

The Adoption of Enterprise Risk Management in US Banks: An Exploratory Study of Contingent Determinants

Juliano Rodrigues Silva

Assistant Professor of the Center for Social and Applied Sciences (CCSA), Mackenzie Presbyterian
University - UPM
Rua da Consolação, 930 – Consolação, Sao Paulo-SP, 01302-907, Brazil
juliano.silva@mackenzie.br

Claudio Parisi

Director of the Center for Social and Applied Sciences (CCSA), Mackenzie Presbyterian University -
UPM
Rua da Consolação, 930 – Consolação, Sao Paulo-SP, 01302-907, Brazil
claudio.parisi@mackenzie.br

Marcelo Daniel Araújo Ermel

Assistant Professor I of the Center for Social and Applied Sciences (CCSA), Mackenzie Presbyterian
University - UPM
Rua da Consolação, 930 – Consolação, Sao Paulo-SP, 01302-907, Brazil
marcelo.ermel@mackenzie.br

The Adoption of Enterprise Risk Management in US Banks: An Exploratory Study of Contingent Determinants

Abstract

The present study aims to investigate the relationship between contingent determinants and the adoption of Enterprise Risk Management (ERM), with a particular focus on understanding the dynamics of the ERM-value relationship. However, the fundamental assertion that ERM adoption generates value limits the scope of the discussion and restricts it to evaluating its existence in relation to value, without considering the contributing factors to its adoption. In this regard, it is imperative to assess its correspondence with five contingent determinants (environmental uncertainty, competition in the sector, company size, company complexity, and board monitoring). To this end, an ERM adoption/maturity score was employed to gather information on risk management and compliance policies from 350 US banks. The findings of this study suggest that the relationship between contingency and ERM adoption is a critical factor in determining value congruence. The implications of these results underscore the necessity for companies to consider contingency factors in ERM adoption and framework as drivers of enhanced opportunities to achieve greater value.

Keywords: enterprise risk management, ERM, contingency theory, firm value, financial institutions.

The Adoption of Enterprise Risk Management in US Banks: An Exploratory Study of Contingent Determinants

1 Introduction

The Enron and WorldCom crises initiated an institutional renaissance of enhanced accounting practices, particularly through the enactment of the Sarbanes-Oxley Act (SOX) of 2002. The subsequent 2008 financial crisis (subprime) prompted the adaptation of governance procedures and the enhancement of quantitative risk management within financial institutions (Aebi et al., 2012), establishing and strengthening a Board-Level Risk Committee (Malik et al., 2020). Enterprise Risk Management (ERM) has emerged as a prominent field of study in risk management, integrating a wide range of risk types within a unified portfolio approach.

The extant research on the subject validates its adoption, predicated on determining assumptions related to economic, financial, market, and sector indicators, greater value performance, and governance elements (Baxter et al., 2013; M. Beasley et al., 2008; M.S. Beasley et al., 2005; Caldarelli et al., 2016; Farrell and Gallagher, 2015; Florio and Leoni, 2017; Hoyt and Liebenberg, 2011; Johnston and Soileau, 2020; Liebenberg and Hoyt, 2003; Malik et al., 2020; McShane et al., 2011; Pagach and Warr, 2011; Subramaniam et al., 2009; Yatim, 2010).

While not exclusive to the financial sector, in a developed capital market, banks and insurance companies that use ERM achieve subsequent gains with greater investment opportunities (Caldarelli et al., 2016; Florio and Leoni, 2017), above all because they seek to integrate each risk into a single scope that enables it to be allocated strategically to achieve greater firm value (Florio and Leoni, 2017; Gordon et al., 2009; Hoyt and Liebenberg, 2011; McShane et al. 2011; Quon et al., 2012).

Despite the assertion that the adoption of ERM generates value without really understanding what factors motivate it, it limits its debate. Therefore, we propose broadening this discussion to markets, with which we hope to find explanatory power for value. In this sense, we argue that contingency variables, if determinant in its adoption, can contribute to explaining the ERM-value correspondence.

Building upon the seminal contributions of Gordon et al. (2009), our study aims to elucidate the relationship between the contingency factors espoused by Chenhall (2003, 2006), Fisher (1995), and Otley (1980) with the ERM-value relationship. In a heavily regulated environment, financial institutions may not derive a substantial competitive advantage, thereby failing to exhibit a discernible difference in value. Consequently, the factors conditioning its

adoption remain largely unexplored, particularly in the context of banks, where limited research has been conducted (see Gordon et al., 2009; Chenhall, 2003, 2006; Fisher, 1995; Otley, 1980). The primary objective aims to investigate the relationship between contingency determinants and ERM adoption. Subsequent analyses will delve into the mechanisms underlying the impact on value creation.

This study expands the ERM framework (Aebi et al., 2012 ; Baxter et al., 2013; Federal Reserve Regulation YY, 2014; Florio and Leoni, 2017; Gordon et al, 2009; Lundqvist, 2014; NYSE, 2004; SEC, 2009, 2017a; S&P, 2005; S&P Global Ratings ERM, 2022; Whitman, 2015) by examining ERM adoption and five determinants based on contingency theory and testing their correspondence to value in a developed market. In other words, we seek to investigate the impact of these variables on the ERM-value relationship.

The results, although differing in terms of company complexity, confirm the research assumption that the adoption of ERM by financial institutions is contingent. We emphasize that environmental uncertainty, industry competition, size, complexity and board monitoring should be investigated in the context of each company as possible drivers of better value opportunities. The findings underscore the necessity of incorporating contingent determinants when assessing the determinants of ERM adoption. Our study illuminates the ERM framework by examining the impact of value, which is partially explained by contingency variables.

Our contribution is twofold: first, we extend the discourse to the absence or inefficiency of the procedures necessary to adopt ERM, and second, we provide a novel framework for understanding the dynamics of ERM adoption and its implications for value creation. Above all, we hope to contribute to companies in the financial sector by highlighting quality gains for aspects of governance and risk, mainly through cultural characteristics, communication, and the creation of value for stakeholders related to business activities.

2 ERM and Contingency Variables

According to M. Beasley et al. (2015), ERM can be defined as a practical and integrated approach dedicated to the management of risks with the objective of enabling competitive advantage in a complex and uncertain environment. The implementation of well-structured ERM is an essential factor for business continuity and the generation of value for the company. In this sense, ERM can be defined as a process sponsored by the board of directors, applied in the definition of strategy, and designed to identify potential events affecting business continuity. According to COSO (2017), ERM aims to manage risks to keep the most diverse

types within a scope of appetite and to provide reasonable assurance for the achievement of the entity's strategic objectives.

In addition to contributing to the development of risk management at high levels of maturity, ERM contributes to containing the dispersion of income and results, mitigating the impact of direct and indirect costs of financial distress, improving the environment for capital structure and allocation decisions, and reducing the problem of informational asymmetry (M. Beasley et al., 2008; M.S. Beasley et al., 2005; Cummins et al., 2001; Graham and Rogers, 2002; Hoyt and Liebenberg, 2011; Mayers and Smith, 1982; Myers and Read, 2001; Nocco and Stulz, 2006).

It is anticipated that the incorporation of ERM into risk management practices will enhance the development of the company's cultural factors (Palermo et al., 2017). This phenomenon is of considerable interest in the context of governance issues and normative and regulatory bodies, as evidenced by studies in the financial sector (Lundqvist and Vilhelmsson, 2018; Malik et al., 2020; Teixeira, 2023; Whitman, 2015).

ERM leverages the benefits of a unified portfolio through natural hedging, which is intrinsic to diverse activities and segments. This approach fosters an objective foundation for resource allocation, enhancing the efficiency of capital utilization and, consequently, value creation (Hoyt and Liebenberg, 2011). In this regard, ERM contributes to the development of management maturity, whereby disparate categories of risk, formerly managed in silos, begin to encourage a strategic approach, while integrating them into a unified portfolio (holistic vision). We thus postulate that, *in an uncertain and complex environment, companies are prompted to maintain a comprehensive risk management structure* (emphasis added).

Gordon et al. (2009), guided by contingency theory as developed by Otley (1980), propose a multifaceted approach to analyzing the ERM-value relationship. This approach involves a comprehensive examination of five contingencies: environmental uncertainty, competition within the sector, company size, company complexity, and board of directors' monitoring. The authors emphasize the necessity of a comprehensive investigative approach to ERM and its determinants, not solely due to its potential to enhance value, but rather because there must be contingency variables associated with the company's strategic actions and its intrinsic characteristics. Accordingly, the five contingency variables employed as value correspondence in the context of the company's adoption of ERM interacts with the necessity of its identification as binding to the implementation of ERM and the consequent impact of value to be achieved.

Focusing on Environmental Uncertainty (EU), this factor underscores the significance of the exponential existence of unforeseeable future events that could affect the organization. According to Gordon et al. (2009), both the responses to such risks and the risks themselves will vary equally depending on the size of the uncertainty. For companies in this scenario, environmental uncertainty fosters the implementation of ERM by companies (Liebenberg and Hoyt, 2003), as well as being crucial in observing and understanding aspects of uncertainty in the context of contingency theory regarding the practice and use of different tools or work schemes between companies. Studies by Chenhall (2003, 2006), Fisher (1995), Gordon et al. (2009), Mikes and Kaplan (2014), and Otley (1980) further support this approach.

Offering products and/or services within the same sector can encourage similarities and lead to possible substitutions. We hope that this factor provides an idea of the impact of business concentration and the counterpoint of competition (Industry Competition – IC), which, in an environment of greater competition (less concentration), the risk of not achieving sustainable levels of profitability is greater, which may favor the implementation of ERM.

Less concentration means more competition, which we expect to be (not be) the case in developed (emerging) markets, given less (more) protectionism and high (low) levels of economic freedom. However, it cannot be positing that high levels of economic freedom (lower concentration, greater competition) favor higher levels of entrepreneurial activity in a country, as these are independent factors (Kuckertz et al., 2016). On the contrary (greater concentration, less competition), it can favor the achievement of extraordinary results (Nguyen et al., 2022). In this way, we hope that greater competition (lower concentration) will favor the development of ERM within the company's strategic objectives.

Firm Complexity (FC) tends to generate greater difficulty in integrating strategic information derived from institutional pillars (DiMaggio and Powell, 1983; Scott, 2008), such as business diversity and the number of commercial transactions, but this is still positively correlated with the adoption of ERM (Hoyt and Liebenberg, 2011). As the number of segments within the conglomerate increases, the greater the complexity, the greater the need for a structure such as ERM to assess risks and allocate them from the same consolidated and strategic perspective.

Otley (1980) suggests that the structure of the organization (Firm Size – FS) affects how information is used. M.S. Beasley et al. (2005) and Hoyt and Liebenberg (2011) point to firm size as a factor positively related to ERM adoption. These findings become even stronger as they corroborate the point already made by COSO (2017), in highlighting the importance of company size for the adoption and development of ERM. It is also worth mentioning that the

value impact resulting from its adoption is directly dependent on the characteristics of its fit with the company's culture, governance and strategy (Palermo et al., 2017).

Above all, although the literature points to the benefits of a positive relationship between the size of the company and the need for an ERM program, the results found are mixed and controversial, since in the face of greater environmental uncertainty (EU), greater competition (IC) and greater complexity (FC), companies with robust structures tend to find it more difficult to manage their assets and reduce the impacts of possible economic jolts in times of crisis, which can result in a negative relationship with value (Allayannis and Weston, 2001; Hoyt and Liebenberg, 2011; Lang and Stulz, 1994).

In this case, a structure in these conditions favors the company implementing the ERM which, in addition to having the structure to maintain it, can also mediate the necessary communication to the market and reduce the problem of information asymmetry. On the other hand, in more developed markets, it is to be expected that there will be competitive dilution, thus less concentration (IC), where ERM would be encouraged, since there would be gains in opportunities due to greater competition (Nguyen et al., 2022). We therefore expect an ambiguous result from the FS variable as a determining contingency factor.

The number of directors is a variable widely used by research in the area and replicated here (Aebi et al., 2012; Baxter et al., 2013; B. Black et al., 2023; B.S. Black et al., 2014; Caldarelli et al., 2016; Florio and Leoni, 2017; Gordon et al., 2009; Grace et al., 2015; Mafrolla et al., 2016). As a rule of corporate governance, the Monitoring by Board of Directors (MBD) is understood that there is a positive relationship between the effective participation of the board of directors and the use of ERM in the organization, whether due to cultural factors (Palermo et al., 2017), agency (Jensen and Meckling, 1976), the context of the evolution of corporate governance practices or its positive association with firm value (Florio and Leoni, 2017).

The need for effective board participation in favor of ERM performance in the organization aims to encourage the adoption of ERM at a strategic and cultural level. The New York Stock Exchange (NYSE), through its Corporate Governance Rules, includes explicit requirements for audit committees to assume specific responsibilities for evaluating companies' risk management, including those beyond those communicated in financial reports (NYSE, 2013). In addition, the banking sector (among its signatories), structures all prudential regulation based on the Basel agreements (I, II, and III) as a way of guiding the composition and minimum rules of governance. Therefore, we expect to find a positive association between this variable and the prerogative to include ERM in high levels of risk management.

3 Methodology

This study is characterized as theoretical-empirical, longitudinal in nature and delimited to the period from 2007 to 2023, in which it was possible to capture the regulatory impacts of Subprime 2008/9 and the effects of the COVID-19 crisis 2020/1. The research is classified as an econometric and descriptive analysis, with the aim of identifying the correspondence of contingent determinants in the ERM-value relationship in a non-probabilistic sample of financial companies listed on the American capital market. For more detail, see Supplementary Material, available online, including the econometric model and descriptive analysis.

4 Analysis and Discussion of Results

The results of equations (1) and (2) in the pooled model and for fixed-effects panel data (see Supplementary Material for equation descriptions) are shown in Tables 1 and 2. The analysis is justified based on the fixed-effects model because it is assumed that there is no randomness in the selection of data, much less for the sample of companies. The adoption of fixed-effects panel data is further substantiated by the relatively aggregated nature of our sample, whether in terms of a sector, region, or country, and the study's objective to predict the aggregate behavior of the sample, as opposed to the behavior of individual entities. Additionally, the individual (unobservable) effects are deemed to be independent of the explanatory variables (Marques, 2000).

The findings reveal that competition in the sector (*IC*), company size (*FS*), and board monitoring (*MBD*) are significant and positive, while *FC* has a negative coefficient and *EU* is not significant. The *FC* result (−0.185) corroborates the findings reported by Gordon et al. (2009), indicating that less complex companies require risk management and control systems in addition to ERM. The findings align with the predictions of the signals for ERM adoption, even when accounting for region fixed-effects (Central, Large, Midsize, Northeastern, Southern, and Western), pandemic dummy (2020 and 2021), and subprime crisis dummy (2008 and 2009).

Table 1
Logistic regression, 1st stage, eq. (1)

	(a)	dy/dx	(b)	(c)	(d)
<i>EU</i>	0.0462 (0.044)	0.0040	0.0419 (0.0450)	0.0469 (0.046)	0.037 (0.047)
<i>IC</i>	102.6 *** (6.888)	8.7697	124.9 *** (10.53)	77.92 *** (8.160)	110.1 *** (11.77)

<i>FC</i>	−0.185 *** (0.064)	−0.0158	−0.230 *** (0.065)	−0.340 *** (0.120)	−0.416 *** (0.126)
<i>FS</i>	0.805 *** (0.034)	0.0688	0.814 *** (0.045)	0.679 *** (0.074)	0.654 *** (0.084)
<i>MBD</i>	0.266 * (0.143)	0.0228	0.263 (0.170)	0.311 ** (0.157)	0.331 * (0.181)
<i>Size_Emp</i>				0.113 * (0.066)	0.141 * (0.073)
<i>Leverage</i>				−2.471 *** (0.879)	−0.956 (0.961)
<i>Div_Int</i>				−0.216 (0.225)	−0.104 (0.237)
<i>Div_Ind</i>				0.335 (0.269)	0.446 (0.274)
<i>Opacity</i>				−8.518 *** (2.730)	−6.913 ** (2.825)
<i>Institutions</i>				1.775 *** (0.294)	1.185 *** (0.307)
<i>Slack</i>				0.0412 (0.092)	0.052 (0.090)
<i>cvEBIT</i>				5.89e−05 (0.001)	0.00016 (0.001)
<i>laglnsdret</i>				−0.211 *** (0.072)	−0.0161 (0.082)
<i>ValueChange</i>				0.0176 (0.0360)	0.00914 (0.045)
<i>Constant</i>	−100.6 *** (6.184)		−119.7 *** (9.369)	−77.90 *** (7.267)	−106.4 *** (10.50)
OTS fixed-effects	—		yes	—	yes
<i>D_pandemic</i>	—		yes	—	yes
<i>D_subprime</i>	—		yes	—	yes
<i>Pseudo R²</i>	0.33		0.36	0.35	0.37
<i>Sensitivity</i>	40.06 %		43.95 %	41.31 %	44.78 %
<i>Specificity</i>	97.48 %		97.28 %	97.06 %	97.43 %
<i>Correctly classified</i>	88.80 %		89.22 %	88.64 %	89.48 %
No. of observations	4761		4761	4761	4761

Note. Std-err in parenthesis. OTS fixed-effects measure as six US regions (Central, Large, Midsize, Northeastern, Southern e Western). Dummy pandemic by the years of 2020 and 2021; and dummy subprime by the years of 2008 and 2009. See Supplementary Material for variable descriptions.

Level of significance: * 10%; ** 5%; and *** 1%.

Though not significant in the *EU*, there is a positive relationship between environmental uncertainty, competition in the sector, company size, and board monitoring and the propensity of companies to favor ERM, which is positively related to maturity level. For company size, larger banks have a positive relationship with the level of ERM maturity. Companies adopt ERM due to environmental uncertainties, their size, and greater competition.

A potential explanation for the negative *FC* coefficient could be that the sample consists of companies from the financial sector, which is subject to stringent regulations. Consequently, the adoption of ERM may be driven by regulatory requirements for standardized management and control, which might not directly influence ERM adoption. This finding suggests that

integrating strategic information across multiple segments can be challenging due to institutional pillars (DiMaggio and Powell, 1983).

While these characteristics are associated with a developed market, it is imperative to examine other markets that exhibit similar characteristics. Undoubtedly, the minimum capital requirement and control standards have the potential to influence financial institutions within the country, thereby discouraging the development of any institutional model based on market logic. This, in turn, highlights the presence of institutional contradictions within the manager's decision-making structure (Teixeira, 2023).

The findings, as presented in Table 2, indicate that the second-stage equation (see Supplementary Material for equation descriptions), ERM is significant and positive (0.9530) for *BTM* in the pooled model and in the fixed-effects panel model (1.2200). These results suggest that financial institutions seek to incorporate determining variables as a means of achieving better value opportunities, thereby confirming our research assumption. Consequently, the companies in the sample employ contingent determinants of ERM as a pivotal driver of its adoption, aiming to achieve a positive impact.

Table 2
2nd stage regression, eq. (2)

	<i>pooled</i>			<i>fixed-effects panel</i>		
	BTM	ROE	ROA	BTM	ROE	ROA
<i>ERM</i>	0,9530 *** (0,201)	0,0894 (0,107)	-0,0427 (0,057)	1,2200 *** (0,306)	-0,0330 (0,044)	-0,0453 (0,034)
<i>Size</i>	-0,2217 *** (0,040)	0,0071 (0,020)	0,0103 (0,012)	-0,2660 (0,219)	0,0118 (0,028)	0,0346 (0,030)
<i>Leverage</i>	0,1700 *** (0,024)	-0,0342 (0,028)	-0,0011 ** (0,0003)	0,1560 *** (0,031)	-0,0365 (0,034)	-0,0004 * (0,0002)
<i>Salesgrowth</i>	-0,0171 (0,013)	0,0067 *** (0,003)	0,0146 *** (0,004)	-0,0016 (0,007)	0,0049 *** (0,002)	0,0154 *** (0,004)
<i>Div_Int</i>	-0,3060 ** (0,144)	-0,0124 (0,011)	0,0405 (0,045)	-0,1945 (0,251)	0,0191 (0,017)	0,0461 (0,038)
<i>Div_Ind</i>	-0,0712 *** (0,026)	0,0096 (0,012)	0,0003 (0,001)	0,0598 (0,064)	0,0088 (0,009)	-0,0031 (0,004)
<i>Dividends</i>	0,0127 (0,189)	-0,0662 (0,141)	0,0111 (0,011)	-0,0242 (0,251)	0,0049 (0,094)	-0,0210 (0,048)
<i>Insiders</i>	-0,7676 * (0,434)	0,2199 ** (0,107)	0,0982 (0,102)	0,9330 (0,843)	-0,0071 (0,275)	-0,0060 (0,026)
<i>InsidersSq</i>	2,1660 *** (0,756)	-0,5030 *** (0,178)	-0,158 (0,151)	-1,9431 (2,175)	0,0947 (0,423)	0,0205 (0,042)
<i>Beta</i>	0,0565 (0,043)	-0,1188 (0,082)	-0,0032 *** (0,001)	0,0932 * (0,056)	-0,0726 (0,062)	-0,0030 ** (0,001)
<i>Constant</i>	2,8370 *** (0,510)	0,1900 (0,212)	-0,1262 (0,147)	3,1730 (1,977)	-0,0006 (0,168)	-0,3208 (0,280)
Year fixed effect	—	—	—	yes	yes	yes
Bank fixed effect	—	—	—	yes	yes	yes
Clusters(bank)	—	—	—	350	350	350

No. of observations	4761	4761	4761	4761	4761	4761
R^2	0,461	0,122	0,037	0,0511	0,108	0,046
VIF(mean)	2,92	2,92	2,92	—	—	—

Note. Std-err in parenthesis. Fixed-effects: year measured as the period from 2007 to 2023; and firm as the 350 banks. See Supplementary Material for variable descriptions.

Level of significance: * 10%; ** 5%; and *** 1%.

Following Hoyt and Liebenberg (2011), we present the results of the maximum-likelihood model with treatment effects in Table 3, where the ERM and BTM value proxy variables are estimated together. The *Wald*-test for the hypothesis of non-correlation of the residuals of models (1) and (2) are consistent and support the joint estimation model. The first column presents the value results, which are consistent with the research assumption, even when controlled for year and region fixed-effects. While leverage is positive, size and business diversification are negative. This indicates that managers are more interested in smaller structures, which are less diversified but more leveraged. The results also indicate *EU*, *IC*, *FS*, and *MBD* as significant and positive, confirming that ERM adoption is related to contingency factors.

Table 3
Full maximum-likelihood treatment effects estimates

	BTM	ERM	BTM	ERM
<i>ERM</i>	0.9810 *** (0.235)		0.9990 *** (0.218)	
<i>Size</i>	-0.225 *** (0.0612)		-0.248 *** (0.0653)	
<i>Leverage</i>	0.1520 *** (0.0321)		0.1440 *** (0.0353)	
<i>Salesgrowth</i>	-0.0188 (0.0138)		-0.00425 (0.00639)	
<i>Div_Int</i>	-0.235 (0.247)		-0.196 (0.234)	
<i>Div_Ind</i>	-0.0891 * (0.0507)		0.0538 (0.0514)	
<i>Dividends</i>	-0.0477 (0.159)		-0.0202 (0.173)	
<i>Insiders</i>	-0.863 (0.866)		-0.920 (0.871)	
<i>InsidersSq</i>	2.3110 (1.422)		2.1830 (1.367)	
<i>Beta</i>	0.0516 (0.0394)		0.0415 (0.0413)	
<i>EU</i>		0.0458 ** (0.0223)		0,0318 (0,0231)
<i>IC</i>		41.6200 *** (10.30)		53,8400 *** (6,555)
<i>FC</i>		-0.0270 (0.0571)		-0,0584 (0,0544)
<i>FS</i>		0.4120 ***		0,3950 ***

		(0.0432)		(0,0458)
<i>MBD</i>		0.4570 **		0,4650 **
		(0,217)		(0,213)
<i>Constant</i>	2.885 ***	−42.68 ***	3.077 ***	−53,32 ***
	(0.819)	(9.436)	(0.843)	(6,167)
OTS fixed-effects		—		sim
Year fixed-effects		—		sim
Bank fixed-effects		sim		sim
<i>Clusters(bank)</i>		350		350
No. of observations		4761		4761
<i>Wald-test</i>		8.10 ***		8,52 ***
<i>Log pseudolikelihood</i>		−7139.46		−6878.96

Note. Std-err in parenthesis. Fixed-effects: OTS measured as six US regions (Central, Large, Midsize, Northeastern, Southern e Western); year measured as the period from 2007 to 2023; and firm as the 350 banks. See Supplementary Material for variable descriptions.

Level of significance: * 10%; ** 5%; and *** 1%.

In the context of high-risk management maturity, it is feasible that banking institutions adopt ERM not only to adhere to legal mandates but also to incorporate risk management components that are inherent to such levels. This phenomenon can be attributed to the propensity of smaller banking institutions to prioritize the implementation of more robust risk management mechanisms, such as committees and compliance parameters. These institutions often exhibit greater potential for long-term value creation and may be undervalued in the present when compared to their industry peers.

The findings suggest that the implementation of ERM may be regarded as a long-term strategic measure, emphasizing resilience and operational efficiency. Given the stringent regulatory environment that characterizes this sector, the benefits associated with ERM adoption may exhibit a discrepancy between internal perceptions of value and market valuations, particularly in the short term. The initial undervaluation may be reversed as the advantages of ERM become more evident, such as enhanced financial stability and resilience during periods of crisis. These results lay the foundation for future research into the market's perception of ERM.

Based on previous studies, when examining the control variables, leverage exhibits an opposite coefficient to that found in Hoyt and Liebenberg (2011), indicating that banks have the ERM to manage debt risk at higher levels. In this scenario, the marginal increase in leverage represents around 14% of value. In the Size variable, the coefficient is negative, suggesting that banks prefer to maintain lower levels of structure, a notion that is further substantiated by the outcome of the diversification variable (*Div_Ind*). Contrary to the results reported by Hoyt and Liebenberg (2011), our findings indicate a direction that extends beyond the observed statistical

non-significance in their study. This further underscores the absence of a clear explanation for the observed sign of one variable with respect to the other.

5 Final Considerations

A sample of 4,761 company-years from 2007 to 2023 was investigated to examine the relationship between contingency variables and the adoption of ERM by banks. The objective was to investigate the relationship between contingency determinants and ERM adoption. The research was limited to investigating whether there is a determining correspondence between five contingency variables and the adoption of ERM by companies in a highly regulated environment. Moreover, the analysis of ERM determinants delved into the mechanisms underlying the impact on value creation.

The findings of our study corroborate the fundamental assertion that the adoption of ERM by financial institutions is contingent. In this sense, we posit that environmental uncertainty, industry competition, size, complexity, and board monitoring should be systematically investigated in the context of each company as possible drivers of better value opportunities.

The significance of this research stems from the recognition that, in the context of decisions regarding the implementation or modification of intricate management frameworks such as ERM, the contingencies in question are inherently uncertain. This is particularly salient given the potential requirement for substantial resources as an investment. In the context of the regulatory market, standardization and control bodies assume a pivotal role in guiding, and, more crucially, supervising, the minimum risk structure deemed essential. This necessity arises from the impact of systemic risk and the counterpoint of the need for timely control between exposure limits, asset and liability management, control compliance, and the governance structure of financial companies.

It is plausible that the actions of supervisory bodies, such as the Federal Reserve, exert considerable pressure on companies within this market. This pressure may differ in other markets; however, in the context of this research, factors related to stringent regulation may influence standardized risk governance structures, thereby exerting minimal influence on the market value of these companies. An illustration of this phenomenon is the divergence of results in the *FC* variable with the implementation of ERM, which exhibited a divergent sign from our initial expectations. Consequently, in a highly regulated market like the financial sector, the

correlation of this variable with ERM implementation might not signify its relevance as a determinant. Instead, it could imply that smaller structures adopt ERM due to legal obligations.

This study is subject to certain limitations. Primarily, it focuses on a specific sector. While our study focuses on a specific sector, this set of companies offers preliminary insights into the role of contingency variables in the adoption of ERM within this segment. A second limitation pertains to access to risk management information, which was obtained exclusively through documentary research. Future research could employ questionnaires or interviews to validate the model that determines ERM adoption and provide answers that extend beyond the scope of this study. Additionally, the restriction of data availability on the stock exchange hinders the calculation of crucial variables within our model. In this case, we acknowledge the potential limitations of our model in this regard. Furthermore, we refer to the characteristics of the market in comparison to other developed markets, such as Europe.

As a recommendation for future research, we propose the investigation of risk assessment models in conjunction with a risk management assessment score structure for financial companies. This is particularly relevant given that prudential regulation of banks addresses the subject by requiring the disclosure of the risk exposure calculation model. This approach aims to assess whether risk management in these institutions, not only due to legal requirements, but also as a differential in the strategic assessment of the model for which each company develops its system. One of the contingency variables is directly related to the assessment of competition and possibly shows that competitive advantage is important for this sector and, consequently, impacts value. Consequently, this comprehensive understanding of regulatory and normative enforcement can motivate the search for greater efficiency in risk management, not only in developed markets but also in emerging ones, and its relationship with the economy and society.

Finally, another promising avenue for exploration in the ERM literature would be to replace the contingency theory lens with the institutional approach to investigate the consequences of infectious forces on risk management practices. In a market where regulatory, supervisory, and/or normative agents exert significant pressure on financial institutions listed on the capital market, it is expected to find explanatory power attenuating value (negative relationship with low or non-existent significance), even if it contradicts finance theory, for which risk management, in an imperfect capital market, claims to be positive and significant. Consequently, future research could investigate the existence of an explanation based on institutional theory. The absence of a legal or normative reference could legitimize mimetic Isomorphism (DiMaggio and Powell 1983; Oyadomari et al., 2008; Scott, 2008).

References

- Aebi, V., Sabato, G., Schmid, M., 2012. Risk management, corporate governance, and bank performance in the financial crisis. *J. of Bank. and Finance*, 36, 12, 3213–3226. <https://doi.org/10.1016/j.jbankfin.2011.10.020>
- Allayannis, G., Weston, J.P., 2001. The use of foreign currency derivatives and firm market value. *Rev. of Financial Studies*, 14, 1, 243–276. <https://doi.org/10.1093/rfs/14.1.243>
- Baxter, R., Bedard, J.C., Hoitash, R., Yezegel, A., 2013. Enterprise risk management program quality: Determinants, value relevance, and the financial crisis. *Contemporary Account. Res.*, 30, 4, 1264–1295. <https://doi.org/10.1111/j.1911-3846.2012.01194.x>
- Beasley, M., Branson, B., Pagach, D., 2015. An analysis of the maturity and strategic impact of investments in ERM. *J. of Account. and Public Policy*, 34, 3, 219–243. <https://doi.org/10.1016/j.jaccpubpol.2015.01.001>
- Beasley, M., Pagach, D., Warr, R., 2008. Information conveyed in hiring announcements of senior executives overseeing enterprise-wide risk management processes. *J. of Account., Auditing & Finance*, 23, 3, 311–332. <https://doi.org/10.1177/0148558X0802300303>
- Beasley, M.S., Clune, R., Hermanson, D.R., 2005. Enterprise risk management: An empirical analysis of factors associated with the extent of implementation. *J. of Account. and Public Policy*, 24, 6, 521–531. <https://doi.org/10.1016/j.jaccpubpol.2005.10.001>
- Black, B.S., Carvalho, A.G. de, Sampaio, J.O., 2014. The evolution of corporate governance in Brazil. *Emerg. Markets Rev.*, 20, 176–195. <https://doi.org/10.1016/j.ememar.2014.04.004>
- Black, B., de Carvalho, A.G., Gallucci, H., 2023. A Decade of Corporate Governance in Brazil: 2010-2019. *Brazilian Rev. of Finance*, 21, 4, 1–14. <https://doi.org/https://orcid.org/0000-0002-3780-1149>
- Bromiley, P., McShane, M., Nair, A., Rustambekov, E., 2015. Enterprise risk management: Review, critique, and research directions. *Long Range Planning*, 48, 4, 265–276. <https://doi.org/10.1016/j.lrp.2014.07.005>
- Caldarelli, A., Fiondella, C., Maffei, M., Zagaria, C., 2016. Managing risk in credit cooperative banks: Lessons from a case study. *Management Account. Res.*, 32, 1–15. <https://doi.org/10.1016/j.mar.2015.10.002>
- Chenhall, R.H., 2003. Management control systems design within its organizational context: Findings from contingency-based research and directions for the future. *Account., Organizations and Society* 28, 2–3, 127–168. [https://doi.org/10.1016/S0361-3682\(01\)00027-7](https://doi.org/10.1016/S0361-3682(01)00027-7)

- Chenhall, R.H., 2006. The contingent design of performance measures. In A. Bhimani. *Contemporary Issues in Management Account.* (1st ed., pp. 92–116). New York: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199283361.003.0005>
- COSO, 2017. Enterprise risk management: Integrating with strategy and performance (Executive Summary, June), In Committee of Sponsoring Organizations of the Treadway Commission – COSO. https://www.coso.org/_files/ugd/3059fc_61ea5985b03c4293960642fdce408eaa.pdf
- Cummins, J.D., Phillips, R.D., Smith, S.D., 2001. Derivatives and corporate risk management: Participation and volume decisions in the insurance industry. *The J. of Risk and Insurance*, 68, 1, 51–91. <http://www.jstor.org/stable/2678132>
- DiMaggio, P.J., Powell, W.W., 1983. The iron cage revisited: isomorphism and collective rationality in organizational fields. *American Sociological Rev.*, 48, 2, 147–160. <https://doi.org/10.2307/2095101>
- Drazin, R., de Van de Ven, A.H., 1985. Alternative forms of fit in contingency theory. *Administrative Science Quarterly*, 30, 4, 514–539. <https://doi.org/10.2307/2392695>
- Fama, E.F., French, K.R., 1993. Common risk factors in the returns on stocks and bonds. *J. of Financial Economics*, 33, 1, 3–56. [https://doi.org/10.1016/0304-405X\(93\)90023-5](https://doi.org/10.1016/0304-405X(93)90023-5)
- Fama, E.F., French, K.R., 1995. Size and book-to-market factors in earnings and returns. *The J. of Finance*, 50, 1, 131–155. <https://doi.org/10.1111/j.1540-6261.1995.tb05169.x>
- Farrell, M., Gallagher, R., 2015. The valuation implications of enterprise risk management maturity. *J. of Risk and Insurance*, 82, 3, 625–657. <https://doi.org/10.1111/jori.12035>
- Federal Reserve Regulation YY March 27, 2014. 12 CFR 252 – Enhanced prudential standards for bank holding companies and foreign banking organizations. Board of Governors of the Federal Reserve System (Board). <https://www.govinfo.gov/content/pkg/FR-2014-03-27/pdf/2014-05699.pdf>
- Fisher, J., 1995. Contingency-based research on management control systems: Categorization by level of complexity. *J. of Account. Literature*, 14, 24–53.
- Florio, C., Leoni, G., 2017. Enterprise risk management and firm performance: The Italian case. *The British Account. Rev.*, 49, 1, 56–74. <https://doi.org/10.1016/j.bar.2016.08.003>
- Froot, K.A., Scharfstein, D.S., Stein, J.C., 1993. Risk management: Coordinating corporate investment and financing policies. *The J. of Finance*, 48, 5, 1629–1658. <http://down.cenet.org.cn/upfile/1/200738184644179.pdf>
- Gatzert, N., Martin, M., 2015. Determinants and value of enterprise risk management: Empirical evidence from the literature. *Risk Management and Insurance Rev.*, 18, 1, 29–53. <https://doi.org/10.1111/rmir.12028>
- Gatzert, N., Schubert, M., 2022. Cyber risk management in the US banking and insurance industry: A textual and empirical analysis of determinants and value. *J. of Risk and Insurance*. <https://doi.org/10.1111/JORI.12381>

- Gordon, L.A., Loeb, M.P., Tseng, C.-Y., 2009. Enterprise risk management and firm performance: A contingency perspective. *J. of Account. and Public Policy*, 28, 4, 301–327. <https://doi.org/10.1016/j.jaccpubpol.2009.06.006>
- Grace, M.F., Leverty, J.T., Phillips, R.D., Shimpi, P., 2015. The value of investing in enterprise risk management. *J. of Risk and Insurance*, 82, 2, 289–316. <https://doi.org/10.1111/jori.12022>
- Graham, J.R., Rogers, D.A., 2002. Do firms hedge in response to tax incentives? *The J. of Finance*, 57, 2, 815–839. <https://doi.org/10.1111/1540-6261.00443>
- Hoyt, R.E., Liebenberg, A.P., 2011. The value of enterprise risk management. *J. of Risk and Insurance*, 78, 4, 795–822. <https://doi.org/10.1111/j.1539-6975.2011.01413.x>
- Jabbour, M., Abdel-Kader, M., 2016. ERM adoption in the insurance sector: Is it a regulatory imperative or business value driven? *Qualitative Res. in Account. and Management*, 13, 4, 472–510. <https://doi.org/10.1108/GRAM-03-2015-0035>
- Jensen, M.C., Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *J. of Financial Economics*, 3, 4, 305–360. [https://doi.org/10.1016/0304-405X\(76\)90026-X](https://doi.org/10.1016/0304-405X(76)90026-X)
- Johnston, J., Soileau, J., 2020. Enterprise risk management and accruals estimation error. *J. of Contemporary Account. & Economics*, 12, 3. <https://doi.org/10.1016/j.jcae.2020.100209>
- Kanu, M.S., 2020. Integrating enterprise risk management with strategic planning for improved firm performance. *EJBMR, European J. of Bus. and Management Res.*, 5, 5, 1–11. <https://doi.org/10.24018/ejbmr.2020.5.5.488>
- Kuckertz, A., Berger, E.S.C., Mpeqa, A., 2016. The more the merrier? Economic freedom and entrepreneurial activity. *J. of Bus. Res.*, 69, 4, 1288–1293. <https://doi.org/10.1016/j.jbusres.2015.10.094>
- Lang, L. H. P., Stulz, R. M., 1994. Tobin's q, corporate diversification, and firm performance. *The J. of Political Economy*, 102, 6, 1248–1280. <http://www.nccr-finrisk.uzh.ch/media/pdf/habib/langStulz.pdf>
- Liebenberg, A.P., Hoyt, R.E., 2003. The determinants of enterprise risk management: Evidence from the appointment of chief risk officers. *Risk Management and Insurance Rev.*, 6, 1, 37–52. <https://doi.org/10.1111/1098-1616.00019>
- Lundqvist, S.A., 2014. An exploratory study of enterprise risk management: Pillars of ERM. *J. of Account., Auditing & Finance*, 29, 3, 393–429. <https://doi.org/10.1177/0148558X14535780>
- Lundqvist, S.A., Vilhelmsson, A., 2018. Enterprise risk management and default risk: Evidence from the banking industry. *J. of Risk and Insurance*, 85, 1). <https://doi.org/10.1111/jori.12151>
- Malik, M.F., Zaman, M., Buckby, S., 2020. Enterprise risk management and firm performance: Role of the risk committee. *J. of Contemporary Account. & Economics*, 16, 1. <https://doi.org/10.1016/j.jcae.2019.100178>

- Mafrolla, E., Matozza, F., D'Amico, E., 2016. Enterprise risk management in private firms: Does ownership structure matter? *The J. of Applied Bus. Res.*, 32, 2, 671–686. <https://doi.org/10.1057/9781137466297>
- Marques, L.D., 2000, Oct. Modelos dinâmicos com dados em painel: Revisão de literatura (Working Paper Centro de Estudos Macroeconómicos e Previsão, Faculdade de Economia do Porto; Vol. 100. Porto. <https://econpapers.repec.org/paper/porfepwps/100.htm>
- Mayers, D., Smith, C.W., Jr., 1982. On the corporate demand for insurance. *The J. of Bus.*, 55, 2, 281–296. https://doi.org/10.1007/978-94-015-7957-5_9
- McShane, M.K., Nair, A., Rustambekov, E., 2011. Does enterprise risk management increase firm value? *J. of Account., Auditing & Finance*, 26, 4, 641–658. <https://doi.org/10.1177/0148558X11409160>
- Mikes, A., Kaplan, R.S., 2014. Towards a contingency theory of enterprise risk management (Harvard Bus. School Working Paper Series n. 13-063). https://web.actuaries.ie/sites/default/files/erm-resources/Contingency_Theory_ERM_HBS_Jan13.pdf
- Myers, S.C., Read, J.A., Jr., 2001. Capital allocation for insurance companies. *The J. of Risk and Insurance*, 68, 4, 545–580. <https://doi.org/10.2307/2691539>
- Nguyen, L.T.M., Cheong, C.S., Zurbrugg, R., 2022. The heterogeneous impact of industry concentration on analyst performance. *Advances in Account.*, 59, 100629. <https://doi.org/10.1016/J.ADIAC.2022.100629>
- Nocco, B.W., Stulz, R., 2006. Enterprise risk management: Theory and practice. *J. of Applied Corporate Finance*, 18, 4, 8–20. <http://fisher.osu.edu/supplements/10/10402/enterprise-risk-mgt.pdf>
- NYSE, 2013. Corporate governance standards: Rule 303A.07 audit committee additional requirements (303A.07). The New York Security Exchange – NYSE. <https://nyseguide.srorules.com/listed-company-manual/09013e2c85c0074b>
- Otley, D.T., 1980. The contingency theory of management Account.: Achievement and prognosis. *Account., Organizations and Society*, 5, 4, 413–428. [https://doi.org/10.1016/0361-3682\(80\)90040-9](https://doi.org/10.1016/0361-3682(80)90040-9)
- Pagach, D., Warr, R., 2011. The characteristics of firms that hire chief risk officers. *J. of Risk and Insurance*, 78, 1, 185–211. <https://doi.org/10.1111/j.1539-6975.2010.01378.x>
- Palermo, T., Power, M., Ashby, S., 2017. Navigating institutional complexity: The production of risk culture in the financial sector. *J. of Management Studies*, 54, 2). <https://doi.org/10.1111/joms.12241>
- Quon, T.K., Zeghal, D., Maingot, M., 2012. Enterprise risk management and firm performance. *Procedia – Soc. and Behavioral Sciences*, 62, 263–267. <https://doi.org/10.1016/j.sbspro.2012.09.042>
- Sarbanes-Oxley Act July 30, 2002. To protect investors by improving the accuracy and reliability of corporate disclosures made pursuant to the securities laws, and for other

purposes. Regulation of Senate and House of Representatives of the United States of America in Congress assembled. <https://www.govinfo.gov/content/pkg/PLAW-107publ204/pdf/PLAW-107publ204.pdf>

Scott, W.R., 2008. Institutions and organizations: Ideas and interests, Third ed. California, Sage.

SEC, 2009. Proxy disclosure enhancements. U.S. Securities and Exchange Commission - SEC. <https://www.sec.gov/files/rules/final/2009/33-9089.pdf>

SEC, 2017. Regulation S-K [17 CFR Part 229]. U.S. Securities and Exchange Commission - SEC. <https://www.ecfr.gov/current/title-17/chapter-II/part-229>

Section 303A, November 3, 2004. Corporate governance rules of the New York Stock Exchange (NYSE). Regulation of Securities and Exchange Commission (SEC). <https://www.sec.gov/rules/sro/nyse/34-50625.pdf>

Smith, C.W., Stulz, R.M., 1985. The determinants of firms' hedging policies. The J. of Financial and Quantitative Analysis, 20, 4, 391–405. <https://doi.org/10.2307/2330757>

Subramaniam, N., McManus, L., Zhang, J., 2009. Corporate governance, firm characteristics and risk management committee formation in Australian companies. Managerial Auditing J., 24, 4, 316–339. <https://doi.org/10.1108/02686900910948170>

Stulz, R.M., 1984. Optimal hedging policies. J. of Financial and Quantitative Analysis, 19, 2, 127–140. <https://doi.org/10.2307/2330894>

S&P, 2005. Enterprise risk management for financial institutions: Rating criteria and best practices. Standard & Poor's - S&P. https://mgt.ncsu.edu/pdfs/erm/sp_erm_busdevbk.pdf

S&P Global Ratings ERM, 2022. Enterprise Risk Management (ERM) evaluation. https://www.spglobal.com/ratings/_division-assets/pdfs/erm-brochure.pdf

Teixeira, A. P., 2023. O dilema da escolha entre os modelos internos e padronizados na busca pela eficiência na gestão de capital regulatório dos bancos no Brasil: Uma análise sob a luz das lógicas conflitantes e contradições institucionais. (Doctorate Thesis). Universidade Presbiteriana Mackenzie, São Paulo, SP, Brasil. <https://dspace.mackenzie.br/handle/10899/33719>

Tufano, P., 1996. Who manages risk? An empirical examination of risk management practices in the gold mining industry. The J. of Finance, 51, 4, 1097–1137. <http://www.jstor.org/stable/2329389>

Whitman, A.F., 2015. Is ERM legally required? Yes for financial and governmental Institutions, no for private enterprises. Risk Management and Insurance Rev., 18, 2, 161–197. <https://doi.org/10.1111/rmir.12045>

Yatim, P., 2010. Board structures and the establishment of a risk management committee by Malaysian listed firms. J. of Management and Governance, 14, 1, 17–36. <https://doi.org/10.1007/S10997-009-9089-6/METRICS>

Preprint not peer reviewed

Supplementary Material of the paper

"The adoption of enterprise risk management in us banks: An exploratory study of contingent determinants"

1 Supplemental: Sample Selection

The final sample comprises 350 US banks, encompassing 4,761 company-years, classified according to SIC sector divisions 6021, 6022, 6029, 6035, and 6036. The requisite data for the research was obtained from the annual information in the DEF 14A and 10-K financial statements, specifically in the sections on risk management policy and internal controls, general meeting of shareholders and management and activities of the issuer. These data are available on the SEC's EDGAR secondary database, Bloomberg, and Capital IQ. In the absence of information through these channels, the company was contacted due to the unavailability or absence of information. To this end, StataNow/BE™ 18.5 statistical software was used to help with the calculations contained in the descriptive tables and unbalanced panel data.

The selection of this market is substantiated by the prevalence of ERM research in both emerging and developed markets, largely attributable to the advancement of corporate governance practices and the adoption of transparency-promoting initiatives by companies. Consequently, the non-observance or neglect of contingent aspects as determinants of ERM renders internal and external communication susceptible to failures and, consequently, misaligns the decision-making process from the objectives of the strategic plan and the purpose of governance that permeates the entire company. This assertion is supported by the findings of Gordon et al. (2009), Jabbour and Abdel-Kader (2016), Kanu (2020), Mikes and Kaplan (2014), and Palermo et al. (2017).

2 Supplemental: Econometric Model

In addressing the issue of endogeneity in the ERM variable, stemming from the lack of randomness in its adoption (Bromiley et al., 2015; Gatzert and Martin, 2015; Gatzert and Schubert, 2022; Hoyt and Liebenberg, 2011), we employed an econometric approach to empirical modeling based on the two-stage models (Ganzert and Schubert, 2022; Hoyt and Liebenberg, 2011). Initially, we departed from Gordon et al. (2009) to capture the determining effect of contingency variables as a prerogative of ERM adoption. The fundamental assumption

is that if companies in the sample engage in superior risk management practices related to these variables, they will be better positioned to enhance investment opportunities (emphasis added). In addition, given that contingent determinants are generally exogenous (Gordon et al., 2009), it is believed that these variables are a determining factor in the adoption of ERM, based on (1).

$$ERM_{it} = \beta_0 + \beta_x \left(\sum_{t=1}^5 \text{contingency variables}_{i,t} \right) + \varepsilon_{it} \quad (1)$$

where, ERM_{it} corresponds to the effective result of ERM implementation captured by a categorical variable (dummy 0 or 1), further described in Section 3.2; β_0 is the constant for each company, invariant over time; contingency variables correspond to EU = environmental uncertainty, IC = competition in the sector, FC = complexity of the company, FS = size of the company and MBD = monitoring of the board of directors; and ε_{it} random residue of the function, assuming normal distribution with mean 0 and variance σ^2 constant, i.e. $\varepsilon_{it} \sim N(0, \sigma^2)$ and homoscedastic.

Widely applied in the literature and similar to what was done in Hoyt and Liebenberg (2011), we included in (1) a set of instrumental control variables, namely: company size (*Size_Emp*), measured by the natural logarithm of the number of employees; leverage (*Leverage*), the result of dividing total debt by total assets; dummy for revenue diversification outside North America (*Div_Int*); dummy for business diversification (*Div_Ind*); asset opacity (*Opacity*); percentage of shares held by institutions (*Institutions*); financial slack (*Slack*); coefficient of variation of EBIT (*cvEBIT*); volatility of return from the previous year, measured by the natural logarithm of the daily return within 360 days (*laglnsdret*); and percentage change in the annual value of equity at market (*ValueChange*).

The coefficients in equation (1) are estimated based on the five contingency variables in relation to ERM best practices (see Table 1), while the equation in the second stage seeks to regress the adjusted variable ERM found in (1) to test the value assumption. We assume that the explanatory variables in (1) are stochastic, but not strictly exogenous and therefore possible to correlate with the error term ε_{it} . Using the adjustment of the coefficient of equation (1) in (2) is justified since there may be unobserved hidden variables in the model that better explain the associative model between ERM and the five contingency variables.

$$Value_{it} = \beta_0 + \beta_1 \widehat{ERM}_{it} + \beta_x \left(\sum_{t=1}^9 \text{control variables}_{it} \right) + u_{it} \quad (2)$$

where, $Value_{it}$ corresponds to the proxy BTM ; $\widehat{ERM}_{it}$ to the 1st stage variable ERM adjusted for the 2nd stage model; $Size$ = log natural total assets; $Leverage$ = leverage divided by total debt to market value of equity; $Salesgrowth$ = change in sales in the current year compared to the previous year; Div_Int = dummy equal to 1

if company discloses revenue outside North America, 0 otherwise; *Div_Ind* = dummy equal to 1 for product diversification, 0 otherwise; *Insiders* = shares held by insiders; *InsidersSq* = *Insiders* × *Insiders*; *Dividends* = dummy equal to 1 if dividends paid in the year, 0 otherwise; *Beta* = beta variation coefficient calculated from the variation of the share's 60-month returns by the variance of market returns.

Once again, as was done in Hoyt and Liebenberg (2011), we included a set of control variables in (2): company size (*Size*), measured by the natural logarithm of total assets; leverage (*Leverage*), the result of dividing total debts by market equity; sales growth (*Selesgrowth*); dummy for revenue diversification outside North America (*Div_Int*); dummy for business diversification (*Div_Ind*); dummy for dividend payments in the year (*Dividends*); percentage of shares held by insiders (*Insiders*); intensification of control (*Insiders* × *Insiders*); and beta of the share (*Beta*). Full details of these variables can be found in Table 1.

Table 1
Variable definition

Panel A: 1st stage ERM characteristics.		
Variable	Definition	Description
<i>Size_Emp</i>	Firm size.	$\ln(\text{Firm employees})$.
<i>Leverage</i>	Firm leverage.	Total debt / total asset.
<i>Div_Int</i>	Geographic diversification by revenue outside North America.	Dummy 1 whether the bank has revenue outside North America, 0 otherwise.
<i>Div_Ind</i>	Business diversification by revenue other than bank industry.	Dummy 1 whether the firm has revenue other than bank industry, 0 otherwise.
<i>Opacity</i>	Total asset opacity.	Intangible assets / total assets.
<i>Div_Ins</i>	Business concentration.	1 – Herfindahl Hirschman index.
<i>Institutions</i>	Institutional stockholder power.	Percentual of institutional stockholders.
<i>Slack</i>	Financial slack.	Cash and equivalent / total assets.
<i>cvEBIT</i>	EBIT coefficient variable.	Coefficient variable of EBIT five years prior.
<i>laglnsdret</i>	Return volatility.	$\text{Lag}(\ln[\text{standard deviation of stock daily return by 360 days}])$.
<i>ValueChange</i>	Annual value change.	$(\text{Current market capitalization} / \text{market capitalization } t-1) - 1$.
Panel B: 2nd stage ERM characteristics and firm value.		
Variable	Definition	Description
<i>Size</i>	Firm size.	$\ln(\text{total assets})$.
<i>Leverage</i>	Firm leverage.	Total debt / market capitalization.
<i>Salesgrowth</i>	Annual sales growth.	$(\text{Total revenue} / \text{total revenue } t-1) - 1$.
<i>Div_Int</i>	Geographic diversification by revenue outside Nort America.	Dummy 1 whether the bank has revenue outside North America, 0 otherwise.
<i>Div_Ind</i>	Business diversification by revenue other than bank industry.	Dummy 1 whether the firm has revenue other than bank industry, 0 otherwise.
<i>Dividends</i>	Annual dividends payment.	Dummy 1 whether payout dividends in the current year, 0 otherwise.
<i>Insiders</i>	Insider stockholders power.	Internal stockholder percentage.
<i>InsidersSq</i>	Insider stockholders power intensification.	<i>Insiders</i> × <i>Insiders</i> .
<i>Beta</i>	Systemic risks.	Coefficient variable of stock return by the return of the market by 60 months.

Our value model (2) assesses the association of ERM with the five contingency variables in (1). Based on this model, the variable $\widehat{ERM}_{it}$ results from a measure of good practice (or best fit) between ERM and the contingent determinants of its adoption (see Drazin and Van de Ven, 1985). Therefore, the smaller (larger) the deviation between ERM and contingency variables, the larger (smaller) the expected value. Thus, we expect to find a positive and significant relationship, represented by the coefficient β_1 , with the value proxies.

ERM value matching is a tradeoff that stems from the risk-return relationship (Froot et al., 1993; Smith and Stulz, 1985; Stulz, 1984; Tufano, 1996). In our model, we will use the value proxy, which is the book value of equity in relation to its market value. Like Tobin's Q (Cummins et al., 2001), the Book-To-Market (BTM) is a common measure for evaluating value opportunities used in models such as the Fama-French Three-Factor Model, where the HML factor (High Minus Low) reflects the additional return associated with high BTM stocks based on relative undervaluation with the market (Fama and French, 1993, 1995). Since the sample is limited to the banking sector, the use of this proxy aims to identify companies whose ERM should still reflect the positive effects of their management over the course of the maturity gain.

Based on BTM , the market identifies undervalued companies as potential generators of returns to future profits (Aboura and Arisoy, 2019), partly because of their association with retained earnings (Ball et al., 2020), especially in terms of the optimal ratio of their capital to the return on the share (Mossman and Rakhmayil, 2011). However, unlike Tobin's Q , whose coefficient reflects the present valuation of the company's liabilities and market equity at replacement cost of the book of asset, Book-To-Market does not use accounting liability figures in its calculation, whose information can distort the assessment of value, since this line in banks represents almost all liabilities arising from financial deposits of account holders (e.g. current account balances), leaving a very small part of debts not related to customers.

$$BTM_{it} = \frac{\text{book of equity shareholders}_{it}}{\text{market value of outstanding shares}_{it}} \quad (3)$$

where, for each period t from 2007 to 2023, BTM_{it} corresponds to the value proxy of company i in year t , calculated by dividing book equity by the total outstanding shares priced at market.

Since we are trying to answer whether contingency variables can explain the value correspondence of ERM, we will illustrate the results with other value proxies such as ROE and ROA, respectively return on equity and return on assets in the pooled fixed-effect-panel models.

3 Supplemental: Contingent Variables

The *EU* variable is then defined on the basis of the change or variability in the company's external environment. It combines three uncertainty metrics: (1) market, which represents the variation in sales from one year to the next; (2) technology, extracted from the investment cash flow figure divided by total assets for each year; and (3) profitability, obtained from the annual difference in pre-tax earnings. For each company, the coefficient of variation is calculated based on the sample period.

So, the environmental uncertainty is defined by $EU = \ln(\sum_{k=1}^3 CV(X_k))$, where $CV(X_k)$ is the coefficient of variation of uncertainty k in $\frac{(\sum_{t=1}^5 (z_{k,t} - \bar{z}_k)^2 / 5)}{|\bar{z}_k|}$, $z_{k,t} = (X_{k,t} - X_{k,t-1})$, $X_{k,t}$ = uncertainty k in year $t = 1, 2, \dots, 5$ in the five-year interval within the sample period, $k = 1, 2, 3$ represents the three uncertainty metrics: market, technology and profitability and $|\bar{z}_k|$, average of uncertainty k as the absolute denominator of $CV(X_k)$ to avoid negative values in possible cases. Thus, the greater the uncertainty, the greater the need for a structure to support strategic development and the decision-making process, such as ERM.

The *IC* variable is measured from the difference in the Herfindahl-Hirschman index to extract the level of competition ($1 - HHI$) in the sector investigated among all the companies in the sample, which are heterogeneous according to sector classifications. The HHI index measures the concentration of companies in a specific sector, where greater concentration indicates less competition. The HHI is extracted from the sum of the squares of each company's market share among all the companies in the sample, with each participation divided by the total for each year of the sample.

The variable Firm complexity (*FC*) refers to the number of segments in the conglomerate, which is consistent with the challenges of managing the entire portfolio. The variable is measured by the number of segments within the conglomerate reported annually. The variable Firm Size (*FS*) is measured by the natural log of the total assets of each company in each year. The variable Monitoring by Board of Directors (*MBD*) is given by the log of the number of directors. Table 2 shows all the variables, their description and the expected sign with the dependent variable ERM.

Table 2

1st stage variable definition and ERM sign expected

Independent variables	Definition	Sign expected
<i>EU</i>	Environmental Uncertainty: measured by the log of the sum of uncertainty coefficient variables k , in period t , for company i .	+
<i>IC</i>	Industry Competition: measured by the Herfindahl-Hirschman Index difference ($1 - \text{HHI}$).	+
<i>FC</i>	Firm Complexity: measured by the number of firm segments.	+
<i>FS</i>	Firm Size: measured by the log of total assets.	+/-
<i>MBD</i>	Monitoring by Board of Directors: measured by the log of the number of directors.	+

4 Supplemental: Interest Variable, ERM score

With the premise of an ERM score, we sought to identify a significant difference in the risk governance structure by means of seven risk management elements. To this end, we followed Florio and Leoni (2017) in constructing the ERM score which, in addition to isolating it from other variables, is also used as a proxy for its adoption, compared to attribution by the mere existence of a structure dedicated to risk management leadership or compliance (Liebenberg and Hoyt, 2003; Pagach and Warr, 2011; Subramaniam et al., 2009; Yatim, 2010). In other words, given that the choice of ERM may not be random, the contingency variables selected in this research may also be related to differences in value and may not be solely and exclusively related to its adoption.

The first group of the score corresponds to three attributes, in which the first (*ERMscope*) comprises the sum of three elements intrinsic to risk management. We argue that the sum of each element means that the company has corporate risk management in line with ERM principles, but it is still limited as to the other attributes in the sequence.

$$ERMscope_{it} = \sum_{k=1}^1 Broad_k + \sum_{k=1}^1 Type_k + \sum_{k=1}^1 Assessment_k \quad (4)$$

where *Broad* corresponds to the identification of risk management with a broad or holistic scope; *Type* refers to the risks integrated within the broad scope; and *Assessment* refers to the analysis of management compliance within the principles of risk governance, at least once a year. Each element was collected based on a search for keywords within the companies' annual reports, which: holistic, strategic, broad scope refer to the first component, risk types to the second and scope assessment to the third.

The next group corresponds to the characteristics of key corporate management risks (*ERMcharacteristic*), divided into two attributes.

$$ERMcharacteristic_{it} = \sum_{k=1}^1 Category_k + \sum_{k=1}^1 Key risks_k \quad (5)$$

where *Category* corresponds to the inclusion of all types of risk within the same framework; and *Key risks* refers to the focus on the treatment of the various types of risk. Each element was collected based on a search for keywords within the companies' quarterly reports, which: credit, liquidity, reputational and operational together with the word risk refer to the first component and key risks to the second.

The last group assesses the level of risk management (*ERMlevel*) is divided into two attributes: value objective and risk appetite and tolerance.

$$ERMlevel_{it} = \sum_{k=1}^1 Value objective_k + \sum_{k=1}^1 Appetite_k \quad (6)$$

where *Value objective* means that risk management aims to increase shareholder value; and *Appetite* refers to the level of tolerance and appetite for risk. Each element was collected by searching for keywords in the companies' quarterly reports, which: shareholder value refers to the first component and appetite and tolerance, together with the word risk, to the second.

The keyword search context in the reports is an important factor. Each time the search returned the context sought, the paragraph was confirmed in full in order to extract elements of risk management based on the characteristics of ERM. Thus, the dependent variable *ERMscore_{it}* is assigned values from zero to seven for the group of attributes intrinsic to risk management, as shown below.

$$\sum_{k=1}^7 ERMscore_{it} = \sum_{k=1}^3 ERMescope_{it} + \sum_{k=1}^2 ERMcharacteristic_{it} + \sum_{k=1}^2 ERMlevel_{it} \quad (7)$$

According to Hoyt and Liebenberg (2011) and McShane et al. (2011), risk management maturity should be understood in terms of five levels: weak, adequate, adequate with a positive outlook, strong, and excellent, where the higher levels correspond to the maturity of the ERM. Thus, we assigned the ERM score the notion of partial or comprehensive maturity in order to attribute to this score the stage of implementation at each moment. A dummy variable equal to 1 was then assigned if the *ERMscore* was greater than or equal to 5, 0 otherwise.

$$ERM_{it}(0 | 1) = \sum_{k=1}^7 ERMscore_k \geq 5 \quad (8)$$

5 Supplemental: Descriptive Analysis

Table 3 shows the distribution of the *ERMscore* score over time, with the highest concentration in the 3-4 score (44.65%) with 306 companies. In the high maturity score (greater than or equal to 5) there are 15.1% with 118 companies. When observed separately, there has been an evolution since 2009/2010, when the effects of the 2008 crisis raised concerns about risk governance structures in financial companies.

Table 3
ERM score frequency distribution (*n* = 4761)

Ano	0-2	3-4	≥5	% ≥5
2007	266	48	1	0,3%
2008	270	51	1	0,3%
2009	261	61	4	1,2%
2010	144	174	13	3,9%
2011	132	183	21	6,3%
2012	125	177	27	8,2%
2013	108	177	32	10,1%
2014	91	181	42	13,4%
2015	83	157	53	18,1%
2016	77	144	55	19,9%
2017	67	140	62	23,0%
2018	66	122	63	25,1%
2019	59	111	70	29,2%
2020	53	114	67	28,6%
2021	42	105	67	31,3%
2022	41	87	69	35,0%
2023	31	94	72	36,5%
2007-2023	1916	2126	719	
Mean	1,628	3,368	5,732	15,1%
s.d.	0,578	0,482	0,773	

Table 4 shows the ERM-related attributes in our sample, with *BTM* averaging 1.114 and median 0.896, while return on equity and return on assets were 5.3% and 0.6% respectively. In companies adopting ERM, *BTM* was close, at 0.908, followed by *ROA* 0.92% and *ROE* 7.7%. On average, the size of the companies, measured by the natural log of total assets (*FS*) was 8.241. In the case of US banks, the average returns, together with the *Beta* coefficient (0.809), show a sector with defensive characteristics, less sensitivity to market variations and stable performance. This points to a characteristic in which they can be understood as a sector with low-risk strategies and pro-economic cyclicity. In the COVID-19 period (2020 and 2021) this average drops to 0.68 (standard deviation of 0.4702), indicating a lower sensitivity of the share price to the crisis event and more defensive behavior in that period (In the subprime period 2008 and 2009, beta had an average of 0.81 and a standard deviation of 0.5523). One possible

explanation for this is that during this period, banks were able to expand their credit lines by injecting liquidity into the US market and the rest of the world.

Table 4
Summary statistics ($n=350$)

Panel A: Contingency variables.	mean	min.	1st Q.	med.	3rd Q.	max.	s.d.	<i>n</i>
<i>EU</i>	2,671	-0,990	1,877	2,460	3,231	10,79	1,143	4761
<i>IC</i>	0,608	0,213	0,444	0,603	0,791	0,920	0,211	4761
<i>FC</i>	0,174	0,000	0,000	0,000	0,000	9,000	0,673	4761
<i>FS</i>	8,241	2,509	7,049	7,884	9,030	15,17	1,645	4761
<i>MBD</i>	2,190	0,000	2,197	2,398	2,565	3,401	0,741	4761
Panel B: Control variables.	mean	min.	1st Q.	med.	3rd Q.	max.	s.d.	<i>n</i>
<i>Size</i>	8,241	2,509	7,049	7,884	9,030	15,70	1,645	4761
<i>Leverage</i>	1,378	0,000	0,365	0,741	1,379	211,6	4,345	4761
<i>Salesgrowth</i>	0,077	-28,04	-0,033	0,039	0,128	60,55	0,986	4761
<i>Div_Int</i>	0,967	0,000	1,000	1,000	1,000	1,000	0,179	4761
<i>Div_Ind</i>	0,087	0,000	0,000	0,000	0,000	1,000	0,282	4761
<i>Dividends</i>	0,998	0,000	1,000	1,000	1,000	1,000	0,048	4761
<i>Insiders</i>	0,094	0,000	0,024	0,054	0,128	0,836	0,106	4761
<i>InsidersSq</i>	0,020	0,000	0,001	0,003	0,016	0,699	0,048	4761
<i>Beta</i>	0,809	-5,826	0,564	0,810	1,039	12,02	0,552	4761
Panel C: proxy value.	mean	min.	1st Q.	med.	3rd Q.	max.	s.d.	<i>n</i>
<i>BTM</i>	1,114	-7,767	0,705	0,896	1,151	42,58	1,131	4761
<i>ROE</i>	0,053	-28,79	0,054	0,083	0,106	4,571	0,479	4761
<i>ROA</i>	0,006	-6,104	0,006	0,009	0,011	1,194	0,094	4761

Note. Contingency variables: *EU* = environmental uncertainty; *IC* = industry competition; *FC* = firm complexity; *FS* = firm size; and *MBD* = monitoring by board of directors. Control variables: *Size* = $\ln(\text{total assets})$; *Leverage* = total debt / market capitalization; *Salesgrowth* = $(\text{total revenue} / \text{total revenue } t-1) - 1$; *Div_Int* = dummy 1 whether the bank has revenue outside North America, 0 otherwise; *Div_Ind* = dummy 1 whether the firm has revenue other than bank industry, 0 otherwise; *Dividends* = dummy 1 whether payout dividends in the current year, 0 otherwise; *Insiders* = internal stockholder percentage; *InsidersSq* = *Insiders* x *Insiders*; and *Beta* = coefficient variable of stock return by the return of the market by 60 months. Firm value proxies: *BTM* = book-to-market measured as the book of equity by the equity market value; *ROE* = return on equity calculated as the net income by the book of equity; and *ROA* = return on assets measured by the net income to the total assets.

Table 5 shows the correlation between the value variable and the control variables, indicating that there are no high correlations that point to possible multicollinearity problems. We note that the highest correlations are related to *Leverage* with *BTM*, *ROE* and *ROA* and size with *Insiders* and *Beta*, the highest being positive *ROA* x *ROE* (0.860). With the dependent variable *BTM*, *Leverage* is positive, which the greater the leverage, the greater the opportunities for value, where interest associated with debt may be contributing to lowering the weighted cost of capital. With *ROA* and *ROE*, *Leverage* is negative, which may indicate that returns on assets and equity are eroding value. This preliminary result corroborates the literature, in which the relationship between value, size and leverage are controversial and can take on positive or negative values, depending on the characteristics of the company under

investigation, such as greater or lesser levels of complexity and debt (Gordon et al., 2009; Hoyt and Liebenberg, 2011).

Table 5

Spearman correlation ($n=4761$) eq. (2)

	BTM	ROE	ROA	Size	Lever	SalesG	DInt	DInd	Divid	Insid	Beta
BTM	1,000										
ROE	-0,547	1,000									
ROA	-0,494	0,860	1,000								
Size	-0,262	0,159	0,244	1,000							
Lever	0,447	-0,304	-0,444	-0,073	1,000						
SalesG	-0,299	0,301	0,293	0,180	-0,189	1,000					
DInt	0,051	-0,068	-0,081	-0,191	0,044	-0,032	1,000				
DInd	-0,092	0,090	0,121	0,181	-0,080	0,134	-0,039	1,000			
Divid	-0,024	0,053	0,052	-0,058	-0,033	0,041	0,016	0,015	1,000		
Insid	0,112	-0,033	-0,127	-0,582	0,034	-0,051	0,182	-0,078	0,071	1,000	
Beta	-0,101	-0,049	-0,019	0,487	0,123	0,043	-0,097	0,038	-0,070	-0,303	1,000

Note. BTM = book-to-market measured as the book of equity by the equity market value; ROE = return on equity calculated as the net income by the book of equity; e ROA = return on assets measured by the net income to the total assets. Size = $\ln(\text{total assets})$; Lever = Leverage = total debt / market capitalization; SalesG = Salesgrowth = $(\text{Total revenue} / \text{Total revenue } t-1) - 1$; DInt = Div_Int = dummy 1 whether the bank has revenue outside North America, 0 otherwise; DInd = Div_Ind = dummy 1 whether the firm has revenue other than bank industry, 0 otherwise; Divid = Dividends = dummy 1 whether payout dividends in the current year, 0 otherwise; Insid = Insiders = internal stockholder percentage; and Beta = coefficient variable of stock return by the return of the market by 60 months.

In Table 6, the highest positive correlations between the contingency variables are in *IC* with *FC* (0.205), *FS* (0.247) and *MBD* (0.274) and 0.174 between *FC* and *FS* and 0.269 between *FS* and *MBD*. Except for the correlations with *EU*, the others have positive coefficients. Together, *FS* and *FC* show that complexity is related to company size. On average, the companies have 0.174 segments, which may indicate the existence of dilution of assets in multiple sectors associated with the conglomerate.

Table 6

Correlation matrix of variables from eq. (2)

	<i>EU</i>	<i>IC</i>	<i>FC</i>	<i>FS</i>	<i>MBD</i>
<i>EU</i>	1				
<i>IC</i>	-0,114***	1			
<i>FC</i>	-0,071***	0,205***	1		
<i>FS</i>	-0,099***	0,247***	0,174***	1	
<i>MBD</i>	-0,028*	0,274***	0,090***	0,269***	1

Note. *EU* = environmental uncertainty; *IC* = industry competition; *FC* = firm complexity; *FS* = firm size; and *MBD* = monitoring by board of directors.

Level of significance: * 10%; ** 5%; and *** 1%.

6 Supplemental: References

- Aboura, S., Arisoy, Y.E., 2019. Can tail risk explain size, book-to-market, momentum, and idiosyncratic volatility anomalies? *J. of Business Finance & Account.*, 46, 9–10, 1263–1298. <https://doi.org/10.1111/jbfa.12403>
- Ball, R., Gerakos, J., Linnainmaa, J.T., Nikolaev, V., 2020. Earnings, retained earnings, and book-to-market in the cross section of expected returns. *J. of Financial Economics*, 135, 1, 231–254. <https://doi.org/10.1016/j.jfineco.2019.05.013>
- Florio, C., Leoni, G., 2017. Enterprise risk management and firm performance: The Italian case. *The British Account. Rev.*, 49, 1, 56–74. <https://doi.org/10.1016/j.bar.2016.08.003>
- Gordon, L.A., Loeb, M.P., Tseng, C.-Y., 2009. Enterprise risk management and firm performance: A contingency perspective. *J. of Account. and Public Policy*, 28, 4, 301–327. <https://doi.org/10.1016/j.jaccpubpol.2009.06.006>
- Hoyt, R.E., Liebenberg, A.P., 2011. The value of enterprise risk management. *J. of Risk and Insurance*, 78, 4, 795–822. <https://doi.org/10.1111/j.1539-6975.2011.01413.x>
- Liebenberg, A.P., Hoyt, R.E., 2003. The determinants of enterprise risk management: Evidence from the appointment of chief risk officers. *Risk Management and Insurance Review*, 6, 1, 37–52. <https://doi.org/10.1111/1098-1616.00019>
- Mossman, C.E., Rakhmayil, S., 2011. Firm size, book-to-market ratio and the macroeconomic environment: Theory and test. *Applied Economics*, 43, 2417–2431. <https://doi.org/10.1080/00036840903196639>