



Article

Development of Risk Index and Risk Governance Index: Application in Indian Public Sector Undertakings

Suneel Maheshwari ^{1,*}, Vasudha Gupta ² and Deepak Raghava Naik ³

¹ Department of Accounting and IS, Indiana University of Pennsylvania, Indiana, PA 15705, USA

² Press Information Bureau Government of India, Delhi 110001, India; vasudhaaguptaa@gmail.com

³ Department of Management Studies, Ramaiah Institute of Technology, Bangalore 560054, India; deepak@msrit.edu

* Correspondence: suneel@iup.edu

Abstract: The purpose of the paper is to develop a risk measure in the form of a risk index and a governance index as an indicator of the quality of governance structure. Using the Delphi technique, two indices are developed (risk index and corporate governance index (CGI)); subsequently, using the 10-year (2005–2015) data of top Indian Public Sector Undertakings (PSUs) and diff-GMM regression (to deal with endogeneity), indices have been validated. Though the data set may appear old, it has only been used to test the risk index and analyze the results. Empirical evidence on indices indicates that Indian PSUs have ‘moderate’ risk levels and ample scope for improvement in their governance structure. Further, a positive relation between governance index and returns and negative relation between risk index and returns lend credence to the indices developed in the study. Notably, the governance index appears to be a moderating variable in the relationship between risk and return. It is perhaps the first study to put forth a comprehensive measure of risk to measure risk levels of PSUs and prescribe a measure of the quality of governance structure. While constructing the CGI, certain non-compliances were observed, even in terms of mandatory requirements, such as the proportion of PSUs may take independent directors. The new datasets may further check for compliance and its effect on the results. Such infringements call for stringent penal provisions and better monitoring of PSUs. Further, if the normative frameworks are adhered to as per the study by the Securities and Exchange Board of India (SEBI) and Ministry of Corporate Affairs (MCA), more effective and efficient decisions with lower risks, and hassle-free management resulting in better return on assets and return on equity.

Keywords: public sector undertaking (PSU); state owned enterprise (SOE); risk; governance; risk governance; performance measurement; performance management; diff-GMM



Citation: Maheshwari, Suneel, Vasudha Gupta, and Deepak Raghava Naik. 2022. Development of Risk Index and Risk Governance Index: Application in Indian Public Sector Undertakings. *Journal of Risk and Financial Management* 15: 225. <https://doi.org/10.3390/jrfm15050225>

Academic Editor: Abderrahim Taamouti

Received: 18 November 2021

Accepted: 11 May 2022

Published: 20 May 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Public sector undertakings (PSUs) are not mere profit-maximizing economic units but a thread that seamlessly ties together the social fabric, forms the cornerstone of economic development, and facilitates self-reliance (Pollitt 2017). Consequently, the performance measurement and management of PSUs assume paramount importance. However, ambiguous objectives (Pollanen 2005), lack of robust governance structures (Almqvist et al. 2013; Hughes 2017), and ineffective control systems in PSUs (Burkert et al. 2011) have been causes of concern for researchers and practitioners alike. These chronic causes called for ‘new’ public management practices (Hood 1991).

New public management (NPM) started to gain currency in Asian markets in the aftermath of the 1997 Asian financial crisis. Widespread reforms in terms of privatization, ‘agencification’, decentralization, and performance management were observed across Asian countries, such as Indonesia, Japan, Malaysia, China, etc. (Koike 2013).

Though, owing to the limitations of NPM, particularly those related to the effectiveness of governance ([Christensen and Laegreid 2007](#)), post-NPM reforms came into being. Post-NPM reforms improved governance repertoire by providing governance frameworks to govern inter-organizational actions more effectively ([Christensen 2012](#)). It also led to the emergence of 'New Public Governance' (NPG) ([Almqvist et al. 2013](#)). Core of these

([Van Thiel 2015](#)). These boards assume greater importance as they are one of the instruments that principals can use to monitor the agent's performance ([Beasley et al. 2006](#)). In addition, the view based on stewardship theory highlights the role of the board as a partner to help improve the organization's performance ([Davis et al. 1997](#)). Further, in the democracy perspective, the board represents society and the general interest. Another model based on stakeholder theory assumes that board members represent specific interests. In the most

evolving (Kennerley and Neely 2002; Johnson 2005), 'devising good indicators of quality is still hard' (Zineldin 2006). Initially, financial indicators were more prevalent, but gradually other indicators (e.g., quality) were introduced. This has led to a proliferation of indicators (Modell 2004; Carlin et al. 2004) but not always an improvement in the quality of the indicators themselves (Lemieux-Charles et al. 2003). As a result, there are four types of indicators: output based, welfare based, performance based and composite indicators that combine all three (Stevens and Zimmerman 2006). Further, Macpherson (2001) states that the most useful numbers are those pertaining to planning, prediction, and budget.

Several authors have proposed various frameworks to assess organization's activity, few being performance prism (Neely and Adams 2001) or the Balanced Scorecard (Kaplan and Norton 1996). Rouse and Putterill (2003) provide a critique of these frameworks and outlines an alternative framework consisting of multi-dimensional views and evaluation frameworks to reflect the variety of stakeholders. However, there is no single framework that suits all organizations (Pun and White 2005). Further, choosing an inappropriate measure may lead to goal-incongruence and exploitation of organizational resources (Alexius et al. 2014).

It is in this context that Rangan (2004) and Kaplan (2001) advocate that goal clarity and measurability of results are of foremost importance to preventing the diffusion of organizational energy. Effective programs and their efficient implementation could be achieved by focusing on controls, i.e., focusing on either output controls, action controls, or clan controls or a mix of these. Output-based controls or performance measurement have been a subject of great debate, resulting in a shift towards outcome-based measures

board or governance for performance management in PSUs remain an under-researched area. It is in this background that few Asian countries have now begun the 'institutionalization' of performance management, yet most governments attempt to apply 'result-based management' (Koike 2013).

The problems associated with performance management are more profound in developing economies, such as India, due to lethargic bureaucracy, patrimonial culture (Koike 2013), red-tapism, and nepotism. Therefore, several researchers have attempted to examine the performance of Indian PSUs, particularly Central PSUs. Singh and Chittedi (2011) observed a significant improvement in the performance of PSUs in the post-liberalization era. Similarly, Gupta et al. (2011a) noted a significant improvement in the performance of PSUs that entered a Memorandum of Understanding with the government. In contrast, disinvestment did not lead to desired outcomes (Gupta et al. 2011b). Interestingly, Ramamurti (1987) documents that most Indian PSUs consider commercial profitability as the measure of their success. He observed that the profit motive in India was stronger than in countries with mixed enterprises or which are more right-winged.

Müller (2000) suggests that the under-performance of PSUs may be attributed, to a marked extent, to the entailing complex governance structure. The complications are intensified with the interference of the government (Simpson 2014). For instance, the top three Indian PSUs accounted for 74.35% of the total loss of all PSUs in 2011–2012. These companies have been incurring losses consecutively since 2009. A survey by Gupta et al. (2011a) leads to a recommendation that directors of PSUs should not involve themselves in the day-to-day functioning of the organization.

In contrast, China has come a long way, considering its experience with privatization. China's 'open policy' of the 1980s to improve the efficiency of state-owned enterprises was based on the twin pillars of privatization and consolidation. Privatization led to productivity gains of over 170 per cent in Chinese firms (Huang et al. 2020). Apart from this, it is also argued that, apart from privatisation, focus on building core competencies of the Chinese state-owned enterprises also played an effective role (Barney 1991, 1995; Cheng and Bennett 2006).

Despite several studies attempting to measure performance measurement, there is no conclusive evidence on the effects of performance measurement (De Bruijn 2002). On the one hand, it brings transparency (Osborne and Gaebler 1992) and helps in shaping accountability (De Bruijn 2001); on the other hand, it prompts game-playing (De Bruijn 2003) and blocks innovation (Smith 1993). To overcome these issues, De Bruijn (2003) suggests an outcome-based measure of performance instead of an output-based measure and has defined the rules of the game.

Therefore, in view of the above and the state of Indian PSUs, it seems imperative that a framework/model is developed that leads to better utilization of resources of PSUs, resulting in improved firm performance (Maheshwari and Ahlstrom 2004).

indicators of various risks. Following this stream of thought and taking inspiration from the work of Tamari (1966), development of a risk index (more appropriately, an 'exposure index') has been attempted in this study. This may also be viewed as normative 'tolerance limits' for various risks.

In the construction of the risk index, the initial step would be to identify the risks that affect a PSU. Logically, the 'one size fits all' analogy of considering all the possible risks would not be appropriate since every company is unique in terms of features such as organizational features, culture features, risk appetite, tolerance, and management practices. Therefore, based on literature and expert opinion, only those risks have been focused upon, which are believed to be pervasive and material. Committee of Sponsoring Organization of Treadway Commission (COSO) also propagates management by exception. In operational terms, the focus should be on the most important risks only. Accordingly, the following risks were identified for the study: accounting risk, attrition risk, competition risk, credit risk, customer satisfaction, interest rate risk, liquidity risk, market risk, operational risk, risk of overdependence on a product or division, risk related to innovation, solvency risk, and taxation risk. Due to unavailability of accurate and reliable data on some of the risks, only the following eight risks could be considered for the construction of the index: market risk, accounting risk, competition risk, contingency risk, credit risk, liquidity risk, operating risk, and solvency risk. Muzzyaccount-1vailabilitr sAaSU. Logically Lfu0.

Table 1. Risks and their corresponding scales used in the construction of the risk index.

Market Risk (Col. 1)	Accounting Risk (Col. 2)	Competition Risk (Col. 3)	Contingency Risk (Col. 4)	Credit Risk (Col. 5)	Liquidity Risk 1 (Col. 6)	Liquidity Risk 2 (Col. 7)	Operating Risk (Col. 8)	Solvency Risk 1 (Col. 9)	Solvency Risk 2 (Col. 10)	(Col. 11)
Beta ()	Auditor's Opinion	Growth/Decline in Market Share	Inverse of Contingency Coverage Ratio (ICCR)	Credit Risk (CR)	Inverse of Acid-Test Ratio (IATR)	Modified Defensive Interval Ration (MDI) (in Days)	Degree of Operating Leverage (DOL)	Total Debt to Equity Shareholders' Funds (TD/E)	Inverse of Interest Coverage Ratio (IICR)	Assigned scores
0 < 0.95	Unqualified	Growth	0 < ICCR 0.1	0 < CR 0.3		180 < MDI	DOL 0	TD/E 0.33		1
					0.667 < IATR 0.8				IICR < 0.33	1.25
0.95 < 1.05	Emphasis of matter	0% < Decline 20%	0.1 < ICCR 0.25	0.3 < CR 0.55		90 < MDI 180	0 < DOL 1.5	0.33 < TD/E 0.5		2
					IATR < 0.4				0.33 < IICR < 0.5	2.5
1.05 < 2	Qualified	20% < Decline 35%	0.25 < ICCR 0.5	0.55 < CR 0.75		30 < MDI 90	1.5 < DOL 3	0.5 < TD/E 0.6		3
					0.4 < IATR 0.667 OR 0.8 < IATR 1				0.5 < IICR 1	3.75
2 < 4	Adverse	35% < Decline 50%	0.5 < ICCR 1	0.75 < CR 0.95		15 < MDI 30	3 < DOL 5	0.6 < TD/E 0.75		4
4 <	Disclaimer	50% < Decline	1 < ICCR	0.95 < CR	1 < IATR	0 < MDI 15	5 < DOL	0.75 < TD/E	1 < IICR	5

3.2. Development of a Corporate Governance Index

Corporate governance may be defined as the system by which companies are directed and controlled (

4. Data and Methodology

Table 3. Description of Variables and their measurement.

Variable	Definition	Measurement
ROA	Return on assets	Net profit after tax+ Interest/Average total assets
ROE	Return on equity	Net profit after tax Preference dividend Dividend distribution tax/Equity shareholders' funds
RI	Risk index	As developed in Table 1
CGI	Corporate governance index	As developed in Table 2a,b
AGE	Age	Number of years since the inception of company
SIZE	Size	Natural log of net total assets of company
GROWTH	Growth	CAGR of sales on year on year basis
Recession dummy		

Table 5. Results of (Arellano-Bond) GMM estimation of ROA and ROE on risk index and CGI.

Variables		ROA	ROE
ROA (1)		0.4471 ***	
		(0.0324)	
ROE (1)			0.4694 ***
			(0.1987)
CGI		0.0047 *	0.0013 *
		(0.0001)	(0.0003)
Risk index		0.0428 ***	0.0941 ***
		(0.0145)	(0.02317)
Age		0.0061	0.0022 **
		(0.0009)	(0.0009)
Growth		0.0059 **	0.0001
		(0.0005)	(0.0021)
Size		0.0261 ***	0.0317 ***
		(0.0007)	(0.0019)
Recession dummy		0.0068 ***	0.0124 ***
		(0.0031)	(0.0058)
Constant		0.3507 ***	0.4242 ***
Number of observations		216	205
Number of instruments		37	36
		Statistic	
Wald Test	$\chi^2(7)$	8354.54 ***	4610.80 ***
Sargan test	$\chi^2(35)$	30.82417	28.71551
Autocorrelation	First order	2.2102 **	2.4392 **
	Second order	1.3721	0.06342

Note: ***, **, * denotes significance at 1% level, 5% level, and 10% level, respectively.

The results also indicate that there is a negative association between risk index and returns. In other words, those PSUs which have lower risk in terms of the normative framework (developed in the paper) can generate higher returns. A recession dummy is negatively related to ROA and ROE at 1% significance level, indicating returns are negatively impacted during a recession. The null of the Wald test was rejected in all estimated models, so all coefficients are different from zero. These results not only validate the framework used to develop the risk index but also provide a yardstick for PSUs to benchmark their risk-taking if they want to maximize their ROA and ROE.

6. Additional Analysis and Tests of Robustness

The results above primarily indicate the effect of CGI when RI is zero and vice-versa. However, such a model seems unrealistic as both the forces, quality of governance structure, and risk levels are operational at any given point in time. Therefore, it seems reasonable to examine the effects of possible interaction between the two variables. A preliminary graphical investigation of CGI and RI with respect to returns revealed distinctly non-

Figure 1. Panel plot of Risk Index and Age of the companies across various sectors with CGI as the size parameter over time.

Table 6. Additional analysis and tests of robustness.

	(1)	(2)	(3)	(4)
Variables	ROA	ROE	Std deviation	Ave Return
ROA (t - 1)	0.3208 *** (0.0208)			
ROE (t - 1)		0.1257 *** (0.0101)		
Std deviation (t - 1)			0.5288 *** (0.0187)	
Ave return (t - 1)				0.4195 *** (0.0049)
RI	0.4504 *** (0.0998)	0.0064 * (0.0007)	0.0275 * (0.0424)	0.1363 *** (0.0211)
CGI	0.3453 *** (0.0708)	0.0608 * (0.0021)	0.0606 *** (0.9644)	0.0978 *** (0.0174)
RI*CGI	0.7345 *** (0.1652)	0.1133 * (0.0347)	0.1354 *** (0.0611)	0.2125 *** (0.0309)
Age	0.0001 (0.0008)	0.0177 *** (0.0022)	0.0018 (0.0004)	0.0009 *** (0.0001)
Size	0.0457 ** (0.0058)	0.0369 *** (0.0080)	0.0118 *** (0.0024)	0.0006 *** (0.0011)
Growth	0.0037 ***	0.0016	0.0155 ***	0.0039

Table 6. Cont.

	(1)	(2)	(3)	(4)
Variables	ROA	ROE	Std deviation	Ave Return
	(0.0017)	(0.0049)	(0.0021)	(0.0003)
Pre-recession	0.0037 ***	0.0106 ***	0.0072 ***	0.0059 **
	(0.0010)	(0.0021)	(0.0018)	(0.0007)
Constant	0.7255 ***	0.5090 ***	0.2288 ***	0.0253 *
	(0.0446)	(0.1426)	(0.0276)	(0.0068)
Number of observations	222	222	221	221
Number of instruments 42	44	44	44	44
	<i>p</i> -value	<i>p</i> -value		<i>p</i> -value
Wald test $\chi^2(8)$	12,227.1	12,169.1	39,298.7	94,116.05
Sargan test $\chi^2(35)$	30.387	28.65	33.0054	30.4958
Autocorrelation				
First order	1.9569 *	1.2816 *	2.9059 **	2.6667 ***
Second order	1.2236	0.7456	0.5338	2.4016

Note: ***, **, * denotes significance at 1% level, 5% level, and 10% level, respectively.

This paper thus provides evidence that the companies that do well in terms of the risk index and governance index developed in the paper are able to demonstrate better performance. Such benchmarks/models/frameworks may be prescribed for PSUs to ensure effective and efficient work on their part. Though the frameworks seem to be practical, caution needs to be taken while implementing them.

8. Concluding Observations

PSUs are the catalyst in the socio-economic development of emerging economies, such as India. Yet, the mere incorporation of PSUs is not a guarantee for social and economic returns. This paper shows that maintaining a high-quality governance structure in the face of high risk is the key to generating higher returns. The governance- and risk-related dimensions dealt with in the paper are, in fact, complementary to the perspective set out by new public management. In this light, the paper is perhaps the first of its kind in general and in the context of a prominent emerging economy (India) that provides and validates a risk index and governance index. While constructing the CGI, certain non-compliances were observed, even in terms of mandatory requirements, such as the proportion of independent directors. Such infringements call for stringent penal provisions and better monitoring of PSUs. Further, if the normative frameworks are adhered to as per the study by the Securities and Exchange Board of India (SEBI) and Ministry of Corporate Affairs (MCA), PSUs may take more effective and efficient decisions with lower risks, and hassle-free management resulting in better return on assets and return on equity.

Finally, we would like to mention the primarily empirical limitations of this research. Risks, such as risks related to innovation and technological changes, could not be considered due to the unavailability of data. Though the data set may appear old, it has only been used to test the risk index and analyze the results. Further, being exploratory in nature, the indices have scope for improvement. The new datasets may further check for compliance and its effect on the results. We strongly believe that cross-country analysis based on these indices may help evolve these frameworks and would make a tangible contribution to the paradigm of new public management.

Author Contributions: Conceptualization, V.G. and S.M.; Methodology, S.M.; Writing—Original Draft, S.M. and V.G.; Data Curation, V.G.; Formal Analysis, V.G.; Writing—Review and Editing, S.M. and D.R.N.; Project Administration, S.M.; Software, D.R.N.; Validation, D.R.N. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding The APC was paid by Suneel Maheshwari on

- Cornforth, Chris. 2011. Limitations of the focus on boards and suggestions for new directions. *Nonprofit and Voluntary Sector Quarterly* 41: 1116–35. [CrossRef]
- Davies Report. 2011. Women on Boards. Department for Business, Innovation & Skills. Government of UK. Available online: <https://www.gov.uk/government/news/women-on-boards> (accessed on 12 July 2021).
- Davis, James H., F. David Schoorman, and Lex Donaldson. 1997. Toward a stewardship theory of Management. *Academy of Management Review* 22: 20–47. [CrossRef]
- De Bruijn, Hans. 2001. *Managing Performance in the Public Sector*. Routledge: London.
- De Bruijn, Hans. 2002. Performance measurement in the public sector: Strategies to cope with the risks of performance measurement. *International Journal of Public Sector Management* 15: 578–94. [CrossRef]
- De Bruijn, Hans. 2003. Output steering in public organizations: About the use of a product approach and a process approach. *Managerial Auditing Journal* 18: 303–12. [CrossRef]
- Egeberg, Morten, and Jarle Trondal. 2009. National agencies in the European administrative space: Government driven, commission driven, or networked? *Public Administration* 87: 779–90. [CrossRef]
- Frost, Jetta, and Michèle Morner. 2011. Governing collective action: Revisiting the theory of the firm. Paper presented at 2nd Conference Humanizing the Firm and the Management Profession, Barcelona, Spain, June 27–28.
- Fryer, Karen, Jiju Antony, and Susan Ogden. 2009. Performance management in the public sector. *International Journal of Public Sector Management* 22: 478–98. [CrossRef]
- García, Félix Madrid. 2014. Developments and challenges in public sector accounting. *Journal of Public Budgeting, Accounting & Financial Management* 26: 345–66.
- Goddard, Andrew. 2005. Reform as regulation—Accounting, governance and accountability in UK local government. *Journal of Accounting and Organizational Change* 1: 27–44. [CrossRef]
- Grandori, A. 1997. Governance structures, coordination mechanisms and cognitive models. *Journal of Management & Governance* 1: 29–47.
- Grandori, Anna. 2001. *Organization and Economic Behavior*. London: Routledge.
- Gupta, S., P. K. Jain, and S. S. Yadav. 2014. *Public Sector Enterprises in India*. New Delhi: Springer India.
- Gupta, Seema, P. K. Jain, and Surendra S. Yadav. 2011a. Impact of MoU on financial performance of public sector enterprises in India. *Journal of Advances in Management Research* 8: 263–84. [CrossRef]
- Gupta, Seema, P. K. Jain, Surendra S. Yadav, and V. K. Gupta. 2011b. Financial performance of disinvested central state-owned enterprises in India: An empirical study on select dimensions. *Journal of Applied Finance and Banking* 1: 57–67.
- Guthrie, James, and Linda English. 1997. Performance information and programme evaluation in the Australian public sector. *International Journal of Public Sector Management* 10: 154–64. [CrossRef]
- Higgs, Derek. 2003. *Review of the Role and Effectiveness of Non-Executive Directors*. Report of the Department of Trade and Industry. London: Department of Trade and Industry. Available online: www.dti.gov.uk/cdn/non_exe_review (accessed on 26 July 2021).

- Khumawala, Saleha B. 1997. Public sector accounting in India: A historical review and an analysis since independence to the economic reforms of the nineties. *Journal of Public Budgeting, Accounting & Financial Management* 9: 305–30.
- Koike, Osamu. 2013. Institutionalizing performance management in Asia: Looking East or West? *International Journal of Public Sector Management* 26: 347–60. [[CrossRef](#)]
- KPMG. 2012. State Owned Enterprises: Unlocking Their Potential. Available online: <https://www.kpmg.com/in/en/industry/publications/aima-PSU.pdf> (accessed on 14 August 2021).
- Lemieux-Charles, Louise, Wendy McGuire, Francois Champagne, Jan Barnsley, Donald Cole, and Claude Sicotte. 2003. The use of multilevel performance indicators in managing performance in health care organizations. *Management Decision* 41: 760–70. [[CrossRef](#)]
- Levin, Andrew, Chien Fu Lin, and Chia Shang James Chu. 2002. Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. *Journal of Econometrics* 108: 1–24. [[CrossRef](#)]
- Ling, Tom. 2002. Delivering joined-up government in the UK: Dimensions, issues and problems. *Public Administration* 80: 615–42. [[CrossRef](#)]
- Macpherson, Malcolm. 2001. Performance measurement in not-for-profit and public-sector organisations. *Measuring Business Excellence* 5: 13–17. [[CrossRef](#)]
- Maheshwari, Sunil Kumar, and David Ahlstrom. 2004. Turning around a state owned enterprise: The case of scooters India Limited. *Asia Pacific Journal of Management* 21: 75–101. [[CrossRef](#)]
- Mansi, Mansi, Rakesh Pandey, and Ehtasham Ghauri. 2017. CSR focus in the mission 0(and)-24 t0emn 0637 0.4582d 0.. 1.006 0 0 1 tP0.0d0p591dc

Singh, Shveta, P. K. Jain, and Surendra Singh Yadav. 2016. *Equity Markets in India: Returns, Risk and Price Multiples*