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Mapping Capital Ratios to Bank Lending Spreads: The Role of Efficiency and Asymmetry in Performance Indices

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Abstract: Beyond the 2007–2008 financial crisis, the collapse of the Silicon Valley Bank and the acquisition of Credit Suisse by the Swiss investment bank UBS Group AG in 2023 have brought fresh attention to the need for new regulatory capital, liquidity risk management, and leverage requirements. To meet tightened capital requirements, banks have to increase their capital ratios either by increasing equity or by decreasing risk-weighted assets. Both options lead to banks' performance deterioration. One remedy for banks to recover is raising their lending spread. A critical question is how much the lending spread should be increased to offset the drop in the bank's financial performance level. In this study, we focus on the asymmetries and efficiency consequences of performance indices such as economic value added (*EVA*) and the more commonly used return on equity (ROE) in determining the loan spread. Using data on the largest U.S. banks over the period 2018–2022, our results show that the ROE rule significantly overestimates the magnitude of the lending spreads required to offset the negative financial consequences of increases in capital ratios. The *EVA* approach, on the other hand, prescribes on average a significantly lower lending spread of 0.4505 basis points against a lending spread of 21.0441 basis points associated with the use of the ROE approach. The efficiency and the level of lending spreads should enable banks to maintain their competitive advantages in the loan markets impacting overall economic productivity and growth.

Keywords: capital ratio; economic value-added; lending spreads; performance measure asymmetry

JEL Classification: G21; E58

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1. Introduction

Beyond the disruptions from the 2007–2008 financial crisis and the collapse of the Silicon Valley Bank in 2023, the second largest bank failure in U.S. history after that of Washington Mutual in 2008, and the acquisition of Credit Suisse by the Swiss investment bank UBS Group AG, global banks have continued to show weakness in absorbing and managing major on- and off-balance sheet risk exposures. Anticipating such challenges, BCBS (2010) introduced new requirements on regulatory capital, liquidity risk management, and leverage, for tier 1 and tier 2 capital. Tier 1 capital is composed of common equity and retained earnings, and tier 2 capital builds additional buffers consisting of undisclosed reserves, general provisions, hybrid debt capital instruments, subordinated debt, and asset revaluation reserves. Basel III gives preference to tier 1 capital rather than tier 2, and the new capital ratio should be 6% for tier 1 and 8.5% for total capital (tier 1 + tier 2). More recently, bank capital regulation has once again been under scrutiny, and a new reform package

modifying capital requirements, known as "Basel III endgame", has been proposed by U.S. bank regulators (Siedlarek 2024). In this paper, we focus on changing common equity to raise the capital ratio because of the importance of tier 1 capital, especially common equity in Basel III, and its vital role in banks' capital structure and financial leverage.

Increasing capital and lowering risk-weighted assets (*RWA*) are two options for banks to meet the prescribed capital requirements (Admati et al. 2013; Bichsel et al. (2022)). Although increasing capital is generally considered a good deleveraging tactic by regulators, as capital is a more expensive source of financing, it always results in deterioration in financial performance measured by metrics such as return on equity (ROE) or return on assets (ROA). Similarly, shrinking *RWA* by replacing riskier (higher-weighted) loans with safer ones or scaling down loan portfolios (selling assets) (Cohen and Scatigna 2016) ultimately shrinks profitability consequently lowering financial performance. In either case, banks seek some ways to recover their profitability, and one option they can choose is to increase lending spreads (Bichsel et al. 2022; Golbabaei and Botshekan 2022; and Hanson et al. 2011).[1]

In this study, we focus on the role and implications of the performance indices chosen by banks in managing the lending spreads when capital ratios are increased. We provide clear support for using the market-based economic value added (*EVA*) approach as opposed to the other more commonly used accounting-based ones such as return on equity (ROE) and return on asset (ROA).[2] Specifically, we highlight that the ROE metric is not risk-sensitive and does not account for changes in default risk. Further, as a point-in-time and an accounting-based measure, ROE is a short-term indicator of the current financial health of the institution. It is not reflective of a bank's long-term strategy, thus exposing it to higher unexpected risk levels and causing the adoption of short-term-oriented approaches to balance sheet risk and profitability management decisions. Specifically, we show that by considering the negative impact of increasing the capital ratio on the cost of equity capital, *EVA* (as a market-based approach) can help banks make more informed decisions when they consider the tradeoff between raising lending spreads (in response to the increase in capital ratios) and keeping competitive loan market advantages by offering attractive rates (Batabyal and Killins 2021; Belkhir et al. 2021 and Goldberg 1999).

Following Bichsel et al. (2022), Golbabaei and Botshekan (2022), and King (2010), the core contribution of this study is the development of a model to formulate the impact of higher capital requirements on bank lending spreads. In this setting and without loss of generality, we assume that a bank increases its capital ratio only by equity, and the increase in the level of equity is offset by the reduction in liabilities. So, the size and composition of the balance sheet and therefore banks' risk-weighted assets remain unchanged, but shareholders' equity and total liabilities would change. All else being equal, the increase in the capital ratio by equity results in a fall in the bank's performance measures captured by ROE or *EVA*.[3] So, the bank can raise its lending spreads to recover the drop in performance measures.

By way of a numerical illustration, we use financial and market information from 10 of the largest U.S. banks by asset size and significant international lending operations reported by SP Global Market Intelligence over the period 2018–2022.[4] We calculate how much the bank needs to increase its lending spreads in response to a given one-percent increase in capital ratio to recover its previous performance level. The 2018–2022 period was selected to capture both the economic and regulatory environments following the 2007–2008 financial crisis and those prevailing during the pandemic. We particularly highlight that increasing capital by equity can decrease equity holders' expected returns and therefore help improve performance measured by the *EVA* index, the improvements that are ignored by ROE. Therefore, using *EVA* provides a more accurate perspective on the overall performance of the bank and shareholders' wealth creation.

The results confirm the risk sensitivity advantage of using *EVA* against ROE. The *EVA* approach prescribes on average a significantly lower lending spread of 0.4505 basis points against a lending spread of 21.0441 basis points associated with the use of the ROE

approach. Another distinguishing feature of our results is that in some cases the decrease in the cost of equity in response to a capital ratio increase is just about sufficient so that the bank does not need to change the lending spread to recover the *EVA*. For example, in the case of the PNC Bank in 2022, the decrease in the cost of equity could recover the decrease in *EVA*, and consequently, the bank would not need to change the lending spread to offset the decrease in *EVA*. As shown in Appendix A, the results and interpretations are the same for other banks and over all periods.

In the balance of this paper, a recent review of the literature on the interplay between regulatory imposed changes on bank capital ratios, loan interest rates, and the competition in the credit market is provided in Section 2. The basic premise of the model which posits that any increase in capital ratio is achieved by increasing shareholders' equity, holding risk-weighted assets constant, is set up in Section 3. The Economic Value Added (*EVA*) approach adapted to the financial and operating structure of a bank is discussed in Section 4. In Section 5, we discuss our numerical illustration on a sample of the largest U.S. and European banks. Finally, concluding remarks are offered in Section 6. Variable definition and numerical illustrations on all individual sample banks are presented in Abbreviations and Appendix A, respectively.

2. Review of the Literature

Changes in capital ratios and risk-weighted assets (*RWA*) are generally considered good deleveraging tactics by regulators to improve banks' risk profiles. Both approaches result in deterioration in banks' financial performance. The competitive implications for banks' performance and the availability of capital in the economy could be quite serious, directly impacting the size of the loan and credit markets and the overall growth in the economy.

Akhavein et al. (2005) have studied the effect of deregulation, technological advance, and increased competitive rivalry on the availability of banking products and services. A number of other studies have focused on the implication of banking regulatory changes for corporate finance, in particular for the firm's capitalization and capital structure, including Calomiris and Mason (2003), Colla et al. (2013), and Graham et al. (2015).

More recently, Thamae and Odhiambo (2022), contend that the policy recommendations regarding the appropriateness and efficacy of bank regulatory measures in influencing bank lending cannot be implemented uniformly across different regions or countries. In general, the evidence from empirical studies shows that the impact of bank regulatory measures on lending is ambiguous. On the other hand, banks may consider raising lending rates in response to reduced profit margins as a result of the higher capital requirements. Bichsel et al. (2022) provide results showing that a one percentage point increase in the capital ratio results in an increase of 0 to 5 basis points in the lending spread. However, they observe asymmetric behavior among banks with surplus capital ratios versus deficit ones.

Using annual observations on insured U.S. commercial banks, Golbabaei and Botshekan (2022) examine the asymmetric effect of capital ratios on the lending spread, where asymmetry relies on the channel (capital and risk-weighted assets) that banks use to increase their capital ratios. They conclude that the impact of capital ratios on lending spreads is more significant and positive for banks that chose higher contributions of capital or risk-weighted assets in response to increases in capital ratios. Stewart and Chowdhury (2021) observe asymmetries in banking sector liquidity and regulatory capital across high-income and middle-income economies. While liquidity provides resilience for economic growth, the effect is only apparent for high-income countries. Hanson et al. (2011) also believe that the new credit will be more expensive if banks shrink their assets by reducing new lending.

Finally, focusing on international data on global regulation, several studies have shown that uncertainty about regulatory and monetary policies could adversely affect stock prices and associated equity costs (Batabyal and Killins (2021); Arouri et al. (2016); Nusair and Al-Khasawneh (2022)). However, in a competitive environment, this decision may lower

demand for loans and other services, posing a serious challenge to banks as to how much they need to increase lending spreads to recover their financial performance.

3. The Model

In the following sections, following Bichsel et al. (2022), Golbabaei and Botshekan (2022), and King (2010), we explain our framework and map the impact of higher capital requirements on bank lending spreads by comparing two performance measures (ROE and *EVA*). We also introduce a new version of *EVA* considering the negative effect of the tightened capital ratio on the cost of equity and show a bank's reaction to the capital ratio increase by raising lending spreads. To begin, the bank's total capital ratio at $t + 1$, TCR_{t+1}, is calculated using the following formula:

$$TCR_{t+1} = \frac{E_{t+1}}{RWA_{t+1}} \tag{1}$$

The formula has two main parts: capital (E) and risk-weighted assets (RWA). Banks can increase the capital ratio either by raising capital or lowering RWA. As discussed earlier, we assume that the bank fulfills a higher capital ratio by increasing equity, and therefore, the change in the total capital ratio is equal to

$$\Delta TCR_{t+1} = \frac{\Delta E_{t+1}}{RWA_{t+1}} \tag{2}$$

By resolving Equation (2) for E_{t+1}, we have

$$\begin{aligned} \Delta E_{t+1} &= \Delta TCR_{t+1} \times RWA_{t+1} \\ E_{t+1} - E_t &= \Delta TCR_{t+1} \times RWA_{t+1} \\ E_{t+1} &= E_t + \Delta TCR_{t+1} \times RWA_{t+1} \end{aligned} \tag{3}$$

E_{t+1} shows the quantity of total equity to meet a higher capital ratio. Assuming that banks increase their capital ratios only by increasing shareholders' equity, the size and composition of the balance sheet and therefore risk-weighted assets are held constant, but shareholders' equity and total liabilities change. On the other hand, as debt is substituted with expensive equity, the increased capital requirement reduces the bank's performance measures, and we assume that the bank would raise lending spreads to prevent the drop in performance measures. To hold the size of the balance sheet constant, the increase in shareholders' equity can be offset by decline in debt:

$$\Delta equity_{t+1} = -\Delta debt_{t+1} \tag{4}$$

Economic Value-Added as a Performance Measure

Economic value-added is a common measure of shareholder value creation. The *EVA* is a value created by a firm on its current investment and defined by the following formula:

$$EVA = NOPAT - (WACC \times Capital) \tag{5}$$

where *NOPAT* is net operating profit after tax, *WACC* is the weighted average cost of capital, and *Capital* is the sum of debt and shareholders' equity (Fiordelisi and Molyneux 2010). As Goldberg (1999) also expresses, the conceptual advantage of *EVA* compared to the other traditional measures (like *ROA* and *ROE*) is mainly due to considering the balance between a firm's total expenses like operating expenses, interest charges and taxes, and an economic return for shareholders captured by the *WACC* (Uyemura et al. 1996).

Economic value-added is also a tool that banks can use for measuring their financial performance. But banks' activities are different from the activities of other non-financial institutions. One important difference between financial institutions and other firms is the function of debt. For non-financial institutions, debt is an important part of the financing,

and therefore part of WACC on the one hand and part of NOPAT, on the other hand. But the liability side of the bank's balance sheet is a part of its business operations, and it is not just a financial resource (Thampy and Baheti 2000). So, the function of debt for banks is different from that for non-financial firms. In an analogy, interest expenses on deposits for banks in this view are the equivalent of the cost of goods sold for non-financial firms. Therefore, for banks, *EVA* should be measured at the equity level, and WACC is replaced by the cost of equity (C_E) and, consequently, "NOPAT" by "Net Income".[5] Thus, the following economic value-added equation (economic profit or equity approach *EVA*) is suggested for banks:

$$EVA_{equity} = net\ income - (C_E \times E) \tag{6}$$

Considering these conceptual advantages, *EVA* can be applied as a performance measure in banking. In this regard, Fiordelisi (2007) states that profit efficiency measures (like ROE) cannot be the most relevant and important performance measure reflecting the bank's strategy. Because they do not explicitly take the risk or the opportunity cost of capital into consideration. Radic (2015) believes that the term profitability (usually calculated by ROA and ROE) is insufficient to appraise bank stability since it does not consider the level of risk taken by banks. High profitability can be interpreted as a signal of bank soundness or high risk-taking.[6]

4. Mapping Higher Capital Ratio and *EVA* to Lending Spreads

The logic of this paper is to show that to offset the fall in performance measures (as a result of capital increase), banks can raise their lending spread. But the role of a suitable performance measure like *EVA* against other traditional measures like *ROE* in determining the required lending spread is vital. So, in this section, we use *EVA* as a principal performance measure and change the lending spread to recover this measure from falling.

Using the above formula and substituting (3) into (6) yields a more complete model for *EVA* for banks:

$$EVA = net\ income_{t+1} - \left(C_{E,t+1} \times (\overbrace{E_t + \Delta TCR_{t+1} \times RWA_{t+1}}^{new\ equity_{t+1}}) \right) \tag{7}$$

where C_E is the cost of equity.[7] On the other hand, the net interest income can be calculated as

$$NetIntIncome_{t+1} = \left[\left(\overbrace{loan_{t+1} \times \alpha}^{loan\ income_{t+1}} \right) + (OIntIncome_{t+1}) \right] - \left[IntExp_{t+1} \right] \tag{8}$$

where *NetIntIncome* is the net interest income, α is the lending rate, *OIntIncome* is the other interest income, and *IntExp* is the interest expenses. Using Equations (7) and (8) simultaneously, we can back out the lending rate (a) for each targeted *EVA*

$$\begin{aligned} loan_{t+1} \times \alpha &= NetIntIncome_{t+1} + IntExp_{t+1} - OIntIncome_{t+1} \\ \alpha &= \frac{\left(\overbrace{NetIntIncome_{t+1} + IntExp_{t+1} - OIntIncome_{t+1}}^{loan\ income_{t+1}} \right)}{loan_{t+1}} \end{aligned} \tag{9}$$

and the targeted net interest income

$$\frac{\overbrace{EVA_{t+1} + (C_{E,t+1} \times E_{t+1})}^{net\ income_{t+1}}}{1 - tax} + OpExp_{t+1} - NonIntIncome_{t+1} \tag{10}$$

where $OpExp$ is the operating expenses and $NonIntIncome$ is the non-interest income.

The same line of reasoning can be used to back out the lending spread needed if the ROE is used as the performance measure. In this study, we assume the bank wants to keep the previous year's performance measure (*EVA* or ROE) and simultaneously increase its capital ratio. So, the question is how the choice of performance measure can affect the lending rate[8] required by the bank to prevent a drop in its performance. This could be highly important for the bank in competitive business conditions, as requiring a lower lending spread can garner a competitive advantage for the bank.

Market Reaction to Higher Capital Ratio and Varying Cost of Equity

Under the assumption of perfect capital markets, Modigliani and Miller (1958) have shown that a firm's capital structure does not impact WACC and finally firm value (Schmidt 2019). WACC is calculated by the following equation:

$$WACC = \left(r_E \times \frac{E}{D+E}\right) + \left(r_D \times \frac{D}{D+E}\right) \tag{11}$$

where r_E (C_E) is the cost of equity, r_D is the cost of debt, D is debt, and E is equity. Accordingly, changes in leverage cause offsetting changes in the cost of equity and the cost of debt (when taxes are disregarded)[9], keeping the overall WACC and thus firm value constant (Schmidt 2019). It means that the increase (decrease) in financial leverage results in an increase (decrease) in the shareholder's expected return (the cost of equity). Several studies focusing on international data have shown that uncertainty about regulatory and monetary policies could adversely affect stock prices and associated equity costs (Batabyal and Killins (2021), Arouri et al. (2016), Nusair and Al-Khasawneh (2022)). Belkhir et al. (2021) shows that a one-percentage-point increase in the equity-to-asset ratio decreases the bank's cost of equity by about 18 basis points. They conclude that capital has a negative impact on the bank's cost of equity. The results are confirmed in both developing and developed countries.[10] To test how investors adjust their expected return in response to the capital ratio increase, the previous equation can be solved for r_E:

$$r_{ACE} = WACC + (WACC - r_D) \times \frac{D}{E} \tag{12}$$

Or

$$r_{ACE} = \frac{WACC \times (D+E) - (r_D \times D)}{E} \tag{13}$$

where r_{ACE} is the adjusted cost of equity.

One of the assumptions of this paper is that the bank increases the capital ratio only by equity. So, increasing equity results in a reduction in financial leverage and thus the cost of equity. As mentioned before, one of the benefits of *EVA* is that it considers the cost of equity. So, using this theorem and the distinguishing feature of the *EVA* (considering the cost of equity), we extend Equation (7) by using a varying cost of equity (Equations (12) or (13)):

$$EVA = net\ income_{t+1} - \left(r_{ACE,t+1} \times (\overbrace{E_t + \Delta TCR_{t+1} \times RWA_{t+1}}^{new\ equity_{t+1}})\right) \tag{14}$$

Using Equation (14), we can also calculate the lending rate in the new formation, where the varying cost of equity decreases in response to the capital ratio increase.

5. Numerical Illustration from the Largest U.S. Banks

By way of a numerical illustration, we use financial and market information from 10 of the largest U.S. banks by asset size and significant international lending operations reported by SP Global Market Intelligence (https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/50-largest-us-banks-by-total-assets-q3-2023-79625289) (accessed on 13 May 2024) over the period 2018–2022 and calculate how much the bank needs to increase its lending spreads in response to a hypothetical one-percent increase in capital ratio to recover its previous performance level. The 2018–2022 period was selected to capture both the economic and regulatory environment post the 2007–2008 financial crisis and those prevailing during the pandemic.

For brevity, we only explain the results for the year 2022. The results for the entire sample over the 2018–2022 are presented in Appendix A.

In the case of bank of America (Panel A of Table 1), when ROE is the performance measure of the bank, a one-percentage-point increase in the capital ratio reduces ROE from 0.121597 to 0.114560. To recover ROE, the bank needs to raise the lending spread by 18.570 basis points for the coming year. On the other hand, when *EVA* is considered as the main performance measure (Panel B of Table 1), the representative bank is required to raise the lending spread by 14.197 basis points to offset the fall in *EVA*. In this case, we assume that the cost of equity remained unchanged in response to the capital ratio increase. As mentioned before, the main advantage of using *EVA* instead of other accounting-based performance measures is considering the dynamics of the cost of equity capital in response to deleveraging. So, in Panel C, we show the negative response of the bank's cost of equity to the capital ratio increase. The results imply that the effect of a one-percentage-point increase in the capital ratio is equivalent to a decrease in the cost of equity from 0.0929 to 0.0877. In this case, *EVA* decreases from 6,466,618 to 6,429,794, and the bank should raise the lending spread by 0.406 basis points to recover *EVA*, which is significantly lower than the amount resulted when using the ROE measure. The results confirm that *EVA* is a better and less expensive performance measure in comparison to other commonly used ones. As shown in Appendix A, similar results are also obtained for other banks over the entire period, 2018–2022.

Table 1. The effect of a 1% increase in the capital ratio on lending spreads in 10 selected U.S. banks in 2022.

Panel A: ROE as a performance measure				
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spreads changes
JP Morgan Chase Bank	0.113089	0.107643	19.797	0.113089
Bank of America	0.121597	0.114560	18.570	0.121597
Wells Fargo Bank	0.099399	0.092785	15.860	0.099399
Citibank	0.093280	0.088357	18.392	0.093280
U.S. Bank	0.148988	0.135729	19.665	0.148988
PNC Bank	0.131513	0.120424	20.187	0.131513
Truist Bank	0.103148	0.096431	16.381	0.103148
Goldman Sachs Bank	0.067810	0.063854	17.873	0.067810
The Bank of New York Mellon	0.079589	0.075499	36.892	0.079589
KeyBank	0.163307	0.145558	26.824	0.163307

Table 1. *Cont.*

Panel B: *EVA* as a performance measure (Fixed cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
JP Morgan Chase Bank	9,450,767	8,206,827	14.143	9,450,767	0.0820
Bank of America	6,466,618	5,179,141	14.197	6,466,618	0.0929
Wells Fargo Bank	1,975,185	973,293	13.867	1,975,185	0.0872
Citibank	−2,078,366	−3,063,192	21.047	−2,078,366	0.1059
U.S. Bank	3,055,273	2,702,942	10.646	3,055,273	0.0807
PNC Bank	1,929,493	1,583,967	13.053	1,929,493	0.0876
Truist Bank	1,011,186	651,955	13.644	1,011,186	0.0863
Goldman Sachs Bank	−1,145,316	−1,435,345	25.241	−1,145,316	0.0915
The Bank of New York Mellon	21,360	−93,159	36.493	213,60	0.0788
KeyBank	842,701	686,719	16.101	842,701	0.0987
Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
JP Morgan Chase Bank	9,450,767	9,441,661	0.104	9,450,767	0.0781
Bank of America	6,466,618	6,429,794	0.406	6,466,618	0.0877
Wells Fargo Bank	1,975,185	1,966,276	0.123	1,975,185	0.0814
Citibank	−2,078,366	−2,092,752	0.307	−2,078,366	0.1003
U.S. Bank	3,055,273	3,029,936	0.766	3,055,273	0.0740
PNC Bank	1,929,493	1,943,297	0.000	1,943,297	0.0801
Truist Bank	1,011,186	1,005,600	0.212	1,011,186	0.0808
Goldman Sachs Bank	−1,145,316	−1,155,444	0.881	−1,145,316	0.0861
The Bank of New York Mellon	21,360	17,196	1.327	21,360	0.0749
KeyBank	842,701	839,028	0.379	842,701	0.0882

Another distinguishing feature of using *EVA* is that in some cases, the decrease in the cost of equity in response to the capital ratio increase is sufficient to keep the *EVA* intact. Looking at the result of PNC Bank (Panel C of Table 1), it shows that the effect of a one-percentage-point increase in the capital ratio could decrease the cost of equity from 0.0876 to 0.0801 which is sufficient to keep the *EVA* unchanged. Finally, overall maintaining the existing financial performance, the *EVA* approach prescribes on average a significantly lower lending spread of 0.4505 basis points against a lending spread of 21.0441 basis points associated with the use of the ROE approach.

For robustness, we have extended our U.S. sample to conduct our analysis on the two largest European banks: HSBC and Barclays reported by EMARKTER: https://www.emarketer.com/insights/largest-banks-europe-list/ (accessed on 13 May 2024). These results are reported in Tables A11 and A12. Consistent with the results on U.S. banks, the *EVA* approach continues to prescribe on average a significantly lower lending spread of

0.7682 basis points against a lending spread of 7.1796 basis points associated with the use of the ROE approach. These results confirm our earlier contention that, by accounting for the impact of the capital ratio changes on the cost of equity capital, the *EVA* rule determines a much lower and more accurate lending spread.

6. Conclusions

Beyond the 2007–2008 financial crisis, the collapse of the Silicon Valley Bank and the acquisition of Credit Suisse by the Swiss investment bank UBS Group AG in 2023 have brought further attention to the need for new regulatory capital, liquidity risk management, and leverage requirements. Capital ratio increases or lowering risk-weighted assets (*RWA*) deteriorate a bank's profitability, and a lending spread increase is one of the main options for banks to offset the drop in their financial performance.

In this study, we attempt to address the critical question of how much the lending spread should be raised to offset the drop in financial performance. We showed that the change in the lending spread is directly dependent on the choice of the performance measures used. The ROE rule significantly overestimates the magnitude of the lending spreads. By accounting for the impact of the capital ratio changes on the cost of equity capital, we show that the *EVA* rule determines a much lower and more accurate lending spread. Our results are confirmed through a numerical illustration on the 10 of the largest U.S. banks by asset size reported by SP Global Market Intelligence over the period 2018–2022. Maintaining the existing financial performance, the *EVA* approach prescribes on average a significantly lower lending spread of 0.4505 basis points against a lending spread of 21.0441 basis points associated with the use of the ROE approach.

A potential limitation of this work is that the information on performance measure approaches used by banks is not publicly available and thus cannot be used to compare increases in lending spreads in response to capital ratio changes. There is also the question of whether similar results could be obtained using other accounting- and market-based performance measure approaches such as market-to-book ratio, EBITDA/total assets, ROA, and different bank portfolio indices. Finally, notwithstanding the focus on large banks, we believe the results on the association between lending spreads and the choice of the performance measurement indices should be equally applicable to medium- and small-sized banks as long as both market and accounting-based performance measures are equally used in pricing and advancing loans and credits. Future studies need to obtain propriety information on bank indices for performance attempting to conduct a longitudinal study of changes in regulatory regimes and bank lending spreads.

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Abbreviations

TCR	Total capital ratio at (t + 1)
E	Equity capital
RWA	Risk-weighted assets
D	Debt capital
EVA	Economic value-added

ROE	Return on equity
NOPAT	Net operating profit after tax
WACC	Weighted average cost of capital
C_E	Cost of equity capital
NetIntIncome	Net interest income
α	Lending rate
$oIntIncome$	Other interest income
IntExp	Interest expenses
r_{ACE}	Adjusted cost of equity

Appendix A

Table A1. The effect of a 1% increase in the capital ratio on lending spreads (JP Morgan Chase Bank).

Panel A: ROE as a performance measure					
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes	
2022	0.113089	0.107643	19.797	0.113089	
2021	0.125645	0.119435	23.871	0.125645	
2020	0.077825	0.073842	14.731	0.077825	
2019	0.127269	0.120794	22.550	0.127269	
2018	0.120475	0.113601	23.333	0.120475	
Panel B: *EVA* as a performance measure (Fixed cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	9,450,767	8,206,827	14.143	9,450,767	0.0820
2021	15,775,061	14,620,179	13.930	15,775,061	0.0736
2020	1,662,162	618,614	13.540	1,662,162	0.0717
2019	8,548,692	7,366,194	15.791	8,548,692	0.0925
2018	6,775,150	5,635,300	16.981	6,775,150	0.0889
Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	9,450,767	9,441,661	0.104	9,450,767	0.0781
2021	15,775,061	15,774,948	0.001	15,775,061	0.0699
2020	1,662,162	1,665,214	0.000	1,665,214	0.0680
2019	8,548,692	8,608,791	0.000	8,608,791	0.0878
2018	6,775,150	6,763,343	0.176	6,775,150	0.0839

Table A2. The effect of a 1% increase in the capital ratio on lending spreads (Bank of America).

Panel A: ROE as a performance measure					
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes	
2022	0.121597	0.114560	18.570	0.121597	
2021	0.111282	0.105418	16.916	0.111282	
2020	0.065403	0.062121	10.240	0.065403	
2019	0.126114	0.119145	20.383	0.126114	
2018	0.140679	0.133157	22.380	0.140679	
Panel B: *EVA* as a performance measure (Fixed cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	6,466,618	5,179,141	14.197	6,466,618	0.0929
2021	5,423,584	4,268,102	13.335	5,423,584	0.0883
2020	−6,019,375	−7,113,072	14.778	−6,019,375	0.0929
2019	2,596,386	1,230,385	17.790	2,596,386	0.1139
2018	10,112,024	9,041,317	14.502	10,112,024	0.0920
Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	6,466,618	6,429,794	0.406	6,466,618	0.0877
2021	5,423,584	5,368,694	0.633	5,423,584	0.0836
2020	−6,019,375	−6,102,771	1.127	−6,019,375	0.0881
2019	2,596,386	2,584,813	0.151	2,596,386	0.1078
2018	10,112,024	10,097,594	0.200	10,112,024	0.0872

Table A3. The effect of a 1% increase in the capital ratio on lending spreads (Wells Fargo Bank).

Panel A: ROE as a performance measure				
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes
2022	0.099399	0.092785	15.860	0.099399
2021	0.102745	0.096352	17.530	0.102745
2020	0.020237	0.019192	1.071	0.020237
2019	0.116940	0.109741	17.089	0.116940
2018	0.131225	0.122887	19.883	0.131225

Table A3. *Cont.*

Panel B: *EVA* as a performance measure (Fixed cost of equity)					
	EVA before the capital ratio increase	*EVA* after a a1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	1,975,185	973,293	13.867	1,975,185	0.0872
2021	3,613,933	2,687,365	13.921	3,613,933	0.0816
2020	−8,993,035	−9,754,153	6.127	−8,993,035	0.0728
2019	4,767,413	3,807,687	12.734	4,767,413	0.0885
2018	7,994,690	7,079,122	12.350	7,994,690	0.0828
Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	1,975,185	1,966,276	0.123	1,975,185	0.0814
2021	3,613,933	3,610,343	0.054	3,613,933	0.0766
2020	−8,993,035	−9,006,348	0.107	−8,993,035	0.0687
2019	4,767,413	4,745,146	0.295	4,767,413	0.0832
2018	7,994,690	7,971,583	0.312	7,994,690	0.0778

Table A4. The effect of a 1% increase in the capital ratio on lending spreads (Citibank).

Panel A: ROE as a performance measure				
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes
2022	0.093280	0.088357	18.392	0.093280
2021	0.110691	0.104399	22.301	0.110691
2020	0.055520	0.052300	10.886	0.055520
2019	0.115792	0.108939	21.561	0.115792
2018	0.112005	0.105141	22.166	0.112005
Panel B: *EVA* as a performance measure (Fixed cost of equity)				
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	−2,078,366	−3,063,192	21.047	−2,078,366	0.1059
2021	652,477	−418,683	21.503	652,477	0.1068
2020	−8,245,673	−9,334,369	21.609	−8,245,673	0.1071
2019	−1,935,141	−3,171,248	24.147	−1,935,141	0.1286
2018	775,346	−261,525	21.070	775,346	0.1068

Table A4. *Cont.*

Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	−2,078,366	−2,092,752	0.307	−2,078,366	0.1003
2021	652,477	645,857	0.133	652,477	0.1007
2020	−8,245,673	−8,258,897	0.262	−8,245,673	0.1008
2019	−1,935,141	−1,962,784	0.540	−1,935,141	0.1211
2018	775,346	744,522	0.626	775,346	0.1005

Table A5. The effect of a 1% increase in the capital ratio on lending spreads (U.S. Bank).

Panel A: ROE as a performance measure					
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes	
2022	0.148988	0.135729	19.665	0.148988	
2021	0.155852	0.155852	26.145	0.155852	
2020	0.093444	0.087247	14.585	0.093444	
2019	0.141995	0.132228	21.802	0.141995	
2018	0.148697	0.138361	23.381	0.148697	
Panel B: *EVA* as a performance measure (Fixed cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	3,055,273	2,702,942	10.646	3,055,273	0.0807
2021	4,290,138	3,988,750	12.284	4,290,138	0.0735
2020	1,139,485	867,317	11.187	1,139,485	0.0721
2019	2,612,453	2,295,459	13.293	2,612,453	0.0891
2018	3,543,429	3,276,524	11.551	3,543,429	0.0757
Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	3,055,273	3,029,936	0.766	3,055,273	0.0740
2021	4,290,138	4,287,517	0.107	4,290,138	0.0682
2020	1,139,485	1,134,685	0.197	1,139,485	0.0674
2019	2,612,453	2,603,929	0.357	2,612,453	0.0833
2018	3,543,429	3,543,429	0.345	3,543,429	0.0707

Table A6. The effect of a 1% increase in the capital ratio on lending spreads (PNC Bank).

Panel A: ROE as a performance measure					
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes	
2022	0.131513	0.120424	20.187	0.131513	
2021	0.097210	0.090669	15.953	0.097210	
2020	0.062566	0.058587	9.388	0.062566	
2019	0.106100	0.098891	16.238	0.106100	
2018	0.112790	0.104948	17.870	0.112790	
Panel B: *EVA* as a performance measure (Fixed cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	1,929,493	1,583,967	13.053	1,929,493	0.0876
2021	786,465	474,474	13.494	786,465	0.0823
2020	−573,965	−809,868	11.303	−573,965	0.0750
2019	750,732	484,307	13.323	750,732	0.0881
2018	1,510,407	1,294,520	11.576	1,510,407	0.0745
Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	1,929,493	1,943,297	0.000	1,943,297	0.0801
2021	786,465	784,944	0.066	786,465	0.0767
2020	−573,965	−577,821	0.185	−573,965	0.0703
2019	750,732	738,129	0.630	750,732	0.0825
2018	1,510,407	1,498,255	0.652	1,510,407	0.0697

Table A7. The effect of a 1% increase in the capital ratio on lending spreads (Truist Bank).

Panel A: ROE as a performance measure				
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes
2022	0.103148	0.096431	16.381	0.103148
2021	0.085662	0.080944	14.032	0.085662
2020	0.063044	0.059782	9.307	0.063044
2019	0.052955	0.050234	7.553	0.052955
2018	0.115889	0.110180	14.783	0.115889

Table A7. *Cont.*

Panel B: *EVA* as a performance measure (Fixed cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	1,011,186	651,955	13.644	1,011,186	0.0863
2021	203,647	−108,962	13.515	203,647	0.0825
2020	−1,351,686	−1,653,613	12.428	−1,351,686	0.0836
2019	−2,482,994	−2,809,444	13.353	−2,482,994	0.0916
2018	1,009,898	902,622	9.314	1,009,898	0.0799
Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	1,011,186	1,005,600	0.212	1,011,186	0.0808
2021	203,647	201,301	0.101	203,647	0.0780
2020	−1,351,686	−1,355,815	0.170	−1,351,686	0.0793
2019	−2,482,994	−2,487,673	0.191	−2,482,994	0.0867
2018	1,009,898	1,033,405	0.000	1,033,405	0.0755

Table A8. The effect of a 1% increase in the capital ratio on lending spreads (Goldman Sachs Bank).

Panel A: ROE as a performance measure				
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes
2022	0.067810	0.063854	17.873	0.067810
2021	0.079975	0.074610	23.245	0.079975
2020	0.030142	0.028231	8.707	0.030142
2019	0.055056	0.051899	15.539	0.055056
2018	0.076884	0.072008	24.636	0.076884
Panel B: *EVA* as a performance measure (Fixed cost of equity)				
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	−1,145,316	−1,435,345	25.241	−1,145,316	0.0915
2021	−209,994	−467,310	24.752	−209,994	0.0850
2020	−1,572,822	−1,780,708	28.837	−1,572,822	0.0825
2019	−1,319,559	−1,536,622	33.431	−1,319,559	0.1000
2018	−521,833	−724,341	33.996	−521,833	0.0957

Table A8. *Cont.*

Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	−1,145,316	−1,155,444	0.881	−1,145,316	0.0861
2021	−209,994	−210,843	0.082	−209,994	0.0793
2020	−1,572,822	−1,575,197	0.329	−1,572,822	0.0762
2019	−1,319,559	−1,327,566	1.233	−1,319,559	0.0934
2018	−521,833	−525,433	0.604	−521,833	0.0891

Table A9. The effect of a 1% increase in the capital ratio on lending spreads (The Bank of New York Mellon).

Panel A: ROE as a performance measure				
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes
2022	0.079589	0.075499	36.892	0.079589
2021	0.078984	0.075471	41.038	0.078984
2020	0.080667	0.077198	53.423	0.080667
2019	0.099873	0.095426	59.331	0.099873
2018	0.112569	0.107184	65.653	0.112569
Panel B: *EVA* as a performance measure (Fixed cost of equity)				
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	21,360	−93,159	36.493	21,360	0.0788
2021	386,628	300,127	34.002	386,628	0.0654
2020	462,949	377,766	42.892	462,949	0.0648
2019	310,065	203,968	51.883	310,065	0.0879
2018	653,377	540,859	50.493	653,377	0.0873
Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	21,360	17,196	1.327	21,360	0.0749
2021	386,628	386,527	0.039	386,628	0.0625
2020	462,949	462,035	0.460	462,949	0.0621
2019	310,065	304,887	2.532	310,065	0.0842
2018	653,377	649,125	1.908	653,377	0.0833

Table A10. The effect of a 1% increase in the capital ratio on lending spreads (KeyBank).

Panel A: ROE as a performance measure					
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes	
2022	0.163307	0.145558	26.824	0.163307	
2021	0.152566	0.140925	25.722	0.152566	
2020	0.080587	0.080134	0.993	0.080587	
2019	0.111872	0.104429	16.902	0.111872	
2018	0.131561	0.122301	20.512	0.131561	
Panel B: *EVA* as a performance measure (Fixed cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	842,701	686,719	16.101	842,701	0.0987
2021	950,784	814,976	16.282	950,784	0.0967
2020	−254,365	−281,905	3.177	−254,365	0.0950
2019	146,382	21,588	15.523	146,382	0.1032
2018	722,156	623,332	13.051	722,156	0.0851
Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	842,701	839,028	0.379	842,701	0.0882
2021	950,784	949,739	0.125	950,784	0.0894
2020	−254,365	−160,309	0.000	−160,309	0.0886
2019	146,382	143,819	0.319	146,382	0.0966
2018	722,156	719,627	0.334	722,156	0.0794

Table A11. The effect of a 1% increase in the capital ratio on lending spreads (HSBC).

Panel A: ROE as a performance measure				
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes
2022	0.085040	0.081546	7.294	0.085040
2021	0.071057	0.068289	6.789	0.071057
2020	0.029753	0.028557	3.282	0.029753
2019	0.045197	0.043301	5.283	0.045197
2018	0.077349	0.074050	8.407	0.077349

Table A11. *Cont.*

Panel B: *EVA* as a performance measure (Fixed cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	3301	2728	5.847	3301	0.0682
2021	4933	4537	4.510	4933	0.0472
2020	−2511	−2871	4.629	−2511	0.0420
2019	−1426	−1870	6.148	−1426	0.0526
2018	2690	2141	6.902	2690	0.0635
Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	3301	3237	0.651	3301	0.0657
2021	4933	4912	0.240	4933	0.0455
2020	−2511	−2540	0.379	−2511	0.0405
2019	−1426	−1480	0.739	−1426	0.0507
2018	2690	2637	0.671	2690	0.0611

Table A12. The effect of a 1% increase in the capital ratio on lending spreads (Barclays).

Panel A: ROE as a performance measure				
	ROE before the capital ratio increase	ROE after a 1% increase in the capital ratio	The rise in the lending spread to recover ROE	Recovering ROE after lending spread changes
2022	0.086240	0.082244	9.643	0.086240
2021	0.100742	0.096417	11.152	0.100742
2020	0.036796	0.035185	4.095	0.036796
2019	0.051081	0.048884	5.774	0.051081
2018	0.040499	0.038611	5.234	0.040499
Panel B: *EVA* as a performance measure (Fixed cost of equity)				
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Cost of equity
2022	1471	1252	7.269	1471	0.0650
2021	4142	4012	4.604	4142	0.0416
2020	140	34	3.862	140	0.0347
2019	623	500	4.703	623	0.0416
2018	−555	−708	6.359	−555	0.0492

Table A12. *Cont.*

Panel C: *EVA* as a performance measure (Varying cost of equity)					
	EVA before the capital ratio increase	*EVA* after a 1% increase in the capital ratio	The rise in the lending spread to recover *EVA* (bp)	Recovering *EVA* after lending spread changes	Adjusted cost of equity after the increase in equity
2022	1471	1441	1.002	1471	0.0624
2021	4142	4132	0.362	4142	0.0400
2020	140	128	0.457	140	0.0334
2019	623	600	0.852	623	0.0401
2018	−555	−583	1.168	−555	0.0473

Notes

1 We use the common definition of the lending spread as the difference between the interest rate charged on loans and the rate paid on deposits, which is also used by Bichsel et al. (2022) and King (2010).

2 While ROE and *EVA* are two commonly used performance metrics, other possible performance measures such as market to-book ratio, and EBITDA/total assets, among others, could be modeled to establish similar results.

3 Cohen and Scatigna (2016) show that retained earnings account for the bulk of capital ratios, while risk-weighted asset reduction plays a lesser role, and on average, banks tend to increase their lending.

4 For more information on largest U.S. and European banks please visit: https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/50-largest-us-banks-by-total-assets-q3-2023-79625289 (accessed on 13 May 2024) and https://www.emarketer.com/insights/largest-banks-europe-list/ (accessed on 13 May 2024).

5 To calculate banks' cost of capital, Maccario et al. (2002) and Fiordelisi (2007) focus on the cost of equity or shareholders' expected rate of return, since they do not include deposits and other liabilities in the capital.

6 O'Byrne (1996), Chen and Dodd (1997), Lehn and Makhija (1997), Bacidore et al. (1997), and Chmelíková (2008) confirm the superiority of *EVA* against other traditional performance measures (ROE, ROA, and others).

7 We have used the capital asset pricing model (CAPM) to calculate banks' cost of equity.

8 In this paper, we just changed the lending rate to raise the lending spread and assume the interest rate is constant. We also changed the interest rate (the lending rate was fixed), and our baseline results held stable.

9 We can also include corporate tax in the cost of equity calculation (Modigliani and Miller's (1958) theorem with corporate tax). Taking this factor into consideration can cause a greater decrease in the cost of equity, lower decrease in the *EVA*, and consequently a lower increase in the lending spread in response to the capital ratio increase.

10 Schmidt (2019) finds that when banks decrease their leverage, investors adjust expected returns following Modigliani and Miller's (1958) theorem.

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