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A non-parametric index of corporate governance in the banking industry: An application to Indian data

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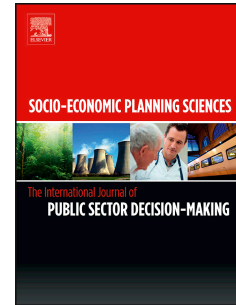
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A non-parametric index of corporate governance in the banking industry: An application to Indian data

Abstract

This paper presents a methodological framework for constructing a non-parametric index of corporate governance for banks. The index is constructed by aggregating six distinct dimensional indices capturing different dimensions of corporate governance, namely board effectiveness, audit function, risk management, remuneration, shareholder rights and information, and disclosure and transparency. For aggregation, a tailored version of data envelopment analysis (DEA) approach which is popularly known as constrained 'Benefit-of-the-Doubt (BoD)' model is employed. This approach is unique and distinctive in the sense that it requires no *a priori* knowledge of weights, and assigns endogenous weights obtained from actual data to individual dimensions of bank governance in order to construct a composite index of corporate governance. This methodological framework has illustrated by applying it for a data set of 40 Indian banks operating in the year 2017. The data set has been compiled using 58 governance regulations as defined by relevant jurisdictions.

Keywords: Corporate governance index; Data envelopment analysis; Benefit-of-the-doubt model; Indian Banks; Composite indicators

JEL codes: G21, G30, G38

1. Introduction

In recent years, especially after the global financial crisis of 2007-09, the issue of corporate governance of banks has attracted serious attention of policy makers and regulators across nations. It is argued that banks are ailing due to multiple agency distortions relating to both equity governance and debt governance (Heremans 2007). There is no doubt that any laxity of banks in adhering to governance regulatory norms affects their ability to withstand the shocks in the system and jeopardizes their growth momentum. In this context, an index of corporate governance for banks provides an indispensable tool, which is beneficial for all stakeholders. Such an index indicates how well banks are adhering to governance practices that are framed by relevant jurisdictions. A composite index of corporate governance compresses the range of governance indicators, which are defined in distinct dimensions of corporate governance such as board effectiveness, audit function, and others, into a single numerical score that could be easier for interpretation, and is a useful tool for benchmarking banks and enabling effective policy analysis. In addition, the changes in the corporate governance index facilitate regulators to judge how governance reforms are working (Sarkar et al. 2012).

Thereby, the focus of this paper is to illustrate how data envelopment analysis (DEA) based benefit-of-the-doubt (BoD) model can be employed to derive a composite index of corporate governance for banks using a wide array of qualitative and quantitative regulatory norms to be adhered by the banks. In particular, we show how the dimensional indices capturing different dimensions of corporate governance of banks can be combined using the idiosyncratic and endogenous weights generated from the BoD model to construct a composite index of corporate governance. The dimensions that are considered in this study to construct a composite index of corporate governance for banks pertain to i) board effectiveness, ii) audit function, iii) risk management, iv) remuneration, v) shareholder rights and information, and vi) disclosure and transparency. An illustration is also provided to show the construction of corporate governance index for 40 Indian banks using data related to 58 governance norms that banks have to adhere to under relevant regulatory jurisdictions.

Note here that there exists an implicit institutional framework for governance of banks in India, which comprises the guidelines by the Ministry of Corporate Affairs under Companies Act, 1956 (recently amended in 2013), the Reserve Bank of India (India's central bank), and the Securities and Exchange Board of India (SEBI) under Clause 49 [Listing

Obligations and Disclosure Requirements] Regulations, 2000 (recently amended in 2015). However, the formal attempt to reinforce corporate governance codes in the banking industry in India was initiated by the Reserve Bank of India with the constitution of Standing Committee on International Financial Standards and Codes: Advisory Group on Corporate Governance in 2000 (Chairman: R.H. Patil). The Committee recommended the Organization for Economic Co-Operation & Development (OECD) principles of corporate governance as a yardstick for Indian banks. Later, the Consultative Group of Director for Financial Supervision (Chairman: A.S. Ganguly) in 2002, and more recently the Committee to Review Governance of Boards of Banks in India in 2014 (Chairman: P.J. Nayak) reviewed governance norms for banks in India. The expert committee under the chairmanship of P.J. Nayak recommended banks to comply with Clause 49 stated by the SEBI regulations, which is applicable for all the companies listed on the Bombay Stock Exchange (BSE) and National Stock Exchange (NSE). To avoid the conflict of interest with their respective statutes by the government, the banking companies remain protected and exempted on a set of governance norms by the listing agency. In India, banks follow a one-tier board structure known as 'Anglo-American model', where the board consists of both executive and non-executive directors. The executive directors perform a managerial role together with their accountability as members of the board of directors. In principle, there is a fair separation of ownership and management in India.

The key contribution of this research endeavour is that this is the first study to the best of authors' knowledge, which proposes the use of DEA based BoD approach to construct a corporate governance index for banking firms. Before this study, there has been no attempt to obtain a robust measure of corporate governance index by using data-driven endogenous weighting system based on non-parametric linear programming methodology. The empirical research on the subject of construction of corporate governance index for banking industry is limited and is at an embryonic stage. Thus, this study contributes to scant literature on this subject. It is noteworthy here that earlier efforts on corporate governance index in banking used traditional approaches such as simple linear unweighted average method (see, for example, Love and Rachinsky 2015) or principal component analysis (PCA) (see, for instance, Song and Li 2012; Ellul and Yerramilli 2013; Tarchouna et al. 2017; Andries et al. 2018). The major limitation of unweighted method is that it relaxes the assumption of non-compensability or non-substitutability of indicators. However, the use of PCA approach is inappropriate when sample size is not large, and the variation of a variable is very small (OECD 2008; Greco et al. 2018).

In the literature on construction of composite indicators, the BoD approach has emerged as a most relevant and successful approach due to its desirable properties and advantages. A few notable advantages of BoD approach are: i) it allows the actual data to decide on the weights (OECD 2008), ii) it assigns a single numerical score to a range of dimensions (Rogge and Puyenbroeck 2007; Puyenbroeck 2018), iii) it is appropriate for small samples, iv) it is independent of *a priori* statistical assumptions and appropriate to aggregate the unit invariant data, and v) it allows endogenously calculated differential weighting and aggregation of dimensions simultaneously (Zhou et al. 2007; Greco et al. 2018).

Owing to these aforementioned properties and advantages, the BoD has been applied for construction of composite indices in diverse fields. For example, Despotis (2005) used it for building a Human Development Index and Cherchye et al. (2008) constructed a Robust Human Development Index; Murias et al. (2006) crafted an Economic Wellbeing Index; Zhou et al. (2007) computed a Sustainable Energy Index; Hermans et al. (2008) obtained a Road-safety Index; Antonio and Martin (2012) built a Child Health Index; Badasyan et al. (2011) worked out a Broadband Achievement Index; Giambona and Vassallo (2013) developed a Financial Development Index; Gaaloul and Khalfallah (2014) devised a Digital

Access Index; Martin et al. (2017) constructed a Travel-tourism Competitiveness Index. Since as noted above, we are not aware of any literature wherein the BoD approach has been applied for the construction of corporate governance index for individual banks, this study contributes to this knowledge. In particular, the present study proposes the use of BoD as a robust approach for constructing an index of corporate governance for banking firms and shows how dimensional indices can be aggregated using the data-driven weights. We believe that researchers, policy makers and regulators would find our non-parametrically generated corporate governance index to be a handy tool for examining the differences in the levels of governance compliance across banks.

The paper is structured as follows. Section 2 presents the relevant literature review. Section 3 elaborates the DEA based constrained BoD model used in this study. Section 4 focuses on the different dimensions of corporate governance and their aggregation for index construction. The final section concludes the paper.

2. Corporate governance in banking: a relevant literature review

Importance of good governance in non-banking firms has long been advocated by the researchers (see, for example, Shleifer and Vishny 1997; Klapper and Love 2004). However, the role of governance in banking firms has received significant attention only in recent years, especially the aftermath of the global financial crisis of 2007-09. Although the vast literature exists on discussing the qualitative aspects of corporate governance in banking (Caprio and Levine 2002; Adams and Mehran 2003; Adams 2011; Mehran et al. 2011; De Haan and Vlahu 2016), yet the empirical works on the quantification of corporate governance for banking firms are very limited (see Bozec and Bozec 2012 for a detailed review). It is argued that better corporate governance practices by banks could be able to restrain the multiple agency conflicts that may arise among stakeholders, that is either between shareholders and managers, and/or between controlling and minority shareholders, and/or between shareholders and creditors (Mülbert 2010). The literature also points out that the governance in banking firms differ from that in non-banking firms, mainly due to their opaque nature, asymmetry in information and moral hazard concerns (Becht et al. 2011). Therefore, the recent studies have shifted the focus on quantification through the construction of an aggregate index of corporate governance for banks distinctly. Table 1 reports empirical studies that made an attempt to construct corporate governance indices for banking firms.

We note that the previous literature reflects two key issues that are inherent in the construction of the composite index for corporate governance for banking firms. These issues pertain to: (i) the choice of indicators/dimensions for the construction of aggregate index, and (ii) index methodology for aggregation of indicators/dimensions. Most of the researchers relied on a self-structured framework, which is based on one or few sets of principle dimensions of corporate governance for the construction of composite index (see, for instance, Song and Li 2012; Ellul and Yerramilli 2013; Love and Rachinsky 2015; Zagorchev and Gao 2015; Andries et al. 2018). There are also some studies where researchers used a structured framework developed by third-party (generally the rating agencies) to obtain composite indices for measuring the strength and quality of governance in banking firms. For example, Peni and Vähämaa (2012) used the Gov-Score corporate governance index developed by Brown and Caylor (2006), which was based on 51 governance indicators; Ellul and Yerramilli (2013) adopted 24 factors G-Index of Investor Responsibility Research Center (IRRC) database that was developed by Gompers et al. (2003).

A deeper scrutiny of the literature on corporate governance index for banking firms helps us to make following observations. First, the majority of the studies have constructed a composite index of corporate governance considering only one or few sets of internal governance mechanisms, and have not considered the full comprehensive set of governance

mechanisms in the construction of such an index. It is important to note that the contemporary literature on corporate governance shields a wide-array of governance mechanisms for banks covering both equity and debt governance concerns (Heremans 2007). Second, the studies have mainly employed the traditional unweighted method to construct corporate governance index, which implicitly implies that weights are equal to one, ignoring the fact that all governance components may not be sharing equal policy priorities by banks. Our study is an attempt to rationally deliberate on the aforementioned issues in the literature on corporate governance in banking industry and proposes a holistic way to construct the corporate governance index for banking firms using the endogenously generated weights using the non-parametric methodological framework.

Table 1: Studies on the construction of corporate governance index for banks			
Author (Year)	Sample (Period)	Governance mechanisms	Methodological framework
Peni and Vähämaa (2012)	61 US large publicly traded banks (2005)	Gov-Score index by Brown and Caylor (2006) based on 51 governance attributes, with each attribute as defined as binary variables	Linear unweighted average index
Song and Li (2012)	48 nations	Self-structured index based on 15 variables related to board structure, ownership structure, executive compensation and transparency index	Linear unweighted average index
Ellul and Yerramilli (2013)	74 US bank holding companies (1999-2007)	G-Index of IRR database developed by Gompers et al. (2003) and Risk Management Index based on six risk governance attributes	Principal component analysis (PCA)
Love and Rachinsky (2015)	Russian and Ukrainian banks	Self-structured index based on 26 indicators relating to five categories- commitment to corporate governance, shareholders' rights, supervisory bodies, audit, and transparency and disclosure	Linear unweighted average index
Zagorchev and Gao (2015)	820 US financial firms including 539 commercial banks (2002-2009)	CG41 index based on 41 governance components for which data are available in Aggarwal et al. (2011) and RiskMetrics' Corporate Governance Quotient (CGQ). This index comprises of four sub-groups: (a) board, (b) audit, (c) anti-takeover provisions, and (d) compensation and ownership.	Linear unweighted average index
Andrieş and Brown (2017)	156 banks from Central and Eastern Europe (2005-2012)	Self-structured index based on four supervisory board and four risk management variables	Linear unweighted average index
Tarchouna et al. (2017)	184 US commercial banks (2000-2013)	Self-structured index based on five corporate governance variables- board size, the board independence, the CEO duality, the majority ownership and the directors and executive officers' ownership	Principal component analysis (PCA)
Andrieş et al. (2018)	17 CEE nations (2005-2012)	Self-structured index based on four supervisory board and four risk management variables	Principal component analysis (PCA)

Source: Authors' elaboration

3. Data Envelopment Analysis based constrained 'Benefit-of-the-Doubt' model

This section presents the constrained BoD model used in this study for constructing a corporate governance index for individual banks. Based on Farrell's (1957) seminal work, Charnes, Cooper and Rhodes (1978) developed the first DEA model to assess relative efficiencies of peer decision-making units (DMUs) in a non-parametric framework, which allows multiple inputs and multiple outputs. Over the years, several theoretical contributions and extensions have been made in DEA modelling. Amongst these extensions, one of the most notable extension is the class of 'benefit-of-the-doubt' models that generate optimised

endogenous weights to aggregate the various dimensions of performance. The BoD modelling approach was originally proposed by Melyn and Moesen (1991) and later developed by Cherchye et al. (2004, 2007). To be more precise, a BoD model is akin to DEA model and aims to aggregate linearly quantitative performance indicators to construct a single composite index when exact weights are not known *a priori* (Cherchye et al. 2007). In the BoD model, the composite index is constructed by treating all the dimensions/indicators as outputs, thereby considering no inputs in the model (Lovell et al. 1995). In fact, a BoD model compares the actual performance of the unit with an internal benchmark rather than an external benchmark that could not be realistically achievable in the specific local context (Giambona and Vassallo 2013). In fact, in the absence of true weights, BoD automatically assigns the benefit-of-the-doubt weights determined by the data to each characteristic in order to build up the composite score, one for each unit (Witte and Rogge 2011).

The constrained BoD model that has been used in the present study is an extension of the basic BoD model. This model retrieves the information on appropriate weights from the observed data, and aggregates the distinct dimensions of corporate governance of banks. The constrained BoD model is a bank-specific model and needs to be solved for each bank in the sample separately so that we can get endogenously computed weights that vary across banks and dimensions. For a typical bank, the essence of the BoD model is to maximize the weights such that the bank's corporate governance performance is as high as possible. Thus, BoD provides the weights that maximise (minimise) the impact of the dimension of corporate governance where the bank performs relatively good (poor) compared to the other banks. Hence, endogenously generated weights from our BoD model are optimal and yield the maximum value of composite index of corporate governance performance for a bank.

To formulate the basic BoD model, we assume that $j=1, \dots, n$ refers to banks, $i=1, \dots, m$ refers to corporate governance dimensions I , and w refers to weights such that $0 \leq w_{ij} \leq 1$ and $\sum_{i=1}^m w_{ij} = 1$. The linear programming formulation of the basic BoD model that looks like a DEA model in the *multiplier form* is given below:

$$CGI_o = \max_{w_{i,o}} \sum_{i=1}^m w_{i,o} I_{i,o} \quad (1)$$

subject to

$$\sum_{i=1}^m w_{i,o} I_{i,j} \leq 1 \quad j=1, \dots, n; \quad (2) \quad (A)$$

$$w_{i,o} \geq 0 \quad i=1, \dots, m \quad (3)$$

The optimal solution of Model (A) provides the observed value of the composite index of corporate governance for the bank o in terms of all the underlying dimensions. A few things are noteworthy here. First, CGI_o lies between 0 (the worst performance among the banks in the sample) and 1 (the best performance). Second, we solve Model (A) n times once for each bank to obtain a set of composite indices $CGI_1, CGI_2, \dots, CGI_n$ for n sampled banks. Third, $w_{i,o}$ are non-negative bank-specific *endogenous* weights. In Model (A), the weights are selected in such a way as to maximize the value of the composite indicator of the evaluated bank. This, in turn, guarantees that any other weighting scheme would worsen the ranking of this bank. Moreover, when these weights are used by any other bank in the sample would not result in a composite indicator greater than one (Thanassoulis et al. 2016). Fourth, in the construction of CGI_o , bank o has always the highest possible scores in relation to other banks in the sample. Thus, a good or bad position of a bank does not depend on a good or bad weighting system because the weights are optimised to produce possible results for each bank

(Giambona and Vassallo 2013). Fifth, Model (A) avoids the subjectiveness in determining weights, and therefore, provides a relatively objective performance score for each sampled bank (Zhou et al. 2007).

Cherchye et al. (2004) note that since the BoD approach uses data-generated weights, therefore, one or few dimensions may get overemphasized or ignored. This situation arises when optimization procedure assigns zero weights to one or more dimensions and that get ignored in the aggregation procedure. Charles and Díaz (2017) argue that this situation arises because the units (here banks) are evaluated in the best possible light in the basic ‘BoD’ model. Therefore, the computed composite indices tend to overfocus on the dimension in which the unit performs the best and completely discard the information of the others. In order to avoid such situations in the construction of a composite index, additional weight restrictions are imposed on endogenous weights, which set lower and upper bounds on the contribution of a particular dimension (see, Wong and Beasley 1990; Allen et al. 1997; Athanassoglou 2016, for more details). Inclusion of constraint (4) as follows, in the basic BoD model (A) transforms it into the constrained BoD model:

$$L_{i,j} \leq \frac{w_{i,j} I_{i,j}}{\sum_{k=1}^m w_{i,k} I_{i,k}} \leq U_{i,j} \quad i = 1, \dots, m; j = 1, \dots, n \quad (4)$$

where $L_{i,j}$ and $U_{i,j}$ represent lower and upper bound on endogenous weight assigned to i^{th} dimension for j^{th} unit. The similar model is used by Badasyan et al. (2011) and Giambona and Vassallo (2013). In the present study, we set lower bound as 10 percent, and the upper limit is assigned accordingly. For example, if lower bound is 0.10 (i.e., 10%) for five dimensions, the proportional contribution for sixth dimension will be at $1 - (5 \times 0.10) = 0.5$ (i.e., 50%). Incorporating weight restrictions in the above manner not only overcomes the major flaw of overfocusing on the best performing dimension in the basic BoD model but also tackle the problem of the presence of outliers on composite index scores to a large extent since no dimension is ignored in the aggregation process. As BoD is sensitive to the dimensional score of zero and one, therefore, before aggregating each dimensional index $I_{i,j}$ is normalized (at mean 100 and standard deviation 10) to account for zero and one values of $I_{i,j}$ dimension (Vidoli and Fusco 2018)¹. In the present study, the weight constrained BoD model is estimated using the command ‘ci_bod_constr’ in Compind package using R software (see Appendix A for R codes used for running the constrained BoD model).

4. Construction of corporate governance index for Indian banks: An illustration

4.1 Data, governance norms and dimensional indices

In order to provide an illustration of how the corporate governance index is computed by using the constrained BoD model, the first step involves collection of data on distinct governance norms adhered to by banks in India. Here, we consider 58 governance norms. The relevant qualitative and quantitative information on 58 governance indicators for 40 listed banks operating in the year 2017 had been obtained from two different sources. The first and primary source is ‘Corporate Governance Report’ of a sampled bank. Note here that this report is an integral part of the annual report of a bank, which is generally publically available on the home page of the bank’s website. The second data source is SANSCO database and the ‘Corporate Governance’ section of the NSE website. We use this source for obtaining and supplementing missing annual reports and data information. In total, we

¹ We are grateful to Francesco Vidoli, one of the developers of Compind package, for this suggestion.

collected 40 annual reports and thoroughly read these reports to gather data on 58 governance indicators. Thus, we have 2,320 (i.e., 40×58) observations in total.

The definition, coding and grouping of the selected governance norms for the construction of corporate governance index is provided in the Table B1 of Appendix B. In the second step, each governance indicator is coded as a binary variable with a value of one implying that a bank complies with the governance regulation, and zero otherwise. In the third step, we construct the dimensional indices. For this, all governance norms are grouped under six mutually exclusive categories based upon the key principles of corporate governance for banks, including board effectiveness, audit function, risk management, remuneration, shareholder rights and information, and disclosure and transparency. Figure 1 illustrates the framework for bank governance used in the present study. Dimensional indices corresponding to each dimension of bank governance are obtained. In the final step, a composite index of corporate governance is constructed by aggregating the six dimensional indices. A discussion of the dimensional indices of corporate governance for banks is warranted and is elaborated below.

- I. *Index for Board Effectiveness*: A bank board with ideal size and optimal combination of inside (full-time executive) and outside (non-executive affiliated and non-affiliated) directors is expected to be more effective in monitoring management and resolving agency conflicts and contribute to superior bank efficiency (Financial Stability Board 2017). Board effectiveness is assessed on 20 indicators pertaining to its composition, structure (presence of qualified and independent board level committees), independence (well-trained and certified non-executive independent directors on the board) and conduct (culture of reinforcing ethical board conduct).
- II. *Index for Audit Function*: An audit committee is essential for an independent audit process, which is assumed to provide a better oversight of the bank's financial reporting process, effectively monitor the internal and statutory audits, and the auditor's independence. A total of 9 governance indicators related to auditing and auditor functioning are used in this study to examine compliance on this dimension. Higher value of this dimensional index represents tight audit controls within the bank.
- III. *Index for Risk Management*: Based on the recommendations by the "Consultative Group of Directors of Banks/Financial Institutions" (Chairman: A.S. Ganguly), Indian banks constitute the board level stand-alone risk management committee to independently monitor the risk policy and strategy for a bank. Banks also appoint the Chief Risk Officer to efficiently monitor and mitigate internal risks. To construct a dimensional index of risk management, we use 5 risk governance indicators. Higher value of this dimensional index represents a tight risk management structure within the bank.
- IV. *Index for Remuneration*: It has been argued that independent non-executive directors are needed to be engaged in deciding payment of incentives to whole-time executives, and shareholders be kept informed of the remuneration policies and structures. This is imperative to counteract the managers' natural risk-aversion, and remuneration gives them incentives to take risk and maximise their wealth. It is also important that excessive risk taking by the manager must be controlled. This dimension is assessed on 5 governance guidelines pertaining to remuneration to directors.
- V. *Index for Shareholder Rights and Information*: Large shareholders can influence the decisions of management/board and control them to protect their investments (Alchian and Demsetz 1972). In order to avoid potential agency conflicts and

protect interests of minority shareholders and investors, the jurisdictions advised banks to constitute a separate stakeholder's grievances committee with a non-executive director as chairman and company secretary as compliance officer of the committee. All the grievances or complaints of investors should be the responsibility of the committee. This dimension is captured by using 11 relevant governance norms.

- VI. *Index for Disclosure and Transparency*: An adequate disclosure and transparency of inside information to outside stakeholders is another important principle of effective governance (BCBS 2015). As mandated by law and regulations, a bank is required to disclose the quality and quantity information in the annual report to mitigate agency problems arising from information asymmetry and enhances market discipline of banks (Tadesse 2006). The compliance on disclosure and transparency is evaluated on a set of 8 indicators.

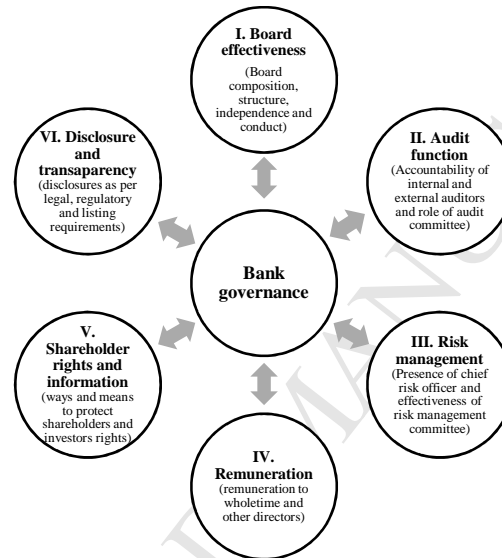


Figure 1: The framework for bank governance

4.2 Construction of corporate governance index for Indian banks

In the present study, we calculate a composite index of corporate governance for banks by combining six distinct dimensional indices using a non-parametric methodological framework. In the first step, we adopt a linear unweighted average method for constructing dimensional indices. The use of this method is popular among researchers to construct not only dimensional indices, but also an overall index of corporate governance (see, for example, Bhagat et al. 2010; Aggarwal et al. 2011; Bozec and Bozec 2012 in case of non-banking firms and Love and Rachinsky 2015 for Russian and Ukrainian banks). In the second step, we differ from the aforementioned studies. In particular, we aggregate dimensional indices that we obtained in the first step by using a DEA based BoD model that assigns endogenous weights to each dimensional index in the process of aggregation². A detailed discussion on the methodological framework used in the present study is elaborated in subsequent sections.

4.2.1 Construction of dimensional indices of corporate governance

² Use of mixed approach is quite common in the construction of a composite index in the social policy research literature. For example, the Multidimensional Poverty Assessment Tool (UNIFAD, 2010) and the Food and Nutrition Security Index (FAO, 2014) are obtained using the linear arithmetic average within a sub-component and geometric average within a component. See, for more details, https://ec.europa.eu/jrc/sites/jrcsh/files/20140922_JRC_COIN_11_Aggregation%28I%29.pdf.

As noted above, we employ the widely used linear unweighted average method for computing dimensional indices. It is important to note here that we rely on this method to obtain dimensional indices because the response on many governance norms is qualitative in nature. This approach provides an index value for each dimension, which varies from zero to one. The dimensional indices are calculated by using the following formula:

$$CG_{\text{Dimensional index}} = I_{i(i=1,\dots,m)} = \frac{\sum_{r=1}^s y_{r,j}}{s_{e,j}}$$

where $y_r = \{y_1, y_2, \dots, y_s\}$ and $y_{r,j} = 1$ if a bank is compliant to the r^{th} indicator/norm of corporate governance, $s_{e,j}$ = total maximum expected score of the corporate governance for j^{th} bank in m^{th} dimension. This approach is adopted to obtain six dimensional indices as defined below:

$$\text{I. Index for Board Effectiveness} = CG_{\text{Board Effectiveness}} = I_1 = \frac{\sum_{r=1}^{20} y_r}{20}$$

$$\text{II. Index for Audit Function} = CG_{\text{Audit}} = I_2 = \frac{\sum_{r=1}^9 y_r}{9}$$

$$\text{III. Index for Risk Management} = CG_{\text{Risk Management}} = I_3 = \frac{\sum_{r=1}^5 y_r}{5}$$

$$\text{IV. Index for Remuneration} = CG_{\text{Remuneration}} = I_4 = \frac{\sum_{r=1}^5 y_r}{5}$$

$$\text{V. Index for Shareholder Rights and Information} = CG_{\text{Shareholder Rights}} = I_5 = \frac{\sum_{r=1}^{11} y_r}{11}$$

$$\text{VI. Index for Disclosure and Transparency} = CG_{\text{Disclosure and Transparency}} = I_6 = \frac{\sum_{r=1}^8 y_r}{8}$$

Table 2 reports non-normalized values of dimensional indices of corporate governance, where index value is suggestive of areas of high or low governance priority for the banks. Among all the dimensions, on an average, higher level of regulatory compliance by banks is observed on the shareholder rights and information (dimension V) followed by disclosure and transparency (dimension VI). This is clear from the value of indices for dimensions V and VI as 0.927 and 0.903. An average index value for dimensions I and III is relatively low. This reflects that there is weak governance by banks on board effectiveness and audit function. We believe that the recently reported big-ticket fraud cases in Indian banking industry are primarily due to poor governance of banks in these two important dimensions of bank governance. Further, banks are 25.5 percent less efficient on risk governance in the sampled year. Only 18 banks (45% of sampled banks) attained the dimensional index score of one on governance guidelines pertaining to disclosure and transparency, 15 banks (37.5% of sampled banks) on shareholder rights and information, 11 banks (27.5% of sampled banks) on risk management, 10 banks (25% of sampled banks) on audit quality while none on board effectiveness. Further, although banks have performed well on protecting shareholder rights and maintaining disclosures, 45% of sampled banks performed below average on audit and risk functions.

We also note substantial differences in bank's obedience to governance regulatory provisions. Our findings suggest that a bank could be better governed with respect to one dimension but relatively worse on another. For instance, Yes Bank Ltd. is compliant ($I_{i,j} = 1$) on all dimensions of governance except on board effectiveness, while nine other banks were

found to be outperforming this bank in this regard. In addition, three banks, namely Jammu & Kashmir Ltd., United Bank of India and State Bank of India attained the index score less than one ($I_{i,j} < 1$) on all six dimensions. This may be due to lacunae in reporting practices. Falling short on all dimensions of bank governance could be a challenge for very large public sector banks such as State Bank of India, which however can be addressed through investing human and financial resources for prioritising reporting.

Table 2: Dimensional indices of corporate governance using linear unweighted average method for the year 2017

Bank code	Dimensions→	I	II	III	IV	V	VI
	Bank name↓	Index of Board Effectiveness	Index of Audit Function	Index of Risk Management	Index of Remuneration	Index of Shareholder Rights and Information	Index of Disclosure and Transparency
B1	Allahabad Bank	0.800	0.778	0.600	0.800	0.909	1.000
B2	Andhra Bank	0.850	0.778	0.600	0.800	1.000	1.000
B3	Axis Bank Ltd.	0.850	1.000	1.000	1.000	0.909	0.875
B4	Bandhan Bank Ltd.	0.650	1.000	1.000	0.800	0.636	0.625
B5	Bank of Baroda	0.650	0.778	0.800	0.800	1.000	0.875
B6	Bank of India	0.725	0.556	0.600	0.800	0.909	1.000
B7	Bank of Maharashtra	0.750	0.778	0.600	0.800	1.000	1.000
B8	Canara Bank	0.725	0.667	1.000	0.800	1.000	0.875
B9	Catholic Syrian Bank Ltd.	0.700	0.889	1.000	1.000	0.636	0.875
B10	Central Bank of India	0.600	0.778	0.600	0.800	0.909	1.000
B11	City Union Bank Ltd.	0.900	1.000	0.800	1.000	0.909	0.750
B12	Corporation Bank	0.700	0.889	0.600	0.200	1.000	1.000
B13	DCB Bank Ltd.	0.925	1.000	1.000	1.000	0.909	0.875
B14	Dena Bank	0.650	0.667	0.600	0.800	0.909	1.000
B15	Dhanalakshmi Bank Ltd	0.950	0.778	0.800	1.000	0.909	1.000
B16	Federal Bank Ltd	0.900	1.000	1.000	1.000	1.000	0.875
B17	HDFC Bank Ltd.	0.900	1.000	0.800	1.000	0.909	0.875
B18	ICICI Bank Ltd.	0.750	0.889	0.800	1.000	1.000	0.750
B19	IDBI Bank Limited	0.750	0.889	1.000	0.800	0.909	0.750
B20	IDFC Bank Ltd.	0.825	1.000	1.000	1.000	1.000	1.000
B21	Indian Bank	0.800	0.778	1.000	0.800	0.818	1.000
B22	Indian Overseas Bank	0.725	0.778	0.400	0.800	1.000	1.000
B23	IndusInd Bank Ltd.	0.925	0.889	0.800	1.000	0.909	0.875
B24	Jammu & Kashmir Bank Ltd.	0.600	0.667	0.600	0.800	0.909	0.875
B25	Karnataka Bank Ltd.	0.775	1.000	0.600	1.000	0.909	0.750
B26	Karur Vysya Bank Ltd	0.950	0.889	0.600	1.000	1.000	0.875
B27	Kotak Mahindra Bank Ltd.	0.875	1.000	0.000	1.000	0.909	0.875
B28	Lakshmi Vilas Bank Ltd.	0.850	0.778	0.800	1.000	0.909	0.750
B29	Oriental Bank of Commerce	0.700	0.889	0.600	0.800	1.000	1.000
B30	Punjab and Sind Bank	0.650	0.778	0.600	0.800	1.000	1.000
B31	Punjab National Bank	0.800	0.889	0.800	0.800	1.000	0.875
B32	RBL Bank Ltd.	0.850	0.889	0.600	1.000	0.818	0.875
B33	South Indian Bank Ltd.	0.900	0.889	1.000	1.000	1.000	1.000
B34	State Bank of India	0.650	0.778	0.800	0.800	0.909	0.750
B35	Syndicate Bank	0.675	0.556	0.800	0.800	0.909	1.000
B36	UCO Bank	0.750	0.667	0.600	0.800	0.909	1.000
B37	Union Bank of India	0.600	0.889	0.600	0.800	1.000	1.000
B38	United Bank of India	0.725	0.889	0.600	0.800	0.909	0.875
B39	Vijaya Bank	0.800	0.778	0.800	0.800	1.000	0.750
B40	Yes Bank Ltd.	0.850	1.000	1.000	1.000	0.909	1.000
	Mean	0.775	0.845	0.745	0.870	0.927	0.903

Source: Authors' calculations

4.2.2 Aggregation of dimensional indices to construct a corporate governance index

After obtaining six distinct dimensional indices, the constrained BoD model is used to generate idiosyncratic and endogenous weights, which aggregates normalised values of dimensional indices to obtain a corporate governance index (CGI) for individual banks. As noted above, this approach is unique in the sense that it is simpler and generates weights based on actual data. The estimated values of corporate governance index for sampled banks and their rankings across different methods of index construction are reported in Table 3. However, in this sub-section, we shall focus on the results obtained using BoD model with 10

percent lower bound restriction. The weight's matrix with this restriction is given in the Table C1 of Appendix C. An index of corporate governance for each bank is expected to lie between a minimum of 0 (the worst governed) and the maximum of 1 (the best governed)³. We note that corporate governance index value at 10 percent weight restriction ($CGI_{BOD_0.10}$) varies from a minimum of 0.8634 to a maximum of 1, implying a considerably high level of banks' adherence to governance regulations set by the jurisdictions in the sampled year. A persistent regulatory oversight and a coercion to avoid any sort of penalties or strictures or restrictions in business operations in recent years have compelled banks to show higher obedience to governance norms in the sampled year. Only three banks, namely South Indian Bank Ltd., IDFC Bank Ltd., and Federal Bank Ltd. attain the status of well governed banks (with $CGI_{BOD_0.10}$ score of 1) and are found to be relative efficient in terms of adherence to corporate governance framework. Although these banks emerge as ideal benchmarks of bank governance in India, they do lack compliance on one or more dimensions of governance. For instance, South Indian Bank Ltd. is not well governed on the dimensions of board effectiveness (dimension I) and audit function (dimension II); IDFC Bank Ltd. lacks perfect governance on board effectiveness (dimension I); Federal Bank Ltd. is not well governed on disclosure and transparency (dimension VI) alongside weakness on board effectiveness (dimension I). The Jammu & Kashmir Bank Ltd. and Bandhan Bank Ltd. attain lower ranking on the basis of their values of composite index of corporate governance, and therefore these banks require greater efforts to improve their compliance with stated governance regulatory provisions. We also note that majority of banks are still far from perfection, and they can achieve the status of "good governed bank" by improving their adherence in different dimensions of bank governance.

Overall, our findings suggest that Indian banks work along the conventional lines, and therefore, put more efforts in protecting shareholder rights and information, and maintaining better disclosure and transparency levels. The results indicate that banks in India focus less on contemporary debt governance principles. In the light of our results, we feel that Indian banks are required to pay a serious attention towards adherence of regulatory norms concerning board quality, audit and risk management practices in order to attain the status of well governed banks, and ultimately, to improve their financial health.

³ In the BoD approach, the index score may take a maximum value of 1 (benchmark bank with a high level of governance). However, achieving a minimum value of 0 (with the overall governance level of zero) is not a case.

Table 3: Corporate governance index and ranking of banks using alternative aggregation methodological frameworks

Bank code	Bank name	Constrained BoD (10%) (CGI _{BOD_0.10})	Rank	Constrained BoD (5%) (CGI _{BOD_0.05})	Rank	Factor Analysis (CGI _{Factor})	Rank	Equal Weighting (CGI _{Equal})	Rank
B1	Allahabad Bank	0.9377	21	0.9678	21	-0.1031	21	0.8145	27
B2	Andhra Bank	0.9523	13	0.9756	13	0.1121	14	0.8380	21
B3	Axis Bank Ltd.	0.9812	8	0.9905	9	0.5097	6	0.9390	6
B4	Bandhan Bank Ltd.	0.8716	39	0.9314	37	-0.8912	40	0.7852	32
B5	Bank of Baroda	0.9314	27	0.9645	27	-0.107	22	0.8171	25
B6	Bank of India	0.9078	35	0.9517	35	-0.4472	36	0.7649	38
B7	Bank of Maharashtra	0.9428	17	0.9706	17	0.0474	18	0.8213	23
B8	Canara Bank	0.9366	22	0.9672	22	-0.0374	20	0.8444	18
B9	Catholic Syrian Bank Ltd.	0.9103	34	0.9531	34	-0.2837	32	0.8500	15
B10	Central Bank of India	0.9173	31	0.9569	31	-0.2325	28	0.7811	34
B11	City Union Bank Ltd.	0.9670	11	0.9832	11	0.1147	13	0.8932	10
B12	Corporation Bank	0.8760	38	0.9339	36	-0.4546	37	0.7315	40
B13	DCB Bank Ltd.	0.9984	4	1.0000	1	0.5583	5	0.9515	5
B14	Dena Bank	0.9128	32	0.9544	32	-0.348	35	0.7710	37
B15	Dhanalakshmi Bank Ltd	0.9912	6	1.0000	1	0.3686	8	0.9061	8
B16	Federal Bank Ltd	1.0000	1	1.0000	1	0.725	4	0.9625	3
B17	HDFC Bank Ltd.	0.9803	9	0.9901	10	0.3732	7	0.9140	7
B18	ICICI Bank Ltd.	0.9494	14	0.9740	14	0.0527	16	0.8648	13
B19	IDBI Bank Ltd.	0.9352	24	0.9665	24	-0.1671	26	0.8497	16
B20	IDFC Bank Ltd.	1.0000	1	1.0000	1	0.935	1	0.9708	1
B21	Indian Bank	0.9436	16	0.9710	16	0.0517	17	0.8660	12
B22	Indian Overseas Bank	0.9286	28	0.9630	28	-0.1376	24	0.7838	33
B23	IndusInd Bank Ltd.	0.9786	10	0.9911	8	0.2416	10	0.8997	9
B24	Jammu & Kashmir Bank Ltd.	0.8634	40	0.8822	40	-0.6389	39	0.7418	39
B25	Karnataka Bank Ltd	0.9398	20	0.9689	20	-0.1351	23	0.8390	19
B26	Karur Vysya Bank Ltd.	0.9882	7	1.0000	1	0.2718	9	0.8856	11
B27	Kotak Mahindra Bank Ltd.	0.9195	30	0.9581	30	-0.3184	34	0.7765	36
B28	Lakshmi Vilas Bank Ltd	0.9400	19	0.9691	19	-0.2133	27	0.8478	17
B29	Oriental Bank of Commerce	0.9470	15	0.9728	15	0.1628	11	0.8315	22
B30	Punjab and Sind Bank	0.9325	25	0.9651	25	-0.0173	19	0.8046	28
B31	Punjab National Bank	0.9554	12	0.9772	12	0.1378	12	0.8606	14
B32	RBL Bank Ltd.	0.9410	18	0.9696	18	-0.1586	25	0.8387	20
B33	South Indian Bank Ltd	1.0000	1	1.0000	1	0.8357	2	0.9648	2
B34	State Bank of India	0.8794	37	0.8973	39	-0.5485	38	0.7811	35
B35	Syndicate Bank	0.9121	33	0.9540	33	-0.3107	33	0.7899	30
B36	UCO Bank	0.9227	29	0.9598	29	-0.2833	31	0.7876	31
B37	Union Bank of India	0.9353	23	0.9666	23	0.0982	15	0.8148	26
B38	United Bank of India	0.9004	36	0.9106	38	-0.2624	29	0.7997	29
B39	Vijaya Bank	0.9322	26	0.9649	26	-0.2686	30	0.8213	24
B40	Yes Bank Ltd.	0.9955	5	1.0000	1	0.7683	3	0.9598	4

Source: Authors' calculations

4.3 Sensitivity analysis

4.3.1 Choice of aggregation method and its impact on ranking of banks on CGI

Corporate governance index obtained using constrained BoD model at 10 percent lower bound restriction (CGI_{BOD_0.10}) is compared with three alternative composite indices – constrained BoD with 5 percent lower bound restriction (CGI_{BOD_0.05}), factor analysis based CGI index (CGI_{Factor}) and equal weight CGI index (CGI_{Equal}). In CGI_{BOD_0.05} and CGI_{BOD_0.10} where the lower bound of weight constraint is restricted at 5 percent and 10 percent, respectively. CGI_{Factor} is based on factor analysis, which is a non-frontier method and assigns data generated weights to each dimension in accordance to the proportion of the variance explained by the dataset (Vidoli and Fusco 2018). In the present study, the CGI_{Factor} index of corporate governance is estimated using the command 'ci_factor' in the Compind package. Equal weight approach assigns a weight of 0.16 (1/m=1/6) to each dimension, and all dimensions are linearly aggregated in a simpler way, implying every bank gives equal policy priority to each dimension of bank governance. The index values and ranking of banks corresponding to different alternative methods are also reported in Table 3. The statistical significance of differences in the ranking of banks across different alternative methodologies is tested using Spearman's rank correlation test.

The matrix of correlation coefficients of the ranks corresponding to four alternative indices reveals that the rank correlation coefficients are very high and statistically significant at 1 percent level (see Table 4). This indicates a greater rank concordance of banks on the corporate governance index obtained by employing different aggregation methods. The ranking of banks across alternative approaches remain stable. Therefore, we can safely infer that BoD is a robust approach and the idea of this approach to assign endogenous generated weights to each dimension is more judicious than assigning fixed or equal or no weights for aggregation purpose. Overall, the construction of corporate governance index for banks using BoD is far superior to unweighted method. Our inference is in line with Wittrup and Bogetoft (2017) who conclude that weighted assessment is superior to unweighted, while determining the court workload.

Aggregation method	Constrained BoD (5%)	Constrained BoD (10%)	Factor Analysis	Equal Weighting
Constrained BoD (5%)	1.000	-	-	-
Constrained BoD (10%)	0.984***	1.000	-	-
Factor Analysis	0.888***	0.954***	1.000	-
Equal Weighting	0.936***	0.983***	0.991***	1.000
Note: *** indicate significance at 1 percent level.				
Source: Authors' calculations				

4.3.2 Lower bound weight choice and its impact on CGI

An increase of the lower bound reflects the sensitivity of assigning weights to individual dimensions of CGI. In the present study, we capture the variations in weight restrictions under two limits – unrestricted with lower bound restriction of 5 percent to a maximum of 16 percent (assuming if equal weight of $1/m$ is assigned to each dimension). Accordingly, twelve alternative corporate governance indices are calculated (see Table C2 in the Appendix C for details on CGI scores corresponding to lower bound from 5 percent to 16 percent). Similar procedure is adopted for conducting a sensitivity analysis by Giambona and Vassallo (2013) in the construction of financial development index. From Table 5, we note that unlike traditional equal weight or unweighted approaches, constrained BoD approach rewards for policy priority by banks and penalizes under-performance in one or more dimensions. For instance, banks' adherence to dimensions V and VI is rewarded by higher average aggregate weightage of 43 percent and 39 percent in the construction of $CGI_{0.05}$ and $CGI_{0.10}$, respectively. However, penalty is imposed on dimensions I (board effectiveness) and II (audit function) in terms of attaining lower 9 percent and 13 percent weightage, respectively, as can be seen from the weight's matrix. As discussed by Cherchye et al. (2004), we also computed the CGI score with no weight restriction in BoD model. We find that unrestricted BoD allocates defective weight of zero percent to board effectiveness dimension and ignores the priority given by banks in improving board quality and over-emphasizes remuneration policy. On the other hand, setting a lower bound equivalent to equal weight in BoD eliminates the difference in the policy priorities by a bank in one dimension relative to other. Thus, weight allocation is an important aspect because ultimately good corporate governance should, sooner or later, involve all the six dimensions to ensure long-term financial sustainability.

Dimensions→	Board Effectiveness (w ₁)	Audit Function (w ₂)	Risk Management (w ₃)	Remuneration (w ₄)	Shareholder Rights and Information (w ₅)	Disclosure and Transparency (w ₆)	Number of banks with CGI=1
Unrestricted (0%)	0.00	0.03	0.12	0.43	0.27	0.15	37
5%	0.09	0.13	0.21	0.14	0.26	0.17	7
6%	0.11	0.15	0.17	0.11	0.16	0.29	7
7%	0.13	0.14	0.20	0.12	0.24	0.16	6
8%	0.16	0.12	0.17	0.14	0.13	0.27	5
9%	0.15	0.14	0.18	0.13	0.24	0.16	4
10%[#]	0.16	0.14	0.18	0.13	0.23	0.16	3
11%	0.16	0.17	0.14	0.13	0.16	0.23	3
12%	0.17	0.15	0.17	0.13	0.16	0.22	3
13%	0.18	0.15	0.16	0.14	0.16	0.21	3
14%	0.17	0.16	0.17	0.15	0.16	0.19	2
15%	0.17	0.16	0.16	0.16	0.17	0.18	2
Equal weight (16%)	0.17	0.16	0.16	0.16	0.17	0.17	1

Note: [#] Bank-wise weights assigned to each dimension are reported in Appendix Table C1.

Source: Authors' calculations

All in all, the study observes that the constrained BoD approach is a robust approach for index construction, and successfully overcomes major methodological flaws that are present in traditional approaches. The constrained BoD model constructs a reliable composite index of corporate governance for individual banks by allowing a sensible weighting scheme for aggregation of normalised values of dimensional indices. These index values can be used for identifying the areas needed for improvement in the governance framework at the level of an individual bank as well as the banking industry as a whole.

5. Conclusions

This paper suggests a methodological framework to construct a non-parametric index of corporate governance for banks using the benefit-of-the-doubt (BoD) approach. This approach is unique, completely robust and distinctive in the sense that it requires no *a priori* knowledge of weights, and assigns endogenous weights obtained from actual data to individual dimensions of governance to construct a composite index of corporate governance. The framework suggested here shows how to use constrained BoD model to eliminate the problem with giving equal or subjective weights to key dimensions of governance of banks while constructing a composite index of corporate governance. In addition, we found that BoD is suitable for application to small samples, such as the case of our data. An illustration has been presented using a data set of 40 Indian banks in the year 2017. The data set is compiled using 58 qualitative and quantitative governance indicators as defined by relevant jurisdictions. In terms of managerial implications, the methodological framework presented in this study provides the policy formulators with the opportunity to not only rank the banks in accordance with their corporate governance performance but also identify strong and weak dimensions of governance in each bank. This, in turn, provides comprehensive guidance for policy formulators to assist them in identifying areas of corporate governance, which might require improvements by the banks. Further, the non-parametric corporate governance index serves as a classification system to monitor each bank's progress on adoption of governance principles. This system is crucial for designing and implementing targeted policies to improve overall governance quality of banks.

The empirical results reveal that considerable efforts have been made by banks in adhering to corporate governance regulations in India in the last decade. This is evident from an estimated value of corporate governance index for sampled banks, which range between a minimum of 0.8634 and maximum of 1. Only three banks, namely South Indian Bank Ltd., IDFC Bank Ltd., and Federal Bank Ltd. tops the list and are found governance efficient with a corporate governance index score of one. Unlike traditional equal weight or unweighted

approaches, our chosen BoD approach with weights constrained fully rewards the success of banks in obeying governance norms pertaining to shareholders' right and information, and imposed a penalty on board effectiveness and audit function. This can be seen from the weights' matrix. Thus, optimal weight allocation is an important aspect because equal weighting eliminates the difference in the policy priorities by a bank in one dimension relative to other. Also, the ranking of banks on the non-parametric corporate governance index remains robust enough and not very sensitive to the choice of aggregation method.

On concluding note, the application of this suggested framework not only provides us with the ranking of banks in accordance of their adherence to governance regulations, but also helps us to identify strong and weak dimensions of governance for each bank. This identification could facilitate with redesigning of existing policies both at bank-level and industry-level. We believe that this framework would be greatly beneficial for improving corporate governance in the banking sector. However, the key limitation of the proposed framework is that it cannot accommodate the negative or binary values of indicators or dimensional indices. The future research can be directed to overcome this drawback. In the future, research can also be directed to use of this framework to assess how the governance performance of banks has evolved over the period.

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Appendix A

R codes used for constrained BoD

```

library(Compind)
options(stringsAsFactors = F)

*****
Importing the comma delimited (.csv) file
*****
DF=read.csv("2017.csv")
summary(DF)

*****
Normalization of indicator/dimension/pillar
*****
data_norm=normalise_ci(DF,c(2:7),polarity = ("POS", "POS", "POS", "POS", "POS", "POS"),
method=1,z.mean=100, z.std=10)

*****
BoD as the constrained version (low_w vary from 0.05 to 0.16)
*****
CI_constr=ci_bod_constr(data_norm$ci_norm,c(1:6), up_w = 1,low_w = 0.1)
CIci_bod_constr_est=CI_constr$ci_bod_constr_est
CIci_bod_constr_weights =CI_constr$ci_bod_constr_weights

*****
Exporting output in comma delimited (.csv) file
*****
summary(CIci_bod_constr_est)
plot(density(CIci_bod_constr_est))
write.csv(CIci_bod_constr_est,"resultsbod.csv")
write.csv(CIci_bod_constr_weights,"resultmatrixbod.csv")

```

Appendix B

Table B1: Definition of dimensions and indicators of bank governance		
Dimensions ($I_m : m \in 1, \dots, 6$)	Indicators in each dimension ($y_r : r \in 1, \dots, s$)	Regulatory/Legal Clause
I. Board Effectiveness (20)	Whether a bank has no more than 15 directors on the board	SEBI Clause 49 (II.A.1), 2015; Companies Bill Clause 149(1.b), 2013
	At least 50 percent of the board comprise of non-executive directors	SEBI Clause 49 (II.A.1), 2015
	Board has not exceeding two nominee directors	SEBI Clause 49 (II.B), 2015
	Board appoint at least one woman director	SEBI Clause 49 (II.A.1), 2015
	Executive director holds directorship/chairmanship on not more than three listed companies	SEBI Clause 49 (II.B.2), 2015
	Non-executive independent director hold directorship on not more than six listed companies	SEBI Clause 49 (II.B.2), 2015
	Board meets at least four times a year	SEBI Clause 49 (II.D.1), 2015
	Chairman of the board held the position for a minimum of five years	Companies Act 2013
	Chairman of the board is non-executive director	SEBI Clause 49 (II.A.2), 2015
	Chairman and CEO are two separate persons on the board	SEBI Clause 49 (II.A.2), 2015
	Bank provide the details about the committee's establishment, mandate and composition including members who are independent in the corporate governance report; 0.5 if details are partially provided.	SEBI Clause 49 (II.D), 2015
	Board include at least one-third of the independent directors, in case of non-executive chairman and at least one-half, in case of executive chairman	SEBI Clause 49 (II.A.2), 2015
	Suitable training is imparted to independent directors and is disclosed by bank in the report or on website	SEBI Clause 49 (II.B.7), 2015
	Independent director(s) has given a separate declaration of their independence included as part of corporate governance report	SEBI Clause 49 (II.B), 2015
	Separate meeting of independent directors is held in financial year and details are disclosed in the report; 0.5 if meeting held and details are not provided	SEBI Clause 49 (II.B.6), 2015
	Board constitute nomination committee for appointment of directors	SEBI Clause 49 (IV); BCBS, 2015; Companies Act Clause 178, 2013
	Bank board publishes its separate corporate governance report as a part of annual report	SEBI Clause 49 (X), 2015
Bank defines code of corporate governance	SEBI Clause 49 (II.E) , 2015	
Board lays down a 'code of conduct' certificate from all board members and senior management	SEBI Clause 49 (II.E) , 2015	
Bank establishes a vigil mechanism for directors and employees through whistle blower policy	SEBI Clause 49 (II.F), 2015	
II. Audit Function (9)	Board constitute audit committee	SEBI Clause 49 (III.A), 2015; Companies Bill Clause 177(1), 2013
	Committee has minimum three members	SEBI Clause 49 (III.A.1) , 2015; Companies Bill Clause 177(2), 2013
	Two-third members of audit committee are independent directors	SEBI Clause 49 (III.A.1), 2015
	Chairman is independent non-executive director	SEBI Clause 49 (III.A.3), 2015
	Internal audit procedure is defined in the report	SEBI Clause 49 (III.D & E), 2015; RBI, 2002
	Statutory auditor is appointed by board	SEBI Clause 49 (III.D & E), 2015; RBI, 2002
	Committee met at least four times a year	SEBI Clause 49 (III.B), 2015
	Company secretary act as a secretary of audit committee	SEBI Clause 49 (III.A.6), 2015; Companies Bill Clause 134.f, 2013
	Bank include a certificate from either the auditors' or practicing company secretaries regarding compliance of conditions of corporate governance and disclose it in the annual report	SEBI Clause 49 (III.D & E), 2015
III. Risk Management (5)	Presence of risk management committee	RBI, 2002; SEBI Clause 49 (VI), 2015; BCBS, 2015
	Appointment of a chief risk officer	RBI, 2002; BCBS, 2015
	Bank disclose the size of risk management committee	RBI, 2002
	Bank disclose the number of meetings held by RMC	RBI, 2002

	Bank have non- executive director as chairman of RMC	RBI, 2002
IV. Remuneration (5)	Board constitute a remuneration for overall oversight of management's implementation of remuneration system.	SEBI Clause 49 (IV), 2015; Companies Bill Clause 178, 2013
	Independent director as a chairman of the committee.	Companies Act 2013
	At least three members, with majority as non-executive directors.	Companies Act 2013
	Information on payments of remuneration/ sitting fees to directors, if any paid is disclosed in the report.	SEBI Clause 49 (II.C), 2015
	All directors are non-executive	Companies Act 2013
V. Shareholder Rights and Information (11)	Board constitute stakeholder's grievance committee.	SEBI Clause 49 (VIII.E.4), 2015; Companies Bill Clause 178, 2013
	Non-executive director act as chairman of stakeholder grievance committee.	SEBI Clause 49 (VIII.E.4), 2015
	Compliance officer reporting to company secretary	RBI, 2002
	Committee look into the matters relating to investor complaints and board discloses the number of complaints received and resolved in a financial year.	SEBI Clause 49 (VIII.E.4), 2015; Companies Bill Clause 178(6), 2013
	Board disclose the information on the last three annual general meeting held in the annual report.	SEBI Clause 49 (XII.6), 2015
	Bank board disclose the information regarding its listing on various stock exchanges in the report.	SEBI Clause 49 (XII.9), 2015
	Disclose its dividend policy and dividend paid, if any, during the year in the report.	SEBI Clause 49 (XII.9), 2015
	Bank disclose the information on market price of its share.	SEBI Clause 49 (XII.9), 2015
	The procedure of share transfer system is explained comprehensively in the report.	SEBI Clause 49 (VIII.E.5), 2015
	Disclosure on the information on the shareholding pattern of shares held by directors is made.	SEBI Clause 49 (XII.9), 2015
	Information about the proportion of dematerialised shares held by bank given in its annual report.	SEBI Clause 49 (XII.9), 2015
VI. Disclosure and Transparency (8)	Bank disclose the policy on dealing with Related Party Transactions.	SEBI Clause 49 (VIII.A), 2015
	Bank disclose the significant accounting policies adopted in Schedule- 17 of the annual report.	SEBI Clause 49 (VIII.B), 2015
	Bank has a separate section on Management Discussion and Analysis as a part of annual report.	SEBI Clause 49 (VIII.D), 2015
	CEO/CFO certify to the board that board has complied accounting standards and code of conduct set by the bank.	SEBI Clause 49 (IX), 2015
	Details of non-compliance by the company, penalties, and strictures imposed on the company by Stock Exchange or SEBI or any statutory authority, on any matter related to capital markets, during the last three years is disclosed in the annual report.	SEBI Clause 49 (XII.7.ii), 2015
	Bank disclose information regarding the ways and means by which shareholders are informed.	SEBI Clause 49 (XII.8), 2015
	Bank disclose the details about resignation or cessation of directors along with the detailed reasons of resignation in report.	SEBI Clause 49 (VIII.F), 2015
	A brief resume of new director or re-appointed director is included for the information to the shareholders	SEBI Clause 49 (VIII.G), 2015
Total dimensions of corporate governance = 6	Total corporate governance norms/indicators = 58	
Source: Authors' compilation		

Appendix C

Tables C1 provides the optimal idiosyncratic weights (specific to dimension and for sampled banks) obtained using BoD model restricted at 10 percent lower bound. Table C2 reports the corporate governance index values for banks obtained corresponding to different weight restrictions on lower bound in BoD model.

	Dimensions	I	II	III	IV	V	VI
Bank code	Bank name	Board Effectiveness (w₁)	Audit Function (w₂)	Risk Management (w₃)	Remunerations (w₄)	Shareholder rights and information (w₅)	Disclosure and Transparency (w₆)
B1	Allahabad Bank	0.1	0.1	0.1	0.1	0.1	0.5
B2	Andhra Bank	0.139147	0.1	0.1	0.1	0.460853	0.1
B3	Axis Bank Ltd.	0.183612	0.156672	0.359716	0.1	0.1	0.1
B4	Bandhan Bank Ltd.	0.1	0.103993	0.496007	0.1	0.1	0.1
B5	Bank of Baroda	0.1	0.1	0.1	0.1	0.5	0.1
B6	Bank of India	0.1	0.1	0.1	0.1	0.1	0.5
B7	Bank of Maharashtra	0.1	0.1	0.1	0.1	0.5	0.1
B8	Canara Bank	0.1	0.1	0.1	0.1	0.5	0.1
B9	Catholic Syrian Bank Ltd.	0.1	0.1	0.5	0.1	0.1	0.1
B10	Central Bank of India	0.1	0.1	0.1	0.1	0.1	0.5
B11	City Union Bank Ltd.	0.218904	0.381096	0.1	0.1	0.1	0.1
B12	Corporation Bank	0.1	0.1	0.1	0.1	0.5	0.1
B13	DCB Bank Ltd.	0.443328	0.156672	0.1	0.1	0.1	0.1
B14	Dena Bank	0.1	0.1	0.1	0.1	0.1	0.5
B15	Dhanalakshmi Bank Ltd	0.5	0.1	0.1	0.1	0.1	0.1
B16	Federal Bank Ltd	0.191851	0.408149	0.1	0.1	0.1	0.1
B17	HDFC Bank Ltd.	0.191851	0.408149	0.1	0.1	0.1	0.1
B18	ICICI Bank Ltd.	0.1	0.1	0.1	0.1	0.5	0.1
B19	IDBI Bank Limited	0.1	0.1	0.5	0.1	0.1	0.1
B20	IDFC Bank Ltd.	0.1	0.1	0.5	0.1	0.1	0.1
B21	Indian Bank	0.1	0.1	0.5	0.1	0.1	0.1
B22	Indian Overseas Bank	0.1	0.1	0.1	0.1	0.5	0.1
B23	IndusInd Bank Ltd.	0.5	0.1	0.1	0.1	0.1	0.1
B24	Jammu & Kashmir Bank Ltd.	0.1	0.1	0.1	0.1	0.5	0.1
B25	Karnataka Bank Ltd.	0.1	0.1	0.1	0.5	0.1	0.1
B26	Karur Vysya Bank Ltd	0.5	0.1	0.1	0.1	0.1	0.1
B27	Kotak Mahindra Bank Ltd.	0.187731	0.156672	0.1	0.355596	0.1	0.1
B28	Lakshmi Vilas Bank Ltd.	0.139147	0.1	0.1	0.460853	0.1	0.1
B29	Oriental Bank of Commerce	0.1	0.1	0.1	0.1	0.5	0.1
B30	Punjab and Sind Bank	0.1	0.1	0.1	0.1	0.5	0.1
B31	Punjab National Bank	0.1	0.1	0.1	0.1	0.5	0.1
B32	RBL Bank Ltd.	0.127231	0.1	0.1	0.472769	0.1	0.1
B33	South Indian Bank Ltd.	0.13294	0.1	0.46706	0.1	0.1	0.1
B34	State Bank of India	0.1	0.1	0.5	0.1	0.1	0.1
B35	Syndicate Bank	0.1	0.1	0.1	0.1	0.1	0.5
B36	UCO Bank	0.1	0.1	0.1	0.1	0.1	0.5
B37	Union Bank of India	0.1	0.1	0.1	0.1	0.5	0.1
B38	United Bank of India	0.1	0.5	0.1	0.1	0.1	0.1
B39	Vijaya Bank	0.1	0.1	0.1	0.1	0.5	0.1
B40	Yes Bank Ltd.	0.283951	0.24229	0.1	0.1	0.1	0.173759
	Average	0.16	0.14	0.18	0.13	0.23	0.16

Source: Authors' calculations

Bank code	CGI_{0.05}	CGI_{0.06}	CGI_{0.07}	CGI_{0.08}	CGI_{0.09}	CGI_{0.10}	CGI_{0.11}	CGI_{0.12}	CGI_{0.13}	CGI_{0.14}	CGI_{0.15}	CGI_{0.16}	Mean	S.D
B1	0.9678	0.9617	0.9556	0.9495	0.9436	0.9377	0.9319	0.9261	0.9205	0.9149	0.9094	0.9039	0.9352	0.0210
B2	0.9756	0.9708	0.9661	0.9615	0.9569	0.9523	0.9478	0.9433	0.9389	0.9345	0.9301	0.9254	0.9502	0.0164
B3	0.9905	0.9887	0.9868	0.9849	0.9831	0.9812	0.9794	0.9776	0.9757	0.9735	0.9709	0.9682	0.9800	0.0071
B4	0.9314	0.9188	0.9065	0.8946	0.8830	0.8716	0.8606	0.8498	0.8393	0.8291	0.8191	0.8093	0.8678	0.0400
B5	0.9645	0.9577	0.9510	0.9443	0.9378	0.9314	0.9250	0.9188	0.9126	0.9065	0.9005	0.8945	0.9287	0.0229
B6	0.9517	0.9426	0.9336	0.9248	0.9162	0.9078	0.8995	0.8914	0.8834	0.8755	0.8678	0.8602	0.9045	0.0300
B7	0.9706	0.9649	0.9593	0.9538	0.9483	0.9428	0.9375	0.9322	0.9270	0.9218	0.9167	0.9116	0.9405	0.0193
B8	0.9672	0.9609	0.9547	0.9486	0.9425	0.9366	0.9307	0.9248	0.9191	0.9134	0.9078	0.9022	0.9340	0.0213
B9	0.9531	0.9442	0.9355	0.9270	0.9186	0.9103	0.9023	0.8943	0.8865	0.8788	0.8713	0.8639	0.9071	0.0292
B10	0.9569	0.9487	0.9407	0.9327	0.9250	0.9173	0.9098	0.9024	0.8951	0.8880	0.8809	0.8740	0.9143	0.0272
B11	0.9832	0.9799	0.9766	0.9734	0.9702	0.9670	0.9638	0.9606	0.9563	0.9506	0.9450	0.9395	0.9638	0.0139
B12	0.9339	0.9217	0.9098	0.8982	0.8870	0.8760	0.8652	0.8548	0.8445	0.8346	0.8248	0.8153	0.8721	0.0388
B13	1.0000	1.0000	1.0000	1.0000	1.0000	0.9984	0.9962	0.9940	0.9917	0.9882	0.9841	0.9800	0.9944	0.0070
B14	0.9544	0.9458	0.9373	0.9290	0.9208	0.9128	0.9049	0.8972	0.8896	0.8821	0.8747	0.8674	0.9097	0.0285
B15	1.0000	1.0000	1.0000	1.0000	0.9962	0.9912	0.9864	0.9815	0.9767	0.9720	0.9673	0.9626	0.9859	0.0143
B16	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9983	0.9957	0.9930	0.9989	0.0023
B17	0.9901	0.9881	0.9862	0.9842	0.9823	0.9803	0.9784	0.9765	0.9746	0.9711	0.9667	0.9624	0.9784	0.0086
B18	0.9740	0.9690	0.9640	0.9591	0.9542	0.9494	0.9446	0.9398	0.9352	0.9305	0.9259	0.9214	0.9473	0.0173
B19	0.9665	0.9601	0.9537	0.9475	0.9413	0.9352	0.9292	0.9232	0.9173	0.9115	0.9058	0.9002	0.9326	0.0217
B20	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000
B21	0.9710	0.9654	0.9598	0.9544	0.9490	0.9436	0.9383	0.9331	0.9279	0.9228	0.9177	0.9127	0.9413	0.0191
B22	0.9630	0.9559	0.9490	0.9421	0.9353	0.9286	0.9221	0.9156	0.9092	0.9029	0.8966	0.8905	0.9259	0.0238
B23	0.9911	0.9893	0.9876	0.9858	0.9827	0.9786	0.9745	0.9704	0.9664	0.9624	0.9584	0.9535	0.9751	0.0128
B24	0.8822	0.8784	0.8746	0.8708	0.8671	0.8634	0.8597	0.8560	0.8524	0.8488	0.8453	0.8418	0.8617	0.0132
B25	0.9689	0.9630	0.9571	0.9512	0.9455	0.9398	0.9341	0.9286	0.9231	0.9176	0.9123	0.9070	0.9373	0.0203
B26	1.0000	1.0000	1.0000	0.9981	0.9934	0.9882	0.9830	0.9779	0.9728	0.9678	0.9629	0.9567	0.9834	0.0156
B27	0.9581	0.9501	0.9423	0.9346	0.9270	0.9195	0.9122	0.9049	0.8978	0.8900	0.8818	0.8737	0.9160	0.0273
B28	0.9691	0.9631	0.9572	0.9514	0.9456	0.9400	0.9344	0.9288	0.9233	0.9179	0.9126	0.9069	0.9375	0.0203
B29	0.9728	0.9675	0.9623	0.9571	0.9520	0.9470	0.9420	0.9370	0.9321	0.9273	0.9225	0.9177	0.9448	0.0180
B30	0.9651	0.9584	0.9518	0.9453	0.9389	0.9325	0.9263	0.9201	0.9140	0.9080	0.9021	0.8962	0.9299	0.0226
B31	0.9772	0.9727	0.9683	0.9640	0.9596	0.9554	0.9511	0.9469	0.9427	0.9386	0.9345	0.9304	0.9535	0.0153
B32	0.9696	0.9637	0.9580	0.9522	0.9466	0.9410	0.9355	0.9300	0.9246	0.9193	0.9140	0.9088	0.9386	0.0199
B33	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9992	0.9999	0.0002
B34	0.8973	0.8937	0.8901	0.8865	0.8829	0.8794	0.8759	0.8725	0.8690	0.8656	0.8622	0.8589	0.8778	0.0126
B35	0.9540	0.9453	0.9368	0.9284	0.9202	0.9121	0.9041	0.8963	0.8886	0.8811	0.8737	0.8664	0.9089	0.0287
B36	0.9598	0.9521	0.9446	0.9372	0.9299	0.9227	0.9156	0.9087	0.9018	0.8950	0.8884	0.8818	0.9198	0.0256
B37	0.9666	0.9601	0.9538	0.9475	0.9414	0.9353	0.9293	0.9233	0.9175	0.9117	0.9060	0.9003	0.9327	0.0217
B38	0.9106	0.9086	0.9065	0.9044	0.9024	0.9004	0.8983	0.8963	0.8943	0.8923	0.8903	0.8884	0.8994	0.0073
B39	0.9649	0.9582	0.9516	0.9450	0.9386	0.9322	0.9259	0.9197	0.9136	0.9076	0.9016	0.8958	0.9296	0.0227
B40	1.0000	1.0000	0.9996	0.9982	0.9969	0.9955	0.9942	0.9928	0.9915	0.9901	0.9887	0.9871	0.9945	0.0045

Source: Authors' calculations

Highlights

- 1) This paper presents the methodological framework to construct a non-parametric corporate governance index for banking firms using DEA based 'benefit-of-the-doubt' approach.
- 2) This paper provides a comprehensive multi-dimensional framework for assessing the corporate governance of a bank.
- 3) An illustration is made using a data set of 40 Indian banks operating in the year 2017.
- 4) The constrained BoD model used assigns endogenous weights to individual dimensions of bank governance.