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THE RELATIONSHIP BETWEEN INFORMATION LITERACY AND KNOWLEDGE SHARING IN STUDENTS OF PUBLIC UNIVERSITY

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ABSTRACT

Background: The aim of this study was to investigate the relationship between information literacy (IL) and knowledge sharing (KS)in University of Qom, Iran. A multiple correlational survey design with a stratified random sampling (N=3476) was used. The data collection instruments included IL subscales and KS questionnaires. Face and content validity of the questionnaires confirmed by experts and its reliability were estimated (r_1=0.79) and(r_2=0.91) through Cronbach's alpha coefficient. The findings showed that subscales of IL were atmid- level but KS was less than mid-level. It was found a direct and significant relationship between scores of IL subscales and KS. Beta coefficients among IL subscales and KS were significant and no auto correlation existed and regression model was significant. University students participate in various information transformation activities on a daily basis, the use of information and knowledge in universities results significant benefits in terms of competitive advantage.

KEYWORDS: *Information Literacy, Knowledge Sharing, Students, University*

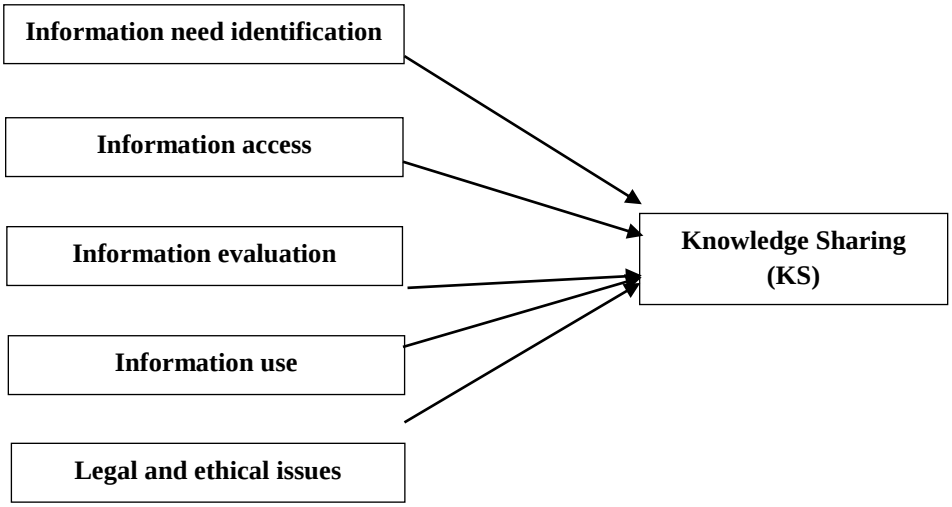
INTRODUCTION

The higher education follows a special mission and that's development of learning courses, this development could help producing life-long learners and confirming the improvement of their abilities of critical thinking. One of the main elements of long-life learning is information literacy (IL), it provides the conformation of well-informed community. The competencies of individuals are enhanced by increasing IL skills beyond the formal class room environment and in the practical lives of individuals, these skills also give self-directions.

Students' unique skills, characteristics and perceptions have made a huge difference in their ability and willingness to seek out and understand education. (Michalak et al., 2017).American Library Association (1989) defines IL as, "to be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information (p. 1)."According to Rehman & Alfaresi (2009) studies : There is some differences between these terms: bibliographic assistance, user education and library instruction and IL, IL is used in a broad context to identify needed information and it also helps meet one's information need by finding relevant sources to become a life-long learner.In any discipline, learning environment and any level of education, IL imbues competencies of individuals, so that they can think critically with content and expand their own researches and prepare for organized learning. Bundy (2004)IL can locate, evaluate and use information's effectively while critical thinking explores and evaluates ideas in order to make a decision or form an opinion on a topic or problem(Wertz et al., 2013) .Kuh et al. (2006) suggested IL as a novel indicator of student success.

The university as a knowledge-intensive organization can help creating and sharing knowledge to students and society and that's why knowledge management is an emerging topic in universities. The use of knowledge in universities results significant benefits in terms of competitive advantage. (Mahdi & Almsafir, 2014).Availability of various resources helps to improve students learning, as a result students are simultaneously directed toward Knowledge Sharing (KS) activities, especially when there is a great demand for education (Osman et al., 2015).Tippins(2003) studied how using the university as a transfer mechanism could help students to improve and perform better by providing them with a knowledge base.According to (Qun&Xiaocheng, 2010) studies, There are 2 types of knowledge: explicit knowledge and tacit knowledge. Explicit knowledge is easy to learn, we can encode it through language, books, words and database and use it through books, journals, patent documents, audiovisual media, software, etc. Tacit knowledge is highly personal so it's very difficult to standardize and transmit it and due to this feature it is also hard to manifest and collect. In this kind of knowledge, if there is no commonality between people, shared activity will become an empty talk(Qun & Xiaocheng, 2012).KS can be defined as "provision of task information and know-how to help others and to collaborate with others to solve problems, develop new ideas, or implement policies or procedures (Wang& Noe, 2010).The advantages of KS include having knowledge and expertise by individuals that helps to improve overall performance by knowledge sharing. (Haas&Hansen, 2007).The integration of information, experience, and theory creates knowledge. Individuals form groups to interact with each other and share knowledge and experiences, thereby enhancing learning (Chang &Chuang, 2011). Coded, social and institutional knowledge are 3 categories of knowledge that can be exchanged by academics. Coded knowledge includes knowledge shared among academics in electronic or written format, Social knowledge is related to shared culture, beliefs, values, ethics, and norms Institutional knowledge refers to university key activities such as research, expertise, and policies (Saad& Haron, 2013).Thus, according to the above points, the conceptual model can be formulated as follows in Figure1:

Figure 1. The conceptual model used in the study



LITERATURE REVIEW

The study of McGuinness (2006) depicted that the exercise of information literacy is comparatively low and steadily among faculty. They usually prefer learning by doing and emerging demand. The findings of X. Shao and Purpur's (2016) study indicated that integrated library educational programs and services are needed to improve students' information literacy skills. A study indicated the workshop improved the students' ability to identify discipline relevant databases, keywords and search terms, and their ability to evaluate information and cite the correct resources according to the standards and guide-lines substantially improved (Baroutian & Kensington-Miller, 2016). A study demonstrated that the student's prior knowledge and experience, the lecturer's prior knowledge and experience, and the course context positively influenced the level of knowledge sharing and lecturers need to promote the students the importance of knowledge sharing (Sriratanaviriyaku& Den, *2017).*Bartol et al. (2018) in a comparative study of IL skill performance of students in agricultural sciences showed that the mean ILT score was 46.35%. Students were most successful in information evaluation and information need identification, and least successful in legal/ethical issues and information use. As expected, IL skills increase from the first to second year of study. Fernández-Ramos(2019) indicated that online I instruction in Mexican University libraries, showed that the main challenges that the libraries that do provide online instruction have had to face are related to a lack of institutional support, a lack of cooperation onthe part of faculty members, students' motivation, and librarians' expertise.

RESEARCH METHODOLOGY

The type of research was descriptive and correlational. The population for the study is 3476 students of Qom University. This study uses a stratified random sampling method to select 346 students. The authors distribute 346 questionnaires and ask for the questionnaires to be completed by faculty members. Of the 300 returned questionnaires, 10 are incomplete. The residual 300 valid and complete questionnaires are intended for the quantitative analysis. Research tools included item information literacy test (ILT) questionnaire with 40 items using five-point Likert scale based on Boh Podgornik et al., (2016) model and knowledge sharing (KS) questionnaire with 6 items using five-point Likert scale based on Chai et al., (2011).The questionnaires were

distributed among examines by researchers who tried to attend for clarification if needed. To watch ethics in research, the examiner agreement to participate was acquired. Impartiality and avoiding bias by researcher, utilizing newest informative and scientific resources, observing objectivity while analyzing data, and avoiding distortion of data and keeping questionnaire data confidential were as well considered. To verify the questionnaires' validity, face and content method and expert opinions were utilized. Reliability coefficient of the questionnaires was estimated through Cranach's alpha coefficient (Table1).

TABLE L. VARIABLES' ALPHA COEFFICIENTS

Variables	**Cranach's alpha coefficient**
ILsubscales	0.78
Information need identification	0.81
Information access	0.79
Information evaluation	0.76
Information use	0.77
Legal and ethical issues	0.80
KS	0.88

Data were analyzed through descriptive statistics for example frequency distribution, percent, standard deviation, and Pearson correlation coefficient and inferential statistics for instance t-test, univariate test, multiple regression, and LSD test utilizing SPSS version 23.

RESULTS

Most respondents (59.00%) aged 21 to 23 years; the participants included 52.00% female and 48.00% male. The number of engineering Sciences students was 45.2% and those whose domain was Social Sciences were 16.4%.According to the result, in Table 2, the means score of the IL subscales was at mid- level, with Information access havingthe highest (3.21± 1.56) and use Legal and ethical issues having the lowest mean score (2.15± 1.91). Moreover, the mean score of KS was less than mid- level (2.25± ***1.81)*** (Table 2).

TABLE 2. MEAN OFIL SUBSCALE SAND KS

Variables	*Mean± (SD)*	*t*	*P value*
IL subscales	3.01±1.67	-22.3	<0.001
Information need identification	3.17± ***1.28***	-26	<0.001
Information access	3.21± 1.49	-20	<0.001
Information evaluation	3.13± 1.56	-11.7	<0.001
Information use	3.02± 1.62	-15.9	<0.001
Legal and ethical issues	2.15± 1.91	-13.35	0.002
KS	2.25±1.181	-22.4	<0.001

As shown in Table 3, Information need identification, Information access, Information evaluation, Information use. Legal and ethical issues of the students had a statistically significant relationship with KS. (P<0.001) (Table 3).

TABLE 3. THE RELATIONSHIP BETWEEN IL SUBSCALES AND KS

IL subscales / **KS**	**Information need identification**		**Information access**		**Information evaluation**		**Information use**		**Legal and ethical issues**	
	P value*	***r***	***P value****	***r***	***P value****	***r***	***P value****	***r***	***P value****	***r***
KS	0.004	0.328	0.000	0.323	0.005	0.215	0.000	0.501	0.003	0.248

Moreover, there was a significant correlation between IL subscales and KS(correlation coefficients =0.409) and modified determination coefficient is 0.167. Therefore, 16.7% of changes related to variance of KScan be explained by a combination of IL subscales(P<0.001).

TABLE 4. REGRESSION BETWEEN IL SUBSCALES AND KS

Variables	*B*	**Beta**	*SE*	*t*	*P value*
Constant	2.601	-	***1.602***	142.6	<0.001
Information need identification	0.141	0.230	***0.110***	491.2	0.002
Information access	0.121	0.236	***0.883***	780.1	<0.001
Information evaluation	0.131	0.120	***0.861***	640.1	0.003
Information use	0.128	0.163	***0.135***	843.1	<0.001
Legal and ethical issues	0.118	0.152	***0.852***	130.4	<0.001

According to the finding shown in Table 4, Beta coefficients of Information need identification, Information access, Information evaluation, Information use, Legal and ethical issues were all statistically significant effective on the KS(P<0.001).

Analysis of covariance showed that observed F in level $p \leq 0.05$ for relation of IL subscales and KSaccording to demographic characteristics is significant. Eta square for sex was 0.02, for course was 0.007 and for faculty was 0.02 which are not statistically significant. But Eta square for age was 0.04 and for year was 0.08 which are statistically significant.

DISCUSSION & CONCLUSION

Technology and the amount of online information are experiencing phenomenal growth. As students are required to know and be able to apply analytical and evaluative skills, information literacy is essential: it enables students to become aware of what they have learnt and provides a means for reflection on their knowledge and learning process (Bruce, 2003).

Research results showed that IL subscales mean such as of Information need identification, Information access, Information evaluation, Information use was at mid-level and the mean score of Legal and ethical issues was less than mid- level. And so, Research results showed that the mean score of KS was less than mid- level. Results of this study are almost compatible with a study that showed the exercise of IL is comparatively low and steadily among faculty (McGuinness, 2006). Sriratanaviriyaku & Den (*2017)*demonstrated that the student's prior knowledge and experience, the lecturer's prior knowledge and experience, and the course context positively influenced the level of knowledge sharing and lecturers need to promote the students the importance of KS.

In general, there is significant multiple relation between IL subscales including Information need identification, Information access, Information evaluation, Information use, Legal and ethical issues and the KS in the studied university. The beta coefficients have been as 0.230 between Information need identification and KS, 0.236between Information accessand KS, 0.120 between Information evaluation and KS, 0.165 between Information use and KS, 0.152 between Legal and ethical issues and KS all of which are statistically significant. The variance inflation factor for explanatory variables has been at least 1.13 to 2.36, which shows that there is no conformity between them. Results of this study are almost compatible with a study that workshop improved the students' ability to identify discipline relevant databases, keywords and search terms, and their ability to evaluate information and cite the correct resources according to the standards and guide-lines substantially improved (Baroutian & Kensington-Miller, 2016). Fernández-Ramos(2019) indicated that online IL instruction in Mexican university libraries, Showed that the main challenges that the libraries that doprovide online instruction have had to face are related to a lack of institutional support, a lack of cooperation on the part of faculty members, students' motivation, and librarians' expertise.

Therefore, with the increase in the subscales of IL in the university, i.e. Information need identification, Information access, Information evaluation, Information use, Legal and ethical issues can improve the KS. In order to justify this finding, it could be said that if Faculty members encourage students to freely express their opinions and Information, and so they have to create the ground for their more participation students in the knowledge.

REFERENCES

American Library Association. (1989). American Library Association Presidential Committee on Information Literacy Retrieved Jan 22, 2013, from http://www.ala.org/acrl/issues/infolit/overview/intro.

Baroutian, S.,&Kensington-Miller, B. (2016). Information Literacy: The impact of a hands-on workshop for international postgraduate students, Education for Chemical Engineers, 14: 16- 23.

Bartol, T.,Dolničar, D., Podgornik, B B., Rodič, B., & Zoranović, T. (2018). A Comparative Study of Information Literacy Skill Performance of Students in Agricultural Sciences. The Journal of Academic Librarianship, 44(3): 374- 382.

Boh Podgornik, B., Dolnicar, D., Sorgo, A., & Bartol, T. (2016). Development, testing, and validation of an information literacy test (ILT) for higher education. Journal of the Association for Information Science and Technology, 67(10): 2420- 2436.

Bruce, C. (2003). Information literacy as a catalyst for educational change. In: UNESCO Information Literacy Leadership Conference, Prague.

Bundy, A. (2004). Australian and New Zealand information literacy framework: Principles, standards and practice (2nd ed.). South Australia: ANZIIL University of South Australia Library.

Chai, S., Das, S., & Raghav, R. H. (2011). Factors affecting Bloggers' knowledge sharing: an investigation across gender. Journal of Management Information Systems, 28(3): 309-341.

Chang, H. H., &Chuang, S. (2011). Social capital and individual motivations on knowledge sharing: participant involvement as a moderator. Information & Management, 48(1): 9-18.

Fernández-Ramos, A. (2019). Online information literacy instruction in Mexican university libraries: The librarians' point of view. The Journal of Academic Librarianship, 45: 242-251.

Kuh, G., Kinzie, J., Buckley, J. A., Bridges, B., & Kayek, J. (2006).What matters to student success: A review of the literature. Commissioned report for the National Symposium on Postsecondary Student Success: Spearheading a dialog on student success Retrieved from http://nces.ed.gov/npec/pdf/kuh_team_report.pdf.

McGuinness, C. (2006). What faculty think- exploring the barriers to information literacy development in undergraduate education. The Journal of Academic Librarianship, 32(6): 573- 582.

Mahdi, O. R.,&Almsafir, M. K. (2014). The Role of Strategic Leadership in Building Sustainable Competitive Advantage in the Academic Environment. Procedia-Social and Behavioral Sciences, 129: 289- 296.

Michalak, R., Rysavy, M.D.T., &Wessel, A. (2017). Students' perceptions of their information literacy skills: the confidence gap between male and female international graduate students. The Journal of Academic Librarianship, 3 (2):100-104.

Osman, s., Kamal, S, Ali, M.N., Noor, J.M., WahiAnuar, M.A.,&Othman, A.(2015).Mechanisms of Knowledge Sharing among Undergraduate Students in UiTM Johor. Procedia Economics and Finance. *International Accounting and Business Conference***,** 31: 903- 908.

Qun, Zeng.,& Xiaocheng, Zhong. (2012). The Design of Individual Knowledge Sharing Platform Based on Blog for Online Information Literacy Education. 2012 International Conference on Medical Physics and Biomedical Engineering. Physics Procedia, 33: 1426- 1432.

Shao, X.,& Purpur, G. (2016). Effects of Information Literacy Skills on Student Writing and Course Performance. The. Journal of Academic Librarianship, 42(6): 670- 678.

Sriratanaviriyaku, N.,& El-Den, J. *(2017).* Motivational Factors for Knowledge Sharing using Pedagogical Discussion Cases: Students, Educators, and Environmental Factors. 4th Information Systems International Conference 2017, ISICO 2017, 6-8 November 2017, Bali, Indonesia. *Procedia Computer Science, 124: 287- 299.*

Rehman, S. U., & Alfaresi, S. (2009). Information literacy skills among female students in Kuwaiti high schools. Library Review, 58(8): 607-616.

Saad, A., &Haron, H. (2013). A case study of higher education academics' shared knowledge and classification. 2013 International Conference on Research and Innovation in Information Systems (ICRIIS), 439- 444.

Tippins, M.J. (2003). Implementing knowledge management in academia: teaching the teachers. The International Journal of Educational Management, 17 (7): 339- 345.

Wang, S.,& Noe, R.A. (2010). Knowledge sharing: A review and directions for future research. Human Resource Management Review, 20(2): 115-131.

Wertz, R. E. H., Fosmire, M., Purzer, S., Sragih, A. I., Van Epps, A. S., Sapp Nelson, M. R., & Dillman, B. G. (2013). Work in progress: Critical thinking and information literacy: Assessing student performance. Proceedings of the 120th ASEE conference. Washington D.C.: American Society for Engineering Education Retrieved from http://www.asee.org/public/conferences/20/papers/6925/view

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DEVISING MACROECONOMIC PARTIAL SCENARIO WITH MAXIMUM IMPACT FACTOR FOR STRESS TESTING OF BANKING SYSTEM

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ABSTRACT

The present study is an empirical presentation of a procedure to devise a Macroeconomic Partial Scenario(s) with Maximum Impact Factor (MePSWMIF) for Stress Testing of a banking system. The researchers have applied Cross Impact Analysis (CIA) (Gordon and Helmer, 1966) as pioneer in the area of econometrics i.e. Stress testing of a banking system Kenneth Chao (2008). The researchers modified the CIA methodology by replacing Cross Impact Matrix (CIM) with a type of Variance Decomposition Matrix (VDM) to compute impact factors of macroeconomic variables to help devise MePSWMIF. These MePSWMIFs are dynamic in nature and their dynamicity is evident from their computations and graphics for different time spans and sizes. Bayesian Vector Auto regression (BVAR) Model with Minnesota priors and Gibbs Sampler technique has been applied with 10000 repetitions to compute the VDMs.

KEYWORDS: *Stress Testing; Partial Scenario; Banking System; Dynamicity; Cross Impact; Macroeconomic*

1. INTRODUCTION

The purpose of this paper is to devise macroeconomic partial scenario with maximum impact factor for stress testing of banking system. Partial scenarios are used in place of scenarios and their importance comes to the fore only when the use of scenarios which are inseparable part of stress

tests becomes difficult. The role of scenarios in stress tests is to alert the Financial Institutions to keep themselves ready to meet the unexpected adversities that may occur at any time in future. For stress testing of banking system these adversities can be generated by giving adverse shocks to the macroeconomic variables which ultimately stress the banking system through the satellite models developed for it in terms of macroeconomic variables (see e.g RAMSI Alessandri et al. (2009)). A scenario becomes problematic when the number of macroeconomic variables (MeVs) constituting it is unnecessarily large and difficult to handle computationally or otherwise. We also know that the testing of financial stability of any financial institution is very lengthy, cumbersome and full of complexities. So, it is advisable that there should have been some criterion which may help decide which macroeconomic variables should be retained for further study on an early stage with minimum possible loss. To deal with such a situation it becomes necessary to sort out those MeVs which matter the most and help devising partial scenario. So, devised partial scenario is considered better performer if it follows some criterion of optimality. With all this in mind the authors as pioneer have made a sincere attempt to devise macroeconomic partial scenario with maximum impact factor for stress testing of banking system.

1.1 Stress Testing

The requirement of Stress-testing of Financial Institutions emerged during financial crisis (2007-2009) in the United States America and United Kingdom when the financial systems had suffered a near-death experience. . At that time The U.S. Treasury and Federal Reserve realized the importance of stress tests and they redesigned them for the nation's major financial institutions including the banks to find out the amount of capital required to restore their financial health if the economy suffered a downturn as severe as the 1930s Great Depression. Though many at that time viewed the stress tests skeptically and apprehended that it was just for the consumption of public to believe that banks were solid even if they were not. But the regulators continued with stress tests under different scenarios and proved that the apprehensions of the critics were totally unfounded. As a result recapitalization of the financial institutions helped save the global economy from a new depression. Stress-testing has now become a standard part of global banking regulation, adopted by the International Monetary Fund for all its member countries.

1.2 Scenarios

Stress test of a banking system is meaningless if there are no scenarios as they are considered a valuable tool that helps organizations to prepare for unexpected severe adversities that may happen in future. As the study takes into account the effect of stressed macroeconomic variables (MeVs) on a banking system, therefore, a well designed macroeconomic scenario will surely ensure that stress test does play a positive role. Mark Zandi, (2013) has given a good account of different types of macroeconomic scenarios and modeling approaches for banking sector.

1.3 Partial Scenarios

The practical problem comes up when the number of such MeVs that constitute a scenario is sufficiently large. In such a situation it becomes rather difficult to handle them computationally and overwhelmingly complex to interpret, many of them have negligible cross-impacts as well. A feasible answer to this problem is to design partial stress scenarios, which involve only a handful of MeVs (risk factors). The only literature traceable dealing with partial scenarios is that of Kupiec (1998), Bonti et al. (2005) and Thomas Breuer et al. (2009). Their works solely emphasize the maximization of plausibility of partial scenarios not the development of partial scenarios. A

solution to such a situation has been provided in this study by, 'Devising Macroeconomic Partial Scenario with Maximum Impact Factor for Stress Testing of Banking System'.

1.4 Application of CIA

To devise MePSWMIF the researchers have taken the aid of the Cross–Impact Analysis (CIA) now a fully grown methodology originally developed by Gordon and Helmer in 1966,T.J. Gordon(1994), Jha et. al. (2018). Since then this methodology has wide applications in diversified fields but none in econometrics Kenneth Chao (2008). However, for the first time the authors have applied it in an area of econometrics i.e Stress testing of banking system. Before it could have been possible, CIA required a basic modification that is the CIM (usually computed by using Delphi [1] method) is replaced by the VDM in it. This gave rise to a new variant [2] of CIA with an application in econometrics. There are many others who have revised the cross-impact method to be more applicable barring econometrics (Duperrin& Godet, 1975; Fontela, 1976; Helmer, 1977; Enzer & Alter, 1978; Sarin, 1978; Novak &Lorant, 1978; Wissema & Benes, 1980; Hanson & Ramani, 1988; Brochner, J.1990; Alarcon, L.F. 1992; Kwak, Y.H., 1997; Víctor A. Bañuls et. al. 2011; Juha Panula-Ontto, 2016; Rahil Farhani et. al. 2017).

[1]Delphi method is a structured process for collecting and distilling knowledge from a group of experts by means of a series of questionnaires interspersed with controlled opinion feedback (Adler and Ziglio, 1996).

[2]For other variants such as Interax , KSIM,SMIC, EXPLORSIM etc. referred toJha et. al. (2018).

2. Variance Decomposition Matrix

Normally, the cross- impact matrix generated by Delphi method or any other such method forms the basis for CIA. But in the field of stress testing of a banking system no such matrix can be generated as cross–impacts of macroeconomic variables are governed by the analytical model that is chosen for the study, therefore, no flexibility is permissible which remains at the core of CIA. Hence none of the standard CIA variants presently available in the literature is applicable in the present case. To overcome this challenge some appropriate measure which can stand for cross–impacts of macroeconomic variables is needed. Variance decompositions have provided solution to this problem.

The variance decomposition indicates the amount of information each variable contributes to the other variables in the autoregression (Wikipedia).In a variance decomposition matrix this amount of information is given by the percentage of variances each variable contributes to the other variables in the BVAR, which also shows the strength with which variables impact each other. The sum total of the percentage of variances calculated for each of the variables or their constant (>0) multiple is the impact factor of the variable, a term used in CIA. Thus variance decomposition matrix provides the base material for CIA application in the field of stress testing of banking system.

2.1 Prerequisites of VDM Computations

Now the problem remains the computation of variance decomposition matrix. The process of its computation itself is lengthy and cumbersome as one has to clear the following steps before being ready for that:

(1) Selection of MeVs (2) Procurement of Chronological data of MeVs (3) Transformation of the data to the same base year (4) Transformation for stationarity of MeVs data (5) Stationarity check

of the transformed data (6) Selection of the model for further study (VAR, BVAR or anyone else) [Appendix I] (7) Selection of priors in case of BVAR [Appendix II] (8) Selection of the software to compute VDMs using Gibbs sampler method or Markov Chain Monte Carlo method(MCMC) [Appendix III].

Though this study is restricted to the development of MePSWMIF yet the end goal is its application in the field of stress testing of banking system. So, whole of the illustrated process is bank oriented. The time series data of MeVs considered important for the stress testing of a banking system has to pass the procedural prerequisites including the statistical tests before they become eligible to devise MePSWMIF. These procedural prerequisites have been summarized in the steps to follow.

2.1.1 Selection of macroeconomic variables

The selection of MeVs has been made on the basis of previous studies and the reports of elite financial institutes dealing with the financial stability of the banking system and the economy as whole such as the Financial Stability Map & Indicator of India etc. The selected variables given below have been the part of financial stability reports of RBI (Reserve Bank of India), the Bank of England and the other such studies.

(1) Nominal Long term Interest rate(10 year G-Sec. Bond rate) (2) CPI inflation (combined) (3) Exports to GDP ratio (4) Household Income Gearing ratio (5) REER (Real effective Exchange rate) (6) S&P&NIFTY Index (average) (7) Nominal short term Interest rate (3 month T-Bill rate) (8) Unemployment rate (9) Weighted average Lending rate (10) Weighted average Call rate (11) Gross Fiscal Deficit to GDP ratio (12) Current Account Balance to GDP ratio (13) Gross Value Added Growth at basic price.

2.1.2 Chronological data of MeVs

The quarterly data have been taken from 2006Q1 to 2017Q4. The sources are RBI, OECD and some other such organizations. In cases where the quarter wise data of MeVs is not available, we have used the technique available in EViews to convert the annual data into quarterly data. Standard methods of interpolation and extrapolation have been used to approximate the missing data if any.

2.1.3 Transformation of the data to the same base year

Deflators have been used to change the base year of the MeVs to the FY 2010-2011, and to make the data fit for further treatment.

2.1.4 Transformation for stationarity of MeVs data

Most of the times the time series data are available in the non- stationary form, therefore, they have been transformed to make them stationary by applying the techniques: first difference log, second difference log, deseasonality etc. The respective transformed variable codes are: **D_10sec, D_cpi , D_expo , D_house , D_reer , D_spnifty , D_treasurybill, DD_unempt, D_walr , D_wacr, D_fiscal, D_cab, D_gva.**

Hereinafter **MeVs** stands for these coded variables.

2.1.5 Stationary check of the transformed data

The Breakpoint Unit Root Test (Dickey-Fuller min-t & Schwarz criterion) has been applied to verify the stationary of the data.

2.1.6 Selection of the model

Bayesian vector autoregressive (BVAR) model [3,4] has been selected to forecast the MeVs with three lags of each variable as regressors. This model has been taken as the base model for the computation of variance decomposition matrices for different time periods. The selection of this model adds value to any study because it includes the experience of the forecasters in addition to the sampled data leading to better outputs. There are many who have subscribed to this conjecture empirically or otherwise. Kinal, Renter (1986), Sheomith (1990), Rangan Gupta and Moses, M. Sichei (2006), Dipankar Bisvas et.al (2010), Marta Banbura et.al (2010), Karlson, S (2012), Korbilis (2013), Koop (2013) are a few to mention.

2.1.7 Selection of priors in case of BVAR

BVAR model with Minnesota [5] priors (Litterman, (1986)) using covariance matrix as defined by Koop and Korobilis(2010) with $H_1 = 0.3$, $H_2 = 0.97$, $H_3 = 1$and lag 3 has been run. Further, to find the stationary posteriori distribution of the parameters in the BVAR model, Monte Carlo Markov Chain (MCMC) or Gibbs Sampler technique has been applied with 10000 repetitions, out of which first 5000 repetitions belong to the burn-in phase and the remaining ones to stabilize the distribution.

The model was then subjected to the tests viz. (i) residual diagnostic checks such as joint normality test, portmanteau autocorrelation test etc. (ii) stability test: AR Lag structure test (iii) forecasting tests: Theils U_1 (<1) coefficient test and MAPE, to pass all these so as to become fit for forecasting and computation of variance decompositions and it did so.

[3]A good description of VAR models, their advantages and disadvantages, is provided by James Stock and Mark Watson. See "Vector Autoregressions," http://faculty. washington.edu/ezivot/econ584/stck_watson_var.pdf VAR models were first introduced by Christopher Sims (1980).

[4]Another popular approach to modeling the macroeconomy is dynamic stochastic general equilibrium or DSGE models. See "Building a Science of Economics for the Real World," http://www2.econ.iastate.edu/classes/econ502/tesfatsion/Solow. StateOfMacro.CongressionalTestimony.July2010.pdf

[5] IMF Working Paper WP/03/102,Matteo Ciccarelli and Alessandro Rebucci (see for other priors)

2.1.8 Selection of the software

Eviews software has been used for making the data stationary, running BVAR and checking diagnostics of the transformed data. BMR package of R has been used for calculating variance decompositions from the data obtained in step (3,1.4) .

2.2 Quarter-wise Variance Decomposition Matrix

Quarter-wise VDMs have been obtained using BMR package of R with 10000 repetitions including the first 5000 of burn-in phase. These are given in Tables 1-4.

TABLE 1: VARIANCE DECOMPOSITION MATRIX FOR 2018 Q1

Variables	D_10sec	D_cpi	D_expo	D_house	D_reer	Dsp_nifty	D_treasury bill	DD_unempt	D_walr	D_wacr	D_fiscal	D_cab	D_gva
D_10sec	0.4439	0.0385	0.00062	0.0452	0.0325	0.0118	0.1087	0.0090	0.0462	0.01183	0.1357	0.0267	0.0773
D_cpi	0.00004	0.3077	0.0253	0.0024	0.0000	0.0005	0.0204	0.0076	0.0146	0.2109	0.2033	0.0615	0.1454
D_expo	0.0181	0.0572	0.2020	0.0083	0.0279	0.0131	0.1521	0.0887	0.0020	0.3670	0.0086	0.0029	0.0522
D_house	0.0541	0.0341	0.0510	0.3002	0.0048	0.0357	0.0140	0.0097	0.1041	0.1539	0.0521	0.0888	0.0975
D_reer	0.0375	0.0022	0.0362	0.1226	0.2836	0.0159	0.1062	0.0543	0.0636	0.1882	0.0111	0.0001	0.0786
D_spnifty	0.0161	0.0704	0.1261	0.0059	0.0093	0.4446	0.0332	0.0011	0.0447	0.0454	0.0626	0.0064	0.1343
D_treasury bill	0.0450	0.0015	0.1565	0.1643	0.0227	0.0137	0.2637	0.0693	0.0000	0.1015	0.0766	0.0639	0.0214
DD_unempt	0.0008	0.0679	0.0001	0.0117	0.1230	0.0173	0.0203	0.2472	0.0038	0.2750	0.1433	0.0096	0.0799
D_walr	0.0212	0.0558	0.0391	0.0005	0.0304	0.0167	0.0097	0.0022	0.5663	0.0082	0.0020	0.0848	0.1632
D_wacr	0.0440	0.0026	0.2896	0.0006	0.0003	0.0499	0.1625	0.0193	0.0346	0.3251	0.0461	0.0000	0.0254
D_fiscal	0.0538	0.0633	0.1014	0.1674	0.0469	0.0042	0.0339	0.0000	0.0032	0.1040	0.4024	0.0052	0.0145
D_cab	0.0064	0.0001	0.0003	0.1527	0.0015	0.0128	0.0030	0.1693	0.0223	0.2287	0.0000	0.3353	0.0676
D_gva	0.0185	0.0393	0.0135	0.0201	0.0973	0.0198	0.0045	0.0842	0.0009	0.1414	0.1074	0.0058	0.4474
Total	0.7598	0.7404	1.0470	1.0019	0.6802	0.6561	0.9322	0.7621	0.9062	2.1675	1.2512	0.6908	1.4046

TABLE 2: VARIANCE DECOMPOSITION MATRIX FOR 2018 Q2

Variables	D_10sec	D_cpi	D_expo	D_house	D_reer	D_spnifty	D_treasury bill	DD_unempt	D_walr	D_wacr	D_fiscal	D_cab	D_gva
D_10sec	0.1172	0.0673	0.1851	0.0917	0.0181	0.0030	0.0370	0.0034	0.0249	0.0064	0.2002	0.0146	0.2311
D_cpi	0.0553	0.1177	0.0205	0.0010	0.0548	0.0695	0.0917	0.0048	0.0392	0.2726	0.0761	0.1337	0.0631
D_expo	0.1010	0.0332	0.1630	0.0983	0.0650	0.0872	0.0801	0.0475	0.0440	0.1994	0.0045	0.0115	0.0653

D_house	0.0608	0.0150	0.1064	0.1938	0.0250	0.0253	0.0106	0.1553	0.1460	0.0683	0.1132	0.0352	0.0451
D_reer	0.0121	0.0011	0.2414	0.1258	0.0808	0.0722	0.0397	0.0367	0.1836	0.1251	0.0070	0.0000	0.0744
D_spnifty	0.0153	0.0127	0.1372	0.0106	0.1077	0.1592	0.1707	0.0750	0.0704	0.0910	0.0943	0.0175	0.0384
D_treasury bill	0.0597	0.0634	0.1087	0.0789	0.1215	0.0104	0.1524	0.0422	0.0046	0.2791	0.0332	0.0265	0.0194
DD_unempt	0.0314	0.0322	0.0316	0.0209	0.1387	0.0951	0.2734	0.0785	0.0589	0.1454	0.0488	0.0186	0.0263
D_walr	0.0113	0.0221	0.0533	0.0223	0.0138	0.0324	0.0035	0.0043	0.2301	0.2382	0.1870	0.1245	0.0573
D_wacr	0.0335	0.0017	0.2147	0.1427	0.0289	0.0103	0.0886	0.0950	0.0191	0.1763	0.1344	0.0262	0.0286
D_fiscal	0.1999	0.0861	0.0235	0.1021	0.0418	0.0055	0.0848	0.0403	0.0075	0.3010	0.0969	0.0030	0.0076
D_cab	0.0030	0.0219	0.0656	0.0681	0.0712	0.0121	0.0884	0.1348	0.0158	0.2407	0.0641	0.1847	0.0294
D_gva	0.0459	0.0210	0.0918	0.0074	0.0467	0.0099	0.0281	0.1237	0.0013	0.1186	0.1981	0.0030	0.3046
Total	0.7462	0.4953	1.4428	0.9636	0.8142	0.5922	1.1490	0.8415	0.8454	2.2622	1.2579	0.5990	0.9906

TABLE 3: VARIANCE DECOMPOSITION MATRIX FOR 2018 Q3

Variables	**D_10sec**	**D_cpi**	**D_expo**	**D_house**	**Dreer**	**Dsp_nifty**	**D_treasury bill**	**DD_unempt**	**D_walr**	**D_wacr**	**D_fiscal**	**D_cab**	**D_gva**
D_10sec	0.1032	0.0804	0.0330	0.0188	0.0762	0.0064	0.0789	0.0541	0.0092	0.3976	0.0381	0.0119	0.0922
D_cpi	0.2057	0.0940	0.0110	0.2473	0.0212	0.0396	0.0350	0.0340	0.0308	0.1014	0.0453	0.1114	0.0233
D_expo	0.0529	0.0412	0.2030	0.0404	0.0282	0.0603	0.1042	0.1333	0.0328	0.1003	0.0686	0.0672	0.0678
D_house	0.0415	0.0059	0.0457	0.0761	0.1529	0.0371	0.1058	0.0613	0.1155	0.0506	0.0481	0.0208	0.2388
D_reer	0.0031	0.0030	0.1426	0.0879	0.0929	0.0510	0.0904	0.0725	0.1340	0.2453	0.0460	0.0101	0.0211
D_spnifty	0.0284	0.0050	0.0584	0.1269	0.1941	0.0799	0.1832	0.0300	0.0601	0.0887	0.0598	0.0739	0.0115
D_treasury bill	0.1434	0.0347	0.1383	0.1461	0.0578	0.0097	0.1303	0.0321	0.0025	0.1429	0.0436	0.0167	0.1018
DD_unempt	0.1033	0.0248	0.1100	0.2793	0.0679	0.0493	0.1010	0.0269	0.0767	0.0582	0.0580	0.0354	0.0093

D_walr	0.0073	0.0130	0.1522	0.0116	0.0400	0.0324	0.0137	0.0494	0.1229	0.2820	0.1220	0.1237	0.0298
D_wacr	0.0235	0.0251	0.0917	0.0867	0.1805	0.0042	0.1211	0.0387	0.0102	0.2892	0.0549	0.0237	0.0502
D_fiscal	0.3097	0.0629	0.0115	0.1524	0.0194	0.0073	0.0322	0.0164	0.0038	0.1703	0.0652	0.0329	0.1160
D_cab	0.0010	0.0079	0.0900	0.0917	0.1240	0.0326	0.2931	0.0407	0.0222	0.1124	0.0233	0.1360	0.0251
D_gva	0.0239	0.0146	0.1862	0.1215	0.0250	0.0200	0.0484	0.0690	0.0456	0.0544	0.2539	0.0025	0.1351
Total	1.0469	0.4127	1.2736	1.4866	1.0801	0.4298	1.3372	0.6584	0.6662	2.0933	0.9268	0.6662	0.9219

TABLE 4: VARIANCE DECOMPOSITION MATRIX FOR 2018 Q4

Variables	**D_10sec**	**D_cpi**	**D_expo**	**D_house**	**D_reer**	**D_spnifty**	**D_treasurybill**	**DD_unempt**	**D_walr**	**D_wacr**	**D_fiscal**	**D_cab**	**D_gva**
D_10sec	0.2699	0.0633	0.0866	0.0942	0.0359	0.0068	0.0403	0.0689	0.0055	0.2481	0.0201	0.0208	0.0396
D_cpi	0.1521	0.0574	0.0117	0.1092	0.0188	0.0399	0.0142	0.0223	0.0523	0.3104	0.0235	0.0470	0.1411
D_expo	0.0248	0.0323	0.0949	0.0534	0.1140	0.0283	0.1474	0.0632	0.0153	0.0932	0.1084	0.1447	0.0800
D_house	0.0433	0.0019	0.0402	0.2042	0.1455	0.0554	0.0786	0.0369	0.1027	0.0549	0.0738	0.0610	0.1016
D_reer	0.0249	0.0014	0.0616	0.1549	0.1913	0.0410	0.0878	0.0320	0.1089	0.1786	0.0494	0.0418	0.0264
D_spnifty	0.0186	0.0017	0.0291	0.2386	0.1772	0.0652	0.1051	0.0172	0.0838	0.1169	0.0369	0.0483	0.0613
D_treasurybill	0.0542	0.0100	0.0452	0.0673	0.0720	0.0028	0.1164	0.0664	0.0079	0.1084	0.0641	0.1094	0.2759
DD_unempt	0.0533	0.0228	0.0581	0.1267	0.1139	0.0414	0.0839	0.0101	0.0827	0.2779	0.0323	0.0124	0.0846
D_walr	0.1061	0.0401	0.0978	0.0658	0.0444	0.0133	0.1742	0.1285	0.0454	0.1734	0.0522	0.0460	0.0127
D_wacr	0.1005	0.0162	0.0731	0.2853	0.1457	0.0038	0.0629	0.0243	0.0215	0.1498	0.0292	0.0174	0.0704
D_fiscal	0.2083	0.0283	0.0092	0.0727	0.0087	0.0042	0.0129	0.0949	0.0021	0.0684	0.0513	0.0257	0.4134
D_cab	0.0175	0.0026	0.0791	0.2712	0.1017	0.0205	0.1256	0.0150	0.0351	0.2076	0.0446	0.0725	0.0069
D_gva	0.0989	0.0402	0.0582	0.0759	0.0523	0.0330	0.1385	0.0412	0.0472	0.2303	0.1105	0.0015	0.0723
Total	1.1724	0.3183	0.7450	1.8193	1.2213	0.3558	1.1879	0.6209	0.6105	2.2178	0.6963	0.6483	1.3861

3. Methodology to Devise MePSWMIF

3.1 Calculation of Impact Factors of MeVs

To calculate the Impact factors of the MeVs, the quarter wise VDMs given in the tables (1-4) above have been used. The column- wise sums provide the impact factors of the variables heading the columns as per CIA methodology. The sums so obtained have been rounded off to two decimals. The quarter wise impact factors of the variables and their totals are given in Table 5.

TABLE 5: QUARTER-WISE IMPACT FACTORS OF THE MEVS AND THEIR TOTALS

MeVs	Impact factor Q1	Impact factor Q2	Impact factor Q3	Impact factor Q4	Yearly Q1-Q4
D_10sec	0.76	0.75	**1.05***	**1.17***	3.73
D_cpi	0.74	0.50	0.41	0.32	1.97
D_expo	**1.05***	**1.44***	**1.27***	0.75	**4.51***
D_house	**1.00***	**0.96***	**1.49***	**1.82***	**5.27***
D_reer	0.68	0.81	**1.08**	**1.22**	3.80
Dsp_nifty	0.66	0.59	0.43	0.36	2.03
D_treasury bill	**0.93***	**1.15***	**1.34***	**1.19***	**4.61***
DD_unempt	0.76	0.84	0.66	0.62	2.88
D_walr	0.91	0.85	0.67	0.61	3.03
D_wacr	**2.17***	**2.26***	**2.09***	**2.22***	**8.74***
D_fiscal	**1.25***	**1.26***	0.93	0.70	**4.13***
D_cab	0.69	0.60	0.67	0.65	2.60
D_gva	**1.40***	**0.99***	0.92	**1.39***	**4.70***

* The MeVs corresponding to these entries have been used in tables 6-8

3.2 Devising of MePSWMIF

The MeVs with impact factors (shown in Table 5) in the descending order devise a MePSWMIF for fixed time span and size.

3.3 Notations

MePSWMIF (s, n) stands for MePSWMIF with sth time span and of size n (no. of MeVs) e.g MePSWMIF (3,5) stands for 3rd quarter and size 5.

MePSWMIF (1-3, 4) is a combined form of MePSWMIF where the time span is the first three quarters and size is 4. The impact factors (combined) here are the sum of the impact factors of the respective MeVs calculated for quarters 1to3 independently. Similar variations can be made in MePSWMIF such as MePSWMIF(1,2,4; 5), MePSWMIF(2-4,6) etc. with their interpretations if situation demands.

This study is an illustration to underline the importance and utility of MePSWMIFs, therefore, it is restricted to the computations of MePSWMIF (s, n) and MePSWMIF (1-4, n) for $s = 1,2,3\ and\ 4$Qs , $n = 4,5, and\ 6$ (no. of variables), only. These have been given in the Tables 6-8. and the graphical representation of the same shown in Fig.1.

TABLE 6: MEPSWMIF(S, 4) WITH S = 1,2,3,4 QS AND COMBINED

Q1	D_wacr	D_gva	D_fiscal	D_expo
Q2	D_wacr	D_expo	D_fiscal	D_treasury bill
Q3	D_wacr	D_house	D_treasury bill	D_expo
Q4	D_wacr	D_house	D_gva	D_reer
Q1-Q4	D_wacr	D_house	D_gva	D_treasury bill

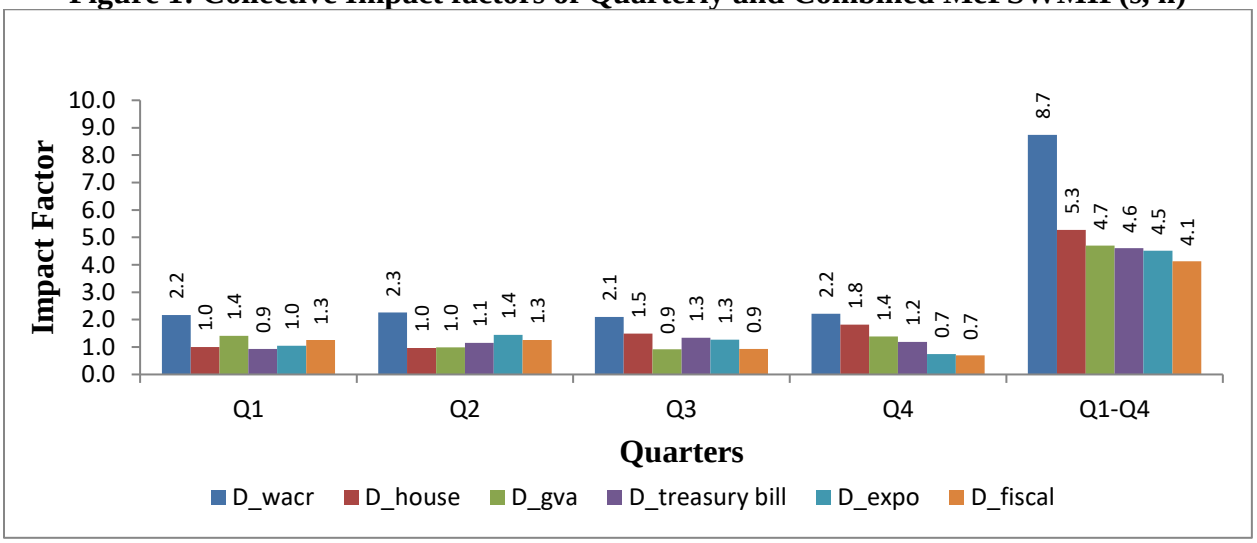
TABLE 7: MEPSWMIF(S, 5) WITH S =1,2,3,4 QS AND COMBINED

Q_1	D_wacr	D_gva	D_fiscal	D_expo	D_house
Q_2	D_wacr	D_expo	D_fiscal	D_treasury bill	D_gva
Q_3	D_wacr	D_house	D_treasury bill	D_expo	D_reer
Q_4	D_wacr	D_house	D_gva	D_reer	D_treasury bill
Q_1-Q_4	D_wacr	D_house	D_gva	D_treasury bill	D_expo

TABLE 8: MEPSWMIF(S, 6) WITH S = 1,2,3,4 QS AND COMBINED

Q_1	D_wacr	D_gva	D_fiscal	D_expo	D_house	D_treasury bill
Q_2	D_wacr	D_expo	D_fiscal	D_treasury bill	D_gva	D_house
Q_3	D_wacr	D_house	D_treasury bill	D_expo	D_reer	D_10sec
Q_4	D_wacr	D_house	D_gva	D_reer	D_treasury bill	D_10sec
Q_1-Q_4	D_wacr	D_house	D_gva	D_treasury bill	D_expo	D_fiscal

Figure 1: Collective Impact factors of Quarterly and Combined MePSWMIF(s, n)*

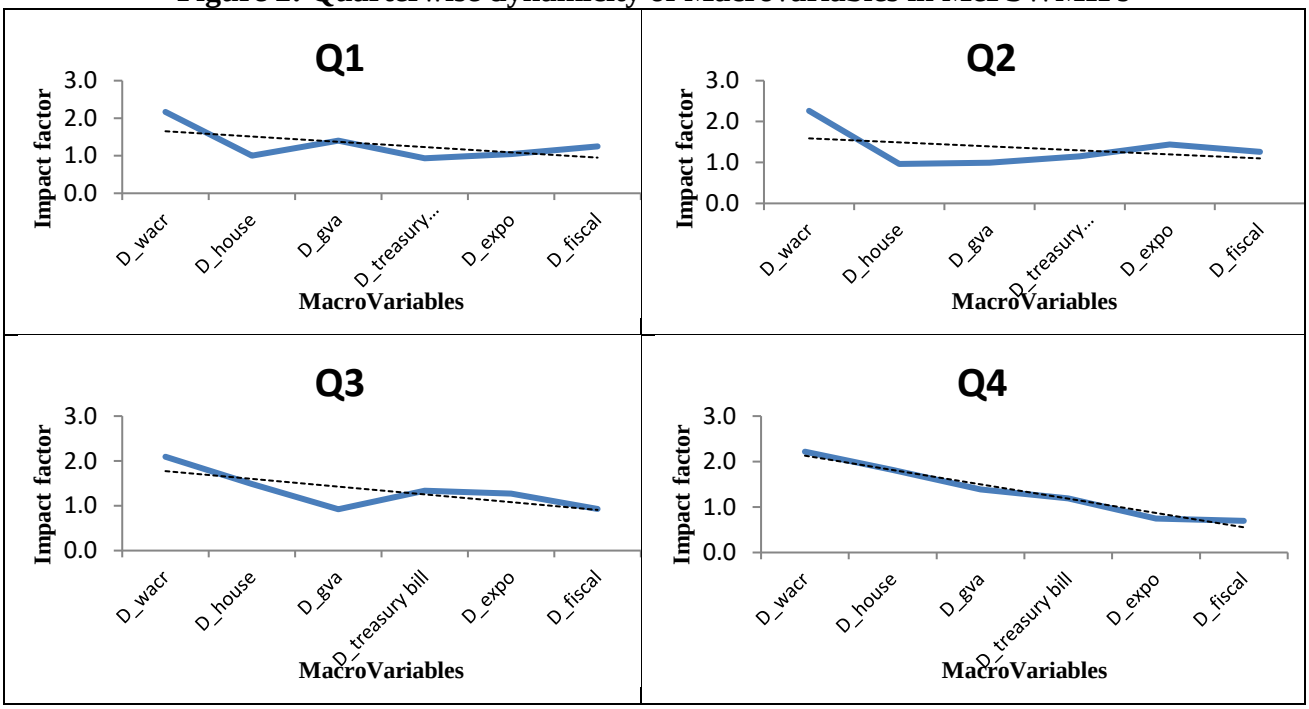


* where s= 1,2,3,4 Qs & n= 4,5,6

4. Dynamicity

The impact factors do not remain static but change with time as is evident from the tables 6-8 and quarter-wise panels of the Fig.2 below. These make MePSWMIFs dynamic as well. This dynamicity of MePSWMIFs will ultimately affect the outputs of a banking system under stress.

Figure 2: Quarterwise dynamicity of Macrovariables in MePSWMIFs



5. Stress testing

Obviously, the devised partial scenarios (quarterly or annually) follow criterion of maximality of impact factors of the macroeconomic variables that constitute them. These impact factors indicate the measure of strength with which the respective MeVs impact the system they constitute. For stress testing of banking system these scenarios play the central role. In cases the scenarios are not manageable computationally or otherwise partial scenarios are used. Naturally, one can't select any subset of MeVs that constitute a partial scenario rather they should follow some criterion of selection preferably an optimal one. This facility has been provided in this paper. The whole exercise illustrates how applicably good partial scenarios can be devised for stress testing. The stressed scenarios are then generated for stress testing of banking system by giving severe adverse shocks of 1s.d, 2s.d or of more intensity. These scenarios affect the outputs of a banking system through the satellite models developed in terms of MeVs and may lead the banking system to default or failure Alessandri et al. (2009). Then, how to preempt or manage such a situation, if it occurs? The solution to such a problem is 'Stress Testing'.

6. CONCLUSION

The authors have devised Macroeconomic Partial Scenario with Maximum Impact Factor for Stress Testing of Banking System to be used in place of a scenario when it becomes problematic due to unnecessarily large number of MeVs constituting it and difficulty in handling computationally or otherwise. In the development of this the authors have used the theories of Cross Impact Analysis and Variance Decompositions in addition to the econometric model BVAR with Minnesota priors. Cross variance decompositions measure the cross impacts of MeVs and hence the impact factor of the partial scenario. The MCMC technique has been used to compute the variance decompositions. MePSWMIF of sizes 4, 5 and 6, (quarter-wise and year-wise) have been devised as an illustration to pave the way forward. In the end the role of partial scenarios in stress testing of banking system has been explained.

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REFERENCES

Adler, M., Ziglio, E. (1996), Gazing into the oracle. Jessica Kingsley Publishers: Bristol, PA.

Alarcon, L.F. (1992), Project performance modeling: a methodology for evaluating project execution strategies, Ph.D. thesis, University of California, Berkeley.

Alessandri, P., P. Gai, S. Kapadia, N. Mora, and C. Puhr, (2009), "Towards a Framework for Quantifying Systemic Stability," International Journal of Central Banking, Vol. 5, No. 3, pp. 47–81.

Brochner, J. (1990), Impacts of information technology on the structure of construction. Construction Management and Economics, 8, 205-218.

Christopher Sims (1980). "Macroeconomics and Reality," Econometrica, Econometric Society, Vol. 48(1), pp. 1-48.

Dipankar, B., Sanjay, S., Arti, S. (2010), Forecasting Inflation and IIP Growth: Bayesian Vector Autoregressive Model, Reserve Bank of India Occasional Papers, Reserve Bank of India, Vol. 31(2), 31-48.

Duperrin, J.C., Godet, M.(1975), 6th SAINT conference on the impact of new technology, Vol. 7, (4), 272-360.

Enzer, A.P.A., Alter, S. (1978), Verification of the consistency between cross impact analysis and classical probability, Futures, June 1978, 10(3), pp. 227-239.

Fontela, E., Gabus, A. (1976) The DEMATEL observer, DEMATEL 1976 Report Switzerland Geneva: Battelle Geneva Research Centre.

Gordon T.J. (1994) Cross impact method, in: Futures Research Methodology, Technological Forecasting and Social Change 78(9):1579-1602

Hanson, W.H., Ramani, N. (1988). Technology forecasting: a hydroelectric company experience. Technology Management Publication, 1(3), 266-270.

Helmer, O. (1972), Cross-impact gaming. Futures, 4 (2), Pages 149-167

Helmer, O. (1977), Problems in futures research: Delphi and causal cross-impact, Futures, 9 (1), 17-31.

JuhaPanula-Ontto (2017), EXIT method for cross-impact analysis method pp 1-16 https://www.researchgate.net/publication/319679034

Karlsson, S (2012), Forecasting with Bayesian vector Autoregressions, Handbook of economic forecasting, 2ed,

Kenneth, C., (2008), A New Look at the Cross-Impact Matrix and its Application in Futures Studies, Journal of Futures Studies, 12(4): 45 – 52.

Kinal, T., Ratner, J. (1986), A VAR Forecasting Model of a Regional Economy: Its Construction and Comparative Accuracy, International Regional Science Review, 1986, 10,(2), 113-126.

Koop, G. (2013), Forecasting with Medium and Large Bayesian VARs, Journal of Applied Econometrics, 28, 177–203.

Koop, Gary and Dimitris Korobilis(2010) "Bayesian Multivariate Time Series Methods for Empirical Macroeconomics," Mimeo, Vol. 3, issue 4, 267-358

Korobilis, D. (2013), VAR forecasting using Bayesian variable selection. Journal of Applied Econometrics, 28, 204-230.

Kwak, Y.H., (1997), A systematic approach to evaluate quantitative impacts of project management, Ph.D. dissertation, University of California, Berkeley.

Mark Zandi,(2013), Designing Macroeconomic Scenarios for Stress-Testing, Economic & Consumer Credit Analytics, Mark.Zandi@moodys.com,pp:1-6

Marta, B. D. Giannone, L.R. (2008) Large Bayesian vector auto regressions, Working paper No 966 / November 2008, European Central Bank, pp:4-42

Novak, E., and Lorant, K., (1978). A method for the analysis of interrelationships between mutually connected events: a cross-impact method. Technological Forecasting and Social Change (12), pp.201-212.

Rahil, F., Seyed, N., Mashhadi, M., Maryam, S. Z (2017) Building a New Urban Highway or Elevating an Old One Finding Optimum Solution Based on Environmental Impacts. American Journal of Civil Engineering and Architecture, 2017; 5(4):136-153

Rangan, G., Sichei, M. (2006) A BVAR Model for the south African economy, South Africa Journal of Economic,74,(3),136

Robert B. Litterman, (1986), Forecasting with Bayesian Vector Autoregressions: Five Years of Experience, Journal of Business & Economic Statistics Vol. 4, No. 1 pp. 25-38

Shoesmith, G.L (1990). The Forecasting Accuracy of Regional Bayesian VAR Models with Alternative National Variable Choices, International Regional Science Review 13(3):257-269

Thomas, Breuer et. al (2009), How to Find Plausible, Severe, and Useful Stress Scenarios, International Journal of Central Banking),5(3), 205-224.

Víctor, A. B., (2011), Scenario construction via Delphi and cross-impact analysis, Technological Forecasting and Social Change 78(9):1579-1602.

Wissema, J.G., Benes, J. (1980), A gross-impact case study: The Dutch construction sector, Futures, Vol. 12(5):394-404

Appendix I

In VAR models, it is assumed that the coefficients β are constant but unknown. On the other hand, in BVAR models, these are considered as variables with some known distribution termed as prior distribution. The parameters of prior distribution are known as hyper parameters. The most popular prior is Minnesota (or Litterman) prior proposed by Litterman (1986). Under this prior, parameter vector Beta has a prior multivariate normal distribution with mean β*and covariance matrix $V_{\beta,}$, hence the prior density in Bayesian VAR model is written as below.

$$f(\beta) = \left(\frac{1}{2\pi}\right)^{K^2 p} \left|V_\beta\right|^{-\frac{1}{2}} \times \exp\left[-\frac{1}{2}(\beta - \beta^*)V_\beta^{-1}(\beta - \beta^*)'\right]$$

Whereas, the likelihood function for the Gaussian process becomes

$$l(\beta|\, y) = (\frac{1}{2\pi})^{KT/2}\, |I_T \otimes \Sigma_u|^{-1/2} \times$$

$$\exp\left[-\frac{1}{2}(y - (X \otimes \mathrm{I}_K)\beta)(I_T \otimes \Sigma_u)^{-1}(y - (X \otimes \mathrm{I}_K)\beta)'\right]$$

Using Bayes theorem,

$$f(\beta/y) = \frac{l(\beta/y)f(\beta)}{\int l(\beta/y)f(\beta)d\beta}$$

the posterior density is written as

$$l(\beta|\, y) \;\propto \exp\left[-\frac{1}{2}\left(\beta - \bar{\beta}\right)\bar{\Sigma}_\beta{}^{-1}(\beta - \bar{\beta})'\right]$$

where the posterior mean is

$$\bar{\beta} = \left[V_\beta^{-1} + (X'X \otimes \Sigma_u^{-1})\right]^{-1}\left[V_\beta^{-1}\beta^* + (X' \otimes \Sigma_u^{-1})y)\right]$$

and the posterior covariance matrix is

$$\overline{\Sigma_\beta} = \left[V_\beta^{-1} + (X'X \otimes \Sigma_u^{-1})\right]^{-1}$$

In practice, the prior mean β* and the prior variance V_β need to be specific.

Appendix II

The Minnesota prior assumes that the equations in VAR model are independent, therefore, the Σ matrix is to be diagonal .The diagonal elements come from equation-by-equation estimation of an AR(*p*) model for each of the *m*-variables. Thus, we have

$$\sum = \begin{bmatrix} \sigma_1 & 0 & 0 & \cdots & 0 \\ 0 & \sigma_2 & 0 & \cdots & 0 \\ 0 & 0 & \sigma_3 & \cdots & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & 0 & \sigma_m \end{bmatrix}$$

The prior distribution of all the parameters in VAR model is assumed to be normal with mean zero except their own-lag terms (and a possible constant term) and prior covariance matrix of β

$$\Sigma_{\beta_{i,j}}(\ell) = \begin{cases} H_1/\ell^2 \\ H_2.\sigma_i^2/(\ell^2.\sigma_j^2) \\ H_3.\sigma_i^2 \end{cases}$$

As defined by Koop and Korobilis, (2010), OR

$$\Sigma_{\beta_{i,j}}(\ell) = \begin{cases} H_1/d(\ell) \\ H_1.H_2.\sigma_j^2/(d(\ell).\sigma_i^2) \\ H_1.H_3 \end{cases}$$

The three terms in each case correspond to own lags, cross-variable lags, and exogenous variables (a constant), respectively. Where $i, j \in \{1,..., m\}$; with the equation being indexed by i, and the

variable indexed by *j and* $\ell \in \{1,..., p\}$. $d(\ell)$ is the 'decay' function. In the first case $d(\ell)= \ell^2$. Also, note that, for cross-equation coefficients, the ratio of the variance of each equation has been inverted in the second case (*i.e.*,σ_i^2 is the denominator and σ_j^2 is in the numerator).

The user can choose any of the two functional forms of d(ℓ) one having geometric and the other harmonic decay respectively,

$$d(\ell) = \begin{cases} \ell^{H_4} \\ H_4^{-\ell+1} \end{cases}$$

Where $H_4 > 0$, (for $H_4 = 1$, we have linear decay $d(\ell)= \ell$).

Appendix III

The Gibbs sampler is a recursive Monte Carlo method which requires only knowledge of the full conditional posterior distribution of the parameters of interest, $p(\beta \mid \sum, Y)$ and $p(\sum \mid \beta, Y)$. Suppose $\sum$ and β are scalars and that the conditional posterior distributions $p(\sum \mid \beta, Y)$ and $p(\beta \mid \sum, Y)$ are known. Then the Gibbs sampler starts from arbitrary values of $\beta^{(0)}$ and $\sum^{(0)}$, and samples alternately from the density of each element of the parameter vector, conditional on the values of the other element sampled in the previous iteration and the data. Thus, the Gibbs sampler samples recursively as follows:

$\beta^{(1)}$ from $p(\beta \mid \sum^{(0)}, Y)$

$\sum^{(1)}$ from $p(\sum \mid \beta^{(1)}, Y)$

$\beta^{(2)}$ from $p(\beta \mid \sum^{(1)}, Y)$

$\sum^{(2)}$ from $p(\sum \mid \beta^{(2)}, Y)$

⋮

$\beta^{(m)}$ from $p(\beta \mid \sum^{(m-1)}, Y)$

$\sum^{(m)}$ from $p(\sum \mid \beta^{(m)}, Y)$

and so on.

The vectors $\vartheta^{(m)} = (\beta^{(m)}, \sum^{(m)})$ form a Markov chain, and, for a sufficiently large number of iterations (say $m \geq M$), can be regarded as draws from the *true* joint posterior distribution. Given a large sample of draws from this *limiting* distribution, any posterior moment or marginal density of interest can then be easily estimated consistently with its corresponding sample average.

S A A R J J o u r n a l o n B a n k i n g & I n s u r a n c e R e s e a r c h (S J B I R)

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EVALUATION OF INSURANCE PERFORMANCE, PRODUCTIVITY AND EFFICIENCY – A COMPARATIVE STUDY

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ABSRACT

Productivity and efficiency are recognized as cornerstones of a country's financial health and symbol of progress, so there is an abundant focus on the issue by many industries including insurance. Insurance is an integral part of financial services system that needs to sustain by productivity and efficiency for the betterment of system, which is highly emphasized in the present competitive economy. Previously, insurance firms were assessing the productivity and efficiency using ratio analysis that could not make completeness. The present paper discusses on the Ratio Analysis, Index Numbers approach and Frontier Efficiency Methods (FEM) with regard to measuring insurance performance, productivity and efficiency with an upshot of Life Insurance Corporation of India (LICI) and State bank of India Life Insurance (SBILI) as case problem with a comparison.

KEYWORDS: *Performance, Productivity, Efficiency, Insurance and Index Numbers.*

1. INTRODUCTION

Insurance sector of India is found competitive by its differentiating products, increasing competitive environment and innovations with the synchronization process and the government support as well as companies promotive measure. This sector in the country seems to be emerged through difficult times, with significant support from the government. The intermediation role of insurance is very curial as performance of the sector critically does impact on other sectors of the economy in a significant manner. The Government is eligible for the hybrid model reflecting the sector's privatization (Rastogi & Sarkar, 2007) and has demonstrated various industry models, such as unregulated regulations, nationalization and privatization, taking into account the sub-optimal performance of the sector with an effective regulatory mechanism. This was initiated with the aim of making the industry competitive so that there would be many players offering a greater variety of products over a larger section of the population. India as well as foreign companies, through the

benefits were little, have reported high rate of growths in the preceding decade due to dynamics caused by changed time, companies are made to measure their performance by focusing on the different strategies like, productivity[1] and efficiency. In practice, productivity is relatively complicated (Miller, 2008; Galarneau & Maynard, 1995). For instance, the information is as possible in the case of labour productivity (Miller, 2008). Miller claimed that it could be simplified by implementing productivity measurements in the process by using key performance indicators. Maynard Galarneau (1995) can also be obtained through the addition quantities of inputs used from the change in quantity produced. Thus, productivity growth also included as the residual portion of growth that cannot be accounted for the additional quantities of the inputs. The performance of the device outputs is based on a bit of value, if performance is superior there is a positive effect on the company and economy of country too, but when there is distressed there is a bandwagon negative effect on the company and economy too. Hence, measuring efficiency is not a simple job as it is complex in nature, particular evaluating the performance, productivity and efficiency of insurance products is very significant as they deal with, Social Security drivers.

2. REVIEW OF LITERATURE

Peter Darker (1999), admitted that by "providing financial protection against the major eighteenth and nineteenth century risk of dying too soon, life insurance became the biggest financial industry of that century. Providing financial protection against the new risk of not dying soon enough may well become that next century's major and most profitable financial industry".

Charles, P. Jones (2002), in its working paper on "Investment analysis and management", the framework for evaluating portfolio performance and the risk assessment of the framework is explicit. Risk-adjusted performance measures are also discussed, as well as the problems associated with measuring the portfolio.

Cummins and Misas (2001), in their studies studied in the Spanish insurance industry, they analyze the causes and effects of consolidation in the insurance industry and those who acquire the mergers and acquisitions market prefer target companies with a relative efficiency.

Boonyasai, Grace and Skipper (2002), in their study reviewed the effect of liberalization and deregulation in the four life insurance markets and found that the liberalization and deregulation of the life insurance industries in Korea and the Philippines seemed to have encouraged improvements and improvements productivity, Taiwanese and historical life insurance.

1. Defined as the ratio of output to the factors of production (Galarneau & Maynard, 1995).

Manjit, S. and Rohit, K. (2009), in their studies, The emerging trends in the financial performance of the insurance industry in general in India show that the results of general private insurers offer better efficiency in terms of management ratio, combined ratio, underwriting results ratio and that increase the market share year after year, while the performance Public insurance companies in the public sector in terms of net profit and return on equity are better than public to private insurance companies.

Mansor and Radam (2000), in its study on productivity and efficiency in the Malaysian life insurance industry, the productivity of the life insurance industry was measured in Malaysia by using the non-discriminatory index approach of Malmquist. The study used the employed DEA to measure technical efficiency, technical changes and factor productivity. Data from 12 Malaysian insurance companies were taken from 1987 to 1997. Three variables were used as output, namely, the new policy issued, the policy and the policy in force and the inputs were used namely claims,

commissions, salaries, expenses and other costs. The results indicated that despite the growth of productivity in the insurance industry. It was relatively low compared to Malaysia's real economic growth. The study found that the future growth of the insurance industry, such as the manufacturing sector, depends on its ability to compete efficiently. The ability to provide an effective service will be an important source of comparative advantages in the era of globalization. Technical efficiency and technical progress contribute to the overall growth of industry productivity.

Mariappan, R. (2011), in his article entitled Growth and productivity in the informal manufacturing sector in India to estimate economic returns on a scale and the marginal productivity of labor and capital inputs for double-digit industries in the informal manufacturing sector in India The results showed that the elasticity of output with respect to labor and capital production has increased and contributed significantly to the growth of production during the post-reform period compared to the period before the reform.

Bikker and Leuven, S. (2008), they studied the competitive nature of the Dutch life insurance industry and provided that competition was limited in the Dutch life insurance industry compared to the Netherlands.

Eling, M. and Luhnen, M. (2010), it provided an overview of the measurement of frontier efficiency in the insurance industry and showed that there was a broad consensus regarding the choice of methodology and input factors, the difference was in the case of product output measurement .

Nitin Tanted (2006), in this document entitled “Strategy for growth and survival of Indian insurers” in the era of emerging global competition, analyzed the impact of the opening of the Indian insurance sector and the strategy of growth and survival of Indian insurers. This document concludes that the development and growth of the insurance sector is fundamental for channeling investments in the infrastructure sector.

Rao (2007), in his study he mentioned that insurance is a vital economic activity and that there is an excellent scope for growth in emerging markets. The opening in the insurance sector has raised hopes among people in India and abroad. The recent metrification in the non-life domain provided great operational freedom for players.

Rajesh (2009), in his study of India’s future insurance sector, he says that around 12.15% of the central government has consumed climatic fluctuations. According to the weakness index of the Joint Wealth Secretariats, Bangladesh ranks first in the top five. For the insurance sector, severe vulnerability can be an opportunity as the population increases and purchase power increases. India has become a potential center for insurance companies around the world and India’s insurance industry has rich credentials to become a market in the near future.

Ram, P.S. (2007), in this document, the outstanding incomes of the Indian life insurance industry: a total factor productivity approach, comparing 13 life insurance companies for financial years 2002-2003 to 2004-2005 in terms of technical efficiency and changes in the total productivity of workers. In order to calculate the technical efficiency and overall productivity of the worker, the annual net income of the life insurance companies was considered the product. The equity capital and the number of agents in the insurance industry were taken as inputs. The results show that all life insurance companies show positive growth in the total production factor during this period.

3. OBJECTIVES

1) To study the financial performance of public and private Life Insurance Companies in India.

2) To analyze and compare the insurance productivity of public and private Life Insurance Companies.

3) To compute and compare the efficiency of public and private Life Insurance Companies.

4. HYPOTHESES

Ho1: There is no significant difference in the financial performance of public and private Life Insurance Companies in India.

Ho2: There is no significant difference in the insurance productivity of public and private Life Insurance Companies.

Ho3: There is no significant difference in the efficiency of public and private Life Insurance Companies.

5. DATA AND METHODOLOGY

The present paper is an analytical and empirical research, it used secondary data sources were used to establish the objectives and examine the hypotheses. To analyze trend and performance of public and private life insurance companies, the data was formed over 10 years period of time that spans over 2006-2016. On the other hand, to assessing the performance, productivity and efficiency, Ratios, Index number and Frontier Efficiency Method (FEM) are employed respectively. They are discussed in the following lines briefly.

5.1 Ratio Analysis

The analysis of financial ratios is one of the methods that have been historically used to compare service providers using performance data (DeLancer, 1996, Hatry & Fisk, 1992, cited in Nyhan and Martin, 1999). Chesnick used financial ratios (2000), financial ratios and objectives between companies oriented to investors and cooperative institutions.

Athanassopoulos and Ballantine (1995) and Lawder (1989) point out that one of the main characteristics of the analysis of financial ratios is the ability to measure the relationship between two figures in the financial statements. They reported that analysis indexes are a performance measurement tool that allows companies to analyze performance in a number of aspects for better understanding.

However, the monochromatic nature of relationship analysis offers significant limitations despite its widespread use of performance evaluation (Athanassopoulos and Ballantine, 1995). An analysis of complex organizations that produce multiple products with input to output relationships as a practice has often yielded little or no conclusion (Ludwin & Guthrie, 1989). Ratios seem to help in little manner when we consider. The most prominent ratios that measure the performance of insurance companies are:

1. Profit to Capital Ratio (PCR) = Profit/ Total Capital
2. Settled Claims to Total Claims Ratio (SCTCR) = Settled Claims/ Total Claims
3. Investment Income to Profit Ratio (IPR) = Profit/ Investment Income
4. Investment Income to Total Investment Ratio (IITIR) = Investment Income/ Total Investment
5. Operating cost to Premium Ratio (OCPR) = Total Operating cost/ Premium

5.2 Index Numbers

Single factor productivity is one when only one variable like capital is used to calculate productivity, which measures the productivity, since it only takes one factor per production at a time. When more than one variable is used to calculate productivity, the measure is called multiple productivity. For a long time, the fractional measure of productivity, such as capital productivity, was the only measure that was generally transferred. Galarneau and Maynard saw that this may have arisen because of the difficulty of collecting and interpreting data on capital, which is required to calculate the productivity of multiple factors. Clearly, measures of productivity measures are changes in the ratios of the specific variable that can be omitted, including certain variables (McLellan, 2004).

Productivity has traditionally been measured as the quantity of production indicator in the input quantity index (OECD, 2001). The OECD index showed that indicators are necessary due to the heterogeneous nature of goods and services, which do not simply allow the addition of units of different types of goods. To achieve this, one of the four indicators was used: Paasche, Laspeyres, Fisher and Tornqvist. In general, it is assumed that Fisher is higher than others, because it satisfies the static reflection and time tests, as well as the measurement of fixed quantities and proportionality (McLellan, 2004). When productivity indicators are created, it is not immediately clear which weighting procedure should be used to weigh the quantities of inputs and outputs when forming the number of entries and the number of entries and on what basis the weight structure should be selected. There are several index formulas that can be used to create input and output pointers. Laspeyres, Paasche, Fisher and Tornqvist are some of the most commonly used index formats.

Suppose that the information about the price of M outputs is available for the period t = 0, ..., T. In reference to the price of the outputs and the number of vectors in the period t as p1 (p^1, ..., p^M) and q^1 (q^1, ... q^M), the Laspeyres output quality indicator (Q^L) is defined as follows:

$$\mathbf{Q}^{l}{}_{t} = \frac{\sum_{m=1}^{m} \boldsymbol{P}^{m}{}_{0}\boldsymbol{q}^{m}{}_{0}}{\sum_{m=1}^{M} \boldsymbol{P}^{m}{}_{0}\boldsymbol{q}^{m}{}_{0}} \qquad \ldots\ldots\ldots 1$$

$$= \sum_{m=1}^{m} W^{m}{}_{0}\, \frac{q^{m}t}{q^{m}{}_{0}} \qquad \ldots\ldots\ldots 2$$

The quantity of Laspeyres production is the sum of the weighted period 0 share of the quantity ratios. The Paasche output quantity index (Q_t^p) index is defined as:

$$Q_t^P = \frac{\sum_{m=1}^{M} P_t^m q_t^m}{\sum_{m=1}^{M} P_t^m q_0^m} \quad \text{.....3}$$

The Paasche production quantity index uses the prices of the t period as weights, unlike the quantity indicator of Laspeyres, which uses the prices of period zero as weights. The Fisher output quantity index (Q_t^F) was found by taking the geometric mean of the Laspeyres and Paasche output quantity indices, that is:

$$Q_t^P = \left(Q_t^l Q_t^P \right) 1/2$$

The input quantity indexes are defined in a similar way using the input prices (C_t) and the input quantities (Xt)

5.3 Frontier Methods

A significant interest in performance measurement has led to the development of classical reference methods called FEM, also called Data Envelopment Analysis (DEA). The DEA, developed by Charles, Cooper and Rhodes (CCR) in 1978 from the idea of efficiency proposed by Farrell (1957) and produces a numerical scale of relative efficiency per unit of Decision Making Unit (DMU). The defenders indicated that the efficiency of any DMU can be obtained as a maximum of the weighted output ratio to the weighted inputs as long as the corresponding ratios for each DMU are less than or equal to unity.

Yeh (1996) describes the DEA as a mathematical programming methodology that can be applied to assess the “relative” efficiency of a variety of institutions that use a variety of input data. He stressed the importance of the term “relative” when referring to the fact that the institution identified by the DEA as an effective unit in a given data set could be considered ineffective in comparison with another set of data. The DEA can be used by building a relative relationship that consists of the total weighted income per institution. The most "efficient" units are the “effective limits” and the degree of inefficiency of other units of effective limits is determined by the mathematical method. The main advantage of the DEA is that it uses data from real models to design the efficiency limits for which each unit in the sample is evaluated without prior information on the same inputs and outputs that are most important in the evaluation procedure (Cooper et al. al., 1996). Instead, effective limits are created when a mathematical algorithm is used to calculate the efficiency of the DEA of each unit. One of the preconditions for the use of DEAs is that the units must be homogeneous and efficient and the modules have similar outputs and inputs.

The model of Charnes, Cooper and Rhodes (CCR) was developed in 1978. The basic tool to evaluate the efficiency between the production units of the result is the total technical efficiency (OTE) for each DMU. An extension of the basic model was developed by Banker, and Charnes and Cooper (BCC) developed a model in 1984. This is often classified as DEA-BCC, which allows variable returns. Measure and calculate the general technical efficiency in purely technical

efficiency and scale efficiency. The Following are Blumenberg (2008) the formulation of CCR model described as

$$\max 0 = \frac{\sum_{j=1}^{s} u_j y_{jk}}{\sum_{i=1}^{n} v_i x_{ik}}$$

$$s.t. \frac{\sum_{j=1}^{s} u_j y_{jl}}{\sum_{i=1}^{m} v_i x_{il}} \leq 1; (l = 1, 2, ..., N)$$

$$u_j, v_i \geq 0; (j = 1, 2, ..., m; i = 1, 2, ..., n):$$

Where θ represents productivity, μ and ν are the weights attached to the outputs y and the inputs χ respectively. In addition, s is the number of outputs and m is the number of inputs. This is a non-linear programming problem due to the denominator in both the objective function and the constraint equation. However, it can be handled by a line that establishes the denominator and therefore:

$$\max \phi$$

$$s.t. \sum_{i=1}^{m} v_i xil, (l = 1,2,.....n)$$

Subject to:

$$\sum_{i=1}^{m} v_i xil = 1;$$

The Linear programming formulation of the model as

$$\max = \sum_{i=1}^{s} u_i xik$$

$$\sum_{i=1}^{m} v_i xik = 1$$

Subject to:

$$\sum_{j=1}^{s} u_j yj \leq \sum_{i=1}^{m} v_i xil = 1; l, (l = 1,2,.....n)$$

$$u_j \geq 0$$

$$v_i \geq 0$$

FEM being used by many organizations, namely, Transportation (Barnum et al, 2007), Insurance (Barros, Ibiwoye and Shunsugi, 2008), Provision of Public Services (Pritchard, 2002), Nursing Service (Nunamaker, 1983; Lewin, 1983), Education (Ludwin and Guthrie, 1988; Ray, 1991 and Sunderland and Price,2007), Advertising (Cheong and Leckenby, 2006), Banking (Yeh, 1996;

Koulenti, 2006; Soteriou and Zenios, 1999; Haag and Jaska, 1995), Hedge Funds (Gregoriou, 2003; Gregoriou et al, 2005), Agriculture (Fan,1999), Hospitals and Health Care (Sherman, 1984; Banker, 1984; Banker, Conrad and Strauss, 1986; Wang and Chou, 2003; Steinmann et al 2004; Ozcan and McCue, 1996; Ehreth, Jenifer L. 1994 and Brockett et al, 2004) and Mutual funds (Morey and Morey, 1999; Grinblatt and Sheridan, 1993). Hence, the same has been employed in the present paper for efficiency and productivity evaluation of insurance.

6. ANALYSIS, DISCUSSION AND FINDINGS

Data for this study was obtained from the annual report and statement of accounts of the select companies covers the period of 10 years, from 2006-07 to 2015-16. Data analysis is shown pertaining to two companies one from public and another from private, namely Life Insurance Corporation of India **(**LICI) and SBI Life Insurance (SBILI) companies.

A very important first step in using DEA is to determine what factors should be taken as inputs and outputs. But, segregation of input and output not so easy under DEA method, hence, to overcome this problem, the paper approached the method of Cummins and Weiss. In general, the input variables are total capital, total operating cost and total investment. Hence, the output variables are profit, net premium, settled and claims, outstanding claims and Investment Income. (see table I (a) and (b) for detail).

6.1.1 Performance of LICI

It can be realised from table I (a) that performance of LICI company over the period of 10 years, i.e., 2006-07 to 2015-16, it can be seen that the enormous increase in TC over the study period from Rs 292.81 crores in 2006-07 to Rs 582.94 crores in 2015-16, with an average of Rs 2612.98 crores. With regard to TOC, it was found that there was an increase in the year 2007-08 and 2008-09 from 2006-07, afterwards, the TOC declined to lower level over the study period, with an average of Rs 28440.25 crores. Similarly, in TI there is a significant up-ward trend was observed from Rs 547422.88 crores in 2006-07 to Rs 1957266.81 crores in 2015-16. With regard to the performance by Profit is enormous increase, over the study period from Rs 773.62 crores in 2006-07 to Rs 2517.85 crores in 2015-16. In the case of Premium, it was found that the increase took place in the year 2007-08 from 2006-07, afterwards, which is declined afterwards year by year till 2009-10. During 2010-11, 2011-12 and 2012-13 the growth was very marginal in business performance. Hence, the company has started growing again in terms of premium in 2014-15. On the other hand, the SC was found increased as a trend which was observed through a move from Rs 53286.46 crores in 2006-07 to Rs 158015.54 crores in 2013-14, hence, the growth finally is declined. In the case of OC there was a significant increase and is observed through 2006-07 to 2015-16, wherein the average of Rs 1809.99 crores was found as minimum OC. Similar kind of trend is also observed in the growth of II performance that was increased from Rs 15.81 crores in 2006-07 to Rs 31.82 crores in 2015-16 (see table I (a) for details).

TABLE I (A) LIFE INSURANCE CORPORATION OF INDIA (LICI) (Rs in crores)

Year	Total Capital	Total Operating Cost	Total Investments	Profit	Net Premium	Settled & Claims	Outstanding Claims	Investment Income
2006-07	292.81	16254.91	547422.88	773.62	127780.07	53286.46	663.55	15.81
2007-08	307.85	17877.41	680866.50	844.63	149698.48	56550.33	819.42	15.22

2008-09	336.08	19097.53	729691.50	957.35	157186.55	52478.14	988.94	28.07
2009-10	365.87	24356.13	1003720.21	1060.72	185978.86	79130.66	1324.24	28.49
2010-11	403.73	30288.96	1150539.37	1171.80	203350.02	111241.19	1666.18	32.39
2011-12	530.57	28950.03	1223470.07	1313.34	202802.90	117472.14	2149.11	32.12
2012-13	515.47	31475.64	1310002.52	1489.92	208589.72	134881.28	2315.54	32.74
2013-14	538.59	40447.18	1489368.59	1656.68	236798.07	158015.54	2669.28	34.05
2014-15	562.54	37484.79	1772906.19	1823.78	239482.77	144125.75	2961.66	32.53
2015-16	582.94	38169.93	1957266.81	2517.85	266225.38	141201.05	2541.96	31.82
Avg.	443.65	28440.25	1186525.00	1360.97	197789.30	104838.30	1809.99	28.32

Source: Annual Reports of Company and IRDA (2006 to Feb, 2018).

6.1.2 Performance of SBILI

It can be realised from table I (b) that performance of SBILI company over the period of 10 years, i.e., 2006-07 to 2015-16, it can be seen that the enormous increase in TC over the study period from Rs 490.64 crores in 2006-07 to Rs 4733.10 crores in 2015-16, with an average of Rs 2237.29 crores. With regard to TOC, it was found that there was an increase in the year 2007-08 from 2006-07, afterwards, the TOC significantly increase to upper level over the study period, with an average of Rs 1428.09 crores. Similarly, in TI there is a significant up-ward trend was observed from Rs 4568.18 crores in 2006-07 to Rs 77842.68 crores in 2015-16. With regard to the performance by Profit in initial years, 2006-07 and 2007-08 the growth is minimal, specifically, in the year 2008-09, the growth was negative, hence, the growth started to revive in the year 2009-10 and positive till 2015-16. In the case of Premium, it was found that the increase took place in the year 2007-08 from 2006-07, afterwards, the premium increase to upper level in the year 2011-12, hence, the growth is revived. On the other hand, the SC was found increased as a trend which was observed through a move from Rs 140.06 crores in 2006-07 to Rs 8780.20 crores in 2013-14, hence, the growth finally is declined. In the case of OC there was a significant increase and is observed through 2006-07 to 2015-16, wherein the average of Rs 72.38 crores was found as minimum OC. Similar kind of trend is also observed in the growth of II performance that was increased from Rs 48.07 crores in 2006-07 to Rs 317.78 crores in 2015-16 (see table I (b) for details).

TABLE I (B) SBI LIFE INSURANCE (SBILI) COMPANY (Rs crores)

Year	Total Capital	Total Operating Cost	Total Investments	Profit	Premium	Settled & Claims	Outstanding Claims	Investment Income
2006-07	490.64	518.36	4568.18	4.84	2923.44	140.06	24.40	48.07
2007-	1006.77	852.32	10148.67	34.38	5611.20	350.85	27.78	73.72

08								
2008-09	1000.00	1087.38	14544.70	-26.31	7202.39	396.65	24.53	60.84
2009-10	1265.23	1419.15	28703.12	276.46	10080.48	851.38	19.00	52.13
2010-11	1629.70	1587.68	40162.86	366.34	12909.16	2925.77	88.06	69.00
2011-12	2155.65	1542.29	44777.62	555.82	13080.84	4726.11	105.14	96.00
2012-13	2710.05	1662.46	50047.86	622.17	10382.11	7791.01	105.76	150.52
2013-14	3342.33	1659.61	56274.62	740.13	10657.10	8780.20	38.89	202.18
2014-15	4039.41	1779.30	69384.78	820.04	12780.00	8197.68	134.64	276.11
2015-16	4733.10	2172.39	77842.68	861.03	15665.45	7959.55	155.60	317.78
Avg.	2237.29	1428.09	39645.51	425.49	10129.22	4211.93	72.38	134.64

Source: Annual Reports of Company and IRDA (2006 to Feb, 2018)

6.2 Performance Analysis –Ratios Approach

From Table II it is evident that possible to build some ratios that are useful on the performance of each organization that is examined. The relationship between profit and total capital for instance represents the performance of the shareholders' fund. Similarly, the ratio Settled Claims to Total Claims, to analyse that most of the companies studied seems to settle a high percentage of their outstanding claims. The ratio of Profit to Investment Income is used to example the return on operating. Another ratio is Investment Income to Total Investment which measures the portfolio and efficiency. The ratio of operating cost to net premiums can indicate the efficiency of management, to control cost.

Financial performance of insurance companies is measured through Profit to Total Capital ratios (PCR), Settled Claims to Total Claims ratios (SCTCR), Investment Income to Profit ratios (IPR), Investment Income to Total Investment ratios (IITIR) and Operating Cost to Premium ratio (OCPR), it is found through the table II that the performance of LICI, SBILI in terms of profit over total capital. In the case of LICI this ratio was below 3 per cent during 2006-07 to 2012-13 in the rest of the years it has reported the best by maximum 4.319 per cent in the year 2015-16, hence, the average ratio of PCR was 3.004 over the study period, whereas, SBILI reported a least performance under this category and negative -0.026 in the year 2008-09 afterwards there was a significant change in 2009-10, which was continued till 2015-16. Hence, the overall performance in average was around of 0.155 over the study period. It indicates that in generating profit LICI is ahead comparatively SBILI. Similarly, in SCTCR both LICI and SBILI have shown down strip and increasing trend that indicates consistency in the performance. On the other hand, IPR both LICI and SBILI have shown stable and down strip trend that indicates consistency in the performance. In the case of IITIR and OCNPR again LICI is found with a significant and considerable ratio right from 2006-07 to 2015-16, hence, the averaging operating under control, it was 0.0001 per cent and 0.0034 per cent that means to say that every 1 rupee of Premium LICI spend earned 0.002 comparative SBILI, which has spend almost 0.130 and 0.146. It can be

ascertain that operating cost of SBILI is not under control; hence, profit values declined due sadden reason. It is very clear from financial performance analysis with that is LICI is still skimming the cream in the market as it is huge in capital formation, premium generation and constant operating cost too (see table II for details).

TABLE II FINANCIAL PERFORMANCE

Year	PCR		SCTCR		IPR		IITIR		OCPR	
	LICI	SBILI	LICI	SBILI	LICI	SBILI	LICI	SBILI	LICI	SBILI
2006-07	2.642	0.010	0.988	0.852	0.020	9.932	0.0001	0.0105	0.013	0.177
2007-08	2.744	0.034	0.986	0.927	0.018	2.144	0.0001	0.0073	0.119	0.152
2008-09	2.848	-0.026	0.982	0.942	0.029	-2.312	0.0001	0.0042	0.121	0.151
2009-10	2.899	0.218	0.984	0.978	0.027	0.189	0.0001	0.0018	0.131	0.141
2010-11	2.902	0.225	0.985	0.971	0.028	0.188	0.0001	0.0017	0.149	0.123
2011-12	2.475	0.259	0.982	0.978	0.024	0.173	0.0001	0.0021	0.143	0.118
2012-13	2.890	0.229	0.983	0.987	0.022	0.242	0.0001	0.0030	0.151	0.160
2013-14	3.076	0.221	0.983	0.996	0.020	0.273	0.0001	0.0036	0.171	0.156
2014-15	3.242	0.203	0.980	0.984	0.018	0.337	0.0001	0.0040	0.156	0.139
2015-16	4.319	0.182	0.982	0.981	0.013	0.369	0.0001	0.0041	0.143	0.139
Avg.	3.004	0.155	0.983	0.960	0.022	1.153	0.0001	0.0034	0.130	0.146

6.3 PRODUCTIVITY ANALYSIS - INDEX NUMBER APPROACH

The focus of this past of study is on productivity, in which output and input are very important. To demonstrate the application of index numbers to measure the productivity of investment income (an output) is used as substitute for quantity and total investment (an input) is used as substitute for price. With regard to productivity analysis it is evident through table III that the efficiency of LICI and SBILI is distinguishable over the study period 2006-07 to 2015-16, accordingly to Laspeyres, Paasche and Fisher Index number, through applying Laspeyres, Paasche and Fisher Index number the result is similar one. Under Laspeyres, Paasche and Fisher method a marginal level of upwards change as a trend is exhibited in LICI during 2006-07 till 2015-16, whereas SBILI denoted a significantly upwards trend during 2006-07 continued till 2015-16 in productivity. At the end it is found that the productivity of SBILI is comparatively better than the LICI (see table III for details).

TABLE III INDEX NUMBERS

Year	Laspeyres		Paasche		Fisher	
	LICI	SBILI	LICI	SBILI	LICI	SBILI
2006-07	1	1	1	1	1	1
2007-08	1.244	2.222	1.244	2.222	1.244	2.222
2008-09	1.333	3.184	1.333	3.184	1.333	3.184
2009-10	1.833	6.283	1.833	6.283	1.833	6.283
2010-11	2.102	8.792	2.102	8.792	2.102	8.792
2011-12	2.235	9.802	2.235	9.802	2.235	9.802
2012-13	2.393	10.956	2.393	10.956	2.393	10.956
2013-14	2.721	12.319	2.721	12.319	2.721	12.319
2014-15	3.238	15.189	3.238	15.189	3.238	15.189

2015-16	3.578	17.040	3.578	17.040	3.578	17.040
Avg.	2.168	8.679	2.168	8.679	2.168	8.679

*Calculations are shown in single digits.

6.4 FEM

Besides Financial ratios and Index Number approaches, farthest analyses FEM is right approach as it is output orientation not only that even, we can analysis through FEM with help of all the outputs and all the inputs simultaneously, whether an insurance company can produce the same level of output with less input or produce higher level of output with the same input. The model of formulation of CCR is applied for the data and analysis is shown through Table IV.

It is evident from table IV (a) and (b) that the efficiency of select insurance companies, namely LICI and SBILI. Under BCC model LICI and SBILI reported significant technical efficiency. On the other hand the scale efficiency reported by LICI and SBILI are same and one. It indicates that LICI is forward in its efficiency in connection with utilization of assets when compared to SBILI. In overall performance both companies are found as able in managing the things. Hence, in efficiency both are same and one and at par.

TABLE IV (a) CHARNES, COOPER AND RHODES (CCR) MODEL (Rs in crores)

		Minimum		Maximum		Mean		Std. Deviation	
		LICI	SBILI	LICI	SBILI	LICI	SBILI	LICI	SBILI
Total Capital	Inputs	292.81	490.64	582.94	4733.10	443.65	2237.29	113.37	1427.43
Total Operating Cost		16254.91	518.36	40447.18	2172.39	28440.25	1428.09	8803.73	483.01
Total Investments		547422.88	4568.18	1957266.81	77842.68	1186525.46	39645.51	465923.59	24955.65
Profit	Outputs	773.62	-26.31	2517.85	861.03	1360.97	425.49	533.26	343.15
Premium		127780.07	2923.44	266225.38	15665.45	197789.28	10129.22	43612.34	3878.20
Settled & Claims		52478.14	140.06	158015.54	8780.20	104838.2	4211.93	41080.62	3694.83
Outstanding Claims		663.55	19.00	2961.66	155.60	1809.99	72.38	829.82	51.41
Investment Income		15.22	48.07	34.5	317.78	28.32	134.63	7.00	98.67

Source: Annual Reports of Companies and IRDA (2006 to Feb, 2018)

The efficiency score presented in table IV(b) are average value for the period but we analysis the insurance companies for all years the result is same all the insurance companies under study display pure technical efficiency also the scale efficiency. Therefore it can be concluded that the SBILI and LICI are able to manage well their function as for as pure technical efficiency concerned. Out of these two companies SBILI is forward than LICI under CCR model. It competitive the SBILI is more efficient than LICI

TABLE IV(b) FRONTIER EFFICIENCY (APPROACH) METHOD

Name of insurance companies	Technical efficiency, Constant Returns-to-Scale CCR model	Technical efficiency, Variable Returns to Scale BCC model	Scale efficiency	Position of the company on the frontier
LICI	0.992	1.00	1.00	Drs*
SBILI	0.946	1.00	1.00	Drs*

Drs: Decreasing return to scale

7. CONCLUSION

The paper concludes that the relative performances operationally and to the scale are both LICI and SBILI is considerable but LICI has to improve the operational performance as per scale. This is needed because the size of business volume of LICI when compare to SBILI. It is very clear from financial performance analysis with that is LICI is still skimming the cream in the market as it is huge in capital formation, premium generation and constant operating cost. The efficiency score of Life insurance companies, in terms of pure technical efficiency and the scale efficiency is same and one, in the case of Technical efficiency by variable returns to scale and scale efficiency, the Public and Private Life insurance companies are not differing significantly in financial performance. It is due to management of business by a good portfolio of varied insurance schemes offers to customers. The financial performance of Private Life Insurance companies is not significant as the proportionate amount of capital was through FDI 26 per cent only over the study period. Hence, the government recently changed the policy and hiked the same to 49 per cent, so, there would be a sea change in various financial performance aspects in the days to come. Hence, the performances of insurance companies in a capsule manner can measured and understand by FEM.

8. REFERENCES

1. Annual reports 2006 to 2018. Retrieved from http://www.dipp.nic.in, accessed on March 5, 2018.

2. Annual reports 2006 to 2018. Retrieved from http://www.rbi.org.in, accessed on March 15, 2018.

3. Annual reports 2006 to 2018. Retrieved from http://www.sbii.in, accessed on March 18, 2018.

4. Annual reports 2005 to 2018. Retrieved from http://www.irda.gov.in, accessed on March 22, 2018.

5. Annual reports 2006 to 2018. Retrieved from http://www.lic.in, accessed on March 28, 2018.

6. Churchil, C. (2007). Insuring the low-income market: Challenges and solutions for commercial insurers. *Risk and Insurance –Issues and practice*, 32 (3), 401-412.

7. Cummins, (1996). Productivity and technical efficiency in Italian insurance industry, The Wharton School, University of pennsylvania, Working Paper Series -10.

8. Eling, M. & Luhnen, M. (2008). Frontier efficiency methodologies to measure performance in the insurance industry, Chair for Risk Management and Insurance working papers on risk management and insurance no. 56.

9. Manjit, S. & Rohit, K. (2009). Emerging trends in financial performance of general insurance industry in India, *Indian Management Studies journal*, 13,31.

10. Mansor, S.A. & Radam, A. (2000). Productivity and efficiency performance of the Malaysian life insurance industry, *Journal Ekonomy Malaysia*, 34,93.

11. Mariappan, R. (2011). Growth & productivity of the unorganized manufacturing sector in India, *The Indian Journal of Industrial Relations*, 47 (1),20.

12. Nyhan, Ronald, C. & Lawrence, L.M. (1999). Comparative performance measurement: a primer on DEA, *Public Productivity and Management Review*, 22 (3), 348.

13. Rao, G.V. (2009). Business trends of two non-life insurance sectors, insurance chronicle, July 2009, pp.30-34.

14. Sinha, R.P (2007). Premium income of Indian life insurance industry- A total factor productivity approach, *ICFAI Journal of financial Economics*, 5 (1),61.

15. Sinha, R.P. (2009). Technical efficiency of Indian general insurance companies: A non-radial approach, *ICFAI Journal of Risk and Insurance*, 6 (1),16.

16. Steven Potter, W. (1998). Life insurer financial distress, best's ratings and financial ratios, *Journal of Risk and Insurance*, 65 (2), 275-288.

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