International Journal of China Studies
Vol. 9, No. 1, April 2018, pp. 97-118

Managing Risk inside China: Insights from In-depth Empirical Analyses in Manufacturing Industry

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Abstract

This article provides key insights into the valuation of enterprise risk management (ERM) inside China. According to data gathered from manufacturing industry in China, the article examined the implication of risk management within firms through the effect of ERM on the relationship between individual risks and risk portfolio, on the relationships among categorical risks and risk structure, and on the relationship between categorical risk and firm performance. In order to evaluate the benefits of ERM in a comprehensive manner, a covariance-based structural equation modeling (CBSEM) was adopted as the major method. The results revealed that ERM mitigated the association between individual risks and risk portfolio in China. In addition, the relationships among categorical risks in the risk structure were weakened as well. Since the relationship between categorical risks and firm performance became significantly weak when firms embraced with ERM, therefore, it implied that ERM can optimize the risk structure and add value to firm performance by managing risk in China.

Keywords: *China, manufacturing industry, risk management, firm performance, structural equation modeling*

1. Introduction

The continuing economic uncertainties and unfortunate operational-risk events affecting firms around the world, a serious concern for both academics and industry commentators, have led to the development of risk management for

organizations (Bhimani, 2009; Gephart, Van Maanen, & Oberlechner, 2009). In this context, the concept of enterprise risk management (ERM), which is also known as integrated risk management, holistic risk management, consolidated risk management, and corporate risk management, has been proposed and rapidly become the criterion reference of managing risk for all entities (Hoyt & Liebenberg, 2011).

Different from silo-based traditional risk management, ERM is a future-focused and process-oriented approach that aims to trade all risk exposures within an organization into one risk portfolio, in which the risk management activates are governed and arranged in an integrate and holistic framework (Verbano & Venturini, 2011). Therefore, ERM is deemed as an appropriate means to benefit governance and allow management to effectively deal with uncertainties, consequent risks, and opportunities that will eventually contribute to the promotion of firm performance (Bromiley, McShane, Nair, & Rustambekov, 2015).

Benefiting from the rapid economic growth, China has become one of the major economies of the world (Su, Wan, & Li, 2013). The huge market potential in China inevitably attracts a growing number of multinational firms who want to join in and take a share of the economic profits. This puts additional pressures on Chinese organizations in facing the increasing categorical business risks, endogenous and exogenous environmental uncertainties, and complicated market competition. Consequently, the unsatisfactory performance of firms in China has been attributed to the lack of readiness in taking advantage of risk management at the enterprise level (Xiaolun, 2010; Xiaochen & Aijing, 2013).

In China, firms undesirably experience barriers in the process of carrying out ERM programs and these barriers include weakness of risk awareness, invalid recognition of risk management, discrepant comprehension of internal control, and confusion of relevant participators (Xiaochen & Aijing, 2013; Xiaolun, 2010). Accordingly, the application of ERM programs for Chinese organizations has been a stringent and difficult process. Nonetheless, this should not serve as a reason to rule out the need to conduct studies for providing empirical analyses of enterprise-wide risk management in China because the application of ERM is essential and necessary.

In order to contribute to the body of knowledge that is related to risk management that is specific to China, this article is inclined to explore whether firms in China can manage risk and enhance performance through establishing the mechanism of ERM programs. Specially, this article is designed to evaluate the effects of ERM on the association between individual risk and risk portfolio, on the relationships among categorical risks in risk structure, and on the association between categorical risk and firm performance.

2. Risk Management in China

Due to the fact that capital markets are not sound and not well served in China, Chinese organizations experience a lack for diversified instruments in implementing risk aversion (Qiya, 2000). In 2009, the International Swaps and Derivatives Association (ISDA) made an inquiry to disclose the utilization of derivatives for the Fortune Global 500 firms. The results indicated that 94 per cent of firms utilized financial derivatives as tools for risk management. Indeed, there were 29 Chinese firms on the list of Fortune Global 500 and 18 of them were regarded as among the 94 per cent target firms. However, the usage rate of derivatives in China was much less than any other top 10 countries which had the minimum rate that is higher than 80 per cent (as shown in Figure 1). In addition, China was seen to be unable to experience the advantage even if it competed with some emerging countries (as shown in Figure 2).

Although the cognition of risk management at the enterprise level for most firms in China is not mature (Huancheng, Changqing, & Yonglai, 2010), the concept of ERM has been generally accepted in China, especially by the fast-developing insurance industry (Qiuying, Yue, Ojiako, Marshall, & Chipulu, 2014). In 2009, the China Insurance Regulatory Commission (CIRC) announced the guidelines for ERM implementation for life insurance markets in China. In 2012, the announcement of a more standardized framework was proposed for assessing the ERM implementation within the insurance industry (Qiuying et al., 2014). Ever since the financial crisis broke out in late 2008, regulators in China have been more concerned about ERM. In the aftermath of the financial crisis, both investors and rating agencies were

Figure 1 Highest Reported Use of Derivatives for Top 10 Countries

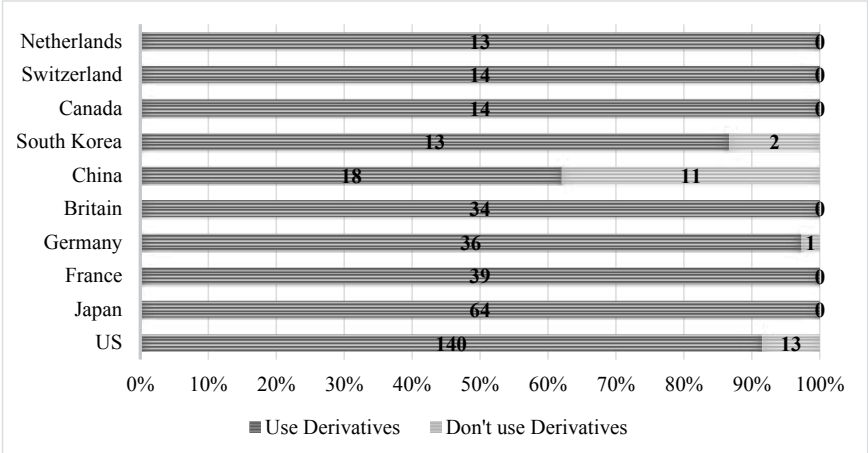
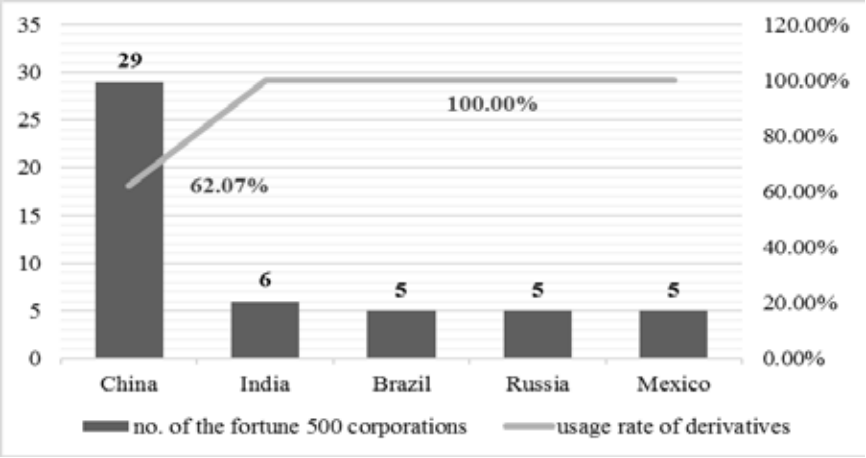


Figure 2 Usage Rate of Derivatives for Emerging Market Economics



beginning to request for ERM implementation within their concerned firms, on a continuous basis.

Known as one of the Big Four accounting firms, KPMG conducted a survey among insurance companies operating in mainland China and Hong Kong in 2009 which aimed at investigating the insurer's awareness of ERM, the responsibility for implementing ERM, the various policies and models available, and the expectations for future risk management initiatives. The results indicated that 73 per cent of the firms surveyed had established a separate department or cross functional committee to govern enterprise risks. In addition, the survey implied that insurance companies in mainland China and Hong Kong preferred to choose risk appetite and tolerance (44 per cent), risk assessment (28 per cent), risk management framework (12 per cent), and risk monitoring and reporting (12 per cent) as further works on risk management. All these signs explicitly demonstrate that insurers in China are aware that ERM is a process of evolution.

According to KPMG's investigation, even if most large firms have established risk management programs, they are not putting in sufficient investments in trading risk issues in a comprehensive manner. This is attributed to the influence of government rules and regulations in China. In 2007, the CIRC announced the principles of a sound risk management framework that identifies the assessment of risk categories and the constitution of risk controls. In 2008, the CIRC supplemented a solvency regulation for insurance companies and set requirements for implementing a risk-based monitoring framework. In 2006, the State-owned Assets Supervision and Administration Commission (SASAC) set out the requirements of risk

management for state-owned firms in China. In 2012, the SASAC announced that all state-owned firms in China need to comprehensively implement ERM programs. As a result, some firms in China are forced to establish ERM programs in their aim to fulfil the compliance purpose.

3. Risk Management with Firm Value

Although there is insufficient evidence to illustrate the benefits of ERM in China, however, the theoretical arguments presented in the literature suggest that ERM can and does indeed add value within organizations (Hoyt & Liebenberg, 2011; Nocco & Stulz, 2006). Due to the existence of numerous market imperfections and frictions occurring in the business world, ERM is deemed to be a value-added project with net present value which helps to mitigate the idiosyncratic risks firms face (Pagach & Warr, 2011). In addition, ERM is recognized as a means of improving firm value by enhancing the value of expected cash flows (Nocco & Stulz, 2006). According to the theory of corporate risk management, firms with smooth cash flows will have lower financial distress costs, less expected tax liabilities, and few contracting costs (Smith & Stulz, 1985).

ERM is posited to create shareholder value by enabling firms to obtain an optimized risk-return tradeoff (Hoyt & Liebenberg, 2011). If ERM can enhance the optimization of risk-return in a cost-effective manner, then it is reasonable to conjecture that risk management would increase firm value (Farrell & Gallagher, 2015). Accordingly, ERM is recommended to benefit firms by enhancing firms' internal decision making, which will ultimately improve their performance through efficient capital allocations (Myers & Read Jr, 2001). In addition, it has been theoretically argued that ERM can lead to an abridgement in the likelihood of large detrimental cash flow shortfalls, costly capital acquisition and distribution, and underinvestment of profitable projects (Farrell & Gallagher, 2015).

Compared to treating each risk exposure in isolation, ERM is inclined to manage and control all risk exposures in the portfolio context, then only the remaining risk requires being governed because conducting each risk independently will add more onerous works to risk mitigation (Farrell & Gallagher, 2015). Therefore, the aggregation of risks benefits firms in avoiding the duplication of risk management expenditures and in reinforcing the coordination among different departments in an organization (Hoyt & Liebenberg, 2011). According to empirical studies in the existing literature, different maturity stages of corporate risk management will bring different impacts to organizations (Ballantyne, 2013; Farrell & Gallagher, 2015). Since firms in China are rarely able to establish mature ERM, thus, it is meaningful to clarify the effects of ERM on firm performance in China.

4. The Sample

After a long period of rapid growth, China has entered into a new stage of economic slowdown. In order to pursue a sustainable development, the government is concentrating on economic system reforming and economic structure optimizing in last decades (Su, Li, & Wan, 2017). Since manufacturing industry is regarded as the pillar of China's economy and contributes most to the growth in GDP, thus, the downward pressure on economy has increased the requirement of transformation and innovation for traditional manufacturers in China (Baichuan, 2016). Accordingly, it becomes more important for Chinese manufacturers to manage all risk exposures in an effective and efficient manner, so as to survive and develop in the complicated and volatile economic environment. In this context, the manufacturing industry in China was chosen as the target for participation in this investigation, which results will provide key insights into empirical evidence of corporate risk management inside China.

Data used in this article were derived from the Wind Financial Database that covered twelve fiscal years between 2004 and 2015. For the purpose of addressing the research objectives, the article categorized manufacturers in China into two groups and attempted to distinguish among different scenarios. Therefore, firms that have established ERM programs were classified as one group while firms that have not established ERM programs were classified as the other group. The identification of ERM implementation was exploited from the publicly displayed information noted in firms' financial reports, internal control reports, and supervisory committee reports. Adapting the method proposed by Hoyt and Liebenberg (2011), a detailed search was focused on phrases with keywords such as "risk management department", "risk management system", "chief risk officer", "ERM framework", "risk management committee", "enterprise risk management", "consolidate risk management", "strategic risk management", "holistic risk management", and "integrated risk management". The search strings were manually reviewed within the mentioned reports for every firm during each year between 2004 and 2015. After excluding invalid data, the sample consisted of 3,012 observations with ERM implementation and 1,356 observations without ERM implementation.

5. Metrics of Risk Indicators

One of the objectives of this article is to assess and manage risk structure within originations by identifying risk portfolio. An investigation of Mercer Management Consulting (MMC) disclosed that the falling stock prices of Fortune 1,000 firms were primarily caused by erroneous decisions in 58 per cent of strategies, 31 per cent of operations, and 6 per cent of finances. In

this context, the risk portfolio in this article is estimated by measuring three categories of risks in respect of strategy, operation, and finance. According to empirical studies, the influence of strategic risk is always reflected in the inefficient collection and distribution of resources as well as the low conversion of profitability. However, the occurrence of operational risk is caused by frictions and imperfections in the utilization of capital, human resources, and techniques for both internal and external control activities. In addition, financial risk is underlyingly correlated with debts and investments, financial market trends, and transactions with third parties (Andersen, 2008; Verbano & Venturini, 2011).

This article adopted management costs (MNTC), operation costs (OPRC), finance costs (FANC), return on total assets (ROTA), return on invested capital (ROIC), and net profit margin (NPM) as the indicators of strategic risks. It applied total asset turnover (TOATO), fixed assets turnover (FXATO), receivables turnover (RECTO), inventory turnover (IVNTO), and operating cycle (OPTC) as the metrics to estimate operational risks. It took operating cash flow ratio (OCFRTO), acid test ratio (ATRTO), debt ratio (DRTO), solvency ratio (SRTO), real ratio (RRTO), and equity ratio (ERTO) as the indicators to examine financial risks. The statistics of these metrics of risk indicators are summarized in Table 1.

6. Metrics of Performance Indicators

This article is also aimed at investigating the effects of risk portfolio on firm performance. According to most prior empirical studies, Tobin's q is an efficient indicator of firm value while estimating the valuation of risk

Table 1 Descriptive Statistics on Risk Indicators

	N	*Mean*	*Median*	*Std. Dev.*	*P 25*	*P 75*
Group 1: Firms Embracing ERM						
MNTC	3012	8.0936	6.6116	7.8546	4.2245	9.8118
OPRC	3012	5.7922	3.9123	6.2614	2.2300	6.6518
FANC	3012	2.6945	2.0530	3.1639	0.8779	3.6833
ROTA	3012	5.0589	4.6780	6.7792	2.5243	7.8458
ROIC	3012	15.4105	10.1690	313.8792	4.9612	19.1806
NPM	3012	2.1425	3.8711	40.0731	0.9413	7.5669
TOATO	3012	0.7984	0.6855	0.4708	0.4935	0.9811
FXATO	3012	3.5283	2.3039	4.4913	1.4012	4.2309
RECTO	3012	31.2115	8.6223	225.4943	4.9257	20.1304
IVNTO	3012	5.1086	4.0564	4.6499	2.5690	6.3305
OPTC	3012	176.1823	142.2635	141.4133	84.8657	221.3761

Table 1 (continued)

	N	*Mean*	*Median*	*Std. Dev.*	*P 25*	*P 75*
OCFRTO	3012	0.1134	0.0853	0.1759	0.0183	0.1873
ATRTO	3012	0.8840	0.7637	0.5804	0.5275	1.0502
DRTO	3012	53.3362	52.8841	16.1659	41.5562	65.0984
SRTO	3012	12.8558	10.1772	17.6762	5.0893	18.0516
RRTO	3012	1.2769	1.1192	0.7474	0.8402	1.4778
ERTO	3012	2.0294	1.2354	6.6881	0.7737	2.0694
Group 2: Firms Not Embracing ERM						
MNTC	1356	8.0531	6.8896	5.8075	4.8540	10.0290
OPRC	1356	6.0110	4.0731	6.0336	2.2427	7.6179
FANC	1356	2.3025	1.9059	2.0742	0.9038	3.3281
ROTA	1356	4.8068	4.4502	6.7370	2.4547	7.4900
ROIC	1356	18.2436	8.9638	337.8389	4.7520	18.3773
NPM	1356	2.9118	3.2596	11.7412	1.1111	7.1584
TOATO	1356	0.8022	0.6824	0.4965	0.5050	0.9760
FXATO	1356	3.7380	2.4108	6.2453	1.3931	4.0811
RECTO	1356	20.2538	7.6950	43.1732	4.3873	16.9850
IVNTO	1356	4.8142	4.0272	3.2874	2.6445	6.1626
OPTC	1356	191.7989	144.4773	158.5564	92.0732	228.8885
OCFRTO	1356	0.1143	0.0972	0.1537	0.0280	0.1874
ATRTO	1356	0.8387	0.7400	0.4294	0.5278	1.0559
DRTO	1356	52.2009	52.5825	15.0812	41.1749	63.2426
SRTO	1356	12.0120	10.3556	14.1939	5.6226	17.6074
RRTO	1356	1.2572	1.1656	0.5551	0.8537	1.5185
ERTO	1356	1.7498	1.1820	3.8284	0.7525	1.8895

Note: Managing costs = Management expenditures / Sales revenue; Operating costs = Operating expenditures / Sales revenue; Financing costs = Financing expenditures / Sales revenue; Return on total assets = EBIT / Book value of assets; Return on invested capital = After tax net income / (Working capital + Book value of fixed assets); Net profit margin = Net income / Sales revenue; Total assets turnover = Sales revenue / Book value of assets; Fixed assets turnover = Sales revenue / Book value of fixed assets; Receivables turnover = Sales revenue / Average accounts receivable; Inventory turnover = Cost of goods sold / Average inventory; Operating cycle = Age of inventory / Collection period; Operating cash flow ratio = Cash flow from operations / Book value of short term liabilities; Acid test ratio = (Book value of liquid assets – Inventories) / Book value of short term liabilities; Debt ratio = Book value of debt / Book value of assets; Solvency ratio = (After tax net profit + Depreciation) / (Book value of short term liabilities + Book value of long term liabilities); Real ratio = Book value of liquid assets / Book value of short term liabilities; Equity ratio = Book value of equity / Book value of assets.

management within organizations. Tobin's q dominates other performance measurements because data normalization or risk adjustment is not indispensable in the computation (Lang & Stulz, 1993). Additionally, Tobin's q can reveal future expectations of investors because the impacts of risks are not expected to be immediately recognized. However, since there are non-tradable shares in China, Tobin's q cannot be directly quantified through market value of shareholder equity in the capital market (Xiaoming & Chunyu, 2009). In this context, the accuracy of Tobin's q in assessing firm performance is not adequate in the case of China.

In order to comprehensively estimate firm performance for Chinese organizations, this article was inclined to apply the structural equation

Table 2 Descriptive Statistics on Key Performance Indicators

	N	*Mean*	*Median*	*Std. Dev.*	*P 25*	*P 75*
Group 1: Firms Embracing ERM						
SIZE	3012	22.0366	21.8954	1.1798	21.1641	22.7179
GROWTH	3012	23.5720	10.6626	264.7724	-4.3768	26.0952
POSITION	3012	1.0621	0.6595	1.3150	0.3604	1.2305
ROA	3012	1.7029	1.5262	5.7828	-0.2594	4.1837
CHANGE	3012	25.3716	4.2186	78.1813	-14.1869	39.8721
VOLATILITY	3012	46.9112	43.3349	17.4408	34.3367	56.0803
WACC	3012	25.6343	22.2562	21.7757	12.6621	34.1964
TOBINQ	3012	1.4467	1.1383	1.0997	0.8158	1.6848
Group 2: Firms Not Embracing ERM						
SIZE	1356	21.6698	21.5658	0.9494	21.0355	22.1991
GROWTH	1356	18.4657	14.5361	34.9863	1.1579	31.8334
POSITION	1356	1.4047	0.6963	2.2601	0.3489	1.3469
ROA	1356	1.7396	1.6405	5.2478	0.0922	3.8842
CHANGE	1356	28.4344	3.2644	124.9150	-14.6463	47.5296
VOLATILITY	1356	47.4523	44.3467	18.8573	32.3318	59.3834
WACC	1356	24.3649	21.3133	17.8157	14.1090	31.3258
TOBINQ	1356	1.4162	1.0438	1.1146	0.8226	1.6545

Note: Firm size = ln (Book value of assets); Sales growth = (Sales revenue$_t$ – Sales revenue$_{t-1}$) / Sales revenue$_{t-1}$; Market position = (Firm sales / Industry sales) / (Firm shares / Industry shares); Return on asset = Net income / Book value of assets; Value change = (Firm value$_t$ – Firm value$_{t-1}$) / Firm value$_{t-1}$; 24-months volatility = Standard deviation of monthly logarithmic return / Square root of 24; Weight average cost of capital = Percentage of debt × After tax cost of debt + Percentage of common equity × Cost of common equity; Tobin' s q = (Market value of common stock + Book value of non-tradable stock + Book value of debt) / Book value of assets.

modeling (SEM) which is designed by using multiple indicators of firm performance. On the basis of empirical evidence in prior studies, the article selected firm size (SIZE), sales growth (GROWTH), market position (POSITION), return on assets (ROA), value change (CHANGE), stock price volatility (VOLATILITY), weight average cost of capital (WACC), and Tobin's q (TOBINQ) as metrics of performance indicators to reflect firm performance in China. The statistics of performance indicators are then summarized in Table 2.

7. Covariance-Based Structural Equation Modeling

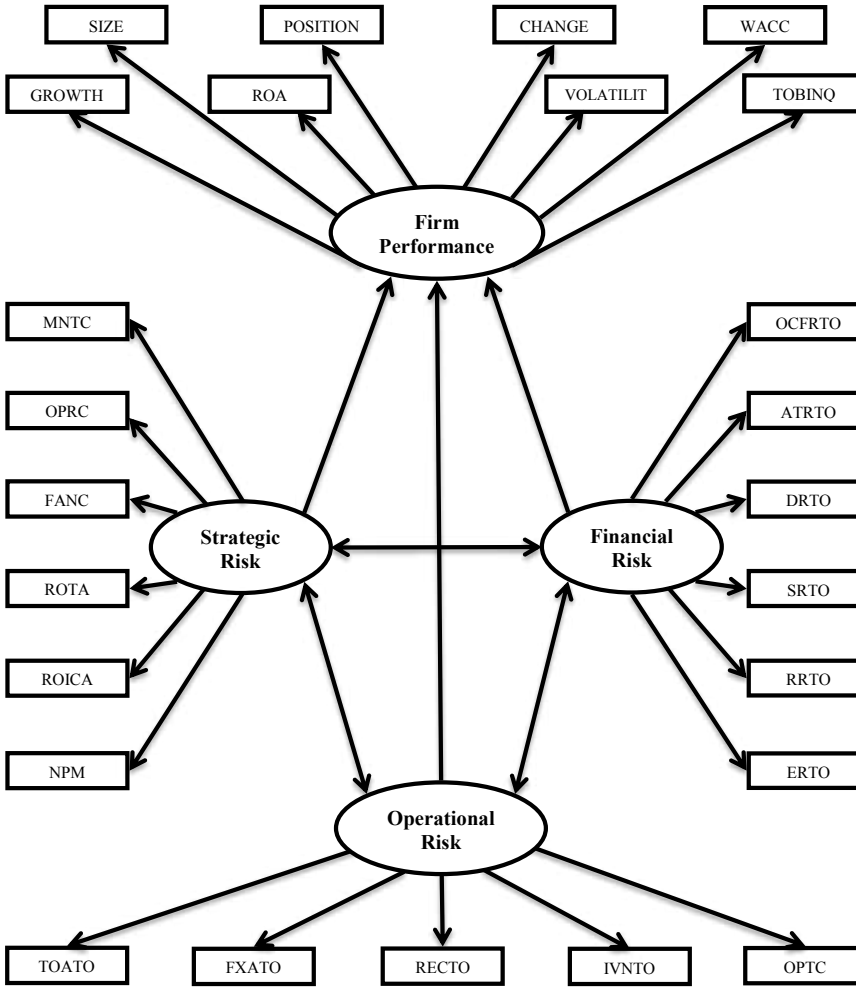
In order to estimate the relationships between individual risks, categorical risks, and firm performance in China, this article adopted a covariance-based structural equation modeling (CBSEM). Compared to regression-based approaches, CBSEM has advantages in modeling unobservable contents with latent variables. In addition, measurement errors will be represented in CBSEM in which case the measurement bias can be eliminated (Finch & French, 2011). Since the categorical risks cannot be directly measured by observable variables, thus, CBSEM is adequate for exploring the risk structure and risk portfolio within organizations by using latent variables. In this context, the structural and measurement models for the whole CBSEM is designed in Figure 3.

According to the CBSEM framework, it can be noted that there are totally three paths in the article. Firstly, it attempted to examine the relationship between individual risk and risk portfolio by comparing the effects of risk indicators in respect of strategy, operation, and finance between firms with ERM and those without. It sought to ascertain whether risk exposures in China can be mitigated by risk management activities. Secondly, the article intended to estimate the components of risk portfolio for Chinese organizations in relative to the risk structure of Fortune 1,000 firms (58 per cent strategic risk, 31 per cent operational risk, and 6 per cent financial risk). Finally, it aimed to explore the contribution of each categorical risk to firm performance. Therefore, if there is a significant relationship between risk indicators and performance indicators, then firms can improve performance by managing risk with the assistance of ERM programs in China.

8. Validity of the CBSEM Model

For the purpose of confirming that the CBSEM model is designed to be perfectly adequate for the research data, this article examined the model validity before analyzing results and findings from the computation. Even if there are many goodness-of-fit statistics that can be used to indicate model

Figure 3 Complete Model of CBSEM



fitness, however, the accurate validity of a measurement model can only be revealed by adopting no less than four goodness of fit indexes as reference standards (Hair, Tatham, Anderson, & Black, 1998). In this context, this article selected the normed fit index (NFI), the comparative fit index (CFI), the goodness-of-fit index (GFI), and the root mean square error of approximation (RMSEA) as the dominating goodness-of-fit indicators to validate the CBSEM model. The outcomes of the validity examination are summarized in Table 3.

Since all observable variables in the article are quantified by accounting formulas and some of them share same elements via assessments, thus, it

Table 3 Summary for Goodness-of-Fit Statistics

Validity Indicators	*Original CBSEM*	*Modified CBSEM*	*Acceptable Criteria*
Normed Fit Index (NFI)	0.4530	0.9118	> 0.90 Good Fit
Comparative Fit Index (CFI)	0.4465	0.9384	> 0.90 Good Fit
Goodness-of-Fit Index (GFI)	0.5872	0.9236	> 0.90 Good Fit
Root Mean Square Error of Approximation (RMSEA)	0.1325	0.0692	< 0.05 Close < 0.08 Good < 0.10 Reasonable

is usual for some of the residual variables to be correlated with each other. In this context, linking errors that are high in terms of relevance should be done during the modification process so as to improve goodness-of-fit for the CBSEM model. It is reasonable to assert that the modified CBSEM model is relatively valid because all validity indicators are well within the range of acceptable criteria.

9. Equivalence of the CBSEM Model

Since this article compares the differences between firms with ERM and firms without ERM by executing two groups of firms separately in the CBSEM model, it is thus necessary to know whether the components in the structural model, as well as the measurement model, are equivalent across groups of firms. In seeking evidence of multigroup equivalence, this article employed five consecutive tests to orderly estimate invariance for measurement weight, structural weight, structural covariance, structural residual, and measurement residual.

In the process of implementation, it sets imposition of equality constraint for measurement weight in model a; adding imposition of equality constraint for structural weight in model b; adding imposition of equality constraint for structural covariance in model c; adding imposition of equality constraint for structural residual in model d; and adding imposition of equality constraint for measurement residuals in model e. The modified CBSEM model in the previous section is treated as the configural model that provides a baseline against which all the tests for invariance are compared.

Normally, the traditional approach in arguing for evidence of invariance is based on the χ^2 difference test. If the difference in value is statistically significant, then evidence of noninvariance is indicated. However, Cheung and Rensvold (2002) claimed that it may be more reasonable to base invariance decisions on the difference in CFI rather than on χ^2 values.

According to their criteria, a ΔCFI with a value less than 0.01 is proposed as evidence of invariance. Therefore, this article adopted both of the two tests to estimate equivalence of five restricted models compared with the unrestricted baseline model.

Table 4 disclosed that even if comparisons of models a, b, c, and d with the configural model result in χ^2 difference tests are statistically significant, the CFI difference tests meet the criteria of invariance. As χ^2 is sensitive to sample size, it will reject even models fit reasonably well when the sample size is large (Schermelleh-Engel, Moosbrugger, & Müller, 2003). The χ^2 difference tests always present excessively stringent tests of invariance, nevertheless, SEM is only approximations of reality in practice (MacCallum, Roznowski, & Necowitz, 1992). Model e is absolute noninvariance because it is common that measure-ments of error variances are rarely constrained equally across groups (Byrne, 2009). Given these findings, it can be concluded that operations of the modified CBSEM model are equivalent but not stringently equivalent to firms with ERM and firms without ERM.

10. Testing for Effect of ERM on Risk Portfolio

Table 5 revealed the different scenarios faced by two groups of firms in China, which is distinguishable in terms of ERM engagement. Since the standard beta of all indicators in respect of financial risk (except for ATRTO) in group 1 is less than that in group 2, it is thus reasonable to assert that the relationship between individual risk and financial risk can be significantly mitigated if firms in China embraced ERM programs. However, among all indicators of operational risk, firms with ERM get higher FXATO and IVNTO. On the contrary, firms without ERM get higher TOATO, RECTO, and OPTC. It indicates that the effect of ERM on the association between individual risk and operational risk is ambiguous. The influence trend is consistent in the association between individual risk and strategic risk. It can be observed that the effects of MNTC, OPRC, and FANC on strategic risk increased for firms that have established ERM. Nevertheless, the effects of ROTA, ROIC, and NMP decreased when firms have not embraced ERM. In this context, the results cannot provide an accurate conclusion about how ERM can affect risk portfolio just based on the variance of regression weight.

The effect of ERM on the relationships between strategic risk, operational risk, and financial risk can be deemed as evidence that indicates the association between ERM and risk portfolio within organizations. It can be noted from Table 6 that there is a significant positive relationship between strategic risk and financial risk for all manufacturing firms in China. In addition, the strategic risk is less interactive with financial risk when firms in China adopt ERM. Although the association between strategic risk and

Table 4 Summary for Multigroup Equivalence

Model Description	χ^2	*df*	$\Delta\chi^2$	Δdf	*Statistical Significance*	*CFI*	ΔCFI
Configural Model: No Equality Constraints Imposed	3212.1884	290	—	—	—	0.9384	—
Model A: All Measurement Weights Constrained Equal	3355.1607	311	142.9723	21	P < 0.001	0.9360	0.0024
Model B: Model A With All Structural Weights Constrained Equal	3367.3067	314	155.1183	24	P < 0.001	0.9358	0.0026
Model C: Model B With All Structural Covariances Constrained Equal	3385.1900	320	173.0016	30	P < 0.001	0.9356	0.0028
Model D: Model C With All Structural Residuals Constrained Equal	3385.2072	321	173.0188	31	P < 0.001	0.9356	0.0028
Model E: Model D With All Measurement Residuals Constrained Equal	5943.8343	470	2731.6459	180	P < 0.001	0.8891	0.0493

Table 5 Association between Risk Indicators and Categorical Risk

		R^2	*St. Beta*	*Beta*	*St. Dev*	*T-Value*	*Sig.*
Group 1: Firms Embracing ERM							
MNTC	← Strategic Risk	0.0577	0.2401	0.6012	0.0552	4.3498	***
OPRC	← Strategic Risk	0.2413	0.4913	1.0471	0.0228	21.5731	***
FANC	← Strategic Risk	0.0281	0.1675	0.1530	0.0356	4.7112	***
ROTA	← Strategic Risk	0.4000	0.6325	1.4089	0.0215	29.3747	***
ROIC	← Strategic Risk	0.1412	0.3758	44.9862	0.0354	10.6078	***
NPM	← Strategic Risk	0.2054	0.4533	3.8691	0.1048	4.3239	***
TOATO	← Operational Risk	0.6129	0.7829	0.3524	0.0700	11.1763	***
FXATO	← Operational Risk	0.4299	0.6556	2.4549	0.0390	16.7923	***
RECTO	← Operational Risk	0.0827	0.2876	63.5425	0.1101	2.6117	**
IVNTO	← Operational Risk	0.5274	0.7262	3.1059	0.1044	6.9551	***
OPTC	← Operational Risk	0.3601	-0.6001	-76.2870	0.3285	1.8266	No Sig.
OCFRTO	← Financial Risk	0.3737	-0.6113	0.2657	0.0201	30.4658	***
ATRTO	← Financial Risk	0.5661	0.7524	1.0170	0.0115	65.3645	***
DRTO	← Financial Risk	0.5108	-0.7147	-28.3119	0.0302	23.6936	***
SRTO	← Financial Risk	0.5845	0.7645	35.6217	0.0140	54.4880	***
RRTO	← Financial Risk	0.5974	0.7729	1.3247	0.0104	74.6620	***
ERTO	← Financial Risk	0.0045	0.0669	1.2420	0.1698	0.3942	No Sig.
Group 2: Firms Not Embracing ERM							
MNTC	← Strategic Risk	0.0145	0.1204	0.3025	0.0347	3.4705	***
OPRC	← Strategic Risk	0.1488	0.3858	0.9312	0.0229	16.8339	***
FANC	← Strategic Risk	0.0071	0.0843	0.0709	0.0184	4.5892	***
ROTA	← Strategic Risk	0.5085	0.7131	1.9082	0.0124	57.7370	***
ROIC	← Strategic Risk	0.1716	0.4142	53.2177	0.0162	25.5543	***
NPM	← Strategic Risk	0.3119	0.5585	2.7609	0.0262	21.3174	***
TOATO	← Operational Risk	0.7284	0.8534	0.3466	0.0113	75.4911	***
FXATO	← Operational Risk	0.3883	0.6231	2.9112	0.0144	43.2127	***
RECTO	← Operational Risk	0.3076	0.5546	18.9104	0.0200	27.7501	***
IVNTO	← Operational Risk	0.4741	0.6885	1.9334	0.0115	60.0752	***
OPTC	← Operational Risk	0.4800	-0.6928	-92.6673	0.0111	62.3147	***
OCFRTO	← Financial Risk	0.3815	0.6177	0.2231	0.0192	32.1887	***
ATRTO	← Financial Risk	0.5327	0.7299	0.7438	0.0105	69.7136	***
DRTO	← Financial Risk	0.6357	-0.7973	-27.7278	0.0102	77.8326	***
SRTO	← Financial Risk	0.6166	0.7852	25.9449	0.0127	61.7032	***
RRTO	← Financial Risk	0.6184	0.7864	1.0400	0.0087	90.2216	***
ERTO	← Financial Risk	0.2638	-0.5136	-3.8268	0.0427	12.0232	***

Table 6 The Relationships among Categorical Risk in Risk Structure

		Correlation	*St. Dev*	*T-Value*	*Sig.*
Group 1: Firms Embracing ERM					
Strategic Risk	↔ Operational Risk	-0.1880	0.0287	6.5613	***
Operational Risk	↔ Financial Risk	0.0265	0.0271	0.6095	No Sig.
Financial Risk	↔ Strategic Risk	0.3625	0.0354	10.2525	***
Group 2: Firms Not Embracing ERM					
Strategic Risk	↔ Operational Risk	-0.2884	0.0397	2.2241	*
Operational Risk	↔ Financial Risk	-0.0159	0.0175	0.9053	No Sig.
Financial Risk	↔ Strategic Risk	0.4099	0.0217	18.8537	***

operational risk is negative, however, its absolute value for firms with ERM is less than that for firms without ERM. In addition, the negative interactions between strategic risk and operational risk turned to be more significant if ERM is established within origination. Since interactions between strategic risk, operational risk, and financial risk are underlying risks within organizations, thus, the buffered relationships among categorical risks can be served as a sign of good performance of ERM on risk portfolio.

11. Testing for Effect of ERM on Risk Structure

The association between categorical risk and firm performance briefly explores the risk structure within organizations for firms in China. It can be noted from Table 7 that the strategic risk and operational risk contribute to most of risk exposures to the whole risk portfolio for Chinese manufacturers no matter whether ERM is adopted or not. Compared to strategic and operational risks, the effect of financial risk on firm performance is slightly weak. The results also revealed that though the relationship between financial risk and firm performance increased a little bit, however, strategic risk and operational risk became less associated with firm performance if ERM was established within originations.

For the purpose of compressively investigating the risk distribution in risk structure, the article attempted to explore the weight of effects of categorical risks on firm performance in China. The measurement of risk distribution is then formulated as Equation 1. It can be observed from Table 7 that the squared multiple correlations (R^2) for firms with ERM and firms without ERM are separately estimated as 0.5689 and 0.6254. It is reasonable to assert

Table 7 Association between Categorical Risk and Firm Performance

	R^2	*St. Beta*	*Beta*	*St. Dev*	*T-Value*	*Sig.*
Group 1: Firms Embracing ERM						
Firm Performance ← Strategic Risk	0.5689	0.5134	0.3403	0.0409	7.6617	***
Firm Performance ← Operational Risk	0.5689	0.5712	0.6735	0.0656	5.6564	***
Firm Performance ← Financial Risk	0.5689	0.3639	0.7490	0.0261	6.2675	***
Group 2: Firms Not Embracing ERM						
Firm Performance ← Strategic Risk	0.6254	0.5689	0.4024	0.0191	19.3576	***
Firm Performance ← Operational Risk	0.6254	0.6469	0.7319	0.0154	29.0102	***
Firm Performance ← Financial Risk	0.6254	0.3058	0.5394	0.0162	6.5447	***

that the risk portfolio which consists of strategic risk, operational risk, and financial risk can interpret 56.89 per cent and 62.54 per cent variance of firm performance for firms that adopt ERM and those that do not adopt ERM.

$$Distribution_{\,i} = \left[Categorical\ Risk_{\,i} \div \sum (St.Beta_{\,i})\right] \times R^2{}_{i} \times 100\% \quad (1)$$

According to the computation in Equation 1, it revealed that all risk exposures in the risk structure for firms with ERM programs is roughly classified as 20.16 per cent of strategic risk, 22.43 per cent of operational risk, and 14.29 per cent of financial risk. While the risk structure for firms without ERM programs is composed of 23.38 per cent of strategic risk, 26.59 per cent of operational risk, and 12.57 per cent of financial risk in an approximate manner. Therefore, it implies that establishing ERM can help to buffer the effects of strategic and operational risks while strengthening the effect of financial risk on the whole risk structure. This result is also supported by the variation trends of the regression weights of categorical risks when manufacturing firms in China engaged in ERM programs.

12. Testing for Effect of ERM on Firm Performance

In the CBSEM model, the percentage variance of firm performance is explained by categorical risk for all firms, which can directly be reflected as the variance of each performance indicator. It can be noted from Table 8 that the R^2 of ROA for all Chinese manufacturers exceeds 0.4. Therefore, it is reasonable to assert that return on asset is the strongest predictor of firm performance in the manufacturing industry in China. In addition, CHANGE is another significant indicator in this article because 1 unit change of standard deviation in risk portfolio will result in 0.56 and 0.53 unit change of standard deviation in firm value respectively. According to the judgment

Table 8 The Association between Performance Indicators and Firm Performance

		R^2	*St. Beta*	*Beta*	*St. Dev*	*T-Value*	*Sig.*
Group 1: Firms Embracing ERM							
SIZE	← Firm performance	0.1261	0.3552	0.3092	0.0260	13.6801	***
GROWTH	← Firm performance	0.1400	0.3742	83.6026	0.0908	4.1216	***
POSITION	← Firm performance	0.2471	0.4971	0.5247	0.0225	22.1401	***
ROA	← Firm performance	0.4281	0.6543	2.7621	0.0230	28.4800	***
CHANGE	← Firm performance	0.3177	0.5636	36.5834	0.0253	22.2487	***
VOLATILITY	← Firm performance	0.0974	0.2921	4.3282	0.0220	14.1808	***
WACC	← Firm performance	0.0773	0.2780	4.7437	0.0776	3.5834	***
TOBINQ	← Firm performance	0.1503	0.3877	0.3407	0.0258	15.0075	***
Group 2: Firms Not Embracing ERM							
SIZE	← Firm performance	0.1951	0.4417	0.2999	0.0170	26.0095	***
GROWTH	← Firm performance	0.2040	0.4516	10.9239	0.0314	14.3653	***
POSITION	← Firm performance	0.2500	0.5000	0.7683	0.0169	29.6159	***
ROA	← Firm performance	0.4302	0.6559	2.4939	0.0144	45.4541	***
CHANGE	← Firm performance	0.2760	0.5254	42.1428	0.0196	26.7460	***
VOLATILITY	← Firm performance	0.0822	0.2867	3.7627	0.0213	13.4857	***
WACC	← Firm performance	0.0759	0.2754	3.4295	0.0258	10.6950	***
TOBINQ	← Firm performance	0.1809	0.4253	0.3338	0.0249	17.1064	***

criteria, indicators with factor loading less than 0.3 should be eliminated from the measurement model (Hair et al., 1998). Therefore, VOLATILITY and WACC are not effective proxies even if they are associated with firm performance at statistically significant level. It is clear that risk portfolio has limited influence on stock price volatility and cost of capital. In this context, it can be demonstrated that all risk exposures within organizations affect firm performance in respect of firm size, sales growth, market position, profitability, change of market value, and Tobin's q.

Looking at the factor loadings of significant performance indicators in Table 8, it is clear that firms embracing ERM have lower SIZE, GROWTH, POSITION, ROA and TOBINQ relative to firms not embracing ERM. The findings revealed that the effect of risk portfolio on firm size, sales growth, market position, profitability, and market value can be mitigated through establishing ERM programs. In contrary, the factor loading of CHANGE for firms in group 1 are higher than that for firms in group 2. However, the result does not mean that ERM has a negative influence on the association between risk portfolio and firm performance in terms of firm value for manufacturing firms in China. Since the establishment of ERM for most

Chinese manufacturers is not mature, thus, the function of ERM programs in managing risks as well as earning profits is limited within organizations.

13. Conclusions

Based on the results and findings above, it is reasonable to assert that ERM is helpful in managing risk in China as it can reduce the effects of some risks to the whole portfolio. In addition, the interactions among categorical risks can also be minimized by ERM. Nevertheless, this function is limited because the establishment of ERM programs is not in a maturity stage for most Chinese organizations and that primarily causes the growing effects of some specific risks on risk portfolio. Therefore, for firms that have embraced ERM, it is better to improve the effectiveness and efficiency of risk management activities into maturity stage. However, for firms that do not embrace ERM, it is necessary to make adequate preparation for establishing ERM.

MMC claims that most Fortune 1,000 firms suffered a decline in stocks due to the failure of decisions in terms of 58 per cent strategies, 31 per cent operations, and 6 per cent finance. Compared to the risk structure of most big firms in the world, the performance change in Chinese organizations is caused by 20 per cent of strategic risk, 22 per cent of operational risk, and 14 per cent of financial risk when firms embraced ERM. However, for those firms without ERM, the firm performance is influenced by 23 per cent of strategic risk, 27 per cent of operational risk, and 13 per cent of financial risk. Differing from the MMC result, firms in China should pay more attention to strategic and operational risks while formulating tactics in response to the achievement of firm objectives. Since strategy and operations are the objectives while establishing the ERM framework, thus, firms in China should enforce ERM programs for better managing of risk exposures.

Managing risk within organizations has been demonstrated to benefit firms in China. It implies that firms with ERM will suffer less impacts of categorical risks on their firm size, growth of sales, market share, earning capacity and market value. In addition, due to the increased association between value change and risk portfolio, it is reasonable to assert that firms in China can realize growth in firm value with the help of ERM. Consequently, it can be concluded that corporate risk management can help firms to mitigate the association between business risk and firm performance in China. Since most Chinese organizations are in the nascent stage of implementing ERM, thus, the theoretical benefits of effective ERM cannot be completely achieved in the current situation. It suggests that if firms in China can improve the ERM effectiveness in a mature manner, then the effects of each risk exposure and/or risk portfolio can be further buffered.

The empirical analyses of this article provide key insights into the valuation of managing risk inside China, especially for the manufacturing industry. Nevertheless, there are several limitations that need to be addressed in future studies. Firstly, since the information about the establishment of ERM is collected from self-reported documents, thus, the reliability of the relative data may be affected by the quality of the documents, which will eventually influence the accuracy of results and analysis. Secondly, due to the restricted information at the enterprise level for firms in China, the determination of either risk indicators or performance indicators is mainly dependent on the availability of data. Therefore, it leads to the bad case scenario that some indicators in the CBSEM is not effective. In this context, further studies that adopt effective proxies of risk exposure and firm performance will better explore the theoretical benefits of ERM.

Notes

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