Calculating Strategic Risk in Financial Institutions

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Abstract *Banks face many intangible hazards that are difficult to calculate. Strategic risk is one of the most critical factors affecting a bank's profitability, financial strength, and commercial success. The impact of risk on profit may be insignificant in the short term. Still, it may become highly significant in the medium and long term, with the potential to cause substantial financial losses and impair bank stability. Hence, strategic risk management is an important endeavor that must be carried out according to the rules set out under the Basel II framework. Analysis of strategic risk is a relatively new research enterprise. The current literature addresses the need to manage this risk and links it to the concept of economic capital, the amount of capital that a company should hold to survive such a risk. However, an action plan has yet to be produced. This paper attempts to address this gap by providing a mathematical analysis of the probability and effect of different strategic risk factors. Specifically, we develop a methodology for calculating a metric of strategic risk in terms of a bank's risk assets. Furthermore, we suggest a way of integrating this metric into the calculation of the capital adequacy ratio.*

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Introduction

Risk signifies uncertainty about the future, a possible deviation from a probable or estimated outcome. In the banking sector, risk indicates the possibility of incurring a loss. However, contrary to individuals, who may choose to minimize risks as far as possible, banks are bound to take risks. Risk-taking is an integral part of business activity since little reward can be expected without a strong element of risk. Thus, the banking sector needs to embrace risk, as risk avoidance incurs financial losses (Stulz, 2015; Yaylali & Veli Safakli, 2015).

In recent decades, the notion of risk management has become a staple of the bankingsector. Risk management has grown to be a primary function guiding a financial institution's decision-making process. Poor outcomes might lead to financial distress, especially when the additional burden of taxes and transaction costs is considered. Hence, the objective of risk management is not to prevent banks from taking risks but to ensure that they take a stake in their capital structure to limit the use of debt. Ultimately, risk management does not exclude or reduce risk but rather clarifies the optimal level of risk, i.e., the level that maximizes bank value subject to regulators' constraints, laws, and regulations (Stulz, 2015; Yaylali & Veli Safakli, 2015).

As alluded to above, risk management in banks is complex and intricate owing to the characteristics of financial institutions and the types of risks they encounter. For example, banks are susceptible to market risk due to ongoing fluctuations, credit risk resulting from defaults on loans, and operational risk because of losses caused by

internal operational issues. Moreover, banks need to deal with strategic risks arising from adverse business decisions or lack of responsiveness to changes in the business environment, such as new competitors or changing customer demand. In light of geopolitical shifts and the global economy's vast uncertainty, strategic risk constitutes a significant risk to financial institutions (Chockalingam et al., 2018).

Nevertheless, the analysis of strategic risk in the academic realm is somewhat limited; while other forms of risk have clear definitions and have been subject to extensive investigation, there is no consensus on the definition of strategic risk (Chockalingam et al., 2018; Miller, 1992). For this reason, strategic risk is the focus of the present study. The application of strategic risk management to the banking sector has the potential to enhance performance. It can improve shareholder value by recognizing, monitoring, and regulating risks that can impede banks from achieving set objectives. Nonetheless, providing banks with distinct guidelines is challenging while embarking on a potentially dangerous activity (Dabari & Saidin, 2014; McConnell, 2014).

Banks need an efficient means of measuring strategic risk to develop mitigation strategies. In the twenty-first century, regulators are no longer satisfied with qualitative risk management statements and instead prefer using quantitative methods to monitor risk (Härle et al., 2015). However, measuring strategic risk is not straightforward. Annual reports do not, in general, clearly lay out a firm's long-term strategies using a set of measurable and concrete objectives; instead, they refer only to vague policies and procedures (McConnell, 2014). Hence, the goal of this study is to devise a measurable definition of strategic risk. The proposed methodology involves calculating strategic risk in terms of a bank's risk assets integrated into the capital adequacy ratio.

In summary, there are no banking transactions without risk; hence, this study's central question is, how to evaluate and measure strategic risk? The research highlights the significance of developing quantifiable risk management approaches to minimize negative consequences for the bank, its assets, and its liabilities. The remainder of the paper is organized as follows: In the next section, we present a review of the academic literature that constitutes the theoretical foundation of this study. Then, in Sect. "Methods and Results," we display the study's methods and results. Finally, Sect. "Conclusion" states the paper's conclusions.

Literature Review

Banks confront an array of risks, and failure to tackle these properly could have systemic effects. Risk-taking is not, in itself, a harmful activity; financial institutions must take calculated risks to expand and remain competitive. However, the key to maintaining stability is to devise a sound and efficient risk management procedure to achieve an appropriate level of risk (Chockalingam et al., 2018).

The goal of Basel II (2006) was to develop suitable measures to allow financial institutions to cultivate a sound risk management culture across all economic levels. The committee highlighted the significance of foreseeing and planning for the future. With that said, an edition of Basel II published in 2004 excludes strategic risk from its explicit capital requirements. Basel III (2009) aimed to strengthen capital requirements in banks to improve the global banking system's total power. Its prime objective was to develop a novel and effective internal control system that could be implemented to manage financial distress. The Basel III framework introduced higher and better-quality capital requirements, improved risk coverage, and a minimum leverage ratio as a backstop to the risk-based requirement.

Strategic Risk

Strategic risk encompasses risks concerning the long-term functioning of a financial institution. It embraces various variables, such as corporate governance and factors based on market characteristics and stakeholders (Maurya & Srivastava, 2022; Roberts et al., 2003). As previously noted, the analysis of strategic risk in the literature is relatively limited, perhaps due to the tendency to include strategic risk under operational risk (Schroeck, 2002) or due to uncertainty surrounding the practical question of who is in charge of strategic risk management in banks (Stulz, 2014). Nevertheless, despite the immaturity and vagueness of the discipline, numerous definitions have been proposed to grasp the essence of strategic risk.

Schroeck (2002) describes strategic risk as the loss incurred due to unanticipated changes in revenue or fixed costs, which in turn are instigated by changes in the bank's competitive environment. Chaffai and Dietsch (2015) define strategic risk as variations in revenue due to a bank's activities. Slywotzky and Drzik (2005) depict strategic risk as the hazard resulting from an array of external incidents and trends (e.g., industry margin squeeze, technological

change, customer priority shift, venture failure, and market stagnation) that can adversely affect a firm's growth and shareholder value. According to Doff (2008), strategic risk is the peril of economic loss due to variations in the competitive environment or the degree to which the institution can promptly adapt to such modifications. Chatterjee et al. (1999) support the aforementioned definitions by maintaining that strategic risk is driven by market deficiencies and limited resources and/or sales. The authors point to a connection between strategic risk and the likelihood that a bank can detach its profits from macroeconomic and market shocks. Chatterjee et al. (1999) further assert that financial institutions have the ability to mitigate risk since they hold the potential to shape market forces and, at the same time, can gain an advantage by exploiting existing flaws and searching for new opportunities.

Several studies tried to comprehend the various features of strategic risk. For example, McConnell (2012b, 2013) contends that strategic risk is the most significant risk confronting businesses, specifically banks, due to the vast uncertainty in the global economy. He divides strategic risk into two facets: strategic positioning risk, which reflects whether the bank's strategy is on the right path, and strategic execution risk, which pertains to the implementation of the chosen strategy. According to Chockalingam et al. (2018), the definition of strategic risk has to incorporate data on "deviation from acceptable" returns (also referred to as the "profitability limit"), which controls the acceptability of a cash flow. Thus, the researchers propose that risk should be measured as a decline in net income beneath a set limit owing to one of the following circumstances: (1) unexpected variations in profits or fixed costs instigated by external trends in the bank's competitive environment or (2) the extent to which the institution is able to respond to these trends promptly.

Official institutions also acknowledge the importance of regulating strategic risk. The Bank of Thailand (2003) describes a strategic risk as a hazard that may result from constructing and implementing a strategic plan that collides with internal and external factors that impact earnings, capital funds, and viability. According to this definition, external factors include competition, behavioral change in target customers, technological change, economic factors, and new regulations. In contrast, internal factors encompass organizational structure, work process, adequacy and quality of personnel, and availability of information. The Basel Committee on Banking Supervision (2009) recognizes that strategic risk affects the profit and loss statement since it focuses on a decline in revenue and reaches beyond the balance sheet. Therefore, the committee upholds that strategic risk is a consequence of a decline in volumes and margins without the prospect of countering the loss of revenue with a decrease in costs.

To conclude, strategic risk is a function of the symmetry between a financial institution's strategic objectives, the business strategies created to attain these objectives, the resources utilized against these goals, and the quality of the implementation process. It can be described as the risk of being in business, a situation in which the changing business environment impacts the profit and loss statement and might cause declining revenues or losses. Hazards from business settings can gravely impact financial institutions' profitability; thus, this field requires the attention of banking management and regulatory entities.

Strategic Risk Management

The banking system heavily emphasizes the growth of expected profit by analyzing potential risks. Thus, an active risk management process is required to achieve the best possible outcomes (Mohamed, 2016; Settembre-Blundo et al., 2021), and risk management is a crucial element of efficient and lucrative financing and investment. The objectives of risk management, in general, and strategic risk management, in particular, are to foster practical banking activities that cater to the public interest while avoiding unsustainable economic practices that do not entail any real added value.

Effective risk management in financial institutions, combined with strict compliance with good corporate governance are critical to the institutions' success (Aebi et al., 2012). Risk management refers to activities intended to reduce the negative impact of uncertainty. Ideally, this should be a systematic process to detect and assess the level of pure loss exposure to which a firm is subjected. Risk management is likely to require selecting and integrating various methods to determine the appropriate levels of exposure (Schmit & Roth, 1990).

Strategic risks are identified as the leading cause of loss of value for financial institutions (Deloitte, 2019), affecting the organization's ability to perform its strategies and accomplish its business aims. Ultimately, these risk exposures may impact shareholder value or the organization's viability (Frigo & Anderson, 2012). As mentioned, the purpose of managing strategic risks is not avoidance but anticipation, comprehension, and planning of how to react. In addition, strategic risk management encompasses the establishment of governance and ownership, including measures such as identifying the stakeholders accountable for the strategy and risk management, implementing independent risk review processes, setting the firm's risk appetite level, and devising frameworks to evaluate the effect of risk on key business variables (Deloitte, 2019).

Strategic risk management focuses on the most significant risks to shareholder value and hazards inherent to strategy development and execution. One of the lessons

learned from the global financial crisis is that financial institutions need to connect strategy and risk management and be capable of identifying and managing risk in a highly uncertain environment. Another lesson is that banks have to center risk management on generating and protecting value (Frigo & Anderson, 2011). Thus, Frigo and Anderson (2011, 2012) describe strategic risk management as the ongoing practice of recognizing, evaluating, and managing the risks in an organization's business strategy, including taking instant action when a hazard is realized. The researchers emphasize that strategic risk management deals with threats and uncertainties due to internal and external events—threats that could hinder an organization's ability to attain its strategic goals and ultimately create and protect shareholder and stakeholder value. The authors highlight that strategic risk assessment ought to explore contingencies to stress-test against external conditions.

The Bank of Thailand (2003) declares that a sound strategic risk management system must continually detect, quantify, monitor, and regulate the organization's risks. Thus, the process needs to be ongoing to observe the outcome of a changing environment. The detection and measurement of strategic risk are regulated through the strategic planning process. Kroszner (2008) asserts that forming a comprehensive strategic risk management framework necessitates reexamining internal practices and the external environment to understand how the two are linked. He maintains that incorporating funding and liquidity into strategic risk management is vital since these factors determine the future success of an institution. Fatemi and Glaum (2000) underline that risk management integrates numerous objectives, such as reducing foreign exchange losses, decreasing volatile cash flow, protecting earnings fluctuations, increasing profitability, and incorporating measures to ensure a firm's survival. The efficiency of strategic risk monitoring relies on detecting and quantifying all hazards. Thus, risk monitoring should be supported by suitable, precise, and timely management information systems or models to assist with analysis and decision-making (Bank of Thailand, 2003). Therefore, the prime objective of the current paper is to develop a model that can identify and measure the complex and diversified risks to financial institutions in an accurate, reliable, and ongoing manner.

In summary, strategic risk management reflects on potential risks and devises measures to guard against them and their accompanying losses, including ensuring sufficient capital and a maintainable capital structure (Yaylali & Veli Safakli, 2015). It is noteworthy that the recommended approach to risk management proposes that banks embed risk within their capital structure framework; thus, it does not inhibit risk but rather manages risk to enhance the bank's financial performance and prevent the bank from incurring losses that it cannot cover or that are considered unacceptable (Yaylali & Veli Safakli, 2015).

In view of the theories stated above, this paper aims to present a systematic quantitative risk management methodology that can be easily adapted to numerous conditions according to the bank's structure, volume, and financial activities and that can be applied on an ongoing basis. In the currently unstable economic world, the public has the right to demand that banks keep their risk-taking activities within acceptable limits. Nowadays, risk management is inextricably linked with capital management and profitability (Agrawal, 2020; Chornous & Ursulenko, 2013). Accordingly, the approach taken in this paper is to protect financial institutions from excessive risk exposure by providing a methodology to ensure that the bank holds sufficient capital to mitigate strategic risk. The expectation is that managers could incorporate this methodology into their risk appetite framework. Determining the optimal level of capital is one of the most multifaceted problems in the banking sector; thus, the following subsection focuses on the meaning of economic capital.

Economic Capital

Financial institutions need to ensure a stable and reliable funding structure in times of economic crisis or financial stress. From a strategic standpoint, banks must inspect their current and future funding situations and weigh up the potential need for deleveraging against the state of liquidity of the financial market. Kroszner (2008) emphasizes the importance of considering the longer-term implications of funding and liquidity and incorporating them into the overall strategic plan.

Economic capital is a measure of a financial institution's total risk exposure that banks frequently use. It measures risk, not capital held (Burns, 2004). Its purpose is to ensure that business activity remains within appropriate risk limits (Soetekouw, 2016). Economic capital is based on a probabilistic valuation of possible future losses, thereby establishing a correlation between capital and risk.

Academic research and formal institutions attempted to outline the meaning of economic capital. The Basel Committee on Banking Supervision (2009) describes economic capital as practices or customs that banks undertake to estimate risk and conceal adverse economic effects of their risky activities. The committee views economic capital as a bank's measurement of absolute risk (or risk across business units) rather than a capital buffer. Schroeck (2002) claims that economic capital can be displayed at either a corporate level or a business-line level, whereby, at the business-line level, correlations between risk types ought to be incorporated to take account of diversification benefits.

Studies also emphasize the statistical aspects of economic capital. For instance, Soetekouw (2016) notes that economic capital can be used as a defense against unanticipated forthcoming losses at a designated confidence level. Sweeting (2011) defines economic capital as the excess of assets or cash flows earmarked for coping with an unpredicted decline in resources or an increase in liabilities over a predefined time within explicit risk limits. The Basel Committee on Banking Supervision Risk (2009) indicates that mitigation objectives are to compute the amount of economic capital and evaluate the likelihood of strategic risk occurrence and consequences. Hence, economic capital corresponds to the difference between the expected value and the upper limit of the distribution of potential future losses. Therefore, the articles mentioned above conclude that one's chosen confidence level defines the upper limit of the distribution, and the expected loss is the anticipated average loss over a specified time.

As noted, quantification is a stimulating and challenging facet of strategic risk. Strategic risks may take on recognized forms, such as financial, operational, technological, or political, but they tend to be difficult to quantify and track (Deloitte, 2016).

It is worth mentioning that there is no fixed or unified method to evaluate economic capital. Thus, banks exercise diverse models and procedures in their internal risk assessment. Nonetheless, the notion of economic capital is similar across banks (Aas & Puccetti, 2014; Chockalingam et al., 2018). To sum up, it is customary to calculate strategic risk by assessing economic capital; hence, this research tackles the relationship between strategic risk and regulatory capital supervision.

Quantifying Strategic Risk

To date, no single accepted methodology exists to assess a bank's strategic risk. The definitions that financing authorities have proposed are generally qualitative or difficult to measure; thus, banks tend to use diverse models and processes in their internal risk assessment. Moreover, at the time of writing, regulatory entities have not set regulations or guidelines to address strategic risk quantification (Aas & Puccetti, 2014; Chockalingam et al., 2018). The situation in the academic world is no different. Most papers are theoretical and focus on the qualitative aspects of strategic risk and risk management. For instance, McConnell (2012a, 2014) analyzes and compares the formal disclosures of several banks to determine how the corporate strategy is described and how strategic risks are assessed in "systemically important" firms. Stulz (2015) presents an overview of risk-taking, bank risk appetite, risk capital, organization of risks, governance, incentives, and risk culture. Härle et al. (2015) advise banks to manage risk

during profound transformation. Allan and Beer (2006) focus on an organization's vulnerability to strategic threats and its ability to identify strategic prospects through a cognitive and soft systems approach. The authors postulate that analysis of how strategic decision-makers comprehend their risk environment enables a distinctive risk profile to be generated, representing an organization's vulnerability to strategic risks.

A small number of studies have aimed to measure strategic risk. McConnell (2012b) suggests that strategic risk should be quantified by monitoring deviations from the board's strategy. He underlines that the starting point for the measurement should be an appraisal of economic capital, that is, the money or assets that a bank holds in reserve to shield itself from negative occurrences and mitigate against risk. Chaffai and Dietsch (2015) define strategic risk as variations in profit caused by changes in the bank's activities. They derive a directional distance function from calculating the disparity between the present profit and the efficiency frontier, which is a measure of profit inefficiency and unforeseen loss.

Doff's (2008) research constitutes another example of strategic risk measurement within an economic capital context. The researcher identifies three frequently used methods for computing strategic risk using economic capital: analogue company approach/peer group analysis, statistical analysis, and scenario analysis. Schroeck (2002) presents two methods of measuring economic capital for application to strategic risk: the historical accounting-based approach and Monte Carlo simulation. The first approach utilizes historical cost and revenue time series, where all trading and credit-related costs and revenues are deducted. These data allow quantification of the expected revenue and the sigma (i.e., volatility); subsequently, the economic capital for strategic risk can be calculated. The second method also relies on historical data. It links the input parameters volumes and margins (to model revenues) as well as fixed and variable costs to a suitable macroeconomic model.

Researchers implemented pedesis to quantify strategic risk. For instance, Böocker (2008) uses the concept of Brownian motion to develop a discounted cash flow model in continuous time. The model projects discounted future cash flows to calculate the capital at risk (CaR). In comparison, Soetekouw (2016) suggests modeling net income (which he regards as a strategy performance measure) as a proper stochastic process. Future net income values are modeled as an arithmetic Brownian motion with drift and volatility. The CAPM (capital asset pricing model) is then used to evaluate the profitability limit of the net income by computing the total cost of equity.

Lastly, Chockalingam et al. (2018) develop a framework that quantifies strategic risk by approximating the sum of

economic capital a bank requires to mitigate a strategic threat. They employ the bank's cost of equity as a profitability threshold to assess the amount of economic capital. They simulate the bank's net income and utilize the VaR framework to evaluate economic capital prerequisites. According to the authors, the proposed structure enables a bank to assess the effect of choosing a risk appetite level and preparing a growth strategy based on its economic capital requirements. Additionally, it allows the evaluation of the impact of a strategy change on economic capital requirements.

The above studies propose measuring strategic risk within a monetary capital framework. The calculation method hinges on data completeness and banking portfolio specificity. The chief shortcomings of using a statistical approach are missing historical data, deficiency of banks' information systems, and partial or unsuitable data on particular bank features (Chornous & Ursulenko, 2013). Hence, a vital contribution of this research is the division between two types of hazards: systematic and unsystematic risks. Contrary to previous studies, which estimated the strategic risk through economic capital, this study proposes calculating the risk in terms of risk assets. The threat is expressed via regulatory capital and the capital adequacy ratio. The proposed quantitative model would provide a standardized, precise method of assessing strategic risk, thereby allowing the risks of different institutions to be compared on an equal basis.

Methods and Results

Calculating regulatory capital for strategic risk provides an estimate of future uncertainty about the business environment in the form of the capital required to withstand strategic risk. Furthermore, it defines the risk assets considering the strategic risk. The proposed method divides strategic risk into two facets: systematic risk and unsystematic risk. Systematic risk refers to external threats that can impact a bank's conduct. These parameters may show some association with each other but do not exhibit high levels of co-correlation. The premise of this study is that a bank's strategic policy must consider systematic risks as an integral component of its overall strategic risk, even though such risks are external. Unsystematic risk pertains to the financial institution's decision-making and represents the effect of risk-taking under fluctuating market conditions. Since unsystematic risk is an internal threat, it is based on the bank's financial reports. This paper argues that a sound and efficient strategic policy should consider both types of risk to ensure that the bank maintains sufficient capital to cover the strategic risk.

Mathematical Background

We first consider unsystematic risk, while the calculation of systematic risk is addressed in Sect. "Systematic Strategic Risk." The calculation of unsystematic risk is based on the measurement of change in the bank's strategy, the effect of this change on the risk assets, and the projected implication for the regulatory capital that must be held against a certain level of risk assets. The assessment relies on positioning the threat on the strategic axis:

$$R_{\text{strategy}} = \vec{R} \cdot \vec{S} \tag{1}$$

where R is the risk vector, and S is the risk vector.

To the best of our knowledge, this is the first attempt to evaluate risks according to the primary axes and not the bank's basic parameters. We contend that if the strategy component relating to risk assets is prominent, the bank is exposed to significant risks. Future studies may wish to examine different primary axes, which could be achieved by applying principal component analysis (PCA) to a sample of banks through the years.

We argue that strategy can only be measured by evaluating the changes in a bank's prioritization, which in turn can be calculated based on the relative investment in each business line. Our approach holds that if the external market experiences change, while, at the same time, the bank does not alter its prioritization, this effectively qualifies as a strategy modification. Hence, the strategy is reflected in the bank's response to the market. If we denote the bank's investment in its varied business ventures as $\vec{P}$, and the projected risk from the market's conditions (according to regulators) as risk weights $\vec{M}$, the bank's effective investment will be:

$$\vec{P}_{\text{eff}} = \text{Diag}(\vec{M})\vec{P}. \tag{2}$$

Hence we can present the strategy as the following derivative formulation:

$$\vec{S} = \frac{\text{d}(\vec{P}_{\text{eff}})}{\text{d}t} \tag{3}$$

Different derivative schemes can be used to calculate this derivative. As the sampling rate increases, so does the accuracy of the derivative's value. Since strategic risk is an important tool in the bank's monitoring mechanism, ideally, derivative precision would be maximized. In what follows, however, we present a calculation based on a more straightforward derivative. Assuming a random sample over time $t_1, \ldots, t_n$, the derivative is:

$$\frac{\mathrm{d}\left(\vec{P}_{\text{eff}}\right)}{\mathrm{d}t}(t_n) \approx \frac{\Delta \vec{P}_{\text{eff}}}{\Delta t} = \frac{\vec{P}_{\text{eff}}(t_n) - \vec{P}_{\text{eff}}(t_{n-1})}{t_n - t_{n-1}}. \tag{4}$$

This scheme stems directly from the derivative's definition

$$\frac{\mathrm{d}\left(\vec{P}_{\text{eff}}\right)}{\mathrm{d}t}(t) = \frac{\vec{P}_{\text{eff}}(t + h) - \vec{P}_{\text{eff}}(t)}{h}, \tag{5}$$

where h is a small number, close to zero.

It is worth mentioning that more advanced derivative schemes would provide higher accuracy and filtering, which could be achieved through an increased sampling rate.

Calculating Unsystematic Risk

The process of measuring unsystematic risk begins with a quantitative evaluation of the bank's strategy. Consequently, the median strategic change in the past year is calculated. Lastly, an assessment of the impact of the strategic modification on risk assets is performed. To quantify the bank's strategy, we measure the relative investment in each business line. We normalize the average credit balance in each venture by calculating the sum of the mean surplus. Multiplication of every venture capital by the business line's Risk Weight parameter represents its risk level. Therefore:

$$s_i(Y) = \frac{C_i}{\sum_j C_j} * \mathrm{RW}_i, \tag{6}$$

where s_i denotes the strategic aspect of business line i and Y refers to the year. C_i is the average balance of credit of the business line and RW_i is its average Risk Weight. It is worth noting that it is not mandatory to reach 100%.

Subsequently, we calculate the strategic change as the difference in bank strategy between two consecutive years for a given business line:

$$\Delta s_i(Y) = s_i(Y) - s_i(Y-1) \tag{7}$$

Next, we multiply the strategic change by the sum of the business line's risk assets to obtain. Hence:

$$r_{s,i}(Y) = \Delta s_i(Y) * R_i \tag{8}$$

where R_i denotes the sum of the business line's risk assets (i.e., the sum of credit risk, market risk, and operational risk). Finally, we calculate the risk aspects of the different business lines. The strategic risk difference between year $Y - 1$ and year Y is

$$\begin{aligned} r_s(Y) &= \sum_i r_{s,i}(Y) \\ &= \sum_i R_i \left(\begin{array}{c} \dfrac{C_i(Y)}{\sum_j C_j(Y)} * \mathrm{RW}_i(Y) \\ - \dfrac{C_i(Y-1)}{\sum_j C_j(Y-1)} * \mathrm{RW}_i(Y-1) \end{array} \right) \end{aligned} \tag{9}$$

We proceed by presenting two numerical examples illustrating how a change in a bank's business strategy generates modifications in its risk level. The first example (Bank A) demonstrates the case of a reduced risk level, whereas the second (Bank B) depicts an increased risk. The data were generated from real Israeli banks' data, modified to express the effect of the different parameters on the calculated unsystematic risk.

Tables 1 and 2 present the strategy for a fictitious bank, Bank A, in 2018 and 2019, respectively. The stated sums of money are in millions of US dollars. It can be seen, for example, that the bank reduced its activity in the big business sector relative to the previous year but increased its activities abroad, household transactions, and housing loans. The risk weight (RW) of housing loans decreased since the approved loans were less risky. Overall, the bank's strategy was less risky in 2019 compared with the previous year. Tables 3 and 4 show, respectively, the strategic change and the change in risk assets for the bank's various business lines.

The total change in unsystematic risk is − 1096, which is the change in risk assets expressed in millions of US dollars. Thus, as stated above, the bank's strategy is less risky in 2019 relative to 2018. It should be noted that only positive changes and not negative changes are taken into account when updating a bank's risk assets.

In the second example, the bank substantially increases its activities in the big business sector (see Tables 5 and 6). As a consequence, the risk weight of small business activity increases. Tables 7 and 8 show, respectively, the strategic change and the change in risk assets for the bank's various business lines. It can be seen that the bank's strategy is riskier in 2019 than in 2018.

The total change in unsystematic risk is 1366, which is the change in risk assets expressed in millions of US dollars. Since this is a positive difference, it is added to the bank's risk calculation. The calculated risk compels the bank to hold regulatory capital against its strategic actions, thereby protecting investors' money.

Table 1 Strategic analysis of business lines for fictitious Bank A in 2018

Households	Housing loans	Private banking	Small business	Medium business	Big business	Institutional bodies	Financial management	Activities abroad	
20,294	15,215	131	20,827	9,571	24,970	525	11,970	4,559	Average credit balance
0.68	0.53	0.75	0.90	0.95	0.97	0.45	0.24	0.82	Average RW
0.13	0.07	0.00	0.17	0.08	0.2241	0.00	0.03	0.03	Strategy

Table 2 Strategic analysis of business lines for fictitious Bank A in 2019

Households	Housing loans	Private banking	Small business	Medium business	Big business	Institutional bodies	Financial management	Activities abroad	
21,460	21,013	126	21,306	9,483	17,105	600	12,468	9,440	Average credit balance
0.65	0.48	0.75	0.91	0.93	0.97	0.45	0.23	0.81	Average RW
0.12	0.09	0.00	0.17	0.08	0.1468	0.00	0.03	0.07	Strategy

Table 3 Strategic change (no units) for the business lines of Bank A

Households	Housing loans	Private banking	Small business	Medium business	Big business	Institutional bodies	Financial management	Activities abroad	
− 0.0042	0.0146	− 0.0001	− 0.0019	− 0.0061	− 0.0773	0.0002	− 0.0012	0.0331	Strategic change

Table 4 Risk change for the business lines of Bank A (the sums represent risk assets in millions of US dollars)

	Activities abroad	Financial management	Institutional bodies	Big business	Medium business	Small business	Private banking	Housing loans	Households	Total
Credit risk	7,646	2,868	270	16,592	8,819	19,388	94	10,086	13,949	96,113
Market risk	14	1,655	–	–	–	–	–	–	–	1,669
Operational risk	762	823	119	1,066	614	1,601	153	900	1,667	7,705
Sum	8,423	5,346	389	17,658	9,433	20,989	247	10,986	15,616	105,488
Risk change	279	− 6	0	− 1,365	− 58	− 40	0	161	− 67	**− 1,096**

Table 5 Strategic analysis of business lines for fictitious Bank B in 2018

	Activities abroad	Financial management	Institutional bodies	Big business	Medium business	Small business	Private banking	Housing loans	Households
Average credit balance	4,559	11,970	525	24,970	9,571	20,827	131	15,215	20,294
Average RW	0.82	0.24	0.45	0.97	0.95	0.90	0.75	0.53	0.68
Strategy	0.03	0.03	0.00	0.2241	0.08	0.17	0.00	0.07	0.13

Table 6 Strategic analysis of business lines for fictitious Bank B in 2019

	Activities abroad	Financial management	Institutional bodies	Big business	Medium business	Small business	Private banking	Housing loans	Households
Average credit balance	4,683	12,468	600	32,682	9,483	21,306	126	15,567	20,351
Average RW	0.81	0.23	0.45	0.98	0.95	0.97	0.75	0.52	0.67
Strategy	0.03	0.02	0.00	0.2731	0.08	0.18	0.00	0.07	0.12

Table 7 Strategic change (no units) for the business lines of Bank B

Households	Housing loans	Private banking	Small business	Medium business	Big business	Institutional bodies	Financial management	Activities abroad	
− 1.14E-02	− 5.60E-03	− 1.06E-04	2.78E-03	− 7.32E-03	4.90E-02	1.16E-04	− 2.13E-03	− 2.24E-03	Strategic change

Table 8 Risk change for the business lines of Bank B (the sums represent risk assets in millions of US dollars)

	Activities abroad	Financial management	Institutional bodies	Big business	Medium business	Small business	Private banking	Housing loans	Households	Total
Credit risk	3,794	2,868	270	32,028	9,009	20,667	94	8,095	13,635	96,113
Market risk	14	1,655	–	–	–	–	–	–	–	1,669
Operational risk	762	823	119	1,066	614	1,601	153	900	1,667	7,705
Sum	4,570	5,346	389	33,094	9,622	22,267	247	8,995	15,302	105,488
Risk change	− 10	− 11	0	1,621	− 70	62	0	− 50	− 175	**1,366**

Fig. 1 Bank A's unsystematic strategic risk from 2013 to 2020

Fig. 2 The strategic risk of four different banks in Israel during the period 2018–2020 in terms of risk assets (millions of US dollars)

Real-Life Case Studies

This section portrays real case studies based on four Israeli banks. The assessment relies on the formulae developed in this study, while the data are derived from published financial reports. First, we calculate the strategic change in Bank A (depicted in Fig. 1) during 2013–2020, showing an overall increase in risk over time, with a particularly sharp increas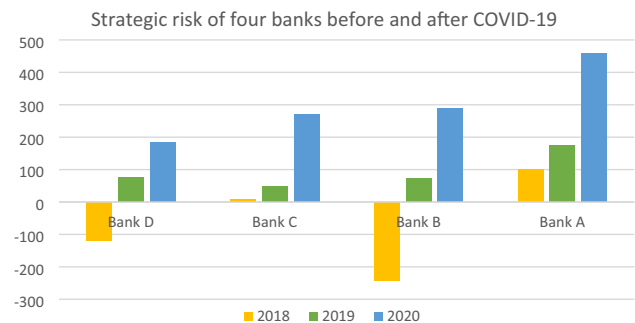e during the Covid-19 pandemic. To determine whether the latter trend is observed more generally, we examine the strategic risk for three additional central banks based on their financial reports from the years 2018–2020 (see Fig. 2).

Figure 2 demonstrates a marked increase in strategic risk for all four banks in 2020. Inspection of the business-line data (not shown) reveals that Banks A and B considerably increased (relatively) their activities in big businesses, Bank C enhanced its activities abroad, and Bank D

Table 9 Systematic strategic risk calculation for a fictitious bank with six risk components (the sums are conveyed in millions of US dollars)

Risk event index	Systematic risk component	Revenue	Probability of risk in the coming year	Recovery time (in months)	Revenue	Systematic risk
1	Real estate crisis	Mortgage and building contractors	1.10%	18	783.33	12.93
2	Macroeconomic risk	Total bank revenue	1.25%	12	2,684.67	33.56
3	Security crisis	Total bank revenue	0.50%	18	2,684.67	20.14
5	Fintech companies and insurance and credit companies	Retail credit revenue	0.10%	18	613.33	0.92
6	Big technology companies	Total bank revenue	0.20%	24	2,684.67	10.74
					78.28	Total

expanded its housing loans. These strategies naturally had different effects on the differential risk. For example, the decision of Bank D to increase housing loans entailed less risk than the strategy of Banks A and B, which focused on big businesses.

Systematic Strategic Risk

Systematic strategic risk is the by-product of unpredictable events in the market that result in economic damage. The risk is calculated as the product of the damage and the probability of occurrence. The level of damage is related to the extent of income loss, whether or not there is a crisis in a specific field (e.g., politics, security, health), and the number of clients who experience the fallout. It is worth mentioning that the calculation of systematic risk assumes that expenditures are stable. The probability of a given systematic strategic risk is determined by the financial department of the country's central bank. The assessment outcome is presented to local commercial banks as a parameters table derived from the damage model.

The systematic risk model calculates the possible damage by assessing the business lines' monetary revenue, their losses, and the time they need to recover. Hence:

$$R = \sum_{i \in E} P_i D_i I_i$$

where E denotes the set of systematic risk events, each affecting a different business line i, P is the probability that an event will occur, D is the event's duration, and I is the relevant profit. Table 9 presents a computational example of systematic strategic risk for six different systematic risk components (i.e., risk events). The total systematic risk (78.28 million US dollars) is smaller than the unsystematic

risk values presented in Sect. "Calculating Unsystematic Risk."

Conclusion

This paper presents a reliable method of calculating strategic risk in terms of a bank's risk assets. A strategic risk measure based on regulatory capital enables market fluctuations and uncertainty to be taken into account and determines the capital required to overcome strategic risk. That is, the strategic risk is added to the bank's risk calculation and compels the bank to hold regulatory capital against its strategic actions, thereby protecting investors' money. This procedure, in turn, helps banks achieve organizational success and reduce negative outcomes.

The methodology proposed in this paper improves our understanding of the potential hazards that can contribute to strategic risk and the ensuing consequences. In particular, it upholds that a sound and efficient strategic policy should consider both systematic and unsystematic risks to assist in setting risk limits and to ensure that banks hold sufficient capital to cover strategic threats. The main contributions of this research are the division between the two types of hazard and the calculation of risk in terms of risk assets via regulatory capital and the capital adequacy ratio. Nevertheless, future research can portray different approaches to calculating strategic risk or present a simplified calculation. For example, studies can calculate risk as a function derived from numerous risks like credit, market, and operational risks.

The proposed method of measuring strategic risk within a monetary capital framework makes use of parameters that are relatively straightforward to obtain. However, the

calculation method hinges on data completeness and banking portfolio specificity. Hence, the study's main shortcoming is its potential reliance on partial statistics, missing historical data, inadequate bank information systems, and incomplete or unsuitable data for particular bank features. Nonetheless, this limitation does not detract from the proposed model's practicality and potential to assess strategic risk precisely. The logical next step for future studies would be examining risk using different primary axes.

Declarations

Conflict of interest The authors have no conflicts of interest to disclose.

References

Aas, K., & Puccetti, G. (2014). Bounds on total economic capital: The DNB case study. *Extremes, 17*(4), 693–715. https://doi.org/10.1007/s10687-014-0202-0

Aebi, V., Sabato, G., & Schmid, M. M. (2012). Risk management, corporate governance, and bank performance in the financial crisis. *Journal of Banking & Finance, 3636*(12), 3213–3226. https://doi.org/10.1016/j.jbankfin.2011.10.020

Agrawal, A. (2020). Modified total interpretive structural model of corporate financial flexibility. *Global Journal of Flexible Systems Management, 21*(4), 369–388.

Allan, N., & Beer, L. (2006). *Strategic Risk: It's all in your head.* University of Bath School of Management Working Paper Series.

Bank of Thailand (2003). *Strategic risk manual.* Risk Assessment and information and technology system department, financial institutions supervision, Bank of Thailand.

Basel Committee on Banking Supervision (2004). *International convergence of capital measurement and capital standards —a revised framework.* Bank for International Settlements.

Basel Committee on Banking Supervision (2006). *International convergence on capital measurement and capital standards.* Bank for International Settlements.

Basel Committee on Banking Supervision (2009). *Range of practices and issues in economic capital frameworks.* Technical Report. Bank for International Settlements.

Böcker, K. (2008). Modelling and measuring business risk. In A. Resti (Ed.), *Pillar II in the new basel accord-the challenge of economic capital* (pp. 179–200). Citeseer.

Burns, R. L. (2004). Economic capital and the assessment of capital adequacy. *Supervisory Insights, 2*, 5–11.

Chaffai, M., & Dietsch, M. (2015). Modelling and measuring business risk and the resiliency of retail banks. *Journal of Financial Stability, 16*, 173–182. https://doi.org/10.1016/j.jfs.2014.08.004

Chatterjee, S., Lubatkin, M. H., Lyon, E. M., & Schulze, W. S. (1999). Toward a strategic theory of risk premium: moving beyond CAPM. *Academy of Management Review, 24*(3), 556–567. https://doi.org/10.2307/259142

Chockalingam, A., Dabadghao, S., & Soetekouw, R. (2018). Strategic risk, banks, and Basel III: estimating economic capital requirements. *The Journal of Risk Finance, 19*(3), 225–246. https://doi.org/10.1108/JRF-11-2016-0142

Chornous, G., & Ursulenko, G. (2013). Risk management in banks: New approaches to risk assessment and information support. *EKONOMIKA, 92*(1), 120–132. https://doi.org/10.15388/Ekon.2013.0.1131

Dabari, I. J., & Saidin, S. Z. (2014). A theoretical framework on the level of risk management implementation in the Nigerian banking sector: The moderating effect of top management support. *Procedia-Social and Behavioral Sciences, 164*, 627–634. https://doi.org/10.1016/j.sbspro.2014.11.156

Deloitte (2016). *Strategic risk: A cornerstone of risk transformation.* Deloitte.

Deloitte (2019). *The future of strategic risk management in financial services.* Deloitte.

Doff, R. (2008). Defining and measuring business risk in an economic capital framework. *Journal of Risk Finance, 9*(4), 317–333. https://doi.org/10.1108/15265940810894990

Fatemi, A., & Glaum, M. (2000). Risk management practices in German firms. *Managerial Finance, 26*, 1–17. https://doi.org/10.1108/03074350010766549

Frigo, M. L., & Anderson, R. J. (2012). Strategic risk management: a primer for directors. *The Conference Board.*

Frigo, M. L., & Anderson, R. J. (2011). What is strategic risk management? *Strategic Finance, 21–22*, 61. https://doi.org/10.1002/jcaf.20677

Härle, P., Havas, A., Kremer, A., Rona, D., & Samandari, H. (2015). *The future of bank risk management.* McKinsey working papers on risk. McKinsey & Company.

Kroszner, R. S. (2008). Strategic risk management in an interconnected world. *BIS Review, 127*, 1–7.

Maurya, D., & Srivastava, A. (2022). Controlling Partner Opportunism in Cross-Sectoral Alliance: Dynamics of Governance Flexibility. *Global Journal of Flexible Systems Management, 23*(Suppl 1), 15–28.

McConnell, P. (2012b). The governance of strategic risks in systemically important banks. *Journal of Risk Management in Financial Institutions, 5*(2), 128–142.

McConnell, P. (2013). Strategic risk: The beanstalk syndrome. *Journal of Risk Management in Financial Institutions, 6*(3), 229–252.

McConnell, P. (2014). Strategic risk management- a tale of two strategies. *Journal of Risk and Governance, 3*(2), 1–11.

McConnell, P. (2012a). *Strategic risk management: Disclosure by systemically important banks.* Macquarie Applied Finance Centre Research, Paper No. 36.

Miller, K. D. (1992). A framework for integrated risk management in international business. *Journal of International Business, 23*(2), 311–331. https://doi.org/10.1057/palgrave.jibs.8490270

Mohamed, W. M. H. (2016). Risk management of banking sector: A critique review. *American International Journal of Social Science, 5*(3), 159–168.

Roberts, A., Wallace, W., & McClure, N. (2003). *Strategic risk management.* Edinburgh Business School.

Schmit, J. T., & Roth, K. (1990). Cost effectiveness of risk management practices. *Journal of Risk and Insurance, 57*(3), 455–470. https://doi.org/10.2307/252842

Schroeck, G. (2002). *Risk management and value creation in financial institutions* (Vol. 155). John Wiley & Sons.

Slywotzky, A., & Drzik, J. (2005). Countering the biggest risk of all. *Harvard Business Review, 83*(4), 78–88.

Soetekouw, R. C. M. (2016). *Economic capital for strategic risk in financial institutions* [Master's thesis, Eindhoven University of Technology]. Series master Theses in operations management and logistics.

Stulz, R. M. (2015). Risk-taking and risk management by banks. *Journal of Applied Corporate Finance, 27*(1), 8–18. https://doi.org/10.1111/jacf.12099

Stulz, R. M. (2014). *Governance, risk management, and risk-taking in banks*. Technical Report. National Bureau of Economic Research.

Settembre-Blundo, D., González-Sánchez, R., Medina-Salgado, S., & García-Muiña, F. E. (2021). Flexibility and resilience in corporate decision making: a new sustainability-based risk management system in uncertain times. *Global Journal of Flexible Systems Management*, 22(Suppl 2), 107–132.

Sweeting, P. (2011). *Financial enterprise risk management*. Cambridge University Press.

Yaylali, P., & Veli Safakli, O. (2015). Risk management in the banking sector: Case of TRNC. *International Journal of Academic Research in Economics and Management Sciences, 4*(2), 20–33. https://doi.org/10.6007/IJAREMS/v4-i2/1654

Key Questions for Further Reflection

1. Which other approaches can be used to calculate strategic risk?
2. Is it possible to present a simplified calculation of strategic risk?
3. Can we examine risk using different primary axes?

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