Bangko Sentral ng Pilipinas
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Do Capital Regulations Influence Banks' Holding of "Excess" Capital?

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Abstract

This study examines the moral hazard and capital buffer theories as motivations of Philippine banks in managing their capital and risks following the adoption of Pillar 1 of the Basel III framework on minimum capital requirement. Using the empirical model of Heid et. al (2004) and Malovaná (2017), the results of the study indicate that most banks adjust their regulatory capital ratio by optimizing their portfolio risk through changes in the level of capital. Banks do not have the tendency to immediately adjust their risk-weighted exposures but are more inclined to maintain a reasonable balance between changes in the size of their assets and capital. Moreover, banks that have lower capital ratios relative to their peers have higher tendency to adjust their capital ratio. The capital buffer theory likewise holds true, that is, banks with low capital buffers rebuild an appropriate level of buffer by decreasing their risk exposures while banks with high capital buffer are inclined to simply maintain their capital ratio when these banks increase their risk exposures. Another interesting finding of the study is that the adoption of minimum capital requirement did not result in moral hazard problem rather banks have become more risk-sensitive. In particular, banks try to rebuild an appropriate buffer by raising their level of capital while simultaneously lowering risk. The results are robust against diagnostic tests, different specifications of the model and alternative estimation method.

JEL classification: E58, G20, G21, G28
Keywords: minimum capital requirement, level of capital, risk-weighted exposures, risk-sensitive capital, regulatory capital
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Do Capital Regulations Influence Banks' Holding of "Excess" Capital?

Cherry Wyle G. Layaoen and Vernalin Domantay-Mailig[1]

1. Introduction

The Bangko Sentral ng Pilipinas (BSP) adopted Pilar 1 of the Basel III framework on minimum capital requirement on 01 January 2014 with the issuance of Circular No. 781 dated 15 January 2013 following the weaknesses observed in the global financial regulations during the 2008 Global Financial Crisis (GFC).

Moreover, other complementary Basel III reforms adopted include (1) capital conservation buffer (CCB) of 2.5 percent, which comprised of CET1 capital was also prescribed if a U/KB wants to make capital distribution (Circular No. 781 dated 15 January 2013); (2) the implementation of a 5 percent leverage ratio (Circular No. 881 dated 09 June 2015); (3) 100 percent liquidity coverage ratio (Circular No. 905 dated 10 March 2016) of unencumbered high quality liquid assets (HQLA) that can be converted easily and immediately in private markets into cash for a 30-calendar day liquidity stress scenario; and (4) domestic systemically important banks (DSIBs) are required to increase their minimum Common Equity Tier 1 (CET1) ratio by 1.5 to 3.5 percentage points depending on which bucket they are classified (Circular No. 856 dated 29 October 2014), among others.

Basically, the adoption of these frameworks aims to implement proactive regulatory reforms to strengthen the composition and quality of bank capital and to enhance the banking system's capacity to absorb financial shocks by requiring banks to put up additional high-quality capital. It is also intended to accumulate capital during good times or economic growth which banks can withdraw to absorb losses during periods of financial and economic stress (Bangko Sentral ng Pilipinas, 2017).

The risk-based capital ratio of a bank refers to the share of qualifying capital to risk-weighted assets (RWA) which should not be less than ten (10) percent for both solo basis (comprised of head office and its branches) and consolidated basis (parent bank and its subsidiary financial allied undertakings excluding insurance companies).

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Qualifying capital consists of Tier 1 (core) capital and Tier 2 (supplemental) capital. Tier 1 capital is composed of common equity tier 1 (CET1) and additional tier 1 capital (AT1) capital. Meanwhile, the RWA is the sum of weighted exposures to credit, market and operational risks. A 6.0 percent CET1 ratio, 7.5 percent Tier 1 ratio and 2.5 percent capital conservation buffer (CCB) were also prescribed (Figure 1). The CCB, however, is an additional capital requirement comprised of CET1 capital if a U/KB and their subsidiary banks and quasi-banks want to make capital distribution with no restriction.

The CET1 capital is a component of Tier 1 capital that consists of: (a) paid up Common stock issued by the bank that meet the eligibility criteria; (b) common stock dividends distributable; (c) additional paid-in capital resulting from the issuance of common stock included in CET1 capital; (d) deposit for common stock subscription; (e) retained earnings; (f) undivided profits; (g) other Comprehensive Income (i.e. net unrealized gains or losses on available for sale (AFS) securities and cumulative foreign currency translation); and (h) minority interest in subsidiary banks which are less than wholly-owned.

Meanwhile, AT1 consists of instruments issued by the bank that are not included in CET1 capital but meet the criteria for inclusion in AT1, required loss absorbency features for instruments classified as liabilities for accounting purposes and at point of non-viability.[2] Additional paid-in capital resulting from the issuance of instruments included in AT1 capital, deposit for subscription of AT1 and minority interest in subsidiary banks which are less than wholly-owned also comprised AT1.

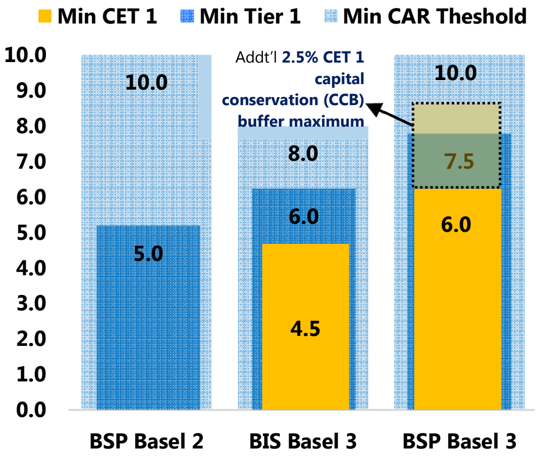
Banks often claim that extra capital requirements reduce their ability to expand business activities because equity is more expensive than debt. However, breaching the regulatory minimum warrants more intense supervisory actions. In particular, non-compliance with the regulatory minimum would entail prohibition or limit on the distribution of net profits and may require that part or all of net profits be used to increase the capital accounts until the minimum requirements are fulfilled.[3] A bank may also be subject to prompt corrective action (PCA) that essentially involves the BSP directing the board of directors (BOD) of a bank, to institute any or all of the following: (1) capital restoration plan, (2) business improvement plan, and (3) corporate governance reforms.[4] It would be then logical to expect banks to operate with their regulatory capital close to the minimum requirements.

Universal and commercial banks (U/KBs) and their subsidiary thrift banks (TBs) have maintained "excess" capital[5] or their total regulatory capital ratios in or well above the regulatory minima of 10 percent[6] (Figure 2). The level of capital stock as of end-March 2018 was augmented by continued growth in earnings, capital raising activities of banks and higher net unrealized gains on AFS securities. During the same period, most U/KBs are compliant with the minimum capital and risk-based capital regulatory requirements set by the BSP with

[2] See Annex B, E and F of Circular No. 781 dated 15 January 2013.
[3] See Item C of Part VIII of Appendix 63c of the Manual of Regulations for Banks.
[4] See Appendix 69 of the Manual of Regulations for Banks.
[5] The "excess" capital is measured against the 10.0% minimum regulatory capital requirement. A bank is considered to have an excess capital if its CAR is more than 10.0%.
[6] Banks usually operate above the minimum regulatory capital requirements in order to minimize the probability of reaching the regulatory limit of solvency ratios should they face adverse developments.

sufficient margin above the regulatory minima and international standard on an individual bank basis.

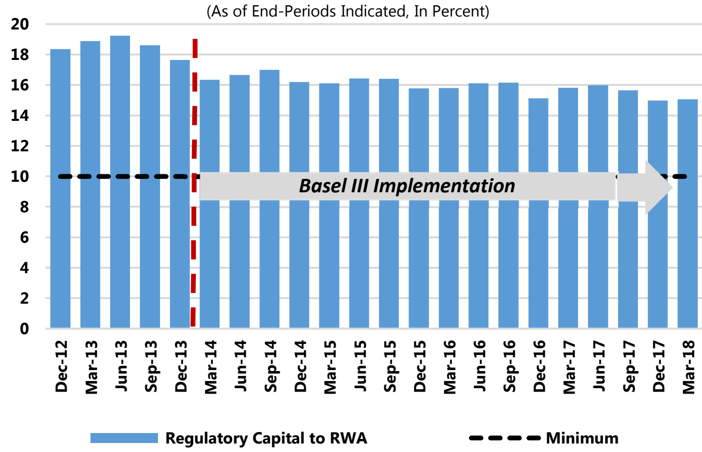
Figure 1. Risk-Based Capital Adequacy Ratio



BIS = Bank for International Settlements
BSP = Bangko Sentral ng Pilipinas

Source: BSP Circular No. 781 dated 15 January 2013

Figure 2. Philippine Universal and Commercial Banks and their Subsidiary Thrift Banks Basel III Capital Adequacy Ratio
(As of End-Periods Indicated, In Percent)



Source: Supervisory Data Center

Most empirical studies build on the moral hazard and capital buffer theories to understand how banks adjust capital in view of minimum capital requirements. Heid et. al (2004) explains that moral hazard theory predicts an increase in bank's risk when faced with additional capital requirements. Meanwhile, the capital buffer theory highlights that the size of capital affects bank behavior towards capital and risk. Banks with high excess capital will simply seek to maintain said excess capital while banks with low excess capital will pursue to rebuild an appropriate level in excess of the regulatory minimum. Hence, banks with high excess capital will display rising excess capital when risk increases and falls when risks moderate (Heid et. al, 2004).

This study examines the motivations of U/KBs and their subsidiary thrift banks' (TBs) in managing their capital and risks following the adoption of Pillar 1 of the Basel III framework on minimum capital requirement and estimates the speed at which they adjust their capital using the empirical model of Heid et. al (2004) and Malovaná (2017). The approach followed the partial adjustment model introduced by Hancock and Wilcox (1994), Shrieves and Dahl (1992) and used by many others (e.g. Berger et al, 2008; Gropp and Heider, 2010). The model is applied to quarterly panel data for 34 U/KBs (including 14 foreign banks) and their 11 subsidiary TBs in the Philippines from December 2012 to March 2018 using dynamic panel Generalized Method of Moments (GMM). To the best of our knowledge, this approach is a first in the Philippines.

The empirical results suggest that U/KBs and their subsidiary TBs do not have the tendency to immediately adjust their risk-weighted exposures but are inclined more to maintain a reasonable balance between changes in the size of their assets and capital. The imposition of minimum capital requirement influences banks' decision to change their internal operations strategy in terms of strong corporate governance, structure and risk management which consequently, allows them to obtain capital cheaply. For instance, good corporate governance improves the creditworthiness and reputation of a bank. Hence, banks can easily raise their required capital at a lower cost from the market. Moreover, U/KBs that have lower regulatory capital ratios relative to their peers have higher the tendency to adjust their capital ratios. The capital buffer theory likewise holds true for most U/KBs in the Philippines and the adoption of Basel III reforms did not result in moral hazard problem rather U/KBs have become more risk-sensitive. These results are robust against different specifications of the model and alternative estimation method.

The next section (Section 2) of this study presents the empirical model, including the hypotheses used as well as the nature of the data. Section 3 discusses the empirical results while Section 4 presents the implications for microprudential policy. Section 5 concludes the paper.

2. The Empirical Methodology

2.1 Partial Adjustment Framework of Bank Capital Requirement

Heid et. al (2004) and Malovaná (2017) show that the manner by which banks manage capital and risks can be explained by moral hazard and capital buffer theories in a partial adjustment framework. The basic intuition is that adjustments in capital are the results of discretionary behavior of banks and exogenous shocks as seen in equation 1,

$$\triangle CAR_{i,t} = \triangle CAR_{i,t}^{d} + \varepsilon_{i,t} \quad (1)$$

where $\triangle CAR_{i,t}^{d}$ is the endogenously determined adjustment and $\varepsilon_{i,t}$ is the exogenous random shocks on capital.

In practice, banks aim to achieve an optimal capital or a "target level" to comply with bank regulations and meet their growth objectives. However, due to unexpected exogenous shocks, the actual capital level may deviate from the target level set by banks during their ICAAP (Circular No. 639 dated 15 January 2009). Banks will adjust their capital only partially towards the target level because an instantaneous full adjustment is too costly and/or impractical. The partial adjustment model follows the earlier work of Heid et. al (2004) and Malovaná (2017) as seen in equation 2:

$$\triangle CAR_{i,t}^{d} = \lambda\left(CAR_{i,t}^{*} - DNCAR_{i,t}\right) \quad (2)$$

Substituting Equation (2) to Equation (1), the observed adjustment in capital can be written as:

$$\triangle CAR_{i,t} = \lambda\left(CAR_{i,t}^{*} - DNCAR_{i,t}\right) \quad (3)$$

$$CAR_{i,t} - DNCAR_{i,t} = \lambda\left(CAR_{i,t}^{*} - DNCAR_{i,t}\right) + \varepsilon_{i,t} \quad (4)$$

where $CAR^{*}_{i,t}$ is the target level of capital adequacy ratio (CAR)[7], $DNCAR_{i,t} = (Capital_{i,t-4} + NP_{i,t})/\ RWA_{i,t-4}$ is the "do-nothing" capital ratio, λ is the speed of adjustment, and $\varepsilon_{i,t}$ is the exogenous random shocks in capital level for bank, where i denotes banks and t denotes quarters. $Capital_{i,t}$, $NP_{i,t}$ and $RWA_{i,t}$ are the total qualifying capital (TQC), annualized net profit[8], and RWA, respectively.

It should be noted that the "do-nothing" CAR refers to the reaction time to elicit bank response that usually takes one year. Moreover, average annual dividend payments which were specified in Malovaná (2017) are not included in this exercise as the data are not available.

Meanwhile, in order to estimate the annual speed of adjustment, the TQC and RWA are lagged by four quarters.

Malovaná (2017) explains that the concept of "speed of adjustment" was introduced by Berger et al (2008) to indicate the portion which can be attributed to changes in the capital and the size of their portfolios, structure and risks. The left-hand side of Equation (4) represents the actively-managed change in the capital ratio by changes in equity and RWA. Meanwhile, the right-hand side of the equation, shows the speed of adjustment λ to move closer to the desired capital ratio $CAR^{*}_{i,t}$. A low estimated λ would indicate that banks adjust gradually to close the gap.

The target capital ratio $CAR^{*}_{i,t}$, on the other hand, is modelled as a linear function of bank-specific and macroeconomic indicators $X_{i,t}$:

$$CAR^{*}_{i,t} = \theta X_{1,i,t} \tag{5}$$

where $X_{i,t}$ includes return on total assets (ROA), the natural logarithm of total assets and loan loss provisions, ratio of loans to individuals for consumption purposes[9] and corporate loans to total assets[10], bank level of risk, the Chicago Board Options Exchange (CBOE) Volatility Index (VIX), and the natural logarithm of real gross domestic product (GDP) and consumer price index (CPI). Heid et. al (2004) defines risk as the ratio of RWA to total assets. This captures the risk profile of a bank's outstanding assets.

7 The ratio of qualifying capital to risk weighted assets. See BSP Circular No. 781 dated 15 January 2013 for the components of qualifying capital and the risk weighted assets.

8 Annualized refers to the sum of the net profit for the current period and December last year less the same period last year.

9 The behavior as well as credit risk profile of loans to individuals for household consumption purposes and corporate loans are different. Thus, loans to individuals for household consumption was separated from corporate loans. Loans to individuals for household consumption include motor vehicle loans, credit card receivables, and salary loans.

10 The share of corporate loans was recorded at 68.7 percent and individual loans at 14.3 percent as of end-December 2017.

Substituting the expression $CAR_{i,t}^{*}$, rearranging the terms yields the following estimation equation:

$$CAR_{i,t} = (1-\lambda)DNCAR_{i,t} + \lambda\theta X_{1,i,t} + \varepsilon_{i,t} \quad (6)$$

Hence, capital ratio in period *t* is a function of TQC, earnings, RWA, bank size, risk profile of the bank, and macroeconomic factors (Heid et. al, 2004; Milne and Whalley, 2001; Ayuso et. al, 2004; Gropp and Heider, 2010; Brei and Gambacorta, 2014; and Malovaná, 2017). Meanwhile, its RWA are affected by global market volatility, business model, business cycle and regulatory approach by the BSP for banks (Cannata et al, 2011; Mariathasan and Merrouche, 2014; Czech National Bank, 2015; Behn et al, 2016; and Malovaná, 2017).

To address the issue of non-linearity, Heid et. al (2004) and Malovaná (2017) further modifies the model by including a dummy $D_{i,t}$ and interaction dummy $D_{i,t}X_{2,i,t}$ variables controlling the bank capitalization variable:

$$CAR_{i,t} = (1-\lambda_1)DNCAR_{i,t} + \lambda_1\theta_1 X_{1,i,t} + \theta_2 D_{i,t} + \varepsilon_{i,t} \quad (7)$$

$$CAR_{i,t} = (1-\lambda_2)DNCAR_{i,t} + \lambda_2\theta_2 X_{1,i,t} + \theta_3 D_{i,t}X_{2,i,t} + \varepsilon_{i,t} \quad (8)$$

The categorical variables included in the framework are: (1) a dummy variable for taper tantrum in 2013 *dTAPER* which takes the value of 1 for periods beginning May to December 2013 and zero otherwise[11]; (2) interaction dummy variables for the level of risk taken by banks *dBASEL3*Risk* before and after January 2014, which takes the value of 1 for periods when Basel III risk-based capital was implemented and zero otherwise; (3) interaction dummy variable distinguishing between U/KBs with high capital buffers d*cBUFF75* and banks with low capital buffers d*cBUFF25*; (4) a criterion to distinguish the level of risk taken between U/KBs with high capital buffers *dCBUFF25*Risk* and banks with low capital buffers *dCBUFF75*Risk*. Capital buffer refers to the difference between actual CAR and the 10 percent BSP minimum regulatory capital requirement (Heid et. al, 2004). From this criterion, a dummy for the lower 25th percentile (75th percentile) capital buffer is *dCBUFF25*Risk* (*dCBUFF75*Risk*); and (5) interaction dummy variables for the speed of adjustment of banks with low (high) capital buffer *DNCAR*dcBUFF25 (DNCAR*dcBUFF75).*

The categorical variables are added to the equations to test if the implementation of Basel III risk-based capital drives banks to increase risk (moral hazard). The study also aims to determine if the adjustment in bank capital depends on the size of its capital buffer (capital buffer theory) or whether banks with low capital buffers take on lower risks than banks with high capital buffer.

[11] In this study, Taper Tantrum refers to the period when: (1) the Former US Federal Reserve (US Fed) Chairman Ben S. Bernanke communicated to the Congress on May 2013 that the Fed may cut the pace of bond purchases at its next meetings should there be indications of sustained economic growth; and (2) the US Fed trimmed its bond purchases to US$75 billion from US$85 billion on December 2013 (Source: Bloomberg).

2.2 Specification and Hypotheses of the Model

Equation 8 can then be specified as follows:

$$CAR_{i,t} = \alpha_0 + \alpha_1 DNCAR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 log(Assets)_{i,t} + \alpha_4 \log(Loan\ Loss\ Provision)_{i,t} + \alpha_5 \frac{Loans\ to\ Individuals}{Assets}_{i,t} + \alpha_6 \frac{Private\ Corporation\ Loans}{Assets}_{i,t} + \alpha_7 log(Real\ GDP)_{i,t} + \alpha_8 log(CPI)_{i,t} + \varepsilon_{i,t} \quad (9.a)$$

$$CAR_{i,t} = \alpha_0 + \alpha_1 DNCAR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 log(Assets)_{i,t} + \alpha_4 \log(Loan\ Loss\ Provision)_{i,t} + \alpha_5 \frac{Loans\ to\ Individuals}{Assets}_{i,t} + \alpha_6 \frac{Private\ Corporation\ Loans}{Assets}_{i,t} + \alpha_7 log(Real\ GDP)_{i,t} + \alpha_8 log(CPI)_{i,t} + \alpha_9 DNCAR * dCBUFF25 + \alpha_{10} dCBUFF25 + \varepsilon_{i,t} \quad (9.b)$$

$$CAR_{i,t} = \alpha_0 + \alpha_1 DNCAR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 log(Assets)_{i,t} + \alpha_4 log(Loan\ Loss\ Provision)_{i,t} + \alpha_5 \frac{Loans\ to\ Individuals}{Assets}_{i,t} + \alpha_6 \frac{Private\ Corporation\ Loans}{Assets}_{i,t} + \alpha_7 log(Real\ GDP)_{i,t} + \alpha_8 log(CPI)_{i,t} + \alpha_{11} DNCAR * dCBUFF75 + \alpha_{12} dCBUFF75 + \varepsilon_{i,t} \quad (9.c)$$

$$CAR_{i,t} = \alpha_0 + \alpha_1 DNCAR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 log(Assets)_{i,t} + \alpha_4 log(Loan\ Loss\ Provision)_{i,t} + \alpha_5 \frac{Loans\ to\ Individuals}{Assets}_{i,t} + \alpha_6 \frac{Private\ Corporation\ Loans}{Assets}_{i,t} + \alpha_7 log(Real\ GDP)_{i,t} + \alpha_8 log(CPI)_{i,t} + \alpha_{13} dCBUFF25 * Risk + \varepsilon_{i,t} \quad (9.d)$$

$$CAR_{i,t} = \alpha_0 + \alpha_1 DNCAR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 log(Assets)_{i,t} + \alpha_4 log(Loan\ Loss\ Provision)_{i,t} + \alpha_5 \frac{Loans\ to\ Individuals}{Assets}_{i,t} + \alpha_6 \frac{Private\ Corporation\ Loans}{Assets}_{i,t} + \alpha_7 log(Real\ GDP)_{i,t} + \alpha_8 log(CPI)_{i,t} + \alpha_{14} dCBUFF75 * Risk + \varepsilon_{i,t} \quad (9.e)$$

$$CAR_{i,t} = \alpha_0 + \alpha_1 DNCAR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 log(Assets)_{i,t} + \alpha_4 log(Loan\ Loss\ Provision)_{i,t} + \alpha_5 \frac{Loans\ to\ Individuals}{Assets}_{i,t} + \alpha_6 \frac{Private\ Corporation\ Loans}{Assets}_{i,t} + \alpha_7 log(Real\ GDP)_{i,t} + \alpha_8 log(CPI)_{i,t} + \alpha_{15} dBASEL3 * Risk + \varepsilon_{i,t} \quad (9.f)$$

$$CAR_{i,t} = \alpha_0 + \alpha_1 DNCAR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 log(Assets)_{i,t} + \alpha_4 log(Loan\ Loss\ Provision)_{i,t} + \alpha_5 \frac{Loans\ to\ Individuals}{Assets}_{i,t} + \alpha_6 \frac{Private\ Corporation\ Loans}{Assets}_{i,t} + \alpha_7 log(Real\ GDP)_{i,t} + \alpha_8 log(CPI)_{i,t} + \alpha_{16} VIX + \varepsilon_{i,t} \quad (9.g)$$

$$CAR_{i,t} = \alpha_0 + \alpha_1 DNCAR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 log(Assets)_{i,t} + \alpha_4 log(Loan\ Loss\ Provision)_{i,t} + \alpha_5 \frac{Loans\ to\ Individuals}{Assets}_{i,t} + \alpha_6 \frac{Private\ Corporation\ Loans}{Assets}_{i,t} + \alpha_7 log(Real\ GDP)_{i,t} + \alpha_8 log(CPI)_{i,t} + \alpha_{17} dTAPER + \varepsilon_{i,t} \quad (9.h)$$

where $\mathcal{E}_{i,t} \sim IID(0, \sigma_\varepsilon^2)$ or that the error terms are independent and identically distributed (IID) with mean 0 and a common variance. Building on the work of Heid et. al (2004), the null hypothesis states that the adjustment in capital to close the gap towards the target rate is equal for banks with high and low capital buffer with the following hypotheses of the coefficients can be stated as:

H_{1a} : α_1> 0, *speed of adjustment in keeping the actual capital ratio close to the target level.* α_1 reports a $(1 - \boldsymbol{\lambda})$ "do-nothing" capital coefficient.

H_{1b} : α_2 > 0 or α_2 < 0, *ROA accounts for the direct effect on capital of retained earnings*. A negative coefficient suggests earnings serve as buffer against unexpected losses and a positive relationship highlights retained earnings raises capital (Heid et. al, 2004; Ayuso et. al, 2004; Gropp and Heider, 2010; Brei and Gambacorta, 2014; and Malovaná, 2017).

H_{1c} : α_3 < 0, t*he natural logarithm of total assets captures the size effects and ease of access to funding by larger banks, thus, requires less capital build-up* (Heid et. al, 2004; Berger et al, 2008; Flannery and Rangan, 2008; Brei and Gambacorta, 2014; and Malovaná, 2017).

H_{1d} : α_4 < 0 or α_4 > 0, *the relationship between provisions and total regulatory capital ratio can either be positive and negative. There is a positive relationship when capital is set in proportion to the riskiness of the loan portfolio while a negative relationship will be evident when raising the level of provisions reduces banks' retained earnings and consequently, their capital. Loan loss provisions show the relative riskiness of banks' loan portfolio. Loan loss provisions increase as credit risk and potential losses rises* (Malovaná, 2017).

H_{1e} : α_5 < 0 and H_{1f} : α_6 < 0, *higher risk weights assigned to riskier assets and additional capital required to be held by regulators. Hence, increased lending to households and corporations reduce capital* (Malovaná, 2017).

H_{1g} : α_7 > 0, H_{1h} : α_8 > 0, *real GDP and CPI highlight the relationship between the magnitude and frequency of macroeconomic shocks and the size of the capital buffer necessary to withstand those shocks.*

H_{1i} : α_9 < 0 and H_{1j} : α_{11} > 0 *suggest that banks with relatively low (high) capital buffers adjust much faster (slower) than better capitalized banks* (Malovaná, 2017).

H_{1k} : α_{10} < 0 and H_{1l} : α_{12} > 0, *distinguishes the effect on capital for banks with relatively low capital buffer from those with high capital buffer.*

H_{1m} : α_{13} < 0, *effect on capital is negatively related for banks with relatively low capital buffers, implying that banks with low capital buffer decrease risk when they increase capital suggesting that they aim to rebuild an appropriate capital buffer* (Heid et. al, 2004) *either to meet regulatory requirements or pursue growth objectives (e.g. lending to a particular sector).*

H_{1n} : α_{14} > 0, *effect on capital is positively related for banks with relatively high capital buffers, implying that banks with high capital buffer increase risk when capital increases indicating that they intend to maintain capital buffer* (Heid et. al, 2004).

H_{1o} : α_{15} > 0, e*ffect on capital is negatively related for periods when Basel III risk-based capital was implemented, suggesting that the adoption did not cause a moral hazard incentives among banks. That is, when Basel III was implemented banks did not increase risk.*

H_{1p} : α_{16} < 0 and H_{1q} : α_{17} < 0, t*aper tantrum and VIX highlight the relationship between the magnitude and frequency of macroeconomic shocks and the size of the capital buffer necessary to withstand those shocks.*

2.3 Data Description

A qualifying capital to risk-weighted assets (RWA) ratio that is not less than 10 percent both for a solo basis (comprised of head office and its branches) and consolidated basis (parent bank and its subsidiary financial allied undertakings excluding insurance companies) adopted on 15 January 2013 pursuant to Circular No. 781 is applicable only to all U/KBs and their subsidiary banks and quasi-banks. For consistency, data are obtained covering periods after the implementation of Basel III capital requirement. The dataset covers a panel of 34 domestic U/KBs (including 14 foreign banks) and their 11 subsidiary TBs from end-December 2012 to end-March 2018. It is based on the balance sheets, income statements and CAR report submitted by these banks to the BSP. To avoid double counting, solo reports are considered in the sample. In order to ensure homogeneity of the time series, U/KBs for which data on variables affecting capital are not available, are excluded from the data set.

For each bank in the sample, data on U/KBs and their subsidiary TBs' balance sheets and income statements as well as CAR reports are used to compute bank-specific indicators that reflect the riskiness of assets and the earning capacity of the bank. Data on RWA, total assets, loan loss provisions, loans to individual for consumption purposes and private corporations are also included. Moreover, the TQC and Tier 1 capital ratio are used in the exercise.

In addition to the information on banks' financial statements, other indicators are used to capture macroeconomic conditions. Data on real GDP and CPI are taken from the Philippine Statistics Authority (PSA). The CBOE Volatility Index (VIX), a popular measure of the stock market's expectation of volatility implied by S&P 500 index options, are culled from Bloomberg.

2.4 Estimation Method

The parameters of the partial regression model are estimated using Arellano and Bond's (1991) difference panel Generalized Method of Moments (GMM) to account for endogeneity of regressors and unobserved time-invariant and bank-specific characteristics. The level of bank capital could also have an impact on asset size, earnings ability, provisioning and loan growth. Unobserved time-invariant and bank-specific characteristics (fixed effects) such as asset quality and liquidity, among others may be correlated with CAR.

The instruments, as defined in Blundell and Bond (1998), the endogenous variables (ROA, natural logarithm of total assets and loan loss provisions, and ratio of individual and corporation loans to total assets) are transformed in first differences and presented as instruments by their first lag in levels (Blundell et al, 1998 and Brei et al, 2014).

The panel data for the U/KBs and their subsidiary TBs have relatively short time dimension (T=22) and large bank dimension (N=44). GMM estimators are usually used for statistical exercises on panel data with small T and large N.

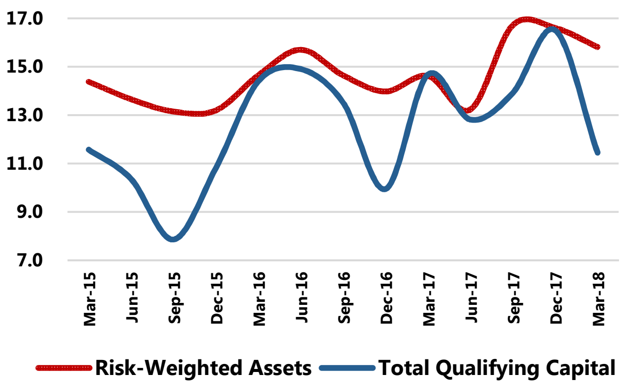
To check the robustness of the results, descriptive and residual diagnostics, including the standard error of regression, as well as the different specifications of the model and alternative estimation method (two-stage least squares or 2SLS) are used. Significance of estimates used are 1 percent, 5 percent and 10 percent levels of significance.

3. Empirical Results

Table 1 (Technical Appendix A) and 2 (Technical Appendix B) present the results of estimating Equation (9). Table 1 presents the results for eight (8) different specifications with a "do-nothing" capital ratio that has lagged RWA as denominator and varies in the way bank-specific and macroeconomic indicators affect bank capital. Meanwhile, Table 2 shows results for the same eight specifications but with a "do-nothing" capital ratio that has RWA in its current value as denominator. In particular, Equations (2), (3), (10) and (11) allow adjustments in CAR to depend on whether banks have low or high capital buffers (includes *dCBUFF*) and Equations (4), (5), (12) and (13) display the interaction of capital and risk adjustments. The effects of risk adjustments when Pillar 1 of the Basel III framework on minimum capital requirement was implemented are provided in Equations (6) and (14). Lastly, Equations (7), (8), (15) and (16) provide the impact of global market conditions.

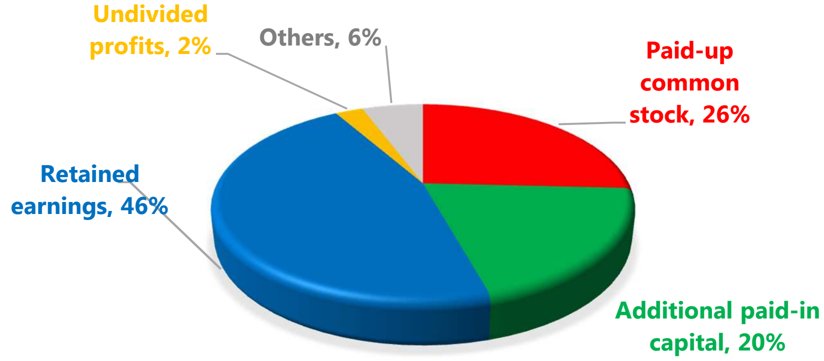
The baseline Equation (1) in Table 1 reports a $(1-\boldsymbol{\lambda})$ "do-nothing" capital coefficient (the "do-nothing" capital ratio with lagged RWA as denominator) instead of $\boldsymbol{\lambda}$. "The coefficient 0.066 is subtracted from 1.0 to obtain the speed of adjustment λ of 93.4 percent. The estimated speed of capital adjustment is highly significant and relatively high. The speed of adjustment, however, is lower at 79.5 percent (Table 2 for baseline Equation 9) when the denominator of the "do-nothing" capital ratio is current RWA. This suggests that roughly 14.9 percent of the overall adjustment is influenced by changes in asset size, bank structure, business and risk profile (risk-weighted assets) and the remaining 85.1 percent can be attributed to changes in the level of capital. Figure 3 shows that changes in TQC of U/KBs are relatively steep compared to RWA indicating banks' steadfast commitment to set aside enough buffer to cover their risk-taking activities. Figure 4 shows that the rise in retained earnings as well as expansion in capital stock (i.e., issuance of common shares) and additional paid-in capital are the commonly observed means to improve bank capital ratio (Figure 4).

Figure 3. Components of Capital Adequacy Ratio of U/KBs and their Subsidiary TBs
(As of End Periods Indicated, In Percent Year-on-Year Growth)



Source: BSP-Supervisory Data Center

Figure 4. Components of Common Equity Tier 1* of U/KBs and their Subsidiary TBs
(As of End-March 2018, % Share to Total)



Source: Supervisory Data Center

*Without regulatory adjustments and the share of CET1 to total TQC was at 87.8 percent.

Moreover, equations (2), (3), (10) and (11) are consistent with findings in some studies that the customary behavior of banks falling in the lower 25th quartile of the total regulatory capital ratio adjust faster than those banks above the 75th percentile (Flannery and Rangan, 2008; Heid et. al, 2004; and Malovaná, 2017).

The results of the empirical exercise provide another interesting insight into the dynamics of capital and risk adjustments between banks with high and low capital buffers. Equations (4), (5), (12) and (13) support the capital buffer theory that banks with low capital buffer are expected to lower their risk to raise capital, thereby rebuilding their capital buffer. By contrast, banks with high capital buffer will have to increase capital if they plan to take on more risk, thereby maintaining their capital.

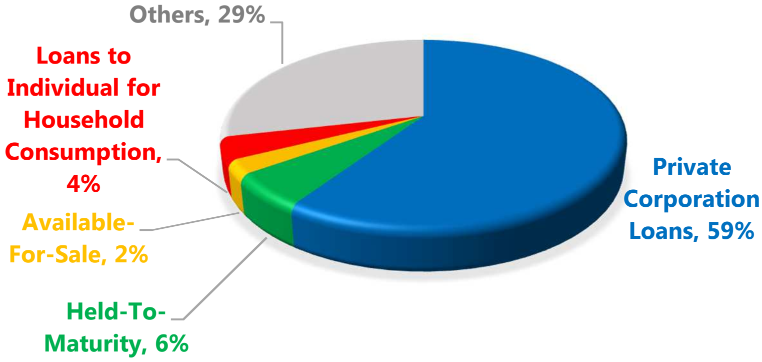
Notably, Equations (6) and (14) suggest that generally the implementation of Basel III minimum capital requirement to all U/KBs and their subsidiary TBs did not result in moral hazard problem, where banks increase their exposure to risk when regulators imposed capital requirement. The negative relationship between capital and risk implies that banks have become more risk-sensitive. That is, banks will try to rebuild an appropriate buffer by raising capital while simultaneously lowering risk[12]. A report of the Office of Supervisory Policy Development on Risk-Based Capital Adequacy Ratio (CAR) of U/KBs and their subsidiary Banks and Quasi-Banks as of 31 March 2014 or the period when the Basel III standards on capital was fully implemented, observed that "there is a noticeable reduction in the level of riskiness of the top tier banks relative to 31 December 2013".

Moreover, the coefficients of other bank-specific indicators such as ROA, total assets, loan loss provisions and lending are in line with theory and intuition. The negative relationship between CAR and ROA highlights the importance of earnings as substitute of capital and as buffer against unexpected losses. Meanwhile, the positive coefficient reflects the significant

[12] In this study, the lowering of risk means changing the structure of the portfolios of banks by investing more on less risky assets.

proportion of retained earnings and undivided profits in banks. In particular, the share of retained earnings and undivided profits to domestic banks' regulatory capital is roughly more than half of TQC.

Figure 5. Components of On-Balance Sheet Exposures of U/KBs and their Subsidiary TBs
(As of End-March 2018, % Share to Total, Risk-Weigthed)



Source: Supervisory Data Center

An increase in loan loss provisions reduces capital ratios, implying that banks hold less capital when there is deterioration in loan quality (Malovaná, 2017). In terms of banks' assets, the negative coefficient affirms the expectation that larger banks tend to hold lower capital ratios (Berger et al, 2008; Flannery and Rangan, 2008; Brei and Gambacorta, 2014; and Malovaná, 2017). Meanwhile, the loan to private corporations is negatively related to regulatory capital ratio as this type of asset entail higher capital withheld. The risk weights range from 20.0 percent to as high as 150.0 percent. The variable loans to individuals, however, has insignificant coefficient. A possible explanation is the relatively marginal[13] share of this type of loan to total risk-weighted on-balance sheet assets (Figure 5). U/KBs are generally highly traditional with a large portion of their lending directed to the corporate sector.

Moreover, the positive coefficients of real GDP and CPI as well as the negative relationship of VIX with the regulatory capital ratio imply a decreasing capital ratio when the economy is contracting and experiencing rising prices or when there are uncertainties in the global financial markets. This finding is not surprising as banks naturally expand their assets during buoyant economic activities and reduce exposures when markets become uncertain.

Lastly, the results of the taper tantrum in May to December 2013 show either positive or negative relationship with CAR. A positive relationship with CAR is seen when the equation has a "do-nothing" CAR variable with current RWA as the denominator. This suggests that banks fared better when they acted early and decisively by adjusting risk exposures when the U.S. Federal Reserve raised to Congress the possibility of tapering purchases of Treasury bonds. Figure 2 shows that the CAR of U/KBs went up following the taper tantrum.

4. Implications for Microprudential Policy

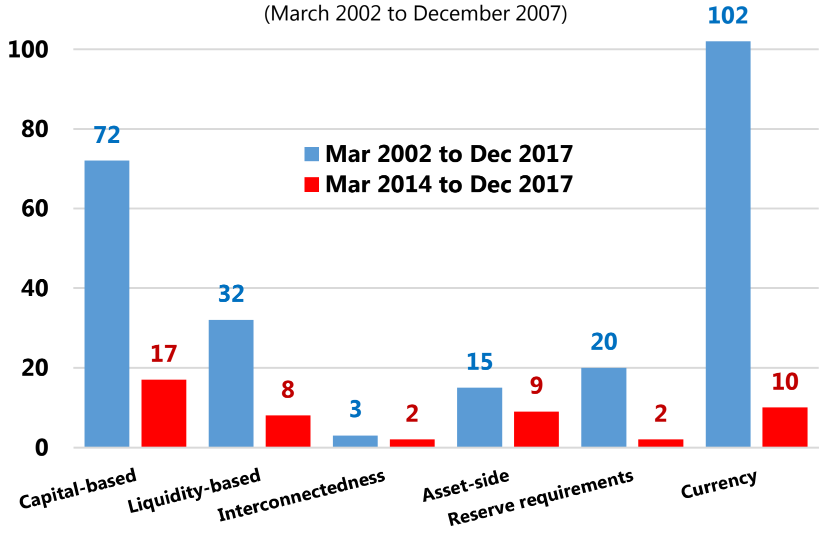
The results of this study show that Philippine U/KBs and their subsidiary TBs are inclined to raise their regulatory capital and have lesser pressure to change the size of their portfolios, structures and risks to manage capital surpluses. This finding also suggests that higher capital requirement influences banks' decision to change their internal operations strategy in terms

[13] As of end-March 2018, the share of loans to individuals for household consumption is at 11.1 percent.

of strong corporate governance, structure and risk management. Moreover, an increase in capital requirement influences Philippine banks to be more risk-sensitive. The findings also imply that banks appear to raise their capital ratios to restore their buffers above the regulatory minimum while simultaneously lowering risk.

Since the Global Financial Crisis, regulators across jurisdictions have increased bank capital requirements in order to improve the resilience of banks to adverse shocks. The BSP adopted prudential tools to strengthen and enhance the resilience of the financial system as well as to control excessive credit cycles. Bayangos and De Jesus (Forthcoming 2019) observed that the BSP implemented more tightening than loosening measures from 2002 to the fourth quarter of 2017 (Figure 6). Majority of the tightening measures were capital- and liquidity-related measures for Basel III compliance while those of loosening measures were currency-related instruments which were implemented following the liberalization of the BSP's foreign exchange framework starting in 2007.

Figure 6. Number of Domestic Prudential Measures Implemented in the Philippines
(March 2002 to December 2007)



Source: Bayangos and De Jesus (Forthcoming 2019)

In response to the rise in capital requirements, banks can choose among three alternative responses: (1) raise equity through earnings retention or capital infusion, (2) cut down lending, (3) reduce asset risk through portfolio rebalancing. Based on data, banks would often choose to raise equity due to relatively liquid market. Nevertheless, banks are seen to simultaneously reduce their asset risk and cut their lending activities. The reduction in bank lending, however, may result to migration of borrowing to less regulated institutions. Thus, it is important that regulators evaluate the impact of prudential policies imposed on banking industry and carefully consider the macroeconomic implications of additional increase in capital requirements. Regulators may calibrate banking regulations in such a way that they address the peculiarities and/or conditions of different types of financial institutions but without compromising regulatory objectives. The adoption of the proportionality approach to banks by the BSP may be used to promote the soundness and stability of the banking system.

5. Conclusion

This study examined the behavior of U/KBs and their subsidiary TBs in managing their capital and risks following the adoption of Pillar 1 of the Basel III framework on minimum capital requirement using the empirical model of Heid et. al (2004) and Malovaná (2017).

The model was applied to quarterly panel data for thirty-four (34) U/KBs (including 14 foreign banks) and their eleven (11) subsidiary TBs in the Philippines from December 2012 to March 2018 using dynamic panel GMM model. The dataset covered a panel of U/KBs and their subsidiary TBs as Pillar 1 of the Basel III framework on minimum capital requirement fully implemented on 01 January 2014 is applicable only to all U/KBs and their subsidiary banks and quasi-banks.

The two dominating theories used to analyze how banks manage capital and risk in view of capital regulation are the moral hazard theory and the capital buffer theory (Heid et. al, 2004; Milne and Whalley, 2001; Peura and Keppo, 2006; and VanHoose, 2007a&b). The paper estimated the speed at which banks adjust their capital close to the target.

Following the residual diagnostics and robustness checks, the results of the study indicate that, in general, U/KBs and their subsidiary TBs in the Philippines adjust their regulatory capital ratios through changes in the level of capital (i.e., capital stock, additional paid-in capital, retained earnings and undivided profits). The contribution of the risk-weighted assets of 18.7 percent, which is below the 30 percent to 60 percent average estimates for other jurisdictions such as the United States (US) banking sector (Flannery and Rangan, 2008; Berrospide and Edge, 2010; Berger et al, 2008; and Gropp and Heider, 2010), indicate that U/KBs and their subsidiary TBs do not have the tendency to immediately adjust their risk-weighted exposures but are inclined more to maintain a reasonable balance between changes in the size of their assets and capital.

In addition, U/KBs that have lower capital ratios relative to their peers have higher the tendency to adjust their capital ratios. The capital buffer theory likewise holds true for most U/KBs in the Philippines, that is, banks with low capital buffers rebuild an appropriate level of capital buffer by decreasing their risk exposures while banks with high capital buffer have greater tendencies to simply maintain capital when they raise their risk exposures. Another interesting finding of the study is that the adoption of Basel III framework on minimum capital requirement did not translate in the moral hazard problem, rather banks have become more risk-sensitive. In particular, banks opt to rebuild an appropriate buffer by raising capital while simultaneously lowering risk.

Meanwhile, economic conditions and market uncertainties also influence U/KBs and their subsidiary TBs decision on the pace at which their capital ratios should be adjusted.

Moving forward, it is also interesting to further examine the speed of adjustment on Common Equity Tier 1 (CET1) capital as the Basel III framework raised the required minimum CET1 ratio. At present, the currently available data on CET1 capital are not sufficient to conduct a regression analysis. Time series data on CET1 only started in March 2014. In addition, it is also interesting to look into the effect of the Internal Capital adequacy Assessment Process (ICAAP) and charter limitations on banks' behavior in managing their capital and associated risks. The observation that banks' excess surplus is a reflection of their intention to grow by acquiring other banks is also another area worthy for future research.

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Technical Appendix A: Estimated Adjustment of Capital Ratio (with Lagged Risk-Weighted Assets)

Table 1: Estimated Adjustment of Capital Ratio (with lagged Risk-Weighted Assets)

Denominator of do-nothing CAR:	Lagged RWA							
Dependent Variable:	Capital Adequacy Ratio (CAR)							
	Equation (1)	Equation (2)	Equation (3)	Equation (4)	Equation (5)	Equation (6)	Equation (7)	Equation (8)
Do-nothing CAR	0.066 ***	0.081 ***	-0.484 ***	0.070 ***	0.113 ***	0.054 ***	0.066 ***	0.065 ***
	(0.001)	(0.003)	(0.190)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)
dCBUFF25*Risk				-0.066 ***				
				(0.009)				
dCBUFF75*Risk					0.049 ***			
					(0.006)			
dBasel3*Risk						-3.606 ***		
						(0.321)		
ROA	-0.034 ***	-0.182 ***	-0.182 ***	-0.124 ***	0.151 ***	-0.151 ***	-0.029 *	-0.102 ***
	(0.010)	(0.036)	(0.036)	(0.021)	(0.023)	(0.016)	(0.018)	(0.020)
log(Assets)	-2.028 ***	-0.803	-0.803	-0.322	-0.537	-3.206 ***	-1.958 ***	-3.176 ***
	(0.335)	(0.991)	(0.991)	(0.563)	(0.627)	(0.426)	(0.436)	(0.388)
log(Loan loss provisions)	-2.165 ***	-2.213 **	-2.213 **	-2.462 ***	-4.101 ***	-1.033 **	-2.222 ***	-2.135 ***
	(0.335)	(1.033)	(1.033)	(0.743)	(0.535)	(0.476)	(0.419)	(0.465)
Loans to individuals/assets	0.006	-0.130	-0.130	-0.072	-0.006	0.000	0.015	0.002
	(0.010)	(0.109)	(0.109)	(0.096)	(0.064)	(0.047)	(0.038)	(0.053)
Private corporation loans/assets	-0.132 ***	-0.124 ***	-0.124 ***	-0.113 ***	-0.079 ***	-0.090 ***	-0.129 ***	-0.124 ***
	(0.009)	(0.040)	(0.040)	(0.021)	(0.019)	(0.016)	(0.013)	(0.014)
log(Real GDP Growth)	2.972 ***	3.318 **	3.318 **	4.302 ***	0.882	1.659 ***	2.929	0.111
	(0.390)	(1.567)	(1.567)	(0.690)	(0.613)	(0.424)	(0.591) ***	(0.514)
log(CPI)	6.525 ***	-8.223	-8.223	-3.867	2.724	8.627 **	6.066 ***	5.817 ***
	(1.694)	(8.244)	(8.244)	(3.949)	(2.406)	(3.614)	(2.092)	(1.818)
VIX								-0.179 ***
								(0.016)
dTAPER							-0.198 ***	
							(0.058)	
dCBUFF25		5.551						
		(3.979)						
dCBUFF75			-5.551					
			(3.979)					
Do-nothing CAR*dCBUFF25		-0.565 ***						
		(0.190)						
Do-nothing CAR*dCBUFF75			0.565 ***					
			(0.190)					
Observations	876	877	877	877	876	877	876	876
S.E. of regression	7.237	15.645	15.645	10.845	6.946	7.205	7.261	7.152
J-statistics	38.360	36.075	36.075	37.761	37.731	39.686	38.291	38.413
Prob(J-statistic)	0.363	0.327	0.327	0.301	0.303	0.269	0.281	0.276
AR(1) test (m-Statistic)	-0.012	-0.140	-0.140	-0.224	-1.716 *	-0.002 ***	-2.389 **	-2.171 **
AR(2) test (m-Statistic)	0.001	-0.030	-0.030	0.105	1.482	0.000	1.217	0.453

Note: This table presents the difference generalized method of moments (GMM) model of equations used to examine the behavior of U/KBs and their subsidiary TBs in managing capital and risks as well as in light of the adoption of the Pillar 1 of the Basel III framework on minimum capital requirement. The sample period is from December 2012 to March 2018. Standard errors are reported in parentheses; ***, ** and * denote the 1%, 5% and 10% significance levels. CAR - total regulatory capital ratio, i.e. regulatory capital over risk-weighted assets; CBUFF - refers to capital buffer and is the difference between the actual CAR and 10 percent regulatory minimum CAR; dCBUFF25 - dummy for lower 25th quartile of capital buffer; dCBUFF75 - dummy for upper 7th quartile of capital buffer; dTaper - takes the value of 1 for periods beginning May to December 2013; RWA - risk-weighted assets; and CPI - consumer price index 2012 = 100. The sample also consisted of 34 U/KBs (of which are 14 foreign bank branches) and their 11 subsidiary TBs.

Technical Appendix B: Estimated Adjustment of Capital Ratio (with Current Risk-Weighted Assets)

Table 2: Estimated Adjustment of Capital Ratio (with current Risk-Weighted Assets)

Denominator of do-nothing CAR:	Current RWA							
Dependent Variable:	Capital Adequacy Ratio (CAR)							
	Equation (9)	Equation (10)	Equation (11)	Equation (12)	Equation (13)	Equation (14)	Equation (15)	Equation (16)
Do-nothing CAR	0.205 ***	0.287 ***	-1.105 ***	0.236 ***	0.228 ***	0.283 ***	0.229 ***	0.313 ***
	(0.002)	(0.003)	(0.215)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)
dCBUFF25*Risk				-0.081 ***				
				(0.010)				
dCBUFF75*Risk					0.044 ***			
					(0.003)			
dBasel3*Risk						-3.434 ***		
						(0.248)		
ROA	-0.043 ***	0.115 ***	0.080	-0.099 ***	0.045 **	0.211 **	0.209 ***	0.339 ***
	(0.014)	(0.032)	(0.055)	(0.027)	(0.020)	(0.031)	(0.024)	(0.023)
log(Assets)	-1.679 ***	-0.529	-0.365	-0.868 *	-0.379	-2.289 ***	-1.943 ***	-0.969 **
	(0.346)	(0.602)	(1.614)	(0.531)	(0.388)	(0.356)	(0.383)	(0.459)
log(Loan loss provisions)	-2.088 ***	-2.043 ***	-2.216	-1.725 ***	-2.022 ***	-0.835	-1.913 ***	-1.968 ***
	(0.341)	(0.703)	(1.582)	(0.456)	(0.408)	(0.422)	(0.361)	(0.566)
Loans to individuals/assets	-0.005	-0.014	0.026	-0.033	-0.001	0.017	0.016	-0.004
	(0.032)	(0.076)	(0.148)	(0.075)	(0.033)	(0.038)	(0.037)	(0.050)
Private corporation loans/assets	-0.112 ***	-0.054 **	-0.016	-0.085 ***	-0.108 ***	-0.015 ***	-0.067 ***	-0.046 **
	(0.013)	(0.024)	(0.047)	(0.015)	(0.013)	(0.016)	(0.014)	(0.020)
log(Real GDP Growth)	3.927 ***	3.375 ***	2.948 **	3.526 ***	2.959 ***	1.657 ***	3.847 ***	1.369 **
	(0.467)	(0.635)	(1.322)	(0.620)	(0.441)	(0.416)	(0.490)	(0.600)
log(CPI)	7.864 ***	-0.537	-6.543	3.312	2.140	7.700 ***	0.870	7.590 ***
	(1.676)	(5.330)	(14.525)	(3.692)	(2.745)	(3.392)	(2.046)	(2.171)
VIX								-0.174 ***
								(0.012)
dTAPER							0.682 ***	
							(0.030)	
dCBUFF25		8.717 ***						
		(1.435)						
dCBUFF75			-18.889 ***					
			(4.016)					
Do-nothing CAR*dCBUFF25		-0.788 ***						
		(0.066)						
Do-nothing CAR*dCBUFF75			1.434 ***					
			(0.214)					
Observations	877	880	880	880	880	880	880	880
S.E. of regression	6.878	6.436	6.430	7.714	6.619	6.300	6.525	6.357
J-statistics	39.027	39.659	34.829	37.728	41.039	40.608	38.772	39.374
Prob(J-statistic)	0.294	0.197	0.381	0.303	0.189	0.202	0.263	0.242
AR(1) test (m-Statistic)	-2.926 ***	-1.532	-0.053	-1.923 **	-2.466 ***	-2.575 ***	-2.547 ***	-1.209
AR(2) test (m-Statistic)	0.331	0.021	0.023	0.565	0.940	1.075	0.482	0.922

Note: This table presents the difference generalized method of moments (GMM) model of equations used to examine the behavior of U/KBs and their subsidiary TBs in managing capital and risks as well as in light of the adoption of the Pillar 1 of the Basel III framework on minimum capital requirement. The sample period is from December 2012 to March 2018. Standard errors are reported in parentheses; ***, ** and * denote the 1%, 5% and 10% significance levels. CAR - total regulatory capital ratio, i.e. regulatory capital over risk-weighted assets; CBUFF - refers to capital buffer and is the difference between the actual CAR and 10 percent regulatory minimum CAR; dCBUFF25 - dummy for lower 25th quartile of capital buffer; dCBUFF75 - dummy for upper 7th quartile of capital buffer; dTaper - takes the value of 1 for periods beginning May to December 2013; RWA - risk-weighted assets; and CPI - consumer price index 2012 = 100. The sample also consisted of 34 U/KBs (of which are 14 foreign bank branches) and their 11 subsidiary TBs.

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