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Structural Break in Private Commercial Banks' Profitability Dynamics: Evidence from Bangladesh

Dr. Farhana Yasmin Liza[1]

Abstract:

This study has investigated the presence of structural break in Bangladesh-based private commercial banks' profitability dynamics revolving Basel III implementation. It was a deductive study and secondary data was used in the positivism-led study. Chow-test along with regulation dummy variable was employed on the banking-industry panel database to study the impact of stringent capital requirement on commercial banks' profitability. It was found that there exists structural break in commercial bank's profitability dynamics surrounding the implementation of Basel III accord. There exists structural break in the relationship between profitability and capital adequacy. Likewise, structural break was evident in the relationship between profitability and asset quality.

Keywords: Structural Break; Bank Profitability; Basel III; Capital Adequacy; Chow Test

JEL Classification: G21, G28, C23, C12

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1.0 Introduction

Bangladesh-based commercial banking industry has been through a number of policy-regime changes. Post independence, all the commercial banks were nationalized; during 1980's, a number of private banks got the license to operate and two nationalized commercial banks were denationalized. Financial Sector Reform Program (FSRP) introduced a number of paradigm-shifters [such as gradual deregulation of interest rate structure, incentivizing priority-sector lending, and improved debt-recovery machinery etc.]. This research focuses on one of the widely recognized paradigm shifters – Basel accord.

Back in 1996, as per the guidance of Bangladesh Bank, commercial banks operating in Bangladesh adopted Basel I framework [for the first time, scheduled commercial

[1] Associate Professor, Department of Business Administration, Daffodil International University, Dhaka, E-mail: drfarhana.ba@diu.edu.bd

banks were required to keep a minimum capital-to-Risk-weighted Assets Ratio (CRAR)]. In 2007, Bangladesh Bank prescribed a road-map [BRPR circular no. 14] to announce the transition plan to Basel II accord. In 2010, adherence to Basel II accord was made mandatory for Bangladesh-based scheduled commercial banks [banks had to keep a minimum CRAR of 10%]. On December 21, 2014, Bangladesh Bank published 'Guidelines of Risk Based Capital Adequacy' [BRPR circular no. 18] and thereby revised the established regulatory capital rules in line with Basel III accord. In 2015, Bangladesh Bank prescribed a road-map [DOS circular no. 1] to announce the multi-phased transition plan to Basel III accord. Between 2019-2020, the full-fledged implementation of Basel III accord was completed.

As per BRPD Circular No.18, scheduled commercial banks have to maintain a minimum common equity tier 1 [CET1] of 4.5%, tier 1 capital ratio of 5.5%-6%, total capital ratio [MCR] of 10%, and capital conservation buffer of 2.5% [adherence to Basel III accord]. Moreover, Basel III prescribes additional liquidity-based regulations like maintaining liquidity coverage ratio (LCR), and net stable funding ratio (NSFR) [eventually forcing commercial banks to hold more liquid assets].

The empirical findings related to banking-industry policy changes [such as implementing Basel III] are often mixed. There are two compelling channels through which the impact of Basel III on commercial banks' profitability dynamics can be explored. According to the more dominant 'Trade-off theory', it is postulated that higher capital requirement would change the asset mix of commercial banks [forcing banks to hold more safe but low-return generating assets], raise the cost of funding, and change the activity mix as well [replacing higher-return generating activities with lower-return generating activities]. Given these paradigm shifts, profitability of commercial banks should suffer (Molyneux and Thornton, 1992). According to the less dominant 'Signaling hypothesis', it is postulated that better-capitalized banks are more prepared to absorb financial shocks [at least perceived by the depositors], so the cost of funding would drop. So, these better-capitalized banks should make substantial profits in the longer run (Berger, 1995). Some meta-analysis posits that there is no significant impact of Basel III on commercial banks' profitability. This startling finding indicates that Basel III implementation should be perceived from a prudential perspective than purely from a risk-taking perspective (Lepetit et al., 2008). In a nutshell, the empirical findings do represent an academic tension. This research has tried to resolve the academic tension in Bangladeshi-case.

Using secondary data, and following a positivism-led philosophy, presence of structural break in Bangladesh-based private commercial banks' profitability was

explored in the research. Chow-test [a standardized method often used in testing structural break] was employed on the banking-industry panel data. Moreover, the impact of Basel III implementation on profitability dynamics was later explored through dummy variable ['Regulation dummy' in this case]. It is established in the empirical papers that the impact of shifts in policy regime on banks' profitability may not be symmetric across clusters. That is why the researcher looked out for the presence of any cross-sectional heterogeneity in the observed effects.

Section 2 [literature review] of the paper presents the empirical findings related to the impact of regime change, and policy change on commercial banks' profitability dynamics. Section 3 [methodology and data] of the paper discusses how a specific research philosophy, research design, research approach was chosen for this study. This chapter also focuses on the econometric challenges related to running Chow-test in case of panel data and panel regression, and how these challenges were addressed in the research. Section 4 [results] of the paper represented the key chow test results and the panel regression results along with the interpretation. And the final section [conclusion] summarizes the key findings of the research, along with the implications of the findings.

2.0 Literature review

Bank profitability rarely evolves as a smooth, continuous process; it is instead punctuated by discrete shifts that econometricians label structural breaks, points at which the parameters governing income, cost, or risk relationships in a bank's earnings function change abruptly rather than gradually. Such breaks tend to originate outside the individual firm, arising from macroeconomic shocks, regulatory overhauls, or shifts in market structure that alter the fundamental drivers of earnings simultaneously across an entire banking sector. Albertazzi and Gambacorta (2009), for instance, showed that the transition toward European monetary integration produced a marked change in the sensitivity of net interest income, non-interest income, and loan-loss provisions to macroeconomic conditions across euro-area banks, effectively creating a pre- and post-convergence regime. Similarly, Demirguc-Kunt and Detragiache (1999) demonstrated that profitability itself behaves as an early warning indicator ahead of banking crises, falling sharply once systemic fragility crosses a critical threshold, a pattern more consistent with a discrete break than a gradual decline. The 2007-2009 global financial crisis is often cited as the clearest recent example, since it simultaneously reset interest margins, credit costs, and funding structures for commercial banks worldwide, forcing later empirical work to explicitly model the discontinuity rather than smooth over it.

Several theoretical strands help explain why profitability parameters shift rather than drift gradually. The structure-conduct-performance paradigm, associated with Bourke (1989) and later extended by Molyneux and Thornton (1992), holds that profitability is tied to market concentration and competitive structure; when that structure is disrupted through consolidation, new entry, or deregulation, the underlying profit-generating relationship itself changes. Berger (1995) offered a competing account through the efficient-structure hypothesis, arguing that profitability differences, and by extension shifts in profitability, stem from variation in individual banks' operating efficiency rather than from market power alone. A related strand comes from income-diversification theory: Lepetit et al. (2008) found that banks expanding into non-interest income activities carry a different risk-return profile than traditional lenders, implying that a change in business-model composition can itself trigger a break in the profitability process. On the econometric side, the multiple-structural-change framework developed by Bai and Perron (1998, 2003) supplies the statistical backbone for detecting and dating such breaks, allowing researchers to test whether coefficients in a profitability equation remain stable across a sample period or shift at one or more unknown points in time.

Basel III is frequently treated in the literature as a textbook case of a regulation-induced structural break. Introduced by the Basel Committee on Banking Supervision (2010) in response to the global financial crisis, the framework imposed materially higher capital adequacy, leverage, and liquidity requirements, altering balance-sheet incentives that had shaped bank earnings for the preceding decade. Giordana and Schumacher (2017) found that the Liquidity Coverage Ratio and Net Stable Funding Ratio changed both the profitability and default-risk profile of Luxembourgish banks once implemented, while Grzeta, Zikovic, and Tomas Zikovic (2023), studying 433 European commercial banks, reported that larger institutions absorbed the post-Basel III regulatory shift far more successfully than smaller ones, indicating that the break's magnitude was not uniform across the sector. Taken together, this body of work suggests that Basel III did not merely tighten existing constraints incrementally; it reconfigured the cost of holding capital and liquidity in a way that is best modeled as a discrete regime change in banks' profitability dynamics rather than as a continuation of pre-crisis trends.

3.0 Methodology and data

In this section, the methodological choices made throughout the research process will be discussed. 'Methodology and data' chapter will also focus on the operational definition of the research variables, descriptive statistics, and correlation table.

The adopted research philosophy was positivism. Interpretivism-led research focuses on exploring the deeper meaning hidden in the survey participants' remarks, facial expressions or chosen options (Kothari, 2014). But it was positivism-led research, whereby facts and figures were taken at their face value (Hayashi, 2021). There was no need to incorporate the help of social scientist to better interpret or reinterpret the collected data and generated results (Dougherty, 2021). There were a few tentative hypotheses and these hypotheses were tested based on the collected information. Theory construction was not a research objective rather established theories related to structural break were tested in light of Bangladesh-based banking industry. From this perspective, this is deductive research. Multiple quantitative methods were used to deeply investigate the research phenomenon. The collected data was numerical and the constructed research variables were in ratio format. So, it was multi-quantitative business research. Generally, researchers employ different data collection techniques [such as – survey, interview, focus group discussion etc.] to collect information in business research (Kothari, 2014). Here, data was collected from selected commercial banks' annual reports. Since the data was already stored in archives [even though in a raw format], one can categorize this research as an 'archival' one (Saunders, et al., 2007).

This research is based on secondary data [data already published in annual report]. Annual reports were downloaded from banks' corporate websites. Macro-data was collected from Bangladesh Bank's website. And industry-level data was aggregated. All the data used in this research was freely available in the public domain and that is why no prior permission was needed to collect the data. It is worth mentioning that secondary data is less prone to standardized ethical concerns [like confidentiality, informed consent etc.] (Dougherty, 2021).

Secondary data was collected from 28 commercial banks [that included both state-owned commercial banks (SCBs) and privatized commercial banks (PCBs)] over a 11 years of research time frame [2014-2024]. Annual-level data was collected. It was assumed that Basel III accord was fully implemented in Bangladesh in 2019 [since, transition to Basel III was a gradual journey]. So, 2014-2018 was assumed to be the pre-Basel regime and 2020-2024 was assumed to the post-Basel regime. Since data was collected from multiple banks and for multiple years, the researcher eventually constructed a panel dataset.

There are more than 28 commercial banks operating in Bangladesh. The choice of the sampled banks was driven mostly by judgments rather than by any probabilistic measurement. So, non-probability sampling technique [convenience] was adopted in

the research. Islamic commercial banks are operated in quite a different eco-system; that is why secondary data was collected only from the conventional commercial banks.

A number of banking papers have cited some common data management issues and this paper is no exception to it. Much like other banking articles, there were 'missing value', 'standardization', and 'outlier' concerns (Kothari, 2014). Instead of imputing the missing values, rows containing missing values were deleted. Research variables were in ratio format, and some variables were transformed into their logarithmic level. So, the variables were standardized. For managing the outliers, data were winsorized at a 5% level.

Before running regressions, a number of diagnosis tests were conducted. For testing whether the relationship between dependent variable ['ROA'/'ROE'/'CAPE' in this case] and the key independent variable ['Regulation dummy'] is linear in parameter or not, established protocols like Ramsey RESET test and Harvey-Collier test were run. It was established that the relationship is linear in parameter. For testing, whether the variance of the error is constant or not, standardized tests like B-P test, White test, and graphical tools were employed (Kothari, 2014). The regression errors turned out to be a function of the covariates. In order to manage heteroscedasticity concerns, 'robust standard error' was used while extracting the beta coefficients. For checking out the presence of any outliers in the dataset, standardized tests like COV ratio, Cook's distance, and diagonal elements of the hat matrix were used (Saunders, et al., 2007). It was observed that there exist outliers in the data and that's why the baseline regression was re-run using winsorized data [tests of robustness]. Multicollinearity in the model, often makes the statistical inferencing process unreliable and that's why the presence of multicollinearity was tested using protocols like VIF, and Condition index (Kothari, 2014). It was well established that multicollinearity was not major concern for this study.

Panel regressions were run to understand the impact of policy change [measured through 'regulation dummy] on profitability dynamics. There are three well-established panel regression models – fixed effects model, random effects model, and first difference model (Dougherty, 2021). Fixed effects model adopts a time-demeaning approach and thus systematically eliminates the unobserved cross-sectional heterogeneity. Conceptually, it is more flexible than the random effects model. The results stemming from Hausman-Wu test also confirm that fixed-effects would be the preferred model for this research. As already mentioned, in order to manage heteroscedasticity concerns, 'robust standard error' was used (Kothari, 2014).

Chow tests are generally preferred to check the presence of structural break in time-series data (Hayashi, 2021). Even though, the test is popular in time-series, here the test was run on panel data. The core idea of Chow test still holds good in a panel data – comparing the RSS of the pooled model against the RSSs stemming from different subgroups [subgroups created by splitting the time] (Saunders, et al., 2007). In a standard time-series based Chow test, there is only one axis (time) to divide the data. In a panel data, there are naturally two units – time and cross-sectional units (Kothari, 2014). So, in a panel-data driven Chow-test, researcher needs to worry about fixed effects as well as the presence of autocorrelation.

The following table will present the operational definition of the research variables in a nutshell.

Table 1: Operational definition of research variables

Variable	Operational definition	Key note
Return on asset (ROA)	ROA = Net income/total asset; the variable was constructed at the firm-level	Ratio variable
Economic profit (EP)	Economic profit = Net income$_t$ – Common stockholder Equity$_{t-1}$ * cost of equity; the variable was constructed at the firm-level	Ratio variable
Cyclicality adjusted price-earnings (CAPE)	CAPE = Stock price/3-year moving average of earnings per share; the variable was constructed at the firm-level	Ratio variable
Business Size (Size)	Business size = Natural logarithm of total asset; the variable was constructed at the firm-level	Ratio variable
Capital adequacy (CAR)	Capital adequacy = Tier-1 & tier-2 capital/RWA; the variable was constructed at the firm-level	Ratio variable
Activity mix	Activity mix = non-operating income/total income; the variable was constructed at the firm-level	Ratio variable
Asset quality	Asset quality = Substandard, doubtful, and bad loan/ total loan; the variable was constructed at the firm-level	Ratio variable
Cost management (NIM)	Cost management = Natural logarithm of overhead; the variable was constructed at the firm-level	Ratio variable

Herfindahl-Hirschman index (HHI)	HHI = Squared market share of top-5 commercial banks; the variable was constructed at the industry level	Ratio variable
Term structure of interest rate (Interest rate)	Term structure = Change in yield spread between treasury securities; the variable was constructed at the macro level	Ratio variable
Inflation rate (Inflation)	Inflation rate = Percentage change in annual CPI; the variable was constructed at the macro level	Ratio variable
Macro-economic growth rate (GDP. GR)	Growth rate = Percentage change in annual GDP; the variable was constructed at the macro level	Ratio variable
Regulation dummy	'1' if the firm-year is '2019'; '0' otherwise	Categorical variable

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The following table will present the descriptive statistics of the research variables.

Table 2: Descriptive statistics

Research variables	**Observations**	**Mean**	**Standard deviation**	**Minimum**	**Maximum**
ROA	298	8.84%	4.21%	-4.33%	19.08%
Economic profit	298	4.11%	5.23%	-8.27%	10.44%
CAPE	298	8.47	13.09%	-5.10	24.45
Size	298	3.11	23.33%	1.53	6.29
Capital adequacy	298	11.08%	10.51%	8.46%	15.29%
Activity mix	298	30.93%	13.73%	23.97%	47.63%
Asset quality	298	12.36%	12.79%	8.56%	20.76%
NIM	298	13.19%	6.10%	9.13%	15.31%
HHI	11	30.58	11.83%	26.36	35.40
Cost management	298	1.71	4.74%	1.24	2.32
Interest rate	11	1.85%	5.10%	0.97	2.39%
Inflation	11	6.75%	7.27%	5.75%	8.99%
GDP growth rate	11	7.22%	9.30%	6.71%	8.67%

Compiled by: The Researcher

Descriptive statistics revealed through the above table indicate that the panel dataset hardly has any outlier [even though COV ratio or Cook's distance indicate otherwise]. As already mentioned, research variables were constructed either in ratio format or by transforming the variable into natural logarithm – perhaps this explains the somewhat perplexing results. Dispersion level [measured through standard deviation] for most of the research variables is quite high – an indication of a possible cross-sectional heterogeneity among the observations (Saunders, et al., 2007).

The following table will present the correlation table of the research variables.

Table 3: Correlation table

Variables	ROA	RE	CAPE	Size	Capital adequacy	Mix	Asset quality	NIM	HHI	Cost manage-ment	Interest rate	Inflation	GDP growth rate
ROA	1.00												
RE	0.65	1.00											
CAPE	0.49	0.46	1.00										
Size	0.11	0.21	0.64	1.00									
Capital adequacy	-0.33	-0.28	-0.24	0.04	1.00								
Activity mix	0.15	0.11	0.17	0.07	0.19	1.00							
Asset quality	0.34	0.21	0.28	0.08	0.12	0.35	1.00						
NIM	0.35	0.31	0.36	0.11	0.08	0.21	0.06	1.00					
HHI	0.18	0.19	0.29	0.68	0.07	0.32	0.09	-0.10	1.00				
Cost management	-0.24	-0.27	-0.24	0.36	0.11	0.26	0.07	-0.14	-0.34	1.00			
Interest rate	0.21	0.23	0.24	-0.05	0.12	0.29	0.06	0.68	0.07	0.04	1.00		
Inflation	0.11	0.08	0.13	0.11	0.18	0.06	0.04	0.44	0.04	0.13	0.62	1.00	
GDP growth rate	0.14	0.23	0.29	0.08	0.03	0.17	0.08	0.57	0.06	0.17	0.49	0.46	1.00

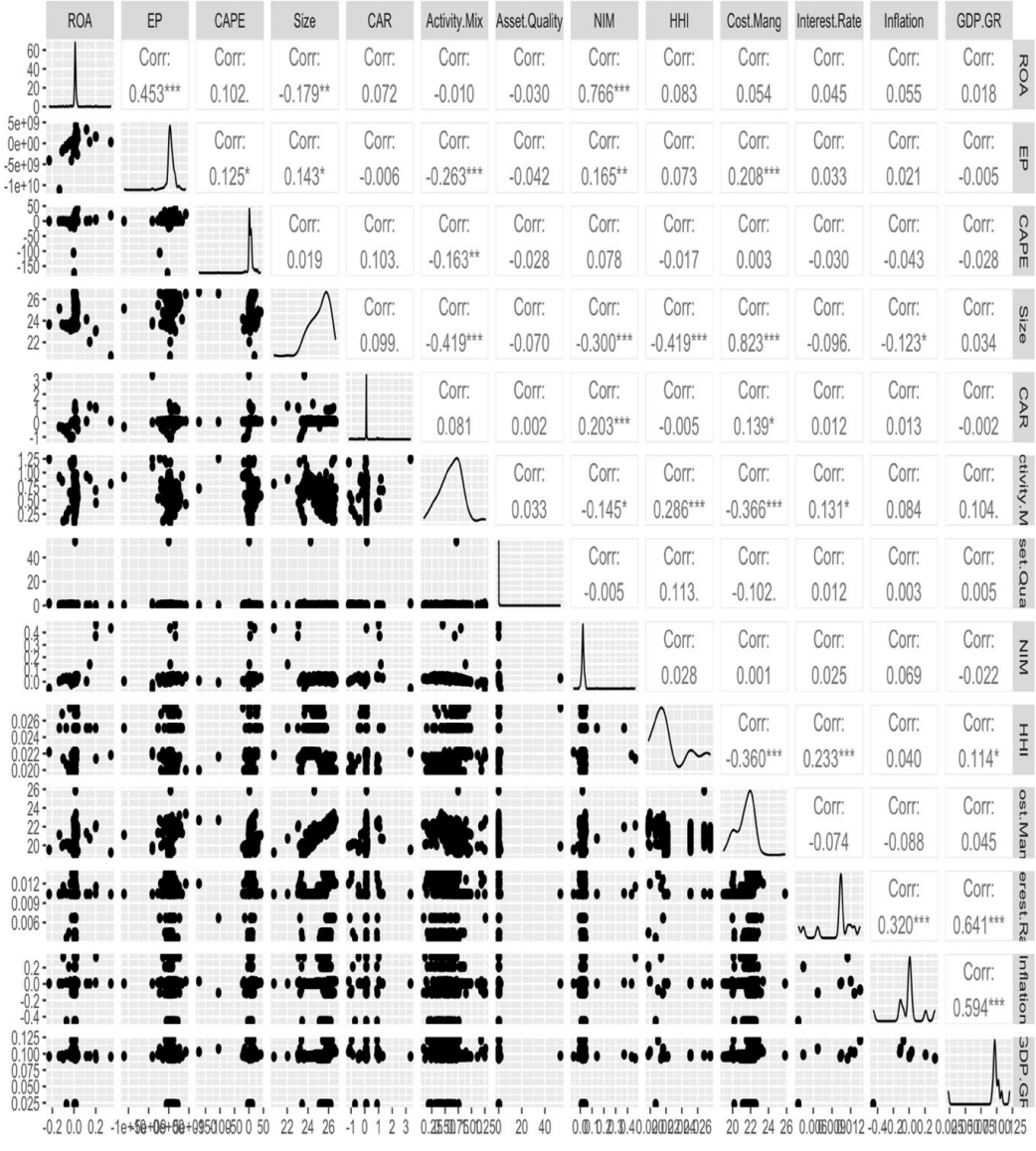
Compiled by: The Researcher

It is evident from the above table that none of the calculated pair-wise Pearson correlations is '1' [perfectly positive] or '-1' [perfectly negative]. So, based on the correlation matrix, it can be concluded that 'perfect multicollinearity' or 'full rank' problem is not a concern for this research (Saunders, et al., 2007). Pearson correlation coefficient between commercial banks' profitability and asset quality is positive [the sign matches with the empirical predictions]. Pearson correlation

coefficient between commercial banks' profitability and capital adequacy ratio is negative [the sign matches with the empirical predictions].

Then probability distribution of the major research variables was calculated using 'ggplot2' and 'GGally' command [using 'R' eco-system]. The following figure will present the probability distribution of the research variables.

Figure 1: Probability distribution of research variables



Source: The Researcher

It is evident from the above figure that none of the research variables are normally distributed. Most of the research variables are asymmetric [skewed in one specific direction]; have excess kurtosis [leptokurtic].

4.0 Results

Before running Chow tests to investigate the presence of structural break in profitability and capital adequacy connection revolving Basel III implementation, three panel regressions were run. One baseline regression covered the overall time-period [2014-2024]. Then dividing the dataset into two segments [one segment covering a 5-year time-horizon: 2014-2018 [denoted as pre-Basel regime], another segment covering a 5-year time-horizon: 2020-2024 [denoted as the post-Basel regime], two more regressions were run. At first, the baseline regression model's specification is presented:

$Y_{i,t} = \alpha + \sum_{i=1}^{5} \beta_i$ Firm-specific factors$_{i,t}$ + β_6 Industry-specific factor + $\sum_{j=1}^{3} \beta_j$ Macro-economic factors$_t$ + $V_{i,t}$

The baseline specification can be elaborated as such:

Profitability$_{i,t}$ = α + β_1 Business Size $_{i,t}$ + β_2 Capital adequacy$_{i,t}$ + β_3 Activity mix $_{i,t}$ + β_4 NIM$_{i,t}$ + β_5 Cost Management$_{i,t}$ + β_6 HHI$_t$ + β_7 Interest rate$_t$ + β_8 Inflation$_{,t}$ + β_9 GDP Growth Rate$_t$ + a_i + Δ_t + $\varepsilon_{i,t}$

It is evident from the above specification that panel disturbance term can be decomposed into three parts – time varying but cross-sectionally invariant error [Δ_t], cross-sectionally varying but unobserved error [a_i] and idiosyncratic error [$\varepsilon_{i,t}$]. Since the baseline regression model has used fixed-effects method, a_i has been systematically eliminated from the model. Usages of time-fixed effects have also neutralized the impact of time-varying error. In the time-demeaned version of fixed effects equation, beta coefficients for the baseline model have been extracted eventually by running an OLS(Saunders, et al., 2007). Since, robust standard error has been used, heteroscedasticity concerns have been managed [the beta vector is an efficient one]. Then the pre-Basel regime regression model's specification is presented:

$Y_{i,t} = \alpha_1 + \sum_{i=1}^{5} \gamma_i$ Firm-specific factors$_{i,t}$ + γ_6 Industry-specific factor + $\sum_{j=1}^{3} \gamma_j$ Macro-economic factors$_t$ + a_i + Δ_t + $\varepsilon_{i,t}$

Panel disturbance terms were decomposed into three parts – time varying but cross-sectionally invariant error [Δ_t], cross-sectionally varying but unobserved error [a_i] and idiosyncratic error [$\varepsilon_{i,t}$]. Since the pre-Basel regression model has used fixed-effects

method, a_i has been systematically eliminated from the model. Usages of time-fixed effects have also neutralized the impact of time-varying error. In the time-demeaned version of fixed effects equation, beta coefficients for the pre-Basel model have been extracted eventually by running an OLS (Saunders, et al., 2007). Since, robust standard error has been used, heteroscedasticity concerns have been managed [the beta vector is an efficient one].

Then the post-Basel regime regression model's specification is presented:

$Y_{i,t} = \alpha_2 + \sum_{i=1}^{5} \delta_i$ Firm-specific $\text{factors}_{i,t} + \delta_6$ Industry-specific factor $+ \sum_{j=1}^{3} \delta_j$ Macro-economic $\text{factors}_t + a_i + \Delta_t + \varepsilon_{i,t}$

Panel disturbance terms were decomposed into three parts – time varying but cross-sectionally invariant error [Δ_t], cross-sectionally varying but unobserved error [a_i] and idiosyncratic error [$\varepsilon_{i,t}$]. Since the post-Basel regression model has used fixed-effects method, a_i has been systematically eliminated from the model. Usages of time-fixed effects have also neutralized the impact of time-varying error. In the time-demeaned version of fixed effects equation, beta coefficients for the post-Basel model have been extracted eventually by running an OLS (Saunders, et al., 2007). Since, robust standard error has been used, heteroscedasticity concerns have been managed [the beta vector is an efficient one].

When pooled OLS, first difference model, and random effects models were used, the regression signs did not flip – an indication that the observed effects are robust to selection of estimation technique. Moreover, the estimated effects are quasi-robust in the out-of-the sample cases as well.

Standard null hypothesis in case of Chow test is as follows:

a. $\alpha_1 = \alpha_2 = \alpha$ [regression constants of the baseline, pre-Basel regime and post-Basel regime are alike]

b. $\sum_{i=1}^{5} \beta_i = \sum_{i=1}^{5} \gamma_i = \sum_{i=1}^{5} \delta_i$ [for the bank-specific covariates]; the null hypothesis is stating that the impact of bank-specific factors across the baseline, pre-Basel regime and post-Basel regime is similar.

c. $B_6 = \delta_6 = \gamma_6$ [for the industry-specific covariate]; the null hypothesis is stating that the impact of industry-specific factor across the baseline, pre-Basel regime and post-Basel regime is similar.

d. $\sum_{j=1}^{3} \beta_i = \sum_{j=1}^{3} \gamma_i = \sum_{j=1}^{3} \delta_i$ [for the macro-economic covariates]; the null hypothesis is stating that the impact of macro factors across the baseline, pre-Basel regime and post-Basel regime is similar.

Chow test assumes that errors are normally distributed and follow an i.i.d process (Hayashi, 2021). Chow-test statistics can be calculated using the following method: $\frac{[SSRc-(SSR1+SSR2)]/k}{[SSR1+SSR2]/[N1+N2-2k]}$

Where SSR refers to the sum of squared residuals, k is equal to the number of constraints [parameters] in model, 'N1' is equal to the observations in the pre-Basel group, 'N2' is equal to the number of observations in the post-Basel group. For decision-making, Chow statistics is compared to the F-test results.

Table 4: Chow Test Results -1

Chow tests: Structural change in profitability- capital adequacy relationship									
Particulars	PCB+SCB			SCB			PCB		
	Overall	Pre-Basel	Post-Basel	Overall	Pre-Basel	Post-Basel	Overall	Pre-Basel	Post-Basel
Sc	0.637			0.509			0.679		
S1		0.642			0.52			0.704	
S2			0.842			0.517			0.911
k	9	9	9	9	9	9	9	9	9
N1		138			44			114	
N2			46			24			38
Sc-S1-S2		-0.846			-0.527			-0.936	
(Sc-[S1+S2])/k		-0.09404			-0.05857			-0.104	
S1+S2		1.484			1.036			1.615	
(S1+S2)/(N1+N2-2k)		0.008938			0.020727			0.006802	
Chow test statistics		-11.047			-2.9669			-16.048	
Absolute value		11.04708			2.9669			16.04758	
F-test statistics	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93
Conclusion		Rejected			Rejected			Rejected	

Compiled by: The researcher

Since the results were generated for the overall database, only private commercial bank database, and only state-owned commercial bank database, there were basically three tests for structural break in the profitability-capital adequacy relationship. Based on the overall database, the null is rejected as the Chow-statistics is way higher

than F-value. So, Basel III implementation has structurally changed the profitability-capital adequacy relationship in the overall case. Likewise, for the SCB [State-owned commercial bank] case, the null is rejected as the Chow-statistics is way higher than F-value. So, Basel III implementation has structurally changed the profitability-capital adequacy relationship in the SCB case. Finally, for the PCB [private commercial bank] case, the null is rejected as the Chow-statistics is way higher than F-value. So, Basel III implementation has structurally changed the profitability-capital adequacy relationship in the PCB case. In a nutshell, there exists structural break in the profitability-capital adequacy relationship due to Basel III implementation.

Before running Chow tests to investigate the presence of structural break in profitability and asset quality connection revolving Basel III implementation, three panel regressions were run. One baseline regression covered the overall time-period [2014-2024]. Then dividing the dataset into two segments [one segment covering a 5-year time-horizon: 2014-2018 [denoted as pre-Basel regime], another segment covering a 5-year time-horizon: 2020-2024 [denoted as the post-Basel regime], two more regressions were run. At first, the baseline regression model's specification is presented:

$Y_{i,t} = \alpha + \sum_{i=1}^{5} \beta_i$ Firm-specific factors$_{i,t}$ + β_6 Industry-specific factor + $\sum_{j=1}^{3} \beta_j$ Macro-economic factors$_t$ + $V_{i,t}$

The baseline specification can be elaborated as such:

Profitability$_{i,t}$ = α + β_1 Business Size $_{i,t}$ + β_2 Asset quality$_{i,t}$ + β_3 Activity mix $_{i,t}$ + β_4 NIM$_{i,t}$ + β_5 Cost Management$_{i,t}$ + β_6 HHI$_t$ + β_7 Interest rate$_t$ + β_8 Inflation$_{,t}$ + β_9 GDP Growth Rate$_t$ + a_i + Δ_t + $\varepsilon_{i,t}$

It is evident from the above specification that panel disturbance term can be decomposed into three parts – time varying but cross-sectionally invariant error [Δ_t], cross-sectionally varying but unobserved error [a_i] and idiosyncratic error [$\varepsilon_{i,t}$]. Since the baseline regression model has used fixed-effects method, a_i has been systematically eliminated from the model. Usages of time-fixed effects have also neutralized the impact of time-varying error. In the time-demeaned version of fixed effects equation, beta coefficients for the baseline model have been extracted eventually by running an OLS (Saunders, et al., 2007). Since, robust standard error has been used, heteroscedasticity concerns have been managed [the beta vector is an efficient one]. Then the pre-Basel regime regression model's specification is presented:

$Y_{i,t} = \alpha_1 + \sum_{i=1}^{5} \gamma_i$ Firm-specific factors$_{i,t}$ + γ_6 Industry-specific factor + $\sum_{j=1}^{3} \gamma_j$ Macro-economic factors$_t$ + $a_i + \Delta_t + \varepsilon_{i,t}$

Panel disturbance terms were decomposed into three parts – time varying but cross-sectionally invariant error [Δ_t], cross-sectionally varying but unobserved error [a_i] and idiosyncratic error [$\varepsilon_{i,t}$]. Since the pre-Basel regression model has used fixed-effects method, a_i has been systematically eliminated from the model. Usages of time-fixed effects have also neutralized the impact of time-varying error. In the time-demeaned version of fixed effects equation, beta coefficients for the pre-Basel model have been extracted eventually by running an OLS. Since, robust standard error has been used, heteroscedasticity concerns have been managed [the beta vector is an efficient one].

Then the post-Basel regime regression model's specification is presented:

$Y_{i,t} = \alpha_2 + \sum_{i=1}^{5} \delta_i$ Firm-specific factors$_{i,t}$ + δ_6 Industry-specific factor + $\sum_{j=1}^{3} \delta_j$ Macro-economic factors$_t$ + $a_i + \Delta_t + \varepsilon_{i,t}$

Panel disturbance terms were decomposed into three parts – time varying but cross-sectionally invariant error [Δ_t], cross-sectionally varying but unobserved error [a_i] and idiosyncratic error [$\varepsilon_{i,t}$]. Since the post-Basel regression model has used fixed-effects method, a_i has been systematically eliminated from the model. Usages of time-fixed effects have also neutralized the impact of time-varying error. In the time-demeaned version of fixed effects equation, beta coefficients for the post-Basel model have been extracted eventually by running an OLS (Saunders, et al., 2007). Since, robust standard error has been used, heteroscedasticity concerns have been managed [the beta vector is an efficient one].

When pooled OLS, first difference model, and random effects models were used, the regression signs did not flip – an indication that the observed effects are robust to selection of estimation technique. Moreover, the estimated effects are quasi-robust in the out-of-the sample cases as well.

Standard null hypothesis in case of Chow test is as follows:

a. $\alpha_1 = \alpha_2 = \alpha$ [regression constants of the baseline, pre-Basel regime and post-Basel regime are alike]

b. $\sum_{i=1}^{5} \beta_i = \sum_{i=1}^{5} \gamma_i = \sum_{i=1}^{5} \delta_i$ [for the bank-specific covariates]; the null hypothesis is stating that the impact of bank-specific factors across the baseline, pre-Basel regime and post-Basel regime is similar.

c. $B_6 = \delta_6 = \gamma_6$ [for the industry-specific covariate]; the null hypothesis is stating that the impact of industry-specific factor across the baseline, pre-Basel regime and post-Basel regime is similar.

d. $\sum_{j=1}^{3}\beta_i = \sum_{j=1}^{3}\gamma_i = \sum_{j=1}^{3}\delta_i$ [for the macro-economic covariates]; the null hypothesis is stating that the impact of macro factors across the baseline, pre-Basel regime and post-Basel regime is similar.

Chow test assumes that errors are normally distributed and follow an i.i.d process (Hayashi, 2021). Chow-test statistics can be calculated using the following method: $\frac{[SSRc-(SSR1+SSR2)]/k}{[SSR1+SSR2]/[N1+N2-2k]}$

Where SSR refers to the sum of squared residuals, k is equal to the number of constraints [parameters] in model, 'N1' is equal to the observations in the pre-Basel group, 'N2' is equal to the number of observations in the post-Basel group. For decision-making, Chow statistics is compared to the F-test results.

Table 5: Chow Test Results-2

Chow tests: Structural change in profitability- asset quality relationship									
Particulars	PCB+SCB			SCB			PCB		
	Overall	Pre-Basel	Post-Basel	Overall	Pre-Basel	Post-Basel	Overall	Pre-Basel	Post-Basel
Sc	0.651			0.48			0.692		
S1		0.644			0.521			0.702	
S2			0.8			0.531			0.834
k	9	9	9	9	9	9	9	9	9
N1		137			44			113	
N2			46			24			38
Sc-S1-S2		-0.794			-0.571			-0.843	
(Sc-[S1+S2])/k		-0.08821			-0.06348			-0.09369	
S1+S2		1.445			1.052			1.535	
(S1+S2)/(N1+N2-2k)		0.008755			0.02104			0.006267	
Chow test statistics		-10.7819			-3.22923			-15.9949	
Absolute value		10.7819			3.22923			15.99491	
F-test statistics	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93
Conclusion		Rejected			Rejected			Rejected	

Compiled by: The researcher

Since the results were generated for the overall database, only private commercial bank database, and only state-owned commercial bank database, there were basically three tests for structural break in the profitability-asset quality relationship. Based on

the overall database, the null is rejected as the Chow-statistics is way higher than F-value. So, Basel III implementation has structurally changed the profitability- asset quality relationship in the overall case. Likewise, for the SCB [State-owned commercial bank] case, the null is rejected as the Chow-statistics is way higher than F-value. So, Basel III implementation has structurally changed the profitability- asset quality relationship in the SCB case. Finally, for the PCB [private commercial bank] case, the null is rejected as the Chow-statistics is way higher than F-value. So, Basel III implementation has structurally changed the profitability- asset quality relationship in the PCB case. In a nutshell, there exists structural break in the profitability- asset quality relationship due to Basel III implementation.

In order to assess the partial effect of Basel implementation on commercial banks' profitability, dummy variable [Regulation dummy] was used. At first, the baseline regression model's specification is presented:

$Y_{i,t} = \alpha + \sum_{i=1}^{6} \beta_i$ Firm-specific factors$_{i,t}$ + β_7 Industry-specific factor + $\sum_{j=1}^{3} \beta_j$ Macro-economic factors$_t$ + β_{11} Regulation Dummy$_t$ + $V_{i,t}$

The baseline specification can be elaborated as such:

$ROA_{i,t} = \alpha + \beta_1$ Business Size $_{i,t} + \beta_2$ Capital adequacy$_{i,t} + \beta_3$ Activity mix $_{i,t} + \beta_4$ NIM$_{i,t} + \beta_5$ Cost Management$_{i,t} + \beta_6$ Asset Quality$_{i,t} + \beta_7$ HHI$_t + \beta_8$ Interest rate$_t + \beta_9$ Inflation$_{,t} + \beta_{10}$ GDP Growth Rate$_t + \beta_{11}$ Regulation Dummy$_t + a_i + \Delta_t + \varepsilon_{i,t}$

It is evident from the above specification that panel disturbance term can be decomposed into three parts – time varying but cross-sectionally invariant error [Δ_t], cross-sectionally varying but unobserved error [a_i] and idiosyncratic error [$\varepsilon_{i,t}$]. Since the baseline regression model has used fixed-effects method, a_i has been systematically eliminated from the model. Usages of time-fixed effects have also neutralized the impact of time-varying error. In the time-demeaned version of fixed effects equation, beta coefficients for the baseline model have been extracted eventually by running an OLS. Since, robust standard error has been used, heteroscedasticity concerns have been managed [the beta vector is an efficient one]. Later on, two alternative definitions of profitability were used.

Economic Profit$_{i,t} = \alpha + \beta_1$ Business Size $_{i,t} + \beta_2$ Capital adequacy$_{i,t} + \beta_3$ Activity mix $_{i,t} + \beta_4$ NIM$_{i,t} + \beta_5$ Cost Management$_{i,t} + \beta_6$ Asset Quality$_{i,t} + \beta_7$ HHI$_t + \beta_8$ Interest rate$_t + \beta_9$ Inflation$_{,t} + \beta_{10}$ GDP Growth Rate$_t + \beta_{11}$ Regulation Dummy$_t + a_i + \Delta_t + \varepsilon_{i,t}$

CAPE$_{i,t} = \alpha + \beta_1$ Business Size $_{i,t} + \beta_2$ Capital adequacy$_{i,t} + \beta_3$ Activity mix $_{i,t} + \beta_4$ NIM$_{i,t} + \beta_5$ Cost Management$_{i,t} + \beta_6$ Asset Quality$_{i,t} + \beta_7$ HHI$_t + \beta_8$ Interest rate$_t + \beta_9$ Inflation$_{,t} + \beta_{10}$ GDP Growth Rate$_t + \beta_{11}$ Regulation Dummy$_t + a_i + \Delta_t + \varepsilon_{i,t}$

Table 6: Regression Results

	Model (1)	Model (2)	Model (3)
Variables	ROA	Economic Profit	CAPE
Basel dummy	-01.912**	-1.85104**	-12.9384**
	(-0.705)	(-1.140)	(-2.241)
Size	-0.0077544**	-2.983e+06	5.018*
	(-2.277)	(-0.0143)	(1.807)
Capital Adequacy	-0.028512***	-5.749e+08**	1.946
	(-7.782)	(-2.540)	(0.650)
Activity Mix	0.01512*	-1.416e+09***	-9.590
	(2.096)	(-3.174)	(-1.625)
Asset Quality	0.000214	0.000278	0.000535
	(0.679)	(0.548)	(0.733)
NIM	0.65124***	2.408e+09	30.802
	(19.030)	(1.140)	(1.102)
HHI	0.488	1.144e+11***	-670.896
	(0.797)	(3.051)	(-1.352)
Cost Management	0.0045036*	5.703e+06	-2.088
	(1.922)	(0.0396)	(-1.095)
Interest Rate	-0.380	8.627e+09	349.164
	(-0.757)	(0.279)	(0.853)
Inflation	-0.000238	1.301e+09	-25.002**
	(-0.0177)	(1.580)	(-2.293)
GDP Growth Rate	0.0274	-1.159e+10	201.204*
	(0.229)	(-1.575)	(2.065)
Constant	0.0764	-3.807e+08	-75.092
	(1.012)	(-0.0820)	(-1.223)
Observations	321.84	322.92	322.92
R-squared	0.747	0.132	0.042
Number of Firm Code	23	23	23
Firm FE	Yes	Yes	Yes
Time dummy	Yes	Yes	Yes
Seasonal adjustment	No	No	No
R2 within	0.807	0.143	0.0449
R2 overall	0.605	0.1040	0.0415
R2 between	0.0608	0.00207	0.0362
F-stat	76.421	4.366	1.247
Prob > F	0	3.802e-05	0.347
t-statistics in parentheses [*** p<0.01, ** p<0.05, * p<0.1]			

Compiled by: The researcher

It is evident from the table that, the sign of 'regulation dummy' is negative when profitability was measured through ROA. So, the impact of Basel III implementation on profitability is negative [on an average, the ROA in the pre-Basel regime is higher than the ROA in the post-Basel regime]. Likewise, the sign of 'regulation dummy' is negative when profitability was measured through economic profit. So, the impact of Basel III implementation on profitability is negative [on an average, the economic profit in the pre-Basel regime is higher than the economic profit in the post-Basel regime]. Finally, the sign of 'regulation dummy' is negative when profitability was measured through CAPE. So, the impact of Basel III implementation on profitability is negative [on an average, the CAPE in the pre-Basel regime is higher than the CAPE in the post-Basel regime].

When pooled OLS, first difference model, and random effects models were used, the regression signs did not flip – an indication that the observed effects are robust to selection of estimation technique. Moreover, the estimated effects are quasi-robust in the out-of-the sample cases as well. When banks were segregated into two groups [large banks and small banks], the researcher observed signs of cross-sectional heterogeneity [so, the impact of Basel III on profitability dynamics is not uniform across the cross-sections].

5.0 Conclusion

It was well evident that there exists structural break in commercial bank's profitability dynamics surrounding the implementation of Basel III accord. The relationship between profitability and capital adequacy during the pre-Basel regime was different from that of the post-Basel regime. Likewise, the relationship between profitability and asset quality during the pre-Basel regime was different from that of the post-Basel regime. Slope coefficient of 'Basel dummy' variable was statistically significant indicating a strong impact of stringent capital requirement on banks' profitability.

These research findings entail a number of policy implications. Firstly, the results indicate that capital regulations [as postulated in Basel III] infused structural effect on banks' behavior; so, we should not merely judge Basel III accord as just another 'compliance cost'. Secondly, the impact of this paradigm shift is not symmetric across all types of commercial banks – so, there has been existence of cross-sectional heterogeneity. Bangladesh has traditionally been a credit-deficit country; so, it would be worth understanding the trade off between financial stability and credit supply from Bangladesh's point of view.

The research has also paved the way for further key research. Future research may focus on which profitability channel [net interest margin, non-interest income, cost-to-income ratio etc.] actually broke due to the paradigm shift. The impact of Basel III implementation on profitability dynamics can be compared with the impact of Basel II implementation on profitability dynamics. Likewise, cross-country comparison revolving the research area of interest can also be explored in future studies.

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