.694[a]	0.618[a]	0.986[a]	0.490[b]	0.414
	(0.881)	(0.990)	(0.932)	(0.216)	(0.375)	(0.246)	(0.366)
FXI	2.826[a]	3.084[b]	3.785[b]	0.816[c]	1.184[b]	0.694[a]	0.769[c]
	(0.894)	(0.542)	(0.125)	(0.435)	(0.511)	(0.421)	(0.411)
DR	−0.729[b]	−0.858[a]	−0.975[a]	−1.037[b]	2.186[a]	1.297[b]	0.454
	(0.317)	(0.122)	(0.374)	(0.519)	(0.698)	(0.605)	(0.560)
LnTA	0.813[a]	0.918[b]	1.105[a]	−0.860[a]	1.419[a]	1.583[a]	0.143
	(0.333)	(0.415)	(0.695)	(0.274)	(0.206)	(0.258)	(0.227)
BSC	0.629[a]	0.811[b]	1.356[a]	−0.311[b]	1.016[a]	0.611[b]	0.321
	(0.189)	(0.351)	(0.492)	(0.147)	(0.325)	(0.264)	(0.526)
AGE	1.209	−0.311	0.446	−0.336	0.188	−0.895	0.189
	(1.216	(0.337)	(0.412)	(0.376)	(0.262)	(0.942)	(0.218)
EP	1.218[a]	1.783[b]	1.976[b]	0.104[b]	1.034[b]	0.941[b]	0.316[b]
	(0.369)	(0.768)	(0.851)	(0.047)	(0.445)	(0.424)	(0.144)
CPI	−1.129[a]	−1.332[b]	−1.640[a]	−2.683[b]	−1.048[b]	1.034[b]	−0.103[c]
	(0.813)	(0.634)	(0.654)	(1.161)	(0.453)	(0.479)	(0.056)
Bank Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trend to capture time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Threshold	0.258[a]	0.165[b]	0.096[a]	0.598[b]	31.61[a]	0.367[a]	38.23[b]
Upper Regime (%)	20.433	18.589	15.314	77.488	14.465	16.781	25.259
Observation	110	110	110	110	110	110	110
Number of Banks	10	10	10	10	10	10	10
Specification Tests (p-values)							
Linearity	<0.001	0.014	0.008	<0.001	<0.001	0.003	<0.001
Arellano-Bond 1st order Autocorrelation	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Arellano-Bond 2nd order Autocorrelation	(0.306)	(0.311)	(0.231)	(0.181)	(0.111)	(0.141)	(0.336)
Hansen J-test	(0.593)	(0.498)	(0.409)	(0.565)	(0.528)	(0.573)	(0.416)
Difference-Sargan Tests[d]	(0.536)	(0.445)	(0.516)	(0.634)	(0.631)	(0.676)	(0.664)
F-statistic	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)

Note.
In parenthesis are Windmeijer [76] two-step cluster robust standard errors.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.
[d] The difference-Sargan test was for the validation of all instruments for level equations.

The Hansen [83] threshold test results in Table 5, though rejecting linear effect of disaggregated and entangled non-interest income on bank performance in favour of nonlinearity, they are in favour of the null hypothesis of a single threshold. This also corroborates the linearity test results presented in Table 8.

4.2.1. Regression result

Static threshold panel data results from three (3) regression models from FMOLS approach using ROE as a regressand with both

Table 8
Hansen [83] non-interest income threshold estimates at 95 % confidence level.

Variable	Threshold	Lower Bound	Upper Bound
TNI	0.196	0.153	0.239
FCI	0.103	0.060	0.146
FXI	0.029	−0.014	0.072

aggregated (TNI) and disentangled (FCI and FXI) non-interest income measures as well as some interaction terms and control variables as regressors are reported in Table 6. Table 7 reports the dynamic threshold panel data results using the same regressand and regressors, though without interaction terms, but using a dynamic panel data threshold approach. Robustness of thresholds are confirmed by results reported in Table 8 and diagnostic checks done. Insights from the results reported in Tables 6 and 7 are as follows. First, the threshold levels are much higher than the averages reported in Table 1. This shows that Zimbabwean commercial banks' income source portfolios are less diversified, evidence of over-reliance and survival on interest income from traditional activities at the expense of non-interest income sources. This confirms the view in extant literature that most African banks rely on traditional (lending) activity as a main source of revenue, and rarely utilize off-balance sheet and fee-based activities as a performance enhancement and survival strategy [3,128,129]. Evidence from Bikker et al. [3] indicates that such thinly diversified income sources of institutions directly involved in intermediation role is a precursor for banking sector fragility since it will be prone to systemic risk, 'hit and run' from non-banking players like telecommunication providers, and contagion effects. Bank income diversification has been observed to have a positive effect on bank performance [130]. Amidu & Wolfe [131,132] also find market power as a possible culprit hindering bank income diversification and funding strategies in developing and emerging economies.[6] Possible reasons from antecedent literature for over-reliance on traditional interest income activities – courtesy of the loan market and at the expense of non-interest income generating activities are – low competition within the sector, too much regulation from central banks [133,134], high cost of living, low economic performance, inefficiency on cost reduction, as well as profit and revenue maximization [48,135].

It has been argued that the outcomes of African banking markets' reliance on loan market activities were competition rather than more diversified non-interest income-generating activities ultimately hinders their performance [128,129]. Another possible reason for the low participation of Zimbabwean commercial banks in non-traditional income generating activities might be too much regulation of non-interest income sources and conservative approaches to regulation by regulators [24,133,134], which impedes financial development, performance and inclusion for the country [136–139]. Claessens & Klingebiel [140] argue that banking activity restrictions hinder banks from diversifying their income sources and achieving economies of scale and scope. Chortareas et al. [141] and Barth et al. [24,142] provide empirical evidence confirming views raised by Djankov et al. [143] that restrictions on banking activities are not only a bad regulation strategy that hinders banking sector performance and efficiency but exacerbates financial sector repressive power of regulators. Too many banking activity restrictions might be the possible cause of Zimbabwean commercial banks' reliance on traditional activities.

From a theoretical perspective, such observed highly skewed and weakly diversified bank income streams portray traits of a low competitive banking sector [144] and cost minimization, as well as profit and revenue maximization inefficiencies [49]. On the observed traits of high market power held by a few commercial banks, Hicks [144] and Bains [145] argues in the quiet life hypothesis (QLH) that it creates a conducive environment for banks to survive on overpriced financial services and huge interest spreads. The arguments of Hicks [144] are that inefficient managers enjoy a 'quiet life' when banking markets are less competitive and enjoy high profit through high-interest margins, neglecting their effort by reducing their managerial inefficiency and diseconomies of scale. In contrast to the QLH view, the Efficiency Structure Hypothesis (ESH) by Demsetz [49] relates our evidence of Zimbabwean bank managers' reliance and survival on interest income neglecting non-interest income activities to harbored inefficiencies, as opposed to a low level of competition. Bank managers compensate for their managerial inefficiencies and diseconomies of scale by overpricing their financial products and services. Though QLH and ESH seem to be juxtaposed, they both converge on the same conclusion that both ills of low competition and inefficiency reinforce each other resulting in overpriced financial services. Such upwards pressure exerted on prices and mark-ups above costs lowers the social welfare of the banking public [146,147] and raises the level of financial exclusion [136–138,148,149] both[7] threatening financial stability and inclusive growth [150–152]. Access to finance by firms and households is also hindered especially in small to medium enterprises driving growth in developing economies [153].

Second, consistently, we observed the non-interest income threshold levels from the dynamic models in Table 7 to be higher than the static models in Table 6. This supports econometric literature arguments that dynamic threshold panel data threshold estimators are asymptotically unbiased, efficient, and consistent compared to the ones from static models mostly plagued with omission bias.[8] Third, both static and dynamic threshold results show a positive effect of non-interest income on the performance of Zimbabwean commercial banks with magnitude increasing in ascending order of TNI, FCI, and FXI. Unlike static panel threshold models, dynamic panel data threshold results in Table 7 show that the size of the positive impact triggered by aggregated and disentangled non-interest income on bank performance is higher for banks in the upper regime than those below the optimal threshold levels. Consistently, the

[6] Amidu & Wolfe [126,127] studied 55 emerging and developing countries, including 22 African states.

[7] In the case of EU-15, in 2002 social welfare loss due to market power was 0.54 % of GDP [146] and in Mexico it was 0.15 % of GDP in 2005 [147].

[8] For a detailed explanation see Kremer et al. [80], Kourtellos et al. [163], Yu & Phillips [156], Seo & Shin [69] and Seo et al. [79].

disaggregated effects are larger than the aggregated ones with FXI leading followed by FCI income and lastly their combined amalgam TNI. Interestingly, results of non-interest income (NI) interaction terms from static threshold models in Table 6 and models 4–7[9] in Table 7 show higher leverage (DR), small-size (lnTA), low banking sector competition (BSC) and age of Zimbabwean commercial banks act as a drag to performance enhancement of both aggregated and disentangle non-interest income.

Fourth, the bulk of our sample banks' non-interest income in Table 7 are below their required thresholds[10]. This indicates that most Zimbabwean banks operate below their minimum required non-interest income thresholds expected to positively propel their financial performance. Fifth, in relation to optimal thresholds, results from equations (4)–(7) in Table 7 show most sampled banks are highly leveraged, small-sized, have high market power, and fewer years in operation, justifying observations in Table 6 that DR, lnTA, BSC and AGE act as drags which dampen the performance benefits of non-interest income.

Lastly, the Hansen [83] fixed effect threshold model estimates for the three non-interest income proxies, and their upper and lower bounds reported in Table 8, are lower than those from the dynamic TFDGMM model reported in Table 7 by six percent. This confirms arguments raised in the literature that the use of static models to assess the thresholds estimates yields inconsistent and asymptotically biased and inefficient estimators due to the presence of endogeneity and reverse causality between bank performance and some of the explanatory factors in our model like non-interest income, leverage, size, market power and economic performance [43,135].

This also supports arguments in econometric theory that use estimation methods, such as ordinary least squares (OLS), maximum likelihood estimation (MLE), instrumental variables (IV), two-stage least squares (2SLS), or three-stage least squares (3SLS) in the presence of endogeneity or reverse causality, provide inconsistency, asymptotically biasedness, and inefficiency estimators (see Refs. [93,94,95,98,99,154]. Thus, stylised facts observed from thresholds reported in Tables 6–8 are that accounting for endogeneity and simultaneity while neglecting dynamic effects yields upward biased threshold estimates (Table 6), whereas failure to account for both endogeneity and simultaneity bias as well as dynamic effects produces downward biased thresholds estimates (Table 8). Therefore, the best threshold estimates which are consistent, asymptotically unbiased and efficient are produced using dynamic threshold models like TFDGMM (reported in Table 7) which account for dynamic effects, firm effects, endogeneity and simultaneity bias [155].

5. Conclusion and policy implications

Provoked by dwindling performance, high three-bank concentration ratios and rising formal banking exclusion, the findings of this study is five-fold.

First, we find disaggregated non-interest measures to have a higher positive impact on bank performance than aggregated, with FXI leading, followed by FCI and lastly TNI. That is, an amalgam of the two non-interest income disaggregates yield the fewest performance benefits compared to their individual effect. This novel evidence and insight is unique since most previous studies employed aggregated non-interest income components neglecting their disaggregates. This suggests the two non-interest income disaggregates partly reinforce each other, confirming the weak negative correlations between FCI and FXI. This implies the best performance benefits accrue to Zimbabwean commercial banks if their managers ensure their income sources are well diversified by focusing more on FXI and then FCI.

Second, we observe both disaggregated and aggregated non-interest income to affect performance asymmetrically (nonlinearly) in both static and dynamic models. Our unique contribution suggests that most evidence in the antecedent literature which only targets aggregated non-interest income employing linear model is less reliable due to omission bias and model misspecification emanating from adopting a wrong functional form and measurement error.

Third, the average static optimal thresholds of TNI, FCI and FXI are 35 %, 28 % and 17 %, whose ranges are 33–37 %, 20–31 % and 14–22 %, respectively. The corresponding optimal thresholds from dynamic models are 26 %, 17 % and 10 %.

Fourth, we observe the impact of both disaggregated and aggregated non-interest income for banks in the upper regime is higher compared to that of banks in the lower regime and the thresholds are minima. Fifth, leverage, size, competition, and age acts as drags (substitutes) which dampen the positive performance benefits of non-interest income. Substitutability evidence is also cemented by higher performance benefits of individual non-interest income disaggregates compared to their amalgam component.

The policy implications derived from this study evidence is three-fold. First, bank managers can deal with the idiosyncratic risk that banks encounter by diversifying their income sources through various non-interest income ventures. Such non-interest income ventures, among others, include securities markets, fund management, insurance, funding informal economy firms which constitute more than 60 % of Zimbabwe's GDP, agriculture and mining sectors. However, care must be taken when promoting banks to venture into non-interest income activity since such activities include opaque sectors and less collateralized firms which might compromise financial stability.[11] Second, to address the drag effect of leverage, size, and market power on the performance benefit of non-interest income, central banks should radically reform legislations and regulations stifling non-interest income activities. To address observed possible traits of the negative impact of market power and inefficiency on the performance benefits of non-interest income, financial

[9] Results of model 4–7 in Table 7 are reported for the purpose of robustness checks and determination of the leverage, size, state of market power and age or period in operation of the bulk of our selected sample of Zimbabwean commercial banks.

[10] The average percentage of sample of commercial banks which falls in the lower category of our threshold levels in the case of dynamic and static threshold panel data models are 81 % and 75 %, respectively.

[11] In Africa such niche markets with less competition, higher return and risk are sectors such as agriculture and financially excluded firms like SMEs [164]. But caution must be taken when financing such opaque sectors and less collateralized firms especially in less mature African credit markets due to mitigating information asymmetry difficulty.

sector regulating authorities should enhance competition and efficiency promoting regulations. Third, as a diversification strategy against systematic risk associated with the Zimbabwean economy, bank managers are advised to enter other African markets and/or partner with other regional and international banks. If they are already present, they can change bank status from subsidiaries to representative office/branch or vice versa.[12] This strategy of international diversification against systemic risk opportunity valves for capitalizing on exchange rate and interest rate differentials will increase FXI. They can be done through borrowing cheaper, raising finance in strong currency markets and placements in markets where currencies are weak.[13] Managers can also diversify their source of earnings through assets and liability diversification and cut their operational costs, ultimately increasing non-interest income.

6. Study limitations and further research suggestions

This study did not cover the influence of political and economic institutions as possible factors dampening the positive impact of non-interest income disaggregates on bank performance. We also focused on a panel of banks using a single country. Therefore, cross-country investigations are required to ascertain which form of bank regulation, supervision, and ownership structure fosters banking sector performance using more direct proxies like efficiency since the paucity available antecedent literature is inconclusive.

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Data availability statement

Data will be made available upon request.

CRediT authorship contribution statement

Canicio Dzingirai: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Mufaro Dzingirai:** Writing – review & editing, Writing – original draft, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendices.

Table A1
Definition of Variables, Measurement Scales, Sources and Expected Signs

Variable	Definition	Source	Expected Sign
	Dependent Variable		
ROE	Return on Equity measured as profit (before tax) to equity	Reserve Bank of Zimbabwe (RBZ)	
	Independent Variables		
NI	Non-interest income vector measured as total fees and commission income (FCI) and foreign exchange income (FXI) separately and aggregated total noninterest income (TNI)	RBZ	Positive
DR	Debt ratio measured as total debt to total assets ratio (%)	RBZ	Positive
lnTA	Bank size measured as natural logarithm of total assets	RBZ	Positive
BSC	Banking sector competition measured by Adjusted Lerner Index (ALI)	RBZ	Positive
AGE	Age of the bank measured by the number of years in operation	RBZ	Positive
EP	Economic performance measured by the gross domestic product growth rate	World Bank	Positive
CPI	Inflation proxied by the consumer price index	World Bank	Negative
	Threshold Transitional Variables		

(*continued on next page*)

[12] Liang et al. [165] find that a bank's profitability is enhanced more by a branching strategy whereas a representative office strategy is better at controlling costs.
[13] Andries & Capraru [166] state that such strategies can be implemented by exploiting arbitrage opportunities caused by currency and interest rate differentials.

Table A1 (*continued*)

Variable	Definition	Source	Expected Sign
FCI	Fees and commission income measured as a ratio of total fees and commission non-interest income to total assets	RBZ	
FXI	Foreign exchange income measured as a ratio of foreign exchange non-interest income to total assets	RBZ	
TNI	Total non-interest income measure by combining FCI and FXI using principal component analysis (PCA)	RBZ	
DR	Debt ratio measured as total debt to total assets ratio	RBZ	
lnTA	Bank size measured as natural logarithm of total assets	RBZ	
BSC	Banking sector competition measured by Adjusted Lerner Index (ALI)	RBZ	
AGE	Age of the bank measured by the number of years in operation	RBZ	

The respective minimum values of total assets of smallest and largest sample bank are $62 million and $24 billion with a mean of $417 million, to avoid the adverse effects of outliers, size and value mismatches on variance of estimators, we use its logarithms. The means of all other variables are close and within the 0–100 range, justifying our use on their non-logarithm values (for more details see Refs. [98,99,110].
Source: Authors' own compilation

Table A2
Components for total non-interest income (TNI)

Component	Eigenvalue	Difference	Proportion	Cumulative
PC1	2.364	2.068	0.928	0.928
PC2	0.296		0.072	1.000
Average	1.330			

Table A3
Eigenvectors of total non-interest income (TNI) index generation

Variable	Component 1	Component 2
Fees and Commission Income (FCI)	0.375	0.183
foreign exchange income (FXI)	0.664	0.312
Average	0.520	0.248

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