Do the diversification of income and assets spur bank profitability in Bangladesh? A dynamic panel data analysis

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Abstract

Purpose – This paper aims to explore the effects of bank diversification (i.e. diversification of income and diversification of assets) on Bangladeshi banks' profitability.

Design/methodology/approach – Using a dynamic panel data model with system generalized methods of moments, the authors examine an unbalanced panel data from 32 banks spanning 318 bank-year observations from 2007 to 2016.

Findings – The findings indicate a significant positive association of income diversification and asset diversification on bank profitability. Therefore, the results show that banks can generate profit from diversification of income and diversification of assets.

Originality/value – One of the rare attempts to investigate the relationship between diversification and profitability in Bangladesh's banking sector is this report. The authors anticipate the results to have major consequences for Bangladeshi bank regulators and other related economies.

Keywords Bank profitability, Dynamic panel model, Income diversification, Assets diversification

Paper type Research paper

1. Introduction
The financial sector, especially the banking sector in developing countries as well as in developed countries, has undergone major changes over the past few decades. Because of globalization, growing competitiveness and deregulation, banks have strengthened their attention to diversified business lines in addition to conventional bank interest-based operations. Diversification is seen as part of the extreme gap in bank behavior in the post-crisis era, as a strategic choice dictated by the macroeconomic climate shifts (Hidayat *et al.,* 2012; Nguyen *et al.,* 2012a; Lin *et al.,* 2012). Nowadays, owing to the evolving business scenario, noninterest-based activities are more popular among banks in earning a profit. By incorporating new revenue streams or new assets, such as investment provision, brokerage services, stock trading and underwriting services, the bank will diversify its asset portfolio (Meslier *et al.,* 2014). Most previous research shows that noninterest income (NII) not only yields a higher return; it also causes danger because of its volatility (Moudud-Ul-Huq *et al.,* 2018). By investigating South Asian banks, Nguyen *et al.* (2012b) suggest that if banks diversify their revenue from all interest and noninterest streams, they will become more resilient. Assets diversification reduces profits and increases costs (Berger *et al.,* 2010). Edirisuriya *et al.* (2015) suggest that banks' efficiency because of asset diversification is not enhanced. Previous research has shown that the correlation between diversification and bank profitability is inconclusive. Therefore, we have implemented two research questions on the Bangladeshi banking industry: What are the impacts on bank profitability of income diversification? Is there any significant relationship between the diversification of assets and the profitability of banks?

The earlier diversification research concentrated primarily on developing countries (i.e. the USA and Europe). Very few studies have found on emerging economy and provide different results (Moudud-Ul-Huq *et al.,* 2018). Deesomsak *et al.* (2004) contend that Asian banks are a critical source of financing for private sector business activity. In addition, the Asian region's banks have been hit by the financial crisis as well, and consolidation projects are underway in several countries. In addition, it has been found that there is a shortage of study on Asian banks. Lee and Hsieh (2013) suggest that in the Asian regions, the banking sector is an exciting and critical research laboratory. Thus, by taking into account the lack of analysis on the Asian economy, this study considered Bangladesh as a key laboratory to explore the effect of income diversification and asset diversification on bank profitability. The latest literature indicates that several scholars have sought to study the determinants of bank profitability in Bangladesh (Rahman *et al.,* 2015; Sufian and Habibullah, 2009; Robin *et al.,* 2018; Sufian and Kamarudin, 2012; Hossain and Ahamed, 2015; Noman *et al.,* 2015; Majumder and Rahman, 2017; Majumder and Li, 2018; Akter, 2017). However, to the best of our understanding, this is a specific study that considers bank diversification as an independent variable and a significant profitability determinant for Bangladesh's banking sector. For the duration 2007–2016, we use an unbalanced panel data collection of 32 Bangladeshi commercial banks, which provides a total of 318 bank-year observations. For the study, we used a system generalized methods of moments (GMM) regression method with a dynamic panel data model. According to the findings of this empirical research, income and asset diversifications in Bangladesh's commercial banks are significant positive factors in improving profitability of the banks.

In many aspects, the present research adds to the current literature. First, we are analyzing a sample of 32 Bangladeshi banks over the period 2007–2016. To the best of our comprehension, this is the unique research on this subject that uses such a rich collection of data on Bangladesh. Second, most recent research has concentrated primarily on the relationship between NII and risk. Still, very little attention has been given to the

relationship between NII and profitability, as well as noninterest-bearing assets and profitability. Third, we use four bank profitability proxies to ensure the robustness of the outcomes that are unusual in methodological literature. Fourth, the analysis used a system GMM regression method with a dynamic panel data model. In contrast, the relevant research focusing on Asian countries are largely centered on a static panel data model. The research would eventually supplement other studies in Asian countries (Nisar *et al.*, 2018; Lee *et al.*, 2014b; Ahamed, 2017; Berger *et al.*, 2010; Nguyen *et al.*, 2012b).

This report is structured as follows. The study of literature is illustrated in Section 2. The research methodology is described in Section 3, whereas the empirical findings are addressed in Section 4. Conclusion and policy implications are given in Section 5.

2. Literature review

2.1 Theoretical underpinnings

The most significant theory of this study is the "portfolio theory." Harry Markowitz is the pioneer of the portfolio theory. The theory originated from Markowitz's (1952) write-up regarding "portfolio selection" and "foundations of portfolio theory" (Markowitz, 1991). The main concept of "portfolio selection" is that the investors should diversify their funds among those securities which give maximum anticipated return and minimum variance. Under this assumption, the law of large numbers to a portfolio of securities cannot be accepted. The yields from securities are highly intercorrelated. Diversification cannot mitigate all variance (Markowitz, 1952). The modern portfolio theory is a philosophy for risk-averse investors to build their portfolio to increase or optimize their anticipated rate of return with a specified amount of market risk. To improve or increase the anticipated benefit of a portfolio, it is only important to invest in one security (Markowitz, 1991). The portfolio theory says, diversified banks avail from economies of confine which refine the performance and reduce risk simultaneously (Nisar *et al.*, 2018). By referring portfolio theory, Elsas *et al.* (2010) argue that banks will benefit from economies of scale, which gradually decreases the risk of banks and increases their profitability. Another group of researchers say banks can reduce their risk by diversifying their assets into different geographic areas or diversifying their revenue sources (Hsieh *et al.*, 2013). According to the portfolio theory, banks may face risk diversification rewards if NII runnels are uncorrelated with interest income. Further, banks may get a higher risk if NII brooks are riskier and have a high correlation with interest income (Moudud-Ul-Huq *et al.*, 2018).

2.2 Empirical review

In this section, this study reviews the existing literature on the impacts of diversification on bank profitability. There is a puzzle about whether diversification improves bank profitability. For example, Boyd *et al.* (1993) claim that the diversification cost may outweigh the advantages if the diversified activities are riskier than the traditional banking activities. Another research using the sample of developed and developing countries, Doumpos *et al.* (2016), concludes that developing countries can gain more advantages from revenue diversification than developed countries. The prior literature indicates two types of bank diversification: income or revenue diversification and asset diversification.

Concerning to the impacts of income diversification on bank profitability, the existing literature shows mixed results. For example, Nisar *et al.* (2018) examine the impact of revenue diversification on bank profitability on eight South Asian countries and conclude that NII positively impacts profitability. Another recent study by Moudud-Ul-Huq *et al.* (2018) investigates association of southeast asian nations (ASEAN's) emerging economies and finds that the diversified banks have lower risks and higher performance. Lee *et al.* (2014b) examine 22

Asian countries that show that NII reduces risk and increases bank profitability in the middle and low-income countries while raising the risk for the high-income countries. Baele *et al.* (2007) highlight the positive impacts of income diversity on the firm's long-term value by examining European banks. By investigating Italian banks, Chiorazzo *et al.* (2008) find that income diversity increases bank risk-adjusted returns. Using data from Canada, Australia, Italy, France, Germany, Switzerland, Spain, the USA and the UK banks, Elsas *et al.* (2010) find that diversification improves bank profitability. Applying 310 yearly observations from a total sample size of 31 Kenyan commercial banks using panel data for the period of 2008–2017 Githaiga (2020) found a significantly positive relationship impact on income diversification and market power with bank performance. Using a sample size of 31 commercial banks and panel data for the period 2008–2017; Githaiga *et al.* (2019) found the positive significant of income diversification on financial performance. The French 412 financial institutions over 10 years' (2002–2012) effect of income diversification on profitability is seen as significantly positive (Jouida, 2018). The effect of diversification on profit efficiency and cost of six commercial banks from ASEAN countries over the period 2007–2014 is a justified positive relationship (Nguyen, 2018). The higher portion of net interest income (NII) generates higher profits and risk-adjusted profits and NII diversification tasks improves the bank profitability (Ahamed, 2017). An empirical study on nationalized banks in Bangladesh for period of 2010–2014 found that the effect of income diversification on bank profitability is found significantly positive (Majumder and Uddin, 2017). The study on unbalanced panel data over the period of 2007–2016 of listed commercial banks in Vietnam stock market investigated that income diversification reduces the insolvency risk and simultaneously enhance the bank performance (Nguyen and Hong, 2017).

Another group of studies reports negative impacts of bank income diversification on profitability. For example, a recent study showed that the relationship among revenue diversification, risk and bank performance among 26 commercial banks in Vietnam over the period 2010–2018 is negative (Githaiga, 2020). The period of 2000–2012, the research on G7 and BRICS (Brazil, Russia, India, China, and South Africa) country's result of revenue diversification, decreases the bank's efficiency (Hu, 2018). Another analysis conducted in European banks from 2002–2012 showed that share of NII had a detrimental impact on bank profitability (Maudos, 2017). Borroni and Rossi (2017) have found using 110 extensive sample size data on eight European Monetary Union (EMU) countries throughout 2005–2013 commercial, saving and cooperative banks, revenue diversification reduces the bank performance. Stiroh (2004) investigates the US community bank and finds a negative association between diversification and bank profitability. Using unbalanced panel data on 88 Chinese banks, Berger *et al.* (2010) argue that diversification increases costs and deteriorates profitability.

Furthermore, some studies use two types of diversification measures, such as income diversification and asset diversification. For example, the study of Moudud-Ul-Huq *et al.* (2018) differentiates between revenue and asset diversification. Their study results conclude that the effects of asset diversification vary from one country to another country. Most of the studies based on the US economy find that assets diversification increases bank performance, such as Hughes *et al.* (1999) and Deng *et al.* (2007). The outcome of asset diversification on bank performance in three Asian countries (Indonesia, Malaysia and Pakistan) with a dual banking system from 2006 to 2012 is positive (Chen *et al.*, 2018). Other studies find negative impacts of asset diversification on profitability (Acharya *et al.*, 2006; Hughes *et al.*, 1996; Rose, 1996). Using listed public banks in south Asian countries, Edirisuriya *et al.* (2015) explore that diversification of assets does not improve bank performance. The income or asset diversifications do not increase the bank stability in Gulf Cooperation Council (GCC) countries is investigated on data period 2001–2014 (Abuzayed *et al.*, 2018).

Thus, the previous study findings were inconclusive. Different diversification measures are researched, e.g. revenue and assets diversification, and different diversification has different impact on bank profitability. Table 1 describes the prior literature more scientifically:

3. Research methodology

3.1 Data and sample

For this analysis, the sample size consists of 32 commercial banks listed on Bangladesh's Dhaka Stock Exchange (DSE). Now, in Bangladesh, a total of 57 scheduled banks are operating. But, because of data unavailability, the analysis omitted 25 banks. Some banks are still recent, hence being omitted from the report. Our final data set involves unbalanced panel data representing a total of 318 observations from 2007 to 2016. Data were extracted from each bank's audited financial statements, accessible on both the bank's website and the DSE. The study also uses macroeconomic control variables that are available in the World Bank database [1]. In addition, we use numerous books, papers and Web resources.

3.2 Model specification, variables and estimation techniques

The empirical model specification is as follows:

$$Y_{i,t} = C + \delta\,Y_{i,t-1} + \lambda\,DIV_{i,t} + \sum_{j=1}^{j} \beta_j X_{it}^j + \in_{it}$$

where $Y_{i,t}$ indicates the proxy of bank profitability (return on assets [ROA], return on equity [ROE], risk-adjusted return on assets [SHROA] and risk-adjusted return on equity [SHROE]) of bank i and year t. $Y_{i,t-1}$ is the one period lagged of bank profitability measures. C is the constant term; δ shows the speed of adjustment to the equilibrium level. DIV_{it} indicates the proxy of bank diversification (income and assets diversification). X_{it} with superscripts j represents control variables (liquidity, capitalization, bank size, credit risk, cost management, concentration, gross domestic product [GDP] and inflation) use in the study. $\in_{it}$ indicates the idiosyncratic error term. λ and β_j represent the coefficients to be estimated. The definitions of all the variables and their references are represented in Table 2.

The above dynamic panel model is estimated by using GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (2000). We use a one-step system GMM rather that two-step system GMM because the former one produces a smaller standard deviation of the estimation and smaller bias (Judson and Owen, 1999). The advantage of using GMM is it avoids autocorrelation and heteroskedasticity problems in the model, and it gives better results compared to ordinary least squares (OLS).

4. Results and discussion

4.1 Descriptive statistics

The descriptive statistics of all the study variables are presented in Table 3. The table shows that the minimum value of bank profitability (ROA, ROE, SHROA and SHROE) indicates a negative figure, which is due to negative earnings of some state-owned banks (see Rupali Bank Ltd. – 2007 and 2016; Agrani Bank Ltd. – 2012 and 2016; Janata Bank Ltd. – 2012 and Sonali Bank Ltd. – 2007 and 2012) and negative shareholder's equity of some state-owned banks (see Rupali Bank Ltd. – 2007, 2008 and 2009). Those state-owned banks are still operating because of support from the Government of Bangladesh. Interestingly, we find that the average ROA of Bangladeshi banks is 1.1%, which is higher than 0.93% as

Authors and year	Country	Period	Methods	Nature of relationship/ empirical findings
Githaiga (2020)	Kenya	2008–2017	Hierarchical regression equations	Income diversification and market power are significantly and positively correlated with performance
Ngoc Nguyen (2019)	Vietnam	2010 –2018	GMM	Revenue diversification negatively impacts profitability
Githaiga et al. (2019)	Kenya	2008–2017	three-stage least squares (3SLS) regression model	The study finds the positive relationship between income diversification and performance, and market power significantly mediates the relationship between income diversification and performance
Nisar et al. (2018)	South Asian countries	2000–2014	Two-step system GMM	A positive relationship is found between revenue diversification and profitability and stability
Moudud-Ul-Huq et al. (2018)	Indonesia, Malaysia, Philippines, Thailand and Vietnam	2011–2015	Dynamic panel GMM	Both of the cases, i.e. the relationship between income and asset diversification on performance are positive
Chen et al. (2018)	Malaysia, Pakistan and Indonesia	2006–2012	Regression model	Asset diversification has a negative effect on conventional banks' performance but a minimal effect on that of Islamic banks. Considering bank size, diversification positively affects the profitability of large Islamic and conventional banks
Hu (2018)	G7 and BRICS countries	2000–2012	Dynamic panel model	Revenue diversification reduces bank efficiency, and it improves individual stability
Jouida (2018)	French	2002–2012	The first-order panel vector autoregressive (VAR) model using GMM estimation	A positive relationship is found between income diversification and profitability
Abuzayed et al. (2018)	GCC countries	2001–2014	Two-step system GMM	Income or asset diversification does not enhance bank stability

(continued)

Table 1.
Summary of empirical studies between diversification and bank profitability

Authors and year	Country	Period	Methods	Nature of relationship/ empirical findings
Nguyen (2018)	Six ASEAN countries	2007–2014.	Regression model	Funding diversification and asset diversification positively impact bank profit efficiency
Ahamed (2017)	India	1998–2014	Dynamic panel model	The higher share of NII yields higher profits and risk-adjusted profits
Maudos (2017)	Europe	2002–2012	GMM	An increase in the share of non-interest income has a negative impact on profitability
Nguyen and Hong (2017)	Vietnam	2007–2016	HHI	Income diversification decreases insolvency risk and enhances performance
Borroni and Rossi (2017)	Eight EMU countries	2005–2013	Regression model	A negative relationship between revenue diversification and bank performance
Hamdi *et al.* (2017)	Tunisia	2005–2012	Dynamic panel data model	Diversification increases bank performance for both ROA and ROE measures
Chen and Lai (2017)	Taiwan	1998–2013	Dynamic panel model	A positive relationship is found between revenue diversification and bank profitability in the long run. But in the short run, the effect is insignificant
Doumpos *et al.* (2016)	111 countries	2001–2010	Regression analysis	A positive relationship between income diversification and financial strength
Nguyen and Nghiem (2016)	Chinese and Indian banks	1997–2011	HHI, two-stage bootstrap procedure	In Chinese banks, diversification of revenue, earning assets and non-lending earning assets are associated with increasing profit efficiency In Indian banks, diversification of earning assets increases profit efficiency while diversification of revenue and earning assets reduces cost efficiency
Alhassan (2015)	Africa	2003–2011	Stochastic frontier analysis, tobit regression model	Positive but a nonlinear relationship is found between income diversification and profit efficiency

(continued)

Table 1.

Authors and year	Country	Period	Methods	Nature of relationship/ empirical findings
Edirisuriya et al. (2015)	South Asian countries	1999–2012	Regression analysis	Interest-only income and bank performance are negatively associated
Lee et al. (2014a)	Asia- Pacific countries	1995–2009	Dynamic panel model and GMM	A positive relationship between diversification and profitability and negative relationship between diversification and risk
Lee et al. (2014b)	22 countries in Asia	1995–2009,	Dynamic panel model and GMM	Noninterest activities decrease profitability as well as increases the risk for savings banks
Gambacorta et al. (2014)	Switzerland	1994–2012	Regression analysis	Income diversification is positively correlated with bank profitability
Amidu and Wolfe (2013)	UK	2000–2007	HHI, 3SLS regression model	Positive relation is found between revenue diversification and bank stability
Sawada (2013)	Japan	1999–2011	Regression model	Revenue diversification positively affects bank market value but provides no evidence that they reduce bank risks
Hsieh et al. (2013)	22 Asian countries	1995–2009	Dynamic panel GMM	A positive relationship between income diversification and bank stability. Asset diversity decreases the bank's stability
Nguyen (2012)	USA	1997–2004	Regression analysis	The study found a statistically significant negative relationship between net interest margin and NII for 1997–2002
Vallascas et al. (2012)	Italy	2006–2008	Regression analysis	Income diversification reduces bank profitability
Nguyen et al. (2012b)	Bangladesh, India, Pakistan and Sri Lanka	1998–2008	GMM	A positive relationship found between revenue diversification and bank stability

Table 1.

calculated by Nisar et al. (2018) on eight South Asian countries and 0.844% as found by Lee et al. (2014b) on 22 Asian countries. ROE is 13.1%, indicating 8.67% higher than the study of Lee et al. (2014b) and 11.85% of the study of Nisar et al. (2018). The study shows that the banks in Bangladesh have earned on an average 27.6% of their income from NII sources, which is lower than 65.58% as measured by Lee et al. (2014b) on Asian countries and 31.954% as found by Nisar et al. (2018) on South Asian countries. The average noninterest bearing assets 33.5% of total assets is also playing a role in enhancing bank profitability in

Variables	Symbol	Definition of variables	References
Dependent variables			
Performance measures			
Return on assets	ROA	Net income/total assets	(Gang Tian and Zeitun, 2007)
Return on equity	ROE	Net income/total shareholder's equity	(Tan, 2016)
Risk-adjusted return on assets	SHROA	ROA/standard deviation of ROA	(Chiorazzo *et al.*, 2008)
Risk-adjusted return on equity	SHROE	ROE/standard deviation of ROE	(Chiorazzo *et al.*, 2008)
Independent variables			
Diversification measures			
Income diversification	INDIV	NII/total income	(Majumder and Uddin, 2017; Akter *et al.*, 2018)
Assets diversification	ADIV	Noninterest bearing assets/total assets	(Edirisuriya *et al.*, 2015)
Control variables			
Liquidity	LIQD	Total loans and advances/total assets	(Goddard *et al.*, 2013)
Capitalization	EQTA	Total shareholder's equity/total assets	(Zheng *et al.*, 2017)
Bank size	BSIZE	Natural logarithm of total assets	(Lee *et al.*, 2014b)
Credit risk	NPLTL	Non-performing loans/total loans	(Lee *et al.*, 2014a)
Cost management	CMGT	Total overhead cost/total assets	(Tan, 2016)
Concentration	CON3	Total assets of the largest three banks/ total assets of the bank industry	(Tan, 2016)
Gross domestic product	GDP	Annual GDP growth rate	(Majumder and Uddin, 2017)
Inflation	INF	Annual inflation rate	(Tan, 2016)

Table 2.
Descriptions of variables

Variables	Mean	SD	Min	Max	Obs
Dependent variables					
Performance measures					
ROA	0.011	0.012	−0.135	0.051	318
ROE	0.131	0.217	−2.741	1.044	318
SHROA	2.312	1.466	−3.008	5.498	318
SHROE	2.468	1.542	−3.049	6.211	318
Independent variables					
Diversification measures					
INDIV	0.276	0.095	0.030	0.564	318
ADIV	0.335	0.087	0.163	0.678	318
Control variables					
LIQD	0.665	0.087	0.322	0.837	318
EQTA	0.079	0.027	−0.129	0.154	318
BSIZE	11.79	0.775	10.04	13.99	318
NPLTL	0.060	0.062	0.002	0.446	318
CMGT	0.022	0.007	0.007	0.047	318
CON3	0.314	0.046	0.275	0.415	318
GDP	6.248	0.619	5.000	7.100	318
INF	6.989	0.801	5.700	8.200	318

Table 3.
Descriptive statistics

Bangladesh. The results of the standard deviation of bank size (BSIZE) 77.5% are showing that there is variability of bank assets in Bangladesh.

4.2 Correlation analysis

Table 4 displays the Pearson correlation coefficient matrix, which shows that the maximum correlation between the independent variables is 0.67 between liquidity (LIQD) and diversification of assets (ADIV). Gujarati (2009) indicates that when the two independent variables' association value exceeds 0.80, multicollinearity is a serious concern. The analysis, therefore, indicates no serious multicollinearity issue in the interpretation of the effects of regression.

4.3 Regression analysis

4.3.1 Effects of bank diversification on profitability. The empirical results of bank diversification's effect on profitability are listed in Table 5. Here, as a dependent variable, we use four proxies of bank profitability such as ROA, ROE, SHROA, SHROE in Models 1 to 4 and 5 to 8, respectively. As independent variables, the analysis uses two proxies of bank diversification. Income diversification is seen in Models 1 to 4 and Models 5 to 8 for asset diversification. The significant positive coefficient of lagging dependent variables is expressed by all models, confirming the degree of persistence in all models and the model's dynamic character.

The findings of the analysis indicate that income diversification (IDIV) has a positive and significant effect on the profitability of Bangladeshi commercial banks in all models, suggesting that more diversified non-income generating activities contribute to higher profitability and the results supported by the research by Jiang et al. (2003). We also find that diversification of assets has significant positive effects on profitability, which means that more value is produced from more noninterest-bearing assets. This is aligned with that of Edirisuriya et al. (2015).

We see a positive correlation between liquidity and bank profitability with respect to the control variables, except in Models 5 and 8. The high ratio means that a large amount of loan sanction to the customers produces more interest revenue, thereby growing profitability. In Models 1, 5, 6 and 7, the Equity-to-Total Assets Ratio (EQTA) reveals a strong positive correlation with profitability, suggesting that the higher the bank's equity capital produces

	INDIV	ADIV	LIQD	EQTA	BSIZE	NPLTL	EFF	CON3	GDP	INF
INDIV	1	–	–	–	–	–	–	–	–	–
ADIV	0.57***	1	–	–	–	–	–	–	–	–
LIQD	(0.47)***	(0.67)***	1	–	–	–	–	–	–	–
EQTA	0.05	(0.23)***	0.18***	1	–	–	–	–	–	–
BSIZE	0.21***	0.44***	(0.34)***	−0.06	1	–	–	–	–	–
NPLTL	0.48***	0.63***	(0.53)***	(0.39)***	0.46***	1	–	–	–	–
EFF	0.27***	0.14**	(0.12)**	0.15***	−0.07	−0.08*	1	–	–	–
CON3	0.04	(0.17)***	0.16***	(0.24)***	(0.66)***	−0.03**	−0.08*	1	–	–
GDP	(0.10)*	0.05	−0.04	(0.11)*	0.17***	0.09	−0.01	−0.01	1	–
INF	−0.09	−0.07	0.05	0.04	(0.20)***	−0.06	0.01	0.13**	−0.08	1

Table 4.
Pearson correlation matrix

Notes: Total number of observations 318; ***correlation is significant at 1% level (two-tailed); **correlation is significant at 5% level (two-tailed); *correlation is significant at 10% level (two-tailed); all variables are winsorized at the 1% level

Variables	M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8
ROA_{t-1}	0.32*** (0.102)	–	–	–	0.35*** (0.116)	–	–	–
ROE_{t-1}	–	0.45*** (0.161)	–	–	–	0.41*** (0.101)	–	–
$SHROA_{t-1}$	–	–	0.335*** (0.097)	–	–	–	0.342*** (0.095)	–
$SHROE_{t-1}$	–	–	–	0.520*** (0.077)	–	–	–	0.489*** (0.085)
INDIV	0.024*** (0.006)	0.247*** (0.079)	1.332* (0.72)	0.391** (0.16)	–	–	–	–
ADIV	–	–	–	–	0.019** (0.008)	0.026*** (0.008)	5.245** (2.115)	4.734*** (1.186)
LIQD	0.013* (0.007)	0.057** (0.029)	1.837* (1.05)	1.055* (0.60)	0.008 (0.021)	0.160*** (0.053)	5.658* (3.154)	4.988 (3.134)
EQTA	0.126*** (0.035)	0.224 (0.311)	8.050 (4.920)	2.146 (3.596)	0.152*** (0.037)	0.551* (0.302)	8.342** (3.684)	1.554 (3.262)
BSIZE	–0.011** (0.005)	–0.010* (0.005)	–0.033*** (0.011)	–0.015** (0.006)	–0.016*** (0.005)	–0.014** (0.007)	–0.172*** (0.065)	–0.192* (0.114)
NPLTL	–0.055* (0.031)	–1.147*** (0.184)	–7.788*** (2.537)	–6.809*** (2.029)	–0.044 (0.029)	–1.047*** (0.180)	–6.958*** (2.152)	–6.789*** (2.053)
CMGT	–0.01*** (0.003)	–0.375*** (0.098)	–1.078* (0.561)	–5.033** (2.262)	–0.036*** (0.013)	–0.195** (0.109)	–0.811*** (0.173)	–8.588 (11.016)
CON3	0.036** (0.017)	0.646*** (0.187)	7.051*** (2.572)	8.800*** (2.308)	0.056*** (0.020)	0.894*** (0.240)	4.563* (2.587)	5.735** (2.673)
GDP	0.012*** (0.001)	0.022*** (0.006)	0.341** (0.130)	0.132 (0.125)	0.002*** (0.001)	0.023*** (0.007)	0.411*** (0.105)	0.192 (0.115)
INF	–0.0001 (0.0001)	–0.003 (0.003)	–0.100 (0.066)	–0.196*** (0.058)	–0.001* (0.000)	–0.008** (0.003)	–0.150** (0.062)	–0.213*** (0.058)

(*continued*)

Table 5.
Effects of bank
diversification on
profitability

Variables	M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8
F-test	204.66***	159.19***	228.12***	151.25***	273.16***	185.10***	253.88***	197.35***
Hansen test[a]	P = 0.30	P = 0.45	P = 0.29	P = 0.26	P = 0.31	P = 0.48	P = 0.39	P = 0.27
AR(1)[b]	Z = −3.19	Z = −2.41	Z = −4.56	Z = −3.77	Z = −3.31	Z = −2.39	Z = −4.55	Z = −3.97
	P = 0.001	P = 0.016	P = 0.000	P = 0.000	P = 0.001	P = 0.017	P = 0.000	P = 0.000
AR(2)[c]	Z = −0.79	Z = 0.55	Z = −0.76	Z = −0.22	Z = −0.99	Z = 0.28	Z = −0.87	Z = −1.11
	P = 0.43	P = 0.58	P = 0.48	P = 0.79	P = 0.36	P = 0.83	P = 0.41	P = 0.28
Number of instruments	11	11	11	11	11	11	11	11
Observations	286	286	286	286	286	286	286	286

Notes: The estimation technique is a one-step system GMM dynamic panel estimators. The dependent variable is the profitability measured by return on assets (ROA), return on equity (ROE), risk-adjusted return on assets (SHROA) and risk-adjusted return on equity (SHROE) in Models 1 to 4 as well as in Models 5 to 8, respectively. Income diversification (INDIV) is the independent variable in Models 1 to 4, whereas asset diversification (ADIV) is the independent variable in Models 5 to 8. *, ** and *** denote significance at 10%, 5% and 1% levels, respectively. Robust standard errors are presented in parenthesis. [a]Test of over-identifying restrictions (Ho: over-identifying restrictions are valid). The tests accept the null hypothesis that over-identifying restrictions are valid. [b]Arellano–Bond test for the first-order autocorrelation (Ho: no autocorrelation). [c]Arellano–Bond test for the second-order autocorrelation (Ho: no autocorrelation). The test results of AR (1) and AR(2) indicate there is autocorrelation exists in the first-order but not in the second-order. All variables are winsorized at the 1% level

Table 5.

higher income. Our result is in line with Zheng *et al.* (2017), Casu *et al.* (2016) and others. Bank size (BSIZE) is significantly negatively related to profitability, suggesting that big banks have management problems relative to smaller banks, thus reducing profitability. This findings in line with Tan (2016) and Majumder and Uddin (2017). The study showed that credit risk (NPLTL) negatively impacts bank profitability; it decreases profitability by suggesting low credit quality. In this case, the results of Almekhlafi *et al.* (2016), Zhang *et al.* (2013) and Lin *et al.* (2005) found identical findings, although not compatible with Naceur and Omran (2011). Cost control (the overall cost-to-total asset ratio [CMGT]) reveals a strong negative profitability correlation. The low ratio implies cost accounting that is efficient; this proof is in line with Rahman *et al.* (2015). The analysis findings indicate that concentration (Herfindahl–Hirschman Index [HHI]) is important and positively related to bank profitability, which is consistent with this research (Tan and Floros, 2012a). The analysis uses two variables of macroeconomic influence, such as GDP and inflation. The significant positive relationship between GDP and bank profitability shows that the higher the GDP growth in Bangladesh, the higher the profitability. The proof is compatible with this study (Tan, 2016). With respect to inflation, the findings show that all models except Models 1 to 3 have a substantial positive effect on profitability, which is confirmed by these analyses (Tan and Floros, 2012b; Majumder and Uddin, 2017).

4.3.2 Robustness of results. By flipping the regression approach from GMM to OLS, we have conducted a robustness examination. As can be seen in Table 6, the expected significant positive association between income diversification (INDIV) and asset diversification (ADIV) and various bank profitability measures has been shown. We noticed a similar association with profitability as in previous approaches in Table 5 with respect to the control variables, which confirm the robustness of our findings.

5. Conclusions
5.1 Summary and policy implications
This article explores the effect on bank profitability in Bangladesh of income diversification and asset diversification. The research uses a one-step GMM framework approach with a dynamic panel model for 32 Bangladeshi commercial banks over the period 2007–2016 for empirical review, producing a total of 318 bank-year observations. The analysis also uses OLS regression for the verification of robustness. As a measure of the dependent variable, we use four bank profitability proxies (ROA, ROE, SHROA and SHROE) and two diversification proxies (income and asset diversification) as a measure of the independent variable. The other control variables such as liquidity, capitalization, bank size, credit risk, cost management, concentration, GDP and inflation are also considered for the analysis.

The study results show that the diversification of income and assets has a significant positive effect on the profitability of commercial banks in Bangladesh. Liquidity, capitalization, concentration and GDP provide a substantial positive effect on profitability in control variables. Bank size, credit risk, cost management and inflation, on the other side, have major negative ties to bank profitability.

Our studies have essential policy consequences for Bangladeshi banking sector regulators and administrators, as well as for developing and emerging economies. The study indicates that banks still generate the majority of income from traditional interest-generating outlets. Banks should also search at other revenue streams, such as fee income and noninterest-bearing assets, as these can be significant and helpful to the banks' profitability.

Variables	M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8
ROA $_{t-1}$	0.24***	–	–	–	0.332***	–	–	–
	(0.066)				(0.108)			
ROE $_{t-1}$	–	0.394***	–	–	–	0.136***	–	–
		(0.125)				(0.047)		
SHROA $_{t-1}$	–	–	0.583***	–	–	–	0.585***	–
			(0.045)				(0.045)	
SHROE $_{t-1}$	–	–	–	0.666***	–	–	–	0.666***
				(0.041)				(0.041)
INDIV	0.024***	0.250***	1.241*	0.413**	–	–	–	–
	(0.005)	(0.056)	(0.66)	(0.194)				
ADIV	–	–	–	–	0.021**	0.032***	4.495**	3.746***
					(0.009)	(0.009)	(1.929)	(0.983)
LIQD	0.012*	0.057**	0.948***	0.235*	0.001	0.193***	0.314**	0.025
	(0.006)	(0.026)	(0.358)	(0.135)	(0.006)	(0.071)	(0.133)	(0.903)
EQTA	0.124***	0.216	5.559**	0.171	0.151***	0.555***	7.216***	0.727
	(0.018)	(0.203)	(2.818)	(2.658)	(0.018)	(0.194)	(2.640)	(2.477)
BSIZE	−0.011***	−0.009**	−0.138***	−0.124*	−0.018***	−0.014***	−0.114***	−0.166***
	(0.004)	(0.004)	(0.041)	(0.016)	(0.003)	(0.001)	(0.016)	(0.010)
NPLTL	−0.055***	−1.151***	−4.401***	−5.170***	−0.043***	−1.025***	−3.898**	−5.012***
	(0.010)	(0.117)	(1.680)	(1.545)	(0.010)	(0.117)	(1.657)	(1.519)
CMGT	−0.018***	−0.384*	−4.200**	−9.031**	−0.036**	−0.110**	−1.228***	−8.041
	(0.005)	(0.227)	(2.356)	(3.866)	(0.015)	(0.045)	(0.423)	(7.204)
CON3	0.030*	0.632***	4.995*	5.573**	0.056***	0.886***	6.318**	6.010***
	(0.016)	(0.183)	(2.578)	(2.409)	(0.015)	(0.180)	(2.457)	(2.286)
GDP	0.002***	0.022***	0.394***	0.178	0.002***	0.023***	0.400***	0.180*
	(0.001)	(0.008)	(0.115)	(0.109)	(0.001)	(0.009)	(0.116)	(0.108)
INF	−0.000	−0.003	−0.24***	−0.260***	−0.001	−0.009	−0.259***	−0.267***
	(0.000)	(0.005)	(0.076)	(0.070)	(0.000)	(0.005)	(0.075)	(0.069)
Constant	0.008***	0.017***	4.094*	3.693*	0.009***	0.027**	4.132**	3.710*
	(0.003)	(0.006)	(2.080)	(1.965)	(0.003)	(0.013)	(2.086)	(1.963)
R-square	0.581	0.556	0.667	0.725	0.541	0.524	0.664	0.725
Observations	286	286	286	286	286	286	286	286

Notes: The estimation technique is OLS estimators. The dependent variable is the profitability measured by return on assets (ROA), return on equity (ROE), risk-adjusted return on assets (SHROA) and risk-adjusted return on equity (SHROE) in Models 1 to 4 as well as in Models 5 to 8, respectively. Income diversification (INDIV) is the independent variable in Models 1 to 4, whereas asset diversification (ADIV) is the independent variable in Models 5 to 8. *, ** and *** denote significance at 10%, 5% and 1% levels, respectively. Robust standard errors are presented in parenthesis. All variables are winsorized at the 1% level

Table 6.
Effects of bank
diversification on
profitability

5.2 Limitations and directions for future research

This analysis is focused on secondary data obtained from 32 Bangladeshi commercial banks and excludes other financial and nonfinancial nonbank organizations. In addition to the banking industry, the prospective researcher may identify other industries or undertake cross-country study to analyze diversification's success impacts. The report uses two forms of diversification, i.e. diversification of income and diversification of assets. The potential researcher should then suggest other diversification forms, such as diversification of bank financing, product diversification, regional diversification and functional diversification. The current study aims to guide the interaction between the dependent and independent variables only; therefore, a mediator or moderator can be identified by future researchers on the correlation.

Note

1 data.worldbank.org.

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