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# Loan Loss Provisioning and Efficiency: A Study of Frontier Market Banks

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Abstract: This paper investigates frontier market bank managers' use of the discretionary component of loan loss provisions to manage earnings and its association with efficiency. Studies have documented that bank managers use loan loss provisions to smooth earnings, yet the association of provisioning with efficiency in frontier markets has not been empirically examined. Employing stochastic frontier analysis as a method of efficiency assessments in 22 frontier market countries, results show bank efficiency declined steadily from 2001 to 2018. This finding is contrary to economic efficiency theory and suggests that loan quality difficulties have persisted despite nations enjoying increasing economic development. Regression analysis results further reveal that earnings management (EM) via loan loss provisioning is inversely related to efficiency. Study findings support prospect theory, indicating that managers engage in risk-seeking behavior while making risk-averse judgments. Overall, the study results imply that banks should expand loan provisioning strategies to optimize resource allocation and business performance.

*Keywords:* Stochastic frontier analysis, earnings management, performance evaluation, banks.

## 1. Introduction

The frontier market banking industry has undergone significant transformations in the past two decades. Banks have expanded their operations and taken advantage of economies of scale, scope, and product diversification (Lam, 2022). Recent gradual liberalization of the financial sector, globalization of financial markets, changes in technology, product innovation, and the expansion of business activities have driven these changes and resulted in frontier market banks regularly acting as financial intermediaries and catalysts for economic growth in their markets. Given their role in the markets in which they operate, the degree of income smoothing (a form of earnings management) should be closely monitored, for it

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has negative implications for the efficiency of the bank's operations.

As efficiency has important regulatory implications, this study investigates the relationship of income smoothing in banking and technical efficiency. Both issues provide crucial data for the development of public policy. In examining this relationship, this study considers the ranking and trend of banks' efficiency, which is an essential application of frontier analysis. Numerous banking studies have concentrated on scale and scope efficiency under the assumption that all banks are efficient, utilizing various methods for calculating bank output. For instance, two such studies are by Partovi and Matousek (2019) and Jin et al. (2018). This study, however, is the first to comprehensively examine the income smoothing-efficiency relationship in a wide range of frontier markets.

The examination of the above-noted relationship contribution to current empirical research is fourfold. First, the decomposition of technical efficiency helps identify efficiency trends by time and region for detecting abnormalities and potential beneficiary outcomes. Second, the linkages between income smoothing and bank efficiency examined via fixed effects and truncated regression estimation validate income smoothing adverse correlation with efficiency. Third, this paper finds bank efficiency consistent across large and small banks, indicating that scale economy is not a factor in efficiency. Fourth, the decreasing efficiency trend indicates that additional inputs are required, signaling poor management, which may result in increased problem loans.

The remainder of this study is structured in the following approach. Section 2 summarizes the prior literature and describes how the study's hypotheses were developed, while Section 3 describes the theoretical lens through which this study is viewed. Section 4 discusses the research methodology and data collection. Section 5 offers and examines empirical findings. Additional analysis with control variables is provided in Section 6. Section 7 finishes with a summary of significant findings and theoretical and practical applications.

## 2. Related research and hypotheses development

### *2.1. Frontier market contextual setting*

Frontier markets are unique from developing or developed markets (MSC1, 2019); hence, this analysis relies entirely on MSCI's frontier market classifications. Frontier markets are classified according to their political and economic context, rather than their gross national income (GNI). Frontier market countries have limited financial markets, weak legal and regulatory infrastructure, and limited ease of doing business for foreign investors (MSCI, 2019). To put frontier markets into context, they account for around 11% of the world's population but only 0.43 and 0.11% of the world's nominal GDP and market capitalization, respectively. The MSCI Frontier Market Index's 5-year returns differed by 55.6% from the SP Index; the latter generated positive returns, while the former generated negative ones[1]. Divergent market returns corroborate Speidell and Krohne (2007)'s conclusion that frontier and mature markets exhibit minimal correlation. Additionally, frontier markets have a low degree of integration with global markets (Martens et al., 2020), and the spillover effects from developed markets to global markets give diversification prospects.

As of 2011, the total market value of frontier and developing markets was 715 billion USD and 20 trillion USD for emerging markets (Speidell, 2011). The World Bank assessed the frontier market capitalization at 1.04 trillion dollars in 2016 (Bank, 2020). Increased development and anomalous growth in frontier markets can reward investors with significant

[1] Source: Refinitiv January 2014 to December 2018. S&P return 40.7%. MSCI Frontier Market Index return -14.9%.

returns (or losses); nevertheless, upside potential can be stifled when firms manipulate their earnings to seem uniform or smooth. Investor protection, capital market stability, and macroeconomic development are jeopardized by EM (Leuz et al., 2003).

Capital outflows hamper macroeconomic performance in frontier countries, a problem exacerbated by the 2008 Global Financial Crisis (GFC) (Abidi et al., 2016). The money flows to countries with greater development prospects and lower costs despite this. Their young and increasing populations, a boom in commerce, investment, technological catch-up potential, rapid mobile communications penetration, immense natural resources, and growing middle class have attracted many international investors (Speidell, 2011). All of this points to the potential of frontier markets.

Many institutional transformations followed the Asian Financial Crisis and the GFCs of 1997 and 2007-2008. Reforms changed bank operations, allowed foreign institutions to enter domestic markets, introduced new financial products, and boosted demand for accounting and auditing standards (Duffie, 2018). Geographic and interest rate limits were also removed. Commercial banks have faced significant competition from both in-state and out-of-state banks due to regulatory reforms (Young, 2013). Stability and resilience are important qualities in frontier economies where banks are the primary loan providers.

### *2.2. Frontier market efficiency studies*

Resource allocation theory states that businesses maximize capital to exploit opportunities in resource-constrained environments (Webb et al., 2013). Similarly, Kumbhakar et al. (2001) argue that economic efficiency requires technical efficiency. To evaluate a bank's efficiency, compare its costs to a best-practice standard while maintaining output (Berger and Mester, 1997). Increasing competition necessitates improved efficiency, profitability, and fund flow (Djalilov and Piesse, 2016). How a bank responds to increased competition is determined by its resource efficiency (Mester, 1996).

Several frontier market country-specific research studies show influences on efficiency. In Vietnam, bank efficiency did not differ between pre and post IPO (Nguyen et al., 2016) while Ngan et al. (2014) note that Vietnamese bank inef- ficiency is strongly related to bank concentration and ownership. The technical efficiency of Islamic banks in Pakistan was lower than that of conventional banks (Gishkori and Ullah, 2013), while in Kenya, public banks outperformed private banks (Miencha et al., 2015). In Bulgaria, private banks outperformed state-owned banks, and EU member- ship is linked to significant efficiency gains (Tochkov and Nenovsky, 2011). Limam et al. (2001), in an examination of Bahrain banks, found bank profitability unassociated with higher efficiency, and thus surmise that the economic environment in which banks operate may be more important than the skills of their managers. In an early study on Kuwaiti banks, Burki and Dashti (2003) noted a significant number of banks had experienced a high degree of cost and allocative inefficiency indicating the necessity to regulate this sector in accordance with the requirements of globalization. Bonin et al. (2005) found in Bulgaria, Croatia, and Romania that privatization affects performance; specifically, voucher privatization does not increase efficiency, and early-privatized banks are more efficient than later-privatized banks in the absence of a selection impact. In a Nigerian based study, (Ajao and Ogunniyi, 2010) found that despite mergers and acquisitions, approximately 25 percent of Nigerian banks are inefficient, but that market power improves efficiency. In Jordan, large bank assets and employees reduce efficiency (Bdour and Al-khoury, 2008). Foreign-owned banks outperform older banks in Croatia (Jemric and Vujcic, 2002). Olson and Zoubi (2011)'s study found that MENA banks are slightly less cost-efficient than European banks but comparable to banks in developing economies. In a study con- ducted in

Sri Lanka, Balagobei (2019) discovered that board actions impact on non-performing loans of listed banks, whereas board size, independence, and CEO duality have no effect on efficiency. Further research finds no link between non-performing assets and a bank's technical efficiency and posits that a technological gap is a significant source of inefficiency (Chao et al., 2018).

A significant corpus of literature on bank efficiency attests to its importance. Frontier markets often liberalize and allow foreign entrance, enhancing competitive dynamics. In competitive markets, increased efficiency and productivity are goals and sources of data on bank performance. Efficiency assessments help organizations set realistic goals by recognizing performance constraints.

### *2.3. Efficiency measurements*

Production economics is based on measuring efficiency where statistical techniques remove price effects and other exogenous market factors. Since Cobb and Douglas (1928)'s seminal work, significant progress has been made in quantifying the maximum output for a given set of inputs. As a result, best practice studies use both parametric and non-parametric methods. Parametric measurement approaches necessitate a specific frontier function specification. In contrast, the non-parametric approaches do not (Murillo-Zamorano and Vega-Cervera, 2001). The main benefits of stochastic frontier analysis (SFA), a parametric approach, are measurement error allowance and firm-specific estimates (Ding and Sickles, 2018). SFA distinguishes inefficiency from random errors, avoiding biased results. SFA also allows for formal statistical testing of hypotheses and confidence intervals (Hjalmarsson et al., 1996). Silva et al. (2017) found that both methods produce a consistent trend in global efficiency scores despite differences in individual efficiency results and values the trend over the efficiency score. A bank is optimally efficient if it produces output levels and mixes that maximize profits while minimizing costs.[2] Efficiency, however, does not always imply effectiveness, and most banks are not fully efficient.

### *2.4. Earnings management*

Banks are more likely than manufacturers to smooth earnings (Ma, 1988; Gulzar et al., 2011; Abernathy et al., 2014)) and that firms that actively manage earnings have higher agency costs (Anwar et al., 2019). To reduce earnings volatil- ity, banks may reduce (increase) reported earnings in years of unusual earnings strength (weakness) via loan loss provisions (LLP) and loan loss reserves (LLR). Smoothed earnings reduce the likelihood of regulatory, market, or shareholder scrutiny (Liu and Ryan, 2003). Given that banks operate in highly regulated industries, where regulators and standard-setting bodies closely monitor non-performing loans, capital adequacy, and liquidity ratios, a bank's ability to demonstrate public confidence through low stock price volatility while maximizing wealth is exceptional. EM incentives arise when efforts are made to circumvent regulations while appearing sound. Figure 1 shows the average net income over average assets. The slight variance in the mean value may indicate efforts to smooth earnings.

Accounting for troubled loans generally involves provisioning during expansionary periods and absorbing them during contractionary periods. While methods may differ, the long-term impact on net income is the same (Ma, 1988). Statistical tools are often used to estimate provisioning, but actual amounts are left to management discretion (Saurina, 2009). Bank EM usually occurs through LLP and LLR (Adams et al., 2009); (Wu et al., 2016). Moreover, Wu et al. (2016) claim that EM bank managers should expect negative LLP and LLR coefficients when regressed against performance.

As shown in the literature, LLP may be used by listed conventional banks for opportunistic

[2] Scale, scope, and operational efficiency range from 0% to 100%.

managerial action (Bou- vatier and Lepetit, 2012, 2008), is measurable (Kanagaretnam et al., 2015) and a positive earnings-LLP relationship may indicate smoothed income. Laeven and Majnoni (2003) also note that banks can smooth earnings by contributing LLP via LLR. Lowering LLP increases earnings and may cause inefficiency. To meet or beat analyst earnings forecasts, firms manage LLR (the largest bank accruals component) downward (Jackson and Liu, 2010). The US Securities and Exchange Commission suspects some banks of manipulating their LLR; excess reserves is viewed negatively by the accounting profession (Turner and Godwin, 1999).

As per the preceding, an inverse relationship between EM vehicles and efficiency is expected, as increases in LLR and LLP reduce net income and the earnings-to-assets ratio, resulting in poor asset quality, decreased liquidity, diminished book value of equity, and ultimately decreased efficiency. The following are the defined hypotheses for this study:

*Hypothesis 1 (H1a): Use of loan loss reserves as an EM vehicle negatively impacts bank efficiency.*

*Hypothesis 1 (H1b): Use of loan loss provisions as an EM vehicle negatively impacts bank efficiency.*

## 3. Theoretical framework

The first theory from which this study is viewed is the resource allocation theory by Kanfer and Ackerman (1994). Corporate managers can allocate resources, and efficient allocation is a key indicator of firm development. A bank's efficiency in allocating innovation resources or scientific and technological resources will explain its resource allocation efficiency. Both monetary and perquisite consumption incentives increase resource allocation efficiency across all businesses. The theory says combining resources, capabilities, and management tools can boost enterprise performance. For increased efficiency, bank management must rationally allocate diverse resources to realize resource allocation benefits.

This study also uses Kahneman and Tversky (1979b)'s prospect theory. Prospect theory is a key part of behavioral finance and banking industry decision-making. Prospect theory suggests that gains and losses relative to a reference point determine an individual's value, not wealth concentrations. It also implies that gains are concave and losses are convex. When a person's wealth goes from a loss to a gain relative to a reference point, the value increases the most. If stakeholder preferences are consistent with prospect theory, management has an incentive to report earnings that exceed the threshold or reference point, including zero earnings levels or zero earnings changes, to get more incentives. We expect smoothing managers to have lower technical efficiency due to risk-taking. This theory's essential elements can be constructed as the value function $v(x)$ and the probability weighting function $\pi(p)$. The expression of value is illustrated in Eq. 1.

$$v(x) = \begin{cases} x^{\alpha}, x \geq 0 \\ -\lambda(-x)^{\beta}, x < 0 \end{cases}, \qquad (Eq.\ 1)$$

where $\alpha$ and $\beta$ respectively indicate the concavity of income and loss areas of the value function, $0 \leq \alpha, \beta \leq 1$. $\lambda$ *reflects* the degree of loss avoidance by decision-makers and is used to depict a steeper loss area of the value function than the gain area, $\lambda \geq 1$.

## 4. Research design

### *4.1. Study data*

This study incorporates annual data spanning eight years (2011-2018). This time frame encompasses more recent periods and those that were insufficiently covered by earlier data. By beginning in 2011, this study does not assess the effects of the 2011 global financial crisis or the late-2018 emerging market currency crisis's spillover effects, which significantly impacted

exchange rate movements. Data was sourced from BankFocus for 22 frontier countries. All publicly-traded commercial banks in each country were included to eliminate survivorship bias. Banks with incomplete SFA and EM financial data are excluded, as are those with negative equity and total sales. To ensure sample homogeneity, specialized financial institutions and finance businesses were eliminated per Ariff and Luc (2008). After eliminations, 567 banks with 3,429 observations remain. Small banks (sample size = 233) outnumber big banks (sample size = 334), and Europe (180) and the Americas (14), respectively, have the most and least banks. An unbalanced panel data set is used as bank movement varies over time. Table 1 lists the sample by year, region, and size.

Table 1: Banks by year, size, and geographic location

Panel A

Sample by country and bank size

| Country | Banks | N | Big | Small |
|---|---|---|---|---|
| Argentina | 9 | 78 | 4 | 5 |
| Bahrain | 26 | 169 | 19 | 7 |
| Bangladesh | 53 | 336 | 37 | 16 |
| Bulgaria | 24 | 140 | 13 | 11 |
| Croatia | 36 | 220 | 11 | 25 |
| Estonia | 12 | 69 | 3 | 9 |
| Jordan | 19 | 130 | 15 | 4 |
| Kenya | 45 | 243 | 14 | 31 |
| Kuwait | 12 | 82 | 10 | 2 |
| Lebanon | 38 | 226 | 27 | 11 |
| Lithuania | 9 | 54 | 6 | 3 |
| Mauritius | 24 | 126 | 11 | 13 |
| Morocco | 17 | 92 | 10 | 7 |
| Nigeria | 35 | 194 | 22 | 13 |
| Oman | 17 | 108 | 11 | 6 |
| Pakistan | 32 | 194 | 24 | 8 |
| Romania | 28 | 155 | 16 | 12 |
| Serbia | 29 | 200 | 12 | 17 |
| Slovenia | 21 | 108 | 16 | 5 |
| Sri Lanka | 23 | 147 | 13 | 10 |
| Tunisia | 26 | 177 | 11 | 15 |
| Vietnam | 32 | 181 | 29 | 3 |
| Total | 567 | 3429 | 334 | 233 |

Panel B

Sample by year, size and region

| Year | Bank | N | Big | Small | Africa | Americas | Asia | Europe | Middle East |
|---|---|---|---|---|---|---|---|---|---|
| 2011 | 46 | 286 | 35 | 11 | 6 | 1 | 13 | 14 | 13 |
| 2012 | 44 | 304 | 30 | 14 | 10 | 1 | 6 | 19 | 9 |
| 2013 | 78 | 464 | 44 | 34 | 11 | 1 | 25 | 25 | 14 |
| 2014 | 76 | 452 | 41 | 35 | 13 | 2 | 24 | 23 | 14 |
| 2015 | 76 | 452 | 45 | 31 | 19 | 2 | 21 | 23 | 11 |
| 2016 | 90 | 530 | 52 | 38 | 17 | 3 | 24 | 26 | 20 |
| 2017 | 86 | 509 | 55 | 31 | 16 | 2 | 21 | 27 | 20 |
| 2018 | 71 | 432 | 40 | 31 | 14 | 2 | 17 | 23 | 15 |
| Total | 567 | 3429 | 334 | 233 | 106 | 14 | 151 | 180 | 116 |

*Notes*: Banks with total assets greater than 1 billion USD are considered big as per Siems et al. (1992) and Navaretti et al. (2019); small otherwise. Asia includes: Bangladesh, Pakistan, Vietnam, Sri Lanka / Africa includes: Kenya, Mauritius, Morocco, Nigeria, Tunisia / Americas countries include: Argentina / European countries include: Croatia, Estonia, Lithuania, Romania, Serbia, Slovenia / Middle Eastern countries include: Bahrain, Jordan, Kuwait, Lebanon, Oman.

### *4.2. Variable selection*

As a service industry, banks may define inputs and outputs in varying methods. Using the 'value-added' method, all bank liabilities and assets are classified as outputs rather than inputs (Sakouvogui, 2020). Banks use labor and capital to gather deposits and convert them into loans and other assets. Banks are seen as financial mediators between savers and investors; the intermediation model better portrays a bank's role in providing financial services (Vu and Turnell, 2010). Accordingly, this analysis follows Ding and Sickles (2018) in its selection of variables, for they specify inputs and outputs according to the intermediation model of Sealey Jr and Lindley (1977) with three inputs and two outputs. The three input variables are (i) borrowed funds, (ii) labor, and (iii) capital. The two outputs chosen include (i) Securities and (ii)

loan Securities. An explanation of the variables can be found in Table 9.

Table 2 reports descriptive statistics for the study sample. The mean and median *LLP* are both 0.01, with a standard deviation of 0.05, indicating significant variation across the sample. A similar conclusion can be drawn about the *LLR* (mean = 0.07, σ = 0.14). *Net Income Growth* had an overall negative mean of -0.20 (median = 0.03, σ = 7.08). Notwithstanding all banks in the sample being classified as frontier market banks, there is significant diversity.

Table 2: Descriptive statistics of key variables

| Stochastic frontier arguments | Mean | Std.Dev | 1st Quartile | Median | 3rd Quartile |
|---|---|---|---|---|---|
| Price of Deposits (W1) | 0.59 | 13.43 | 0.02 | 0.04 | 0.06 |
| Price of Labour (W2) | 0.02 | 0.02 | 0.01 | 0.01 | 0.02 |
| Price of Physical Capital (W3) | 6.85 | 113.55 | 0.27 | 0.60 | 1.42 |
| Total Financial Securities (y1) | 1,139,524.0 | 2,659,164.0 | 60,834.6 | 305,144.1 | 896,525.0 |
| Total Loans (y2) | 2,757,976.0 | 4,991,452.0 | 309,087.3 | 1,155,074.0 | 3,036,222.0 |
| Total Operating Cost (TOC) | 107,286.5 | 189,086.6 | 15,113.7 | 46,789.7 | 118,234.2 |
| Regression arguments | Mean | Std.Dev | 1st Quartile | Median | 3rd Quartile |
| Total Assets | 4,835,772.0 | 8,525,795.0 | 529,546.9 | 1,895,257.0 | 5,127,845.0 |
| Fixed Assets | 65,437.3 | 135,583.1 | 5,843.0 | 22,006.5 | 66,459.7 |
| Total Deposits | 3,637,405.0 | 6,483,415.0 | 345,757.9 | 1,375,604.0 | 3,858,692.0 |
| Total Liabilities | 4,302,115.0 | 7,715,444.0 | 438,516.5 | 1,639,897.0 | 4,537,809.0 |
| Loan Loss Provisions (%) | 0.01 | 0.05 | 0.00 | 0.01 | 0.01 |
| Loan Loss Reserves (%) | 0.07 | 0.14 | 0.01 | 0.04 | 0.07 |
| Net Income Growth (%) | -0.20 | 7.08 | -0.31 | 0.03 | 0.31 |

*Notes*: All variables are reported in thousands of USD.

The regressors' relationship is examined using Pearson's correlation matrix (Table 3). Notably, most variables are statistically significantly connected, with *LLP* being an exception. LLP is uncorrelated with Total Loans, Total Assets, and Total Liabilities. The association between *Net income growth*, *Price of labor*, and *Price of physical capital* costs were not significant.

Table 3: Correlation matrix of key variables

| | w1 | w2 | w3 | y1 | y2 | TOC | TA | FA | TD | TL | LLP | LLR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Price of Labor (w2) | 0.1771* | 1 | | | | | | | | | | |
| Price of Physical Capital (w3) | -0.0205 | 0.1958* | 1 | | | | | | | | | |
| Total Financial Securities (y1) | -0.0291 | -0.3732* | -0.1971* | 1 | | | | | | | | |
| Total Loans (y2) | -0.1270* | -0.4345* | -0.1642* | 0.7902* | 1 | | | | | | | |
| Total Operating Cost (TOC) | -0.0471* | -0.1291* | -0.0765* | 0.8126* | 0.8914* | 1 | | | | | | |
| Total Assets (TA) | -0.1043* | -0.4481* | -0.1929* | 0.8801* | 0.9771* | 0.9136* | 1 | | | | | |
| Fixed Assets (FA) | -0.0073 | -0.1871* | -0.4160* | 0.7586* | 0.8021* | 0.8550* | 0.8332* | 1 | | | | |
| Total Deposits (TD) | -0.1727* | -0.4441* | -0.1927* | 0.8657* | 0.9529* | 0.8847* | 0.9731* | 0.8152* | 1 | | | |
| Total Liabilities (TL) | -0.1049* | -0.4524* | -0.1922* | 0.8784* | 0.9759* | 0.9080* | 0.9973* | 0.8295* | 0.9808* | 1 | | |
| Loan Loss Provision (%) | 0.1099* | 0.2219* | 0.0748* | -0.0398* | -0.0047 | 0.0809* | -0.0235 | 0.0540* | -0.0211 | -0.022 | 1 | |
| Loan Loss Reserve (%) | -0.1081* | 0.1945* | -0.0772* | -0.0367 | -0.0926* | 0.0147 | -0.0764* | 0.0548* | -0.0835* | -0.0821* | 0.3758* | 1 |
| Net Income Growth (%) | -0.0078 | -0.1236* | -0.0249 | 0.0818* | 0.1183* | 0.0747* | 0.1114* | 0.0526* | 0.1098* | 0.1112* | -0.1108* | -0.1228* |

*Notes*: Significance is identified at three levels: 0.05*, 0.01**, and 0.001***.

*4.2. Bank efficiency*

This study estimates efficiency using the SFA method. A production plan is technically inefficient if a higher output level is achievable for the given inputs (output-oriented measure) or if the observed output level can be achieved with fewer inputs (input-oriented measure). Thus, the core principle of SFA technical efficiency (*TE*) is the ratio of realized output to maximum attainable output, as in Eq (2):

$$TE_{it} = \frac{y_{it}}{y_{it}^{*}} = \frac{f(x_{it};\beta)e^{-u_{it}}e^{v_{it}}}{f(x_{it};\beta)e^{v_{it}}} = e^{-u_{it}} \in (0,1] \qquad (Eq.\ 2)$$

where $y_{it}^{*}$ is the maximum attainable output for unit *i* given $X_{it}$ and where $f(x_{it};\beta)$ is a log-linear production function. $\varepsilon$ denotes the error term.

Estimation for the parameters of the SFA model can be achieved by applying the maximum likelihood estimation method, which estimates the likelihood function in terms of two variance parameters (Battese and Coelli, 1995) as per Eq (3):

$$\gamma = \sigma_u^2/\sigma_s^2; \sigma_s^2 = \sigma_v^2 + \sigma_u^2 \qquad (Eq.\ 3)$$

where gamma ($\gamma$) reflects the impact of random disturbances (*v*, *u*) and will fall between zero and one. The closer $\gamma$ is to one, the smaller the gap between actual and maximum possible output. When $\gamma$ is at one, the sample bank is fully efficient, whereas a $\gamma$ close to zero is essentially meaningless since it indicates that SFA output is uncontrolled by random factors.

Following researchers Ding and Sickles (2018), this paper specifies a cost frontier model with two-output ($\gamma$), and three-input *(w)*, parameters. We consider a cost frontier model with input-oriented technical efficiency and a translog specification of the cost function developed by Christensen et al. (1973), which assumes a composite error term con- sisting of inefficiency and random components. The inefficiency component of the error term follows an asymmetric distribution (typically a truncated or half-normal distribution). In contrast, the random component follows a symmetric distribution (usually the standard normal distribution). In addition, it is assumed that inefficiencies and random errors are orthogonal to input prices, outputs, and bank-specific variables. The translog frontier model can be written as per Eq (4). *TOC* is a vector of the dependent variable total cost, $\gamma_m$ is the $m^{th}$ banks' outputs ($m$ = 1, 2). $w_n$ is $n^{th}$ input price ($n$ = 1, 2). $w_3$ is the price of borrowed funds. $\beta$ is a vector of the coefficients to be estimated. $v$ is a random error identically and independently distributed as N(0, $\sigma_{2n}$). The term $\mu$ measures an individual bank's distance to the efficient frontier and represents a bank's one-sided inefficiency. Subscripts denoting firm and year have been dropped for presentation ease. Table 9 describes the input and output variables.

$$\ln\left(\frac{TOC}{w_3}\right) = \beta_0 + \sum_m \alpha_m \ln y_m + \sum_n \beta_n \ln\left(\frac{w_n}{w_3}\right) + \frac{1}{2}\sum_m\sum_j \alpha_{mj} \ln y_m \ln y_j + \frac{1}{2}\sum_n\sum_k \beta_{nk} \ln\left(\frac{w_n}{w_3}\right)\ln\left(\frac{w_k}{w_3}\right) + \sum_n\sum_m \gamma \ln\left(\frac{w_n}{w_3}\right)\ln y_m + u + v \qquad (Eq.\ 4)$$

*4.3. Income smoothing*

This study additionally examines the effect of income smoothing via LLP or LLR on *TE* scores in the banking industry of frontier markets. Like Wu et al. (2016), this study applies both the random effect regression and the truncated re- gression model for greater robustness. The Breusch-Pagan Lagrange Multiplier test supports the Hausman test, which indicates that the random effects (RE) model is most appropriate. Support for the truncated regression follows sug- gestions by Simar and Wilson (2007) and Perelman and Serebrisky (2010). A test for multicollinearity was conducted via the Variance Inflation Factor (VIF). On the total data sample, the VIF test produces a result of 3.41, which is sig- nificantly less than 10. According to Menard (2002), larger VIF values cause collinearity issues; in this context, VIF values imply that the independent variables are not highly correlated. The final model is stated as Eq (5).

$$TE_{it} = \alpha_0 + \alpha_1 LLP_{it} + \alpha_2 LLR_{it} + \alpha_3 Total\,Assets_{it} + \alpha_4 GROW_{it} + \alpha_5 Total\,Liabilities_{it} + \sum Year_i + \sum \text{Country}_i + \varepsilon_{it} \quad (Eq.\ 5)$$

where *TE* is the technical efficiency based on SFA analysis. *LLP* and *LLR* are loss provisions scaled by loans, and loan loss reserves scaled by loans. *Total Assets* (TA) is the natural logarithm of total assets and is used to control for firm size. *GROW* is the net income growth rate and a control variable for the growth opportunities of banks. *Total Liabilities* (TL) are total liabilities scaled by total assets and a proxy for the individual bank's risk-taking. $\sum Year$ and $\sum$ *Country* are year-specific and country-specific effect dummy variables. These dummy variables control for different loss provision levels across countries and capture time-invariant effects not captured by the regression. The error term is denoted by $\varepsilon$. Subscripts *i* and *t* denote company and time, respectively. This study predicts that the $\alpha_1$ and $\alpha_2$ coefficients will be negative if a bank manages earnings using LLP and LLR.

## 5. Results

### *5.1. Estimation of results for SFA*

Table 4 displays the SFA efficiency model findings for all frontier market banks from 2011 to 2018. The table also shows the efficiency scores for large and small banks by country and year. Overall, efficiency trended downward, from 0.84 in 2011 to 0.763 in 2018, a 9.6% drop.

### *5.2. Efficiency by region*

The findings in Table 4 also report the efficiency across the five geographical regions in the sample. The region with the highest mean efficiency score is Europe, at 82.6% efficiency. The European region also experienced the smallest decline in efficiency of the study period at 5.8%. The Americas is the least efficient region, with a mean score of 66.7% efficient and a 26.6% decline over the study period. This latter finding, however, should be interpreted cautiously, as the Americas region contains only one country (Argentina). Lithuania has the highest efficiency score (84.1%), while Romania has the lowest (80.0%). Like the overall sample, efficiency trends by region show each region losing efficiency over time, with the Americas region losing the most efficiency (26.6%). However, the European region's efficiency fell the least (5.8%).

### *5.3. Efficiency by size*

According to conventional economic efficiency theory, size encourages efficiency by reducing the costs of data col- lection and processing (Rozzani and Rahman, 2013). The implications of this theory suggest that large banks will exhibit increasing economies of scale. To examine the alignment with economic efficiency theory, we also present mean efficiency scores by large and small banks of 80.4 and 79.8% efficient, respectively (see Table 4). Although these mean values demonstrate that large banks are more efficient, a Mann-Whitney test for equality of means reveals no statistically significant difference between large and small banks. When scores were examined by size and region, three out of the five regions reported higher scores for large banks. Accordingly, the findings align with researchers (Girardone et al., 2004; Ruslan et al., 2019) who also found no clear association between size and efficiency. The lack of a clear relationship could result from uncontrollable external macroeconomic forces or internal factors such as ineffective asset management.

### *5.4. Regression results*

Tables 5 and 6 report the outcomes for the full data sample, by bank size and geographic region. Table 5 presents random-effects regression results, while Table 6 shows truncated regression outcomes. Regression findings signify that LLP and LLR are significant and negative when applied to the entire data set (coefficients of -0.046 and -0.027 respectively

for random effects regression; and -0.069 and -0.040 respectively for truncated regression). The negative coefficients for both variables suggest an inverse relationship between technical efficiency and both LLP and LLR. The findings indicate only a slight difference in the degree of managed earnings between the two methods. As a result of this finding, hypotheses H1a and H1b are supported.

Table 4: Efficiency scores by year, country, and bank size

| Country | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Mean | Large Banks (Mean) | Small Banks (Mean) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | 0.776 | 0.747 | 0.688 | 0.701 | 0.663 | 0.623 | 0.603 | 0.569 | 0.671 | 0.667 | 0.634 |
| Bahrain | 0.851 | 0.841 | 0.838 | 0.823 | 0.816 | 0.806 | 0.792 | 0.764 | 0.816 | 0.819 | 0.805 |
| Bangladesh | 0.836 | 0.821 | 0.813 | 0.798 | 0.781 | 0.773 | 0.760 | 0.746 | 0.791 | 0.783 | 0.795 |
| Bulgaria | 0.852 | 0.844 | 0.832 | 0.827 | 0.825 | 0.822 | 0.809 | 0.816 | 0.828 | 0.835 | 0.814 |
| Croatia | 0.850 | 0.841 | 0.841 | 0.833 | 0.830 | 0.829 | 0.814 | 0.815 | 0.832 | 0.821 | 0.838 |
| Estonia | 0.840 | 0.842 | 0.849 | 0.848 | 0.834 | 0.823 | 0.811 | 0.767 | 0.827 | 0.833 | 0.814 |
| Jordan | 0.862 | 0.849 | 0.831 | 0.818 | 0.809 | 0.800 | 0.783 | 0.767 | 0.815 | 0.811 | 0.825 |
| Kenya | 0.823 | 0.795 | 0.801 | 0.787 | 0.768 | 0.749 | 0.740 | 0.732 | 0.774 | 0.762 | 0.769 |
| Kuwait | 0.859 | 0.847 | 0.835 | 0.827 | 0.818 | 0.801 | 0.786 | 0.776 | 0.819 | 0.820 | 0.792 |
| Lebanon | 0.857 | 0.845 | 0.835 | 0.822 | 0.808 | 0.784 | 0.768 | 0.748 | 0.808 | 0.813 | 0.793 |
| Lithuania | 0.863 | 0.853 | 0.836 | 0.838 | 0.845 | 0.842 | 0.829 | 0.821 | 0.841 | 0.843 | 0.832 |
| Mauritius | 0.876 | 0.848 | 0.838 | 0.839 | 0.823 | 0.830 | 0.821 | 0.801 | 0.834 | 0.851 | 0.802 |
| Morocco | 0.863 | 0.853 | 0.831 | 0.817 | 0.813 | 0.803 | 0.800 | 0.767 | 0.818 | 0.818 | 0.824 |
| Nigeria | 0.816 | 0.794 | 0.784 | 0.768 | 0.753 | 0.756 | 0.736 | 0.726 | 0.767 | 0.754 | 0.781 |
| Oman | 0.855 | 0.841 | 0.815 | 0.797 | 0.787 | 0.770 | 0.762 | 0.745 | 0.796 | 0.813 | 0.737 |
| Pakistan | 0.834 | 0.824 | 0.814 | 0.802 | 0.798 | 0.787 | 0.778 | 0.765 | 0.800 | 0.798 | 0.804 |
| Romania | 0.824 | 0.813 | 0.813 | 0.806 | 0.801 | 0.796 | 0.784 | 0.762 | 0.800 | 0.799 | 0.800 |
| Serbia | 0.821 | 0.815 | 0.796 | 0.794 | 0.801 | 0.809 | 0.802 | 0.796 | 0.804 | 0.810 | 0.799 |
| Slovenia | 0.863 | 0.852 | 0.846 | 0.847 | 0.843 | 0.836 | 0.825 | 0.809 | 0.840 | 0.838 | 0.847 |
| Sri Lanka | 0.845 | 0.822 | 0.813 | 0.808 | 0.803 | 0.785 | 0.769 | 0.752 | 0.800 | 0.792 | 0.804 |
| Tunisia | 0.854 | 0.841 | 0.836 | 0.821 | 0.811 | 0.804 | 0.781 | 0.764 | 0.814 | 0.800 | 0.826 |
| Vietnam | 0.844 | 0.823 | 0.835 | 0.828 | 0.819 | 0.812 | 0.799 | 0.782 | 0.818 | 0.815 | 0.831 |
| Mean | 0.844 | 0.830 | 0.819 | 0.811 | 0.802 | 0.793 | 0.780 | 0.763 | 0.805 | 0.804 | 0.798 |
| Region | | | | | | | | | | | |
| Africa | 0.835 | 0.814 | 0.805 | 0.789 | 0.774 | 0.766 | 0.750 | 0.739 | 0.784 | 0.769 | 0.790 |
| Americas | 0.776 | 0.747 | 0.688 | 0.701 | 0.663 | 0.623 | 0.603 | 0.569 | 0.671 | 0.667 | 0.634 |
| Asia | 0.838 | 0.822 | 0.819 | 0.807 | 0.797 | 0.786 | 0.774 | 0.758 | 0.800 | 0.795 | 0.802 |
| Europe | 0.846 | 0.837 | 0.829 | 0.824 | 0.820 | 0.819 | 0.808 | 0.797 | 0.822 | 0.826 | 0.817 |
| Middle East | 0.856 | 0.844 | 0.832 | 0.818 | 0.809 | 0.792 | 0.778 | 0.761 | 0.811 | 0.815 | 0.791 |

*Notes*: Results from the non-parametric Mann-Whitney test show that the null hypothesis $H_0$ of equality of mean technical efficiency across bank size. The null hypothesis was accepted at the 5% significance level, indicating no significant difference in efficiency between large and small banks. The Kruskal-Wallis test for equality of medians had a chi-square value of 512.592 with 4 degrees of freedom and a p-value less than 0.05, indicating the efficiency score median is unequal between regions. Levene's T-test for equal variances results in a T value of 42.12, and the null of equal variance between the groups is rejected at a *p-value* less than 0.05.

Both regression models reveal a statistically significant relationship between LLP and small banks, and between LLR and big and small banks. From this, it is inferred that large banks are more likely to employ LLR as a vehicle to manage earnings, while small banks use both LLP and LLR to smooth earnings. In the Americas region, this study failed to detect a

meaningful relationship between efficiency and EM and suggests that greater availability of investor protection constraints EM. Tables 4 and 5 also indicate a bank's income smoothing vehicle preference. In the Middle East, LLP is preferred, while LLR is favored in Africa. The Asian region showed mixed results, with both LLP and LLR being significant and negative for the random effects method. However, both LLP and LLR methods show a significant relationship in the truncated model. Overall, European banks appear to favor LLR as an EM technique.

Table 5: Earnings management random effect regression results

Random effects regression

| | | Size | | Region | | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | All | Big | Small | Africa | Europe | Middle East | Americas | Asia |
| Intercept | 0.767*** | 0.707*** | 0.737*** | 0.733*** | 0.774*** | 0.608*** | -0.381 | 0.626*** |
| | (0.026) | (0.036) | (0.047) | (0.061) | (0.042) | (0.098) | (1.003) | (0.053) |
| LLP | -0.046*** | -0.027 | -0.046** | -0.146** | -0.007 | -0.222** | 0.837 | -0.011 |
| | (0.010) | (0.022) | (0.014) | (0.053) | (0.011) | (0.077) | (0.972) | (0.050) |
| LLR | -0.027*** | -0.030* | -0.022*** | 0.031 | -0.014** | -0.050 | -0.656 | -0.128*** |
| | (0.005) | (0.013) | (0.007) | (0.020) | (0.005) | (0.027) | (0.877) | (0.031) |
| TA | -0.001 | 0.002 | 0.004 | 0.002 | -0.001 | 0.009 | 0.069 | 0.010* |
| | (0.002) | (0.002) | (0.004) | (0.004) | (0.003) | (0.007) | (0.070) | (0.004) |
| GROW | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.017 | -0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.010) | (0.000) |
| TL | 0.018 | 0.027 | -0.012 | -0.036 | 0.046 | 0.020 | -0.012 | -0.019 |
| | (0.013) | (0.021) | (0.022) | (0.024) | (0.024) | (0.030) | (0.162) | (0.021) |
| Year Dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| F Statistic | 293.79 | 355.45 | 28.22 | 101.90 | 30.43 | 96.37 | 5.85 | 179.21 |
| Adj. $R^2$ | 0.515 | 0.671 | 0.087 | 0.69 | 0.142 | 0.65 | 0.561 | 0.715 |
| Observations | 2557 | 1748 | 809 | 458 | 857 | 516 | 35 | 726 |

*Notes*: The *p-value* denotes significance at three levels: 0.05*, 0.01**, and 0.001***. F Statistics are significant at the 0.01 level, except for the Americas, significant at the 0.05 level.

## 5. Robustness checks

Several bank and country-specific control variables were added to Eq (5) to add robustness and mitigate a potential omitted variable bias. Inflation and GDP growth were included to control for the variability in accounting earnings due to macroeconomic factors. Earnings management strategies may be adversely impacted by high inflation, while prior research indicates that GDP growth explains disparities in finance, ownership, and payment policies between nations (Leuz et al., 2003). Return on Assets *(ROA)* was incorporated to control for firm performance (Huang and Sun, 2017). *Rule of Law* and *Regulatory Quality* were included. *Rule of Law* is an overarching norm of cultural autonomy and antithetical to corruption (Licht et al., 2007; Martens et al., 2021). *Regulatory Quality* is an external environmental factor that reinforces an institutional shareholders' role in ensuring accurate earnings reporting and

strengthens the effect of institutional ownership on EM (Bao and Lewellyn, 2017). *Change in Loan Losses* was included as a proxy for institutions' risk. Higher loan losses require increased LLP for the additional risk (Anandarajan et al., 2006). *Commission fee and fee income (CFEE)*. CFEE is the commission fee and other income to total assets ratio. Greater interest in non-depository banking activities may necessitate greater loan loss reserves (Anandarajan et al., 2007).

Regression results show that the inclusion of control variables do not quantitatively change the main variables under the truncated regression method; however, a few differences are noted. Under the random-effects regression, LLP remains inversely related to efficiency but fails to show statistical significance in a few subsections of the random effects estimation. In the truncated regression, a negative relationship between small banks and African banks is present. Total liabilities are considered a proxy for risk-taking, and thus a negative coefficient is expected. Applying random-effects regression, no significant relationship appears, yet under truncated regression, a significant positive relationship appears for big banks and a significant negative relationship for small banks. This evidence demonstrates that risk impacts vary according to size and risk exposure. Additional illumination on the relationship between efficiency and other control variables is detailed below, while Table 6 and 7 show the results.

Inflation harms efficiency under both regression estimations, whereas GDP growth positively impacts efficiency. The logic here is that when GDP growth is robust, banks are more likely to see increased deposits and loan growth (Dietrich and Wanzenried., 2014). Inflation negatively influences a bank's ability to allocate resources (Azad et al., 2017); this is particularly true when inflation is unanticipated, for costs will rise, reducing efficiency (Boyd and De Nicolo, 2005). *ROA* shows a significant positive relationship with efficiency. This finding is in line with Adelopo et al. (2018) and Farandy et al. (2017) and suggests that higher bank profitability levels will produce more efficient banks. *Rule of law* and *Regulatory Quality* are not significant, suggesting that institutional frameworks do not influence costs and, hence, efficiency. *Change in Loan Losses*, a risk proxy, is similarly not influential on efficiency. *CFEE* exhibits a strong, significant negative relationship with efficiency, suggesting that income from non-depository banking activity harms efficiency.

## 6. Conclusion

This study evaluates the role of LLR and LLP as earnings management vehicles. From 2001 to 2018, the overall efficiency scores of 567 banks in 22 frontier marker economies decreased. The downward trend shows structural adjustments are required. This analysis also shows that EM reduces efficiency and that bank size has little effect on efficiency. Country growth correlated positively with efficiency, implying that growth influences fund flow and, hence, efficiency. The results are resilient to multiple empirical assumptions and include macroeconomic and financial control factors particular to banks and counties.

### *6.1. Theoretical implications*

There are two theoretical implications for this study. First, resource allocation theory views finite resources as a performance-limiting factor. Bureaucracy and antiquated management practices may impede banks' ability to realize resource gains (Clark and Thrift, 2005). As a result, frontier market bank resources are not fully allocated when using EM vehicles, which is supported by the resource allocation theory. The second theoretical implication is a continuation of the first. The decreased technical efficiency resulting from EM activities is consistent with Wu et al. (2016)'s non- parametric efficiency assessment model as well as Kahneman and Tversky (1979a) and Shu et al. (2002)'s behavioral studies.

### 6.2. Practical implications

This study has four practical implications. First, the finding that bank size has no effect on technical efficiency suggests that performance gains obtained by large banks through economies of scale are not reflected in technical efficiency and asserts that future research should examine X-efficiency as well.[3] Second, the study results suggest that frontier market banks should reconsider their income smoothing and credit provisioning practices. The use of non-discretionary LLPs and LLRs as EM vehicles decreases the efficiency and, consequently, a bank's competitiveness. Competitiveness influences the behavior of depositories, owners, and regulators (Porter, 1997). Therefore, banks must balance capital re- turns, with diminished efficiency and competitiveness resulting from income smoothing. Thirdly, the findings indicate that banks should consider alternative loss provisioning systems, such as a dynamic provisioning system that adapts to economic phases. Dynamic provisioning will contribute to a more streamlined credit cycle while preserving the integrity of the financial system and the credibility of financial reports. Fourth, corporate governance regulators must recognize that EM poses a threat to the quality and transparency of information, necessitating governance measures that prioritize the implementation of effective governance.

Table 6: Earnings management truncated regression results

| Truncated regression | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Size | | Region | | | | |
| Variable | All | Big | Small | Africa | Europe | Middle East | Americas | Asia |
| Intercept | 0.838*** | 0.822*** | 0.800*** | 0.889*** | 0.814*** | 0.725*** | 0.633*** | 0.875*** |
| | (0.010) | (0.018) | (0.030) | (0.014) | (0.017) | (0.021) | (0.042) | (0.015) |
| LLP | -0.069*** | -0.081 | -0.060** | -0.118* | -0.020 | -0.375*** | 0.773 | -0.376*** |
| | (0.015) | (0.043) | (0.018) | (0.051) | (0.015) | (0.107) | (0.550) | (0.049) |
| LLR | -0.040*** | -0.100*** | -0.031*** | -0.077** | -0.027*** | -0.070 | -0.978 | -0.036** |
| | (0.005) | (0.017) | (0.007) | (0.027) | (0.006) | (0.039) | (0.542) | (0.012) |
| TA | -0.004*** | -0.005*** | -0.002 | -0.004*** | -0.002** | -0.005** | 0.022*** | -0.001 |
| | (0.001) | (0.001) | (0.002) | (0.001) | (0.001) | (0.001) | (0.004) | (0.001) |
| GROW | -0.000 | -0.000 | 0.000 | 0.000 | -0.000 | -0.000 | -0.017*** | -0.001*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.005) | (0.000) |
| TL | 0.009 | 0.056*** | -0.078*** | -0.118*** | 0.010 | 0.164*** | -0.383*** | -0.116*** |
| | (0.008) | (0.014) | (0.014) | (0.017) | (0.015) | (0.015) | (0.030) | (0.015) |
| Year Dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.035 | 0.029 | 0.039 | 0.032 | 0.032 | 0.035 | 0.024 | 0.03 |
| Observations | 2557 | 1748 | 809 | 458 | 857 | 516 | 35 | 726 |

*Notes:* The *p-value* denotes significance at three levels: 0.05*, 0.01**, and 0.001***. All Sigma values are significant at the 0.01 level.

[3] According to Sealey Jr and Lindley (1977), the two main components of X-efficacy are 1) improvements in the inefficient markets for knowledge, and 2) increases in motivational efficiency, where workers are motivated by incentive pay or managed by competition or other challenges.

Table 7: Earnings management random effects regression with additional control variables

| Random effects regression | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Size | | Region | | | | |
| Variable | All | Big | Small | Africa | Europe | Middle East | Americas | Asia |
| Intercept | 0.873*** | 0.834*** | 0.968*** | 0.651*** | 0.823*** | 0.768*** | 0.935 | 0.657*** |
| | (0.018) | (0.027) | (0.048) | (0.094) | (0.042) | (0.103) | (0.000) | (0.057) |
| LLP | -0.017 | -0.009 | -0.018 | -0.054 | 0.005 | -0.074 | -3.337 | 0.045 |
| | (0.009) | (0.022) | (0.013) | (0.060) | (0.010) | (0.078) | (0.000) | (0.063) |
| LLR | -0.014** | -0.007 | -0.003 | 0.006 | 0.000 | -0.024 | -4.452 | -0.098*** |
| | (0.004) | (0.013) | (0.007) | (0.026) | (0.005) | (0.028) | (0.000) | (0.029) |
| TA | -0.005*** | -0.004* | -0.016*** | 0.008 | -0.004 | 0.003 | 0.000 | 0.011** |
| | (0.001) | (0.001) | (0.004) | (0.006) | (0.003) | (0.008) | (0.000) | (0.004) |
| GROW | 0.000 | -0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.000* |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| TL | 0.024* | 0.044* | 0.045* | -0.008 | 0.068** | -0.027 | 0.000 | -0.042 |
| | (0.010) | (0.017) | (0.023) | (0.029) | (0.022) | (0.030) | (0.00) | (0.022) |
| Inflation | -0.001*** | -0.001*** | -0.002** | -0.000 | -0.002*** | -0.000 | 0.000 | -0.003*** |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) |
| GDP growth | 0.001*** | 0.000* | 0.002** | -0.003** | 0.000 | -0.000 | 0.000 | 0.001 |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.000) | (0.001) | (0.000) | (0.001) |
| ROA | 0.192*** | 0.156*** | 0.264*** | 0.376*** | 0.216*** | 0.328* | 0.000 | -0.263** |
| | (0.020) | (0.043) | (0.032) | (0.073) | (0.023) | (0.134) | (0.000) | (0.096) |
| Rule of Law | -0.003 | -0.006 | 0.003 | -0.007 | -0.020* | -0.006 | 0.000 | 0.030*** |
| | (0.004) | (0.004) | (0.012) | (0.016) | (0.009) | (0.011) | (0.000) | (0.006) |
| Regulatory Quality | 0.007 | 0.017*** | -0.018 | 0.002 | 0.013 | -0.014 | 0.000 | -0.043** |
| | (0.005) | (0.005) | (0.014) | (0.024) | (0.011) | (0.012) | (0.000) | (0.015) |
| Change in Loan Losses | 0.019 | -0.021 | 0.047** | 0.089 | 0.032** | 0.014 | 0.000 | 0.018 |
| | (0.010) | (0.032) | (0.014) | (0.055) | (0.011) | (0.104) | (0.000) | (0.074) |
| CFEE | -0.978*** | -1.136*** | -1.096*** | -0.146 | -1.319*** | -1.214*** | 0.000 | -1.019* |
| | (0.072) | (0.119) | (0.166) | (0.231) | (0.206) | (0.180) | (0.000) | (0.412) |
| Year Dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj. R2 | 0.5134 | 0.6491 | 0.242 | 0.691 | 0.312 | 0.633 | 0.000 | 0.723 |
| Observations | 2557 | 1748 | 809 | 458 | 857 | 516 | 35 | 726 |

*Notes*: The *p-value* denotes significance at three levels: 0.05*, 0.01**, and 0.001***. Inflation data and GDP growth figures source from World Bank for 2011 - 2018. ROA is the ratio of net income to average total assets. Rule of law sourced from World Bank and captures perceptions of the extent to which agents have confidence in and abide by the rules of society. Scores are collected annually for each year and range from -2.5 to 2.5. Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Annual data is sourced from the World Bank and ranges from -2.5 to 2.5. Change in Loan Losses is the ratio of change in loan losses to total assets. CFEE is the ratio of commission and fee income to total assets.

Table 8: Earnings management truncated regression with additional control variables

| Truncated regression | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Size | | | Region | | | | |
| Variable | ALL | Big | Small | Africa | Europe | Middle East | Americas | Asia |
| Intercept | 0.877*** | 0.882*** | 0.856*** | 0.931*** | 0.864*** | 0.811*** | 0.871*** | 0.864*** |
| | (0.010) | (0.016) | (0.029) | (0.030) | (0.041) | (0.020) | (0.078) | (0.037) |
| LLP | -0.038* | 0.019 | -0.043* | 0.412*** | -0.032* | -0.339*** | -1.442 | -0.303* |
| | (0.016) | (0.039) | (0.019) | (0.066) | (0.016) | (0.093) | (0.990) | (0.125) |
| LLR | -0.026*** | -0.061*** | -0.018** | -0.136*** | -0.004 | -0.103** | -0.169 | -0.035** |
| | (0.005) | (0.015) | (0.007) | (0.027) | (0.006) | (0.036) | (0.698) | (0.011) |
| TA | -0.004*** | -0.005*** | -0.005** | -0.009*** | -0.001 | -0.007*** | -0.007 | -0.004** |
| | (0.001) | (0.001) | (0.002) | (0.001) | (0.001) | (0.001) | (0.011) | (0.001) |
| GROW | -0.000 | -0.000** | 0.000 | 0.000 | -0.000 | -0.000 | -0.053** | -0.002*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.017) | (0.000) |
| TL | 0.002 | 0.017 | -0.048*** | -0.073*** | 0.003 | 0.124*** | -0.132 | -0.040* |
| | (0.007) | (0.013) | (0.014) | (0.015) | (0.014) | (0.014) | (0.096) | (0.019) |
| Inflation | -0.001** | -0.001* | -0.002 | -0.000 | -0.003** | -0.000 | 0.000 | -0.004*** |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.001) | (0.00) | (0.001) |
| GDP growth | 0.001* | 0.000 | 0.003** | -0.001 | 0.001 | -0.001 | 0.000 | -0.000 |
| | (0.000) | (0.000) | (0.001) | (0.002) | (0.001) | (0.001) | (0.00) | (0.002) |
| ROA | 0.117*** | 0.337*** | 0.091* | 0.615*** | 0.071* | 0.383* | 0.000 | 0.091 |
| | (0.028) | (0.061) | (0.036) | (0.080) | (0.030) | (0.154) | (0.00) | (0.120) |
| Rule of Law | 0.001 | -0.011 | 0.028 | 0.004 | -0.029 | -0.005 | 0.000 | 0.038* |
| | (0.008) | (0.007) | (0.020) | (0.029) | (0.016) | (0.020) | (0.00) | (0.015) |
| Regulatory Quality | -0.004 | 0.024* | -0.027 | -0.016 | 0.011 | -0.022 | 0.000 | -0.051 |
| | (0.010) | (0.010) | (0.023) | (0.040) | (0.021) | (0.023) | (0.00) | (0.034) |
| Change in Loan Losses | -0.016 | 0.015 | -0.017 | 0.085 | -0.008 | 0.020 | 0.000 | 0.204 |
| | (0.017) | (0.058) | (0.020) | (0.097) | (0.016) | (0.182) | (0.00) | (0.181) |
| CFEE | -0.847*** | -1.670*** | -0.607*** | -1.604*** | -2.006*** | -0.560*** | 0.000 | -0.211 |
| | (0.046) | (0.075) | (0.066) | (0.143) | (0.140) | (0.059) | (0.00) | (0.292) |
| Year Dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj. R2 | 0.2147 | 0.3169 | 0.2121 | 0.3462 | 0.1461 | 0.2262 | 0.004 | 0.1909 |
| Observations | 2557 | 1748 | 809 | 458 | 857 | 516 | 35 | 726 |

*Notes:* The *p-value* denotes significance at three levels: 0.05*, 0.01**, and 0.001***. Inflation data and GDP growth figures source from the World Bank for 2011 - 2018. ROA is the ratio of net income to average total assets. Rule of law sourced from World Bank and captures perceptions of the extent to which agents have confidence in and abide by the rules of society. Scores are collected annually for each year and range from -2.5 to 2.5. Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Annual data is sourced from the World bank and ranges from -2.5 to 2.5. Change in Loan Losses is the ratio of change in loan losses to total assets. CFEE is the ratio of commission and fee income to total assets.

Table 9: Definition of key variables

| Variable | | Definition |
|---|---|---|
| *TOC* | = | Total Operating Costs calculated as the sum of interest + non-interest expense. |
| **Outputs** | | |
| *γ 1* | = | Total Loans calculated as gross loans less reserve for loan loss provision |
| *γ 2* | = | Total Financial Securities calculated as the sum of securities held to maturity and securities held for sale |
| **Input Prices** | | |
| *w1* | = | Price of deposits calculated as the ratio of interest expense to total deposits |
| *w2* | = | Price of labour calculated as the ratio of salaries to total assets |
| *w3* | = | Price of physical capital calculated as the ratio of expenditure on premises and fixed assets to fixed assets |
| **Earnings** | | |
| **Management** | | |
| LLP (%) | = | Loan loss provisions calculated as the ratio of Loan Loss Provision to Total Loans |
| LLR (%) | = | Loan loss reserves calculated as the ratio of Loan Loss Reserves of Total Loans |
| FA | = | Fixed assets calculated as the sum of Property, Plant and Equipment |
| GROW (%) | = | Net income growth calculated as the ratio of Growth Rate of Net Income |
| TA | = | Natural logarithm of total assets, the sum of current + non-current assets |
| TL | = | Total liabilities calculated as the ratio of total liabilities to total assets |

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