



Corporate Governance and Firm Efficiency: Empirical Study of Pakistan

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ABSTRACT

In this exploratory study, we examine the effect of firm level corporate governance on firm efficiency calculated through Data Envelopment Analysis (DEA) during the period from 2008-2017 for a sample of 136 non-financial firms listed on Pakistan Stock Exchange (PSX). DEA is a non-parametric technique developed by Charnes, Cooper and Rhodes (1978) which is used to measure firm efficiency by taking different input and output variables. In this study we have used three input and three output variables for firm overall technical efficiency (OTE) measurement, input variables were Total Assets, Total Liabilities and Cost of Goods Sold (CGS) and output variables were Gross Sales Revenue (Sales), Income before Tax (IBT) and Net Income (NI). Overall technical efficiency was calculated through DEA for selected non-financial firms. In the second stage, the association between firm efficiency measured through DEA and corporate governance estimated by Corporate Governance Index has been fully confirmed in selected firms. Firm size, growth, dummy variable for financial crises 2007-09, GDP growth, and operating cash flows (OCF) were used as control variables. The results show that better implementation of CG practices by the firms will help in increasing their efficiency. In other words, better CG practices help firms to utilize their resources in the better way to produce firm outputs (sales/Profit).

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1. Introduction

In the modern world, it is becoming highly important for organization to know how efficiently and effectively its operations are? As compare to its competitors. For example, these comparisons may be take place among different universities, such as the department of one university may compare its performance with the same department in some other university. Similarly, a bank branch in one city may compare its performance with the branch in some other city of the country; furthermore, the firms in non-financial sector may compare their results with each other. This paper in fact is an attempt to measure the efficiency of non-financial firms listed in Pakistan.

What does this word 'efficient' mean? It means working well, without waste and quickly; while the word 'effective' means to produce what is actually desired. This thesis is primarily concerned to measure the efficiency of the non-financial firms that how well, without waste and quickly firm performs. The concept of efficiency was discussed in more details in the thesis from which this paper extracted.

To calculate the efficiency of the companies, different research studies have been conducted. Farell, (1957) for the first time empirically calculated the firm efficiency and Charnes et al., (1978) generalized the Farell's concept of technical efficiency measurement from a single input and single output to multiple inputs and multiple outputs. This model was presented by Charnes, Cooper and Rhodes, that is why it is known as CCR model. Which was further extended in 1984 by Banker, Charnes and Cooper, and that model was named as BCC model. This method combines different inputs and outputs of a set of decision-making units (DMUs) to produce efficiency.

Corporate Governance has become an independent and new area of research in the last three decades (Denis, 2011). It is discussed in the different areas of study such as finance, management, accounting, economics, politics, law, and organizational behavior. There are different definitions of CG available in the literature (Shleifer & Vishny, 1997; OECD, 1999). There are many more definitions of CG, which were categorized by the researchers and scholars into two types, such as "broad" or "Narrow". This categorization is based on the concentration of CG system to which degree it is satisfying shareholders or all stakeholders. If the CG system is only emphasizing on shareholders it can be called narrow (Sternberg, 2004; West, 2006) and if it is satisfying a wide range of all stakeholders interests then it is known as broad context (gillan, 2006).

There are different scholars who have been given narrow CG definitions. For example, Shiekh & Chatterjee (1995, p.5) defined CG as;

"a system whereby directors are entrusted with responsibilities and duties in relation to the direction of company's affairs". Similarly, (Sheifer & Vishny, 1997 p. 737) define CG as *"the way in which suppliers of finance to corporations assure themselves of getting a return on their investment"*

Sir Adrian has been given broad CG definition in World Bank Report (1999, p.7) as

"concerned with holding the balance between economic and social goals and between individual and communal goals.... the aim is to align as nearly as possible the interests of individuals, corporations, and society"

This paper is an attempt to study the association of corporate governance and firm efficiency in the non-financial firms listed in Pakistan Stock Exchange (PSX). For efficiency measurement, a very well-known model Data Envelopment Analysis (DEA) was used.

DEA was initiated by E. Rhodes in his doctoral dissertation supervised by W.W. Coopers, at Carnegie Mellon University on the doctoral dissertation. E. Rhodes evaluated the "unfairness" black and Hispanic students experience under government subsidized public education program. In order to evaluate the accomplishment of the program, "increase in the pride of the students who receive the benefit of the program" was used as an output, and "hours mother spend with their children on reading books together" was used as an input. The results were published on European Journal of Operation Research in 1978. Since then, DEA has been developed mainly for the purpose of estimating output efficiencies of decision-making units (DMUs herein after).

In this paper three input and output variables were used to estimate the firm Overall Technical Efficiency (OTE), input variables were total assets, total liabilities and cost of goods sold (CGS) and output variables were Sales, Income Before tax and Net Income. DEA was used to estimate the efficiency score, after calculating the efficiency score of 136 non-financial firms. These OTE scores were used as dependent variable and Corporate Governance Index (CGI) was used as independent variable to check the effect of CG on Firm efficiency, some control variables were also added to the model to better predict the effect of CG on firm Efficiency. The results suggest that good CG practices positively affect the firm efficiency.

2. Literature Review

Firm performance is used as dependent variable and is very relevant construct in the research of management field. Regardless of this relevance, no concrete consensus has been developed about its definition measurement and dimensionality, different researcher has used different proxies for firm performance.

Efficiency is important for the purpose that organization performance is an important characteristic. Organizations such as financial and non-financial, small or big must get the optimal performance so that to compete in the market. mohamad & Said, (2010) recommend that the major objective of the organization is to improve performance. Many experts and researchers define performance in different ways. One aspect of firm's performance is efficiency measurement. It can be in terms of increasing outputs, decreasing cost or maximizing the profits. A firm is considered as technical efficient if from the given level of inputs, producing maximum level of outputs or at the minimum level of input produce given level of output.

Most of the literature suggests that efficiency measures of DMUs are compared to firm operating in the same industry or sector (Mantri, 2008). One example is study of Philips et al., (1994) who compare all the US computer industry firms by measuring productive efficiency using the inputs and outputs from their financial statements. Similarly, Reynolds & Thompson (2007) measure the efficiency of 62 full service restaurants for comparison where their input variables are restaurant seats, hourly server wage and a standing alone facility restaurant as a coding variable, and total daily sales and percentage of tip as output variables. Abbott & Doucouliagos (2003) measure the efficiency of 36 Australian public sectors universities in teaching and research.

DEA is also used to analyze the time series data of DMUs operating in the same sector/country. For example Flegg et al., (2004) Applied DEA to 45 British universities to measure efficiency in the period of 1980/81 to 1992/93. Barros & Santos (2006) used Portuguese hotel industry from the period of 1998 to 2002 to measure efficiency. DEA also allows firms from same sector across countries for comparison, as Mantri (2008) compared efficiency of German and Swiss hospitals. Firms in finance sector have gained great attention to compare efficiency of firms. Touhami & Solhi (2008) studied Moroccan banks efficiency during the period from 1993 to 2006.

Batra & Tan (2003) used the data of six countries SME's Indonesia, Malaysia, Mexico, Colombia, Guatemala and Taiwan to measure technical efficiency. Their results showed that technical efficiency rises with the firm size and a substantial overlap occurs in the distribution of efficiency with firm sizes, while some small firms are producing higher efficiency than the large firms. There are some factors that differentiate high efficient companies from low level of efficient companies in these six countries, and these factors are, education and training of employees, use of latest technology and automation, and quality control.

Wu (2005) uses the data of Taiwan's steel industry during the period of 1970-1996 to examine the performance, their results recommend that technical efficiency and industry evolution is highly affected by the companies involved in liberalization and adopting new technology. While Wu et al., (2006) uses DEA to examine the retailing industry performance in Taiwan, the results showed that half of the companies were inefficient.

Hong & Park (2007) used DEA based approach and examined that through Support Vector Machine (SVM), they evaluated single company and efficiency of IT venture business was provided without comparing with other firms. The most important variables to provide financial information were capital turnover, employees' productivity and sales/employees for efficiency evaluation of IT business venture.

Din et al., (2007) used output oriented DEA approach under CRS and VRS model assumption to evaluate the technical efficiency of large manufacturing sector in Pakistan. Data of 101 companies were collected in two parts, from 1995-96 and 2000-2001. Capital, industrial and non-industrial cost and labour were used as inputs variables and contribution of GDP was used as output variable. The result of CRS model showed improvement in mean efficiency from 0.23 in 1995-96 to 0.42 in 2000-01. On the other hand, an increase in efficiency score has occurred from 0.31 to 0.49 during these two periods under variable return to scale model. Singh (2006-07) used DEA model to measure the efficiency of sugar mills in Uttar Pradesh. The results found 93 percent of overall technical efficiency during the period of 1996-97 to 2002-03, and further suggested that the mill may reduce 7 percent of inputs to become more efficient than others.

Meenakumari & Kumaraj (2008) evaluated the efficiency of 29 public electric utilities (SOEU's) in India and employed CRS and VRS model assumption of DEA to calculate efficiency. Yearbook 2004/05 and TERI energy data directory were used for data collection. First of all, correlation between inputs and outputs were calculated through regression analysis and found positive correlation among all variables. And the DEA results recommend that under CRS and VRS model, 24% of SOEU's were efficient.

Joshi & Singh (2009) used CCR and BCC models of DEA to evaluate the productivity efficiency of readymade garment in India. Primary data of eight garments firms were used. Inputs variables were stitching machines and operators and garments pieces produced are used as output variable. Primarily, correlation analysis showed that inputs and output are significantly correlated. Their results recommend that under CRS model firms are 75 percent efficient and could increase by 25 percent. While firms are 83 percent efficient under VRS model.

Barita et al., (2011) have used CRS model of DEA to find out the technical efficiency and to find out the benchmarking units for Indian safety performance industries. The output taken was the number of accidents and annual budget percentage was taken as input variable; under CRS model, out of thirty units only seven were found efficient and for inefficient units benchmarking was done to become efficient.

Mahadevan (2002) analyzed the data of Malaysian manufacturing firms during the period of 1981 to 1996 to measure the growth of productivity. He used DEA to calculate the Malmquist index of growth and technical change in TFP (total factor productivity). From Malmquist index change in technical and scale efficiencies were decomposed. They had taken capital and labor as inputs variables and value added was taken as output variable. The higher TFP growth was obtained by non-ferrous metal industry, which was 3.7 percent and lowest TFP growth was obtained by petroleum refineries which was -0.3 percent. They also recommended 0.8 percent weighted average TFP growth; 0.3 percent technical change; 0.5 percent technical efficiency, 0.4 percent pure technical efficiency and 0.1 percent scale efficiency changes were found. They claimed that due to minimal gain in technical change and technical efficiency, TFP growth was low, with other industries operating at optimal scale.

Baten et al., (2006) applied stochastic frontier production approach on Bangladesh manufacturing industry to examine the technical efficiency during the period of 1981/1982 to 1999/2000. 3-digit census selected factories were covered. They used value added labor and capital as their research variables. To model the: half normal distribution and truncated normal distribution, these two alternative distributions were applied. They found that under truncated normal distribution, the technical efficiency was estimated for the selected industry was 40.22 percent while 55.57 percent under half normal distribution potential output was estimated. They also recommended that parameter of time varying inefficiency was positive which shows decline in technical efficiency in the selected period of time.

Duzakin & Duzakin (2007) analyzed 480 firms' performance of manufacturing firms from 12 industries in Turkey during the year of 2003. CRS model of DEA output oriented based model was applied. two input and three output variables were used. Net assets and average number of employees were used as inputs variables and gross value added, profit before tax and export revenue were used as output variables. They analyzed that deviation from the standard was average scored from 0.178 to 0.989 and recommended that 278 firms results remained below average, and 65 firms were identified efficient firms. The main reason of inefficiency in Turkish firms was the minimum level of inefficient exports.

Watanabe & Tanaka (2007) used the Chinese industry at province level to examine efficiency over the period of 1994 to 2002. The two efficiency measures were estimated through directional output distance function, the one, which consider only desirable output, and the other, which consider both desirable and undesirable outputs. Inputs were material, capital and labor while industrial products was taken as desirable output and sulfur dioxide was taken as undesirable output. They recommended that the result with only desirable output, the efficiency level was biased. They concluded that ignoring the undesirable output may tend to overestimate efficiency of industries in Sichuan, Shandong and Hubei. They also added that industrial structure of province significantly affects the efficiency levels.

2.1 Corporate governance and firm efficiency

Lin, Ma, & Su (2002) studied 461 manufacturing firms listed in china to study the relationship between corporate governance and firm efficiency. Efficiency was measured through DEA. There results recommend that firm efficiency is significant negatively affected by state ownership while state and managerial ownership positively

affect firm efficiency, U shaped relationship was found among ownership concentration and firm efficiency.

Andries, Alin, Bogdan & Simona (2016) this study attempted to study influence of corporate governance on firm efficiency, the sample consists of 139 commercial banks from 17 central and eastern Europe from the period of 2005 to 2012. The results show that good corporate governance practices significantly affect technical efficiency.

This study examines the relationship between corporate governance and the efficiency of Turkish banks using a sample of 10 banks listed in Borsa Istanbul from the period of 2005 to 2015. Efficiency was estimated through Data Envelopment Analysis (DEA) and panel regression models were used to find out the effect of CG on banks efficiency. The results revealed negative and significant association among free float rate and board independence with the efficiency of the banks. Finally, the consequences have showed that there is no statistically significant relationship among corporate governance and bank efficiency. (Mustafa, Işıl & Fatih, 2016).

this research examined the effect of corporate governance on the efficiency of financial performance of oil and gas companies listed in Kuala Lumpur Stock Exchange Malaysia from the period of 2007 to 2011. Efficiency was estimated through Data envelopment analysis (DEA) technique under constant return to scale (CRS) model and variable return to scale (VRS) model. Results show that firm size and CEO/chairman duality significantly affect the efficiency of corporate governance in producing financial performance. (Ong, Soh, The & Ng, 2014).

Kashif Rashid (2008) studied the developing (Malaysia) and developed (Australia) capital markets to check the relationship between corporate governance and firm performance. The results shows that there is positive association between corporate governance and firm value.

Ece Oguz (2016) studied the association of Corporate governance and firm performance of 90 firms listed in Turkey during the period from 2008 to 2014. There results recommended that corporate governance variables significantly affect firm performance.

Kusuma H., Ayumardani A., (2016) studied 11 islamic banks of Indonesia to examine the effect of corporate governance efficiency on bank performance during the period from 2010 to 2014. For corporate governance efficiency, Data envelopment analysis (DEA) was applied. The results show that corporate governance significantly affects the firm efficiency.

Leora F. Klapper Inessa Love (2002) studied the association among CG, investors protection and firm performance in 25 developing market. Their results suggest that countries where protection to shareholders are weak and judicial efficiency is poor, firm level corporate governance matters a lot in those countries.

Humera Khatab, etal (2011) explore the relationship between corporate governance and firm performance of 20 listed firm in Karachi stock exchange during the period from 2005 to 2009. Their results suggest that corporate governance practices positively affect the performance measured through ROA, ROE and Tobin's Q.

3. Data Collection and Methodology

The population of this study was all firms listed on Pakistan Stock Exchange (PSX), the sample size of the conducted study was extracted from PSX listed companies and include only 136 non-financial firms listed on PSX. The panel data have total numbers of firm year observations are 1360, which represent 136 non-financial listed firms selected from Pakistan Stock Exchange (PSX) over a period of 2008-2017. Input and output variables data for firm efficiency measurement and corporate governance index was collected from annual reports of the companies.

Table 1: represent the inputs and outputs variables used in the study

Input Variables	Output Variables
Total Assets (TA)	Gross Sales Revenues (SALE)
Total Liabilities (TL)	Income before Taxes (IB)
Cost Of Goods Sold (CGS)	Net Income (NI)

Firm overall technical efficiency scores were calculated through DEA by taking the above given input and output variables. Firms efficiency score was used as dependent variable, corporate governance index (CGI) and other control variables were used as independent variables

The regression model is given below;

$$OTE_{it} = \beta_0 + \beta_1*CGI + \beta_2*WGI + \beta_3*SIZE + \beta_4*LEV + \beta_5*F_CRISES + \beta_6*GROWTH + \beta_7*GDPG_{it} + \beta_8*BETA + \beta_9*OCF + \epsilon_{it}$$

This part of the research discusses the quantitative data and results analysis conducted in this research study. In the first instance, it presents the assumptions of regression analysis. It provides the descriptive statistics of the data; then testing hypotheses to check the effect of country governance and corporate governance on firm efficiency. These results based on the panel data analysis techniques, but before conducting panel data analysis, the dependent variables were first measured through Data Envelopment Analysis (DEA) technique (see introduction section of the thesis for details)

Table: 1 Descriptive statistics

	OTE	CGI	SIZE	LEV	GROWTH	F_CRISES	GDPG	OCF
Mean	0.707	78.074	15.823	1.360	12.273	0.298	3.449	1.183
Median	0.657	78.572	15.702	1.078	12.093	0.000	3.507	0.066
Maximum	1.000	100.000	19.840	3.678	16.099	1.000	4.833	3.108
Minimum	0.460	57.158	11.907	-1.188	8.010	0.000	1.607	-1.801
Std. Dev.	0.106	7.534	1.507	1.177	1.968	0.458	1.150	1.607
Skewness	0.245	-0.033	0.339	0.234	0.299	0.881	-0.320	0.753
Kurtosis	3.007	2.869	3.143	2.914	2.945	1.776	1.744	3.270

OTE is dependent variables where the OTE stands for Overall Technical Efficiency, CGI is independent variables where CGI stands for Corporate Governance Index of listed Firms the rest of variables were used as control variables which consist of SIZE which was the logarithm of total assets of the selected listed Firms, LEV is the leverage of the selected listed Firms calculated as ratio of Debts/equity, Growth is the change in sales of selected listed Firms, F_crisis is the dummy variable for financial crises, GDPG is the growth of gross domestic products, OCF is the operating cash flows of selected listed Firms. All variables were winsorised at 1 and 99 percentiles to remove outliers.

Table: 2 Correlation Matrix of variables included in the study

	OTE	CGI	SIZE	LEV	GROWTH	F_CRISES	GDPG	OCF
OTE	1							
CGI	0.112*	1						
SIZE	0.027	0.081*	1					
LEV	-0.133*	0.094*	0.133*	1				
GROWTH	0.214*	0.085*	0.630*	0.07*	1			
F_CRISES	-0.04**	-0.15*	-0.13*	0.14*	-0.08*	1		
GDPG	0.059*	0.072*	0.05**	-0.08*	0.04	-0.19*	1	
OCF	0.08*	-0.035	-0.11*	-0.05*	0.02	0.02	0.03	1

*(**) represent the significance level at 5% and 10% respectively

3.1 Test for Multicollinearity

To test the relationship between independent variables, this study has calculated variance inflation factor (VIF) to check whether independent variables are highly correlated or not with each other. High correlation between two or more independent variables lead to high multicollinearity which can affect regression estimation (Hair *et al.*, 2009), the test results are given below (Wooldridge, 2002):

$$VIF = \frac{1}{1 - R_i^2}$$

Where, R_i^2 denotes unadjusted R^2 of the model after running the regression of dependent and independent variables. If the value of VIF is greater than 10, it means there is the problem of Multicollinearity (Gujarati, 2003).

The below tables shows that VIF results are less than 10, it means that there is no problem of multicollinearity.

Table: 3 VIF Values

Variables	VIF	1/VIF
CGI	1.06	0.943
SIZE	2.06	0.485
LEV	1.07	0.935
GROWTH	1.95	0.513
F_CRISES	1.28	0.781
GDPG	1.32	0.758
OCF	1.02	0.980
Mean VIF	1.38	

3.2 Test for Heteroscedasticity

To test for the issue of heteroscedasticity in the data, Breusch-Pagan / Cook-Weisberg was conducted as the problem of heteroscedasticity can invalidate significance of statistical tests that assume that error term variance does not vary, and the model is uniform and uncorrelated (Johnston, 1972). Table given below shows that the results of Breusch-Pagan for which the null hypothesis is $H_0 = \text{constant variance}$. Below given table shows that there is problem of Heteroscedasticity among the models.

Table: 4 Heteroscedasticity test results

Model	Breusch-Pagan / Cook-Weisberg [if $F < 0.05 \rightarrow$ there is Heteroscedasticity]
Model 01 (OTE)	Chi2(1)=40.23 Prob > F = 0000

3.3 Test for Autocorrelation

In panel data models, serial or autocorrelation can bias the standard errors, due to which the results can be caused less efficient (Drukker, 2003). For this purpose, Durbin-Watson test was applied on the panel data to check for autocorrelation. The below given table shows that there is the problem of autocorrelation in the model as the value of Durbin-Watson test is less than 2.

Table 5: Test for Autocorrelation

Model	Durbin-Watson Statistics
Model 01 (OTE)	0.79743

3.4 Model Specification

This study uses panel data to examine the effect of corporate level governance on firm efficiency, for this purpose, some model specification tests were carried out to select the best model among pooled, fixed and random effect models for regression analysis. These model specification tests were Chow test for selection among pooled and fixed effect model, Hausman test for selection among fixed effect and random effect model, and Breusch-Pagan LM test for selection among random and pooled regression models. (see Hausman, 1978; Gujarati, 2003; Breusch and Pagan, 1979). Below table shows the summary of all models specification test for regression panel models.

Table 6: Model Specification

Model Specification Tests	Model 01 (OTE)
Chow test for pooled versus Fixed effect model if $\leq 0.05 \rightarrow$ Fixed effect	Prob>chi2= 0.0000
Hausman test for Fixed versus Random effect model if $\leq 0.05 \rightarrow$ Fixed effect	Prob>chi2= 0.0000
Breusch-Pagan LM test for Pooled versus Random effect model if $\leq 0.05 \rightarrow$ Fixed effect	-----
Decision	Fixed effect model

Table: 7 Results of Fixed Effect Model with Dependent Variable (Overall Technical Efficiency).

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.098	0.0408	-2.396	0.017
CGI	0.001	0.0004	3.549	0.000
SIZE	0.004	0.0026	1.735	0.083
LEV	-0.012	0.0024	-5.026	0.000
GROWTH	0.014	0.0019	7.263	0.000
F_CRISES	-0.011	0.0067	-1.717	0.086
OCF	0.000	0.0001	3.338	0.001
GDPG	0.002	0.0027	0.714	0.475
R-squared	0.505			
Adjusted R-squared	0.458			
F-statistic	22.624			
Prob(F-statistic)	0.0000			

3.5 Main regression results

Table 7 depict the results of fixed effect models of regression analysis showing the effect of corporate governance on firm efficiency (overall Technical Efficiency) during the period from 2008 to 2017. All the variables were evaluated statistically by looking into its P-values, variable at 1% significance level were considered highly significant, significant at 5% and marginally significant at 10%. On the other hand, the coefficient values of each variable represent change in dependent variable due to unit change in independent variable holding all other variables constant.

Table 7 depict that there is significant positive association between corporate governance index and efficiency score calculated through DEA under Constant return to scale (CRS) model at the significance level of 1%, where 0.1% change in corporate governance index practices brings 1% change in firm efficiency. These results confirm the first hypothesis of the study and was consistent with prior studies on performance (firm efficiency) and corporate governance (see Klapper and Love, 2004; Thomsen, Pedersen and Kvist, 2006; Huang Hsiao and Lai, 2007; Ponnu and Karthigeyan, 2010; Le and Buck, 2011; Dedu and Chitan, 2013; Andreou, Louca and Panayides, 2014; Gupta and Sharma, 2014; Yoo and Jung, 2014).

4. Conclusion of the study

This research study is an attempt to check the association among corporate governance and firm efficiency. Firms efficiencies were estimated through Data Envelopment Analysis (DEA) developed by Charnes, Cooper and Rhodes (1978). Firms overall technical efficiencies (OTE) were calculated through DEA under constant return to scale model. After estimating the firm efficiencies, corporate governance was estimated as corporate governance index (CGI) developed by Attiya Javed (2010). Some control variables were added to the regression model to better predict the effect of corporate governance on firm overall technical efficiency. These control variables were firm size (logarithm of total assets), leverage (ratio of debts to equity) firm growth (change in sales) GDP growth (change in GDP), a dummy variable for world financial crises of 2007-09 and operating cash flows. The regression results show that good corporate governance significant positively affect the firm overall technical efficiency. Leverage and period of financial crises has significant negatively affect the firm efficiency while firm size, growth and operating cash flows have significant positively affected the firm efficiency. GDP growth has shown no relationship with firm efficiency.

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