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Efficiency Analysis of Firms Listed in Pakistan Stock Exchange

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The current study estimates the efficiency of the firms listed in Pakistan Stock Exchange by using the unbalanced panel data of 360 firms listed during the years 2010-2018 and employing Stochastic Frontier Analysis in two frontiers, i.e., market value frontier and profit frontier. The results show that firm size impacts the market value in U-shaped pattern while the expenditure on capital and firm's risk negatively impact the market value. For the profit frontier, the firm size has also shown U-shaped impact while dividends and leverage have shown encouraging effect on profit frontier. The firm's risk has shown negative impact on profit frontier. The results show that an average firm reaches 74.05 percent of the best performing peer market value and 71.2 percent of the best performing peer's profit. There is a positive correlation between the two efficiencies, which stipulates that an average firm in Pakistan suffers from inefficiency or agency conflicts to a certain extent, regardless of whether short-run or long-run growth prospects drive the firm.
Keywords: Market value front, Profit value front, Pakistan Stock Exchange, Stochastic frontier analysis.

INTRODUCTION

Generally, the results of agency cost hypothesis tests depend on how the performance of the firms is measured. In the literature, a number of performance measures are used. Himmelberg, Hubbard, and Palia (1999) used Tobin Q, Mehran (1995) used return on assets and Tobin Q, Cole and Mehran (1998) used the stock price, Ang, Cole, and Lin (2000) used expense ratio and asset utilization ratio, Quader and Dietrich (2014) used return on assets and Zabri, Ahmad, and Wah (2016) also used return on assets (ROA) and return on equity (ROE) as a measure of firm performance.

In the literature broadly three efficiency procedures are found prevalent: (a) technical efficiency that implies maximizing production from a specific combination of factors. (b) allocative efficiency is based on reducing the cost of input prices for each level of production; and (c) revenue efficiency is linked to maximize the value creation, gross income, or any other economic parameter. Nevertheless, there is no consensus on the favored method for efficiency measurement. The efficiency estimates tend to diverge due to varying methods of efficiency measurement.

The agency cost stemming from conflicts of interest among different stakeholders restricts firms from achieving the best practices with other peers. By developing best practices peers minimize the agency costs. In this case, efficiency measurement becomes closest to the concept of agency cost (Berger & di Patti, 2006). It is essential to know how to minimize agency costs. Firms with similar technology can meet the benchmark, while this benchmark is assumed a fictitious value, and the firm's core and actual value assumptions estimate the firm's inefficiency. Thus, the firms at a low shortfall level may have low inefficiency, and they may be more efficient than other firms. For this computational easiness and internal consistency, Stochastic Frontier Analysis (SFA) does exceptionally well in many ways than other alternative parametric and non-parameterized methods to estimate the efficiency. It is frequently used in the literature. For instance, Lundvall and Battese (2000) for technical efficiency of the firms in Kenya, Nguyen and Swanson (2009) for firm efficiency and portfolio returns in USA, and Quader and Dietrich (2014) for corporate efficiency in UK have utilized SFA.

The current study has adopted the stochastic frontier technique to estimate the efficiency of firms in Pakistan. However, in the literature, the focus of financial management has changed from traditional to modern approach. The traditional approach focuses on the goal of achieving profitability. The modern approach does not focus on to maximize the profits but to maximize wealth or value, and the long-term range of evaluations to achieve the sustainable performance of the firms. For a commercial firm, profit is not necessarily the only purpose. A firm can focus on other aspects, like increased sales, increased market share, and manage profitability. Therefore, profit maximization is a subset of wealth maximization that contributes to wealth or value creation. The management of modern business based on value creation has become a modern way of financial management which leads to better real business evaluation.

So, using unbalanced panel data of the firms listed in Pakistan Stock Exchange for the time period 2010-2018, we estimate two different frontiers: market value frontiers and profit frontier. G. E. Battese and Coelli (1995) were the pioneers of developing the technique that allows firms to simultaneously illustrate diverse business-related direct factors' inefficiency. The calculations of efficiency from the frontier of market value is called long-term efficiency, and the efficiency estimation of the profit frontier is called short-term efficiency. In view of the diverse maximizing objectives, the comparison between the dynamism or agency costs is facilitated. The current work is characterized by use of a larger and more comprehensive data set. The empirical significance of short-term efficiency and long-term competence is also another novelty of the study. Furthermore, the corporate efficiency of firms operating in Pakistan has not been estimated earlier, so it is desirable to evaluate corporate efficiency in Pakistan.

The corporate governance environment where in the Pakistani firms are operating is not subject to the firm's market management. The role of significant collaborators, institutional investors, and the board of directors' supervision is limited. For

all of these reasons, Pakistan is an excellent choice for agency costs evaluation because firms have a wide range of management discretion. Therefore, to contribute in the literature, it is an exciting quest to investigate the impact of agency cost on firms' performance in Pakistan.

LITERATURE REVIEW

An extensive literature exists on the efficiency of the firms comprising of different measures of efficiency and employing of various techniques. Lundvall and Battese (2000) employed the stochastic frontier production model to investigate the relationship between firm's age, firm size, and technical efficiency in Kenya. They found that size of the firm increases technical efficiency, while firm's age does not affect efficiency in the wood and textile sector of Kenya.

Berger and Bonaccorsi di Patti (2006) analyzed the association between the firm's capital structure and performance using a parametric measure of efficiency as an indicator of the agency cost of commercial banks of USA. They found that higher leverage was positively associated with efficiency. Dimitris Margaritis and Psillaki (2007) also performed similar test to estimate the impact of leverage on firm's performance in New Zealand. They analyzed the efficiency through non-parametric analysis DEA and found a positive impact of leverage on overall efficiency. However, the impact was found low at medium-level leverage and negative at high-level leverage firms.

Weill (2008) utilized the cost stochastic frontier to assess the relationship between firm performance and leverage in seven European countries, including Germany, Portugal, Norway, Italy, Belgium, France, and Spain. The study found a positive relationship between firm performance and leverages in five countries, while this relationship was found negative in the remaining two countries.

Nguyen and Swanson (2009) examined the firm's efficiency and equity returns in USA by using the Stochastic Frontier Approach and concluded that firm's efficiency is a major determinant of stock returns. D Margaritis and Psillaki (2010) have analyzed the relationship between firm performance and capital structure of French manufacturing firms. They employed data envelopment analysis to find the efficiency of firms and concluded that a high leverage level firm is associated with higher performance.

Quader and Dietrich (2014) used a stochastic frontier to measure the corporate efficiency of UK firms listed on the London Stock Exchange. They found that, on average, a firm in the UK suffers from inefficiency or agency conflicts to a certain extent, no matter whether the short-run or long-run growth perspectives drove the firm.

Zabri et al. (2016) analyzed the role of corporate governance in firm's performance in Malaysia. The corporate performance was measured by board size and board independence, and firm's performance was measured by returns on assets and returns on equity. The study found a negative relationship between corporate governance and firm's performance. The larger board size lowers the firm's return on assets. The study also found that there was no relationship between board independence and firm performance.

The role of firm's ownership and capital structure in firm's financial decisions was estimated by Sun, Ding, Guo, and Li (2016) for UK. The primary objective of the study was to investigate the role of agency costs in leverage decisions of firms. The study found a non-monotonic relationship between managerial ownership and debt ratio. It was further found that institutional ownership positively impacs the leverage level of firms.

For Pakistani firms, Sadiq, Ehtesham, and Khan (2017) investigated the role of financial constraints of firms listed in the KSE on investment and firm's performance. The multivariate probit results explained that financial constraints have significant impact on investment expenditure.

Griffin, Hong, and Ryou (2018) analyzed the role of innovative corporate efficiency in credit status of the firms in USA. Innovative corporate efficiency was measured by the number of patents or citations and R & D expenditures. The study concluded that corporate efficiency improves the credit ratings of the firms.

Banerjee and Homroy (2018) attempted to see the role of ownership structure on firm's performance listed in the Bombay Stock Exchange. Firm performance was measured by returns on assets, while the ownership structure was divided into two categories, i.e. business group affiliates and stand-alone business. The study found that turnover performance was evident in the stand-alone business. The firms with stand-alone ownership structure focus on short term goals while firms with business group affiliates focus on the long-term goals. The study found no difference in firm performance of business group affiliates and stand-alone ownership firms. Rossi, Barth, and Cebula (2018) investigated the relationship between agency costs and ownership structure of Italian firms and found that family-owned firms decrease agency costs.

Laghari and Chengong (2019) estimated the relationship between corporate performance and working capital requirements of Chinese firms and found a U-Shaped relationship between corporate performance and working capital requirements. The study explained that the working capital requirement of financially constrained firms remains low due to higher costs of external financing.

For American firms, Kim, Kim, Mantecon, and Song (2019) probed the role of institutional investors in mitigating the agency costs between shareholders and creditors. The study found that the investment horizons of institutional investors were negatively correlated with the number of loan covenants and loan spreads. They found that short-term (long-term) institutional ownership was positively (negatively) correlated with the number of covenants.

For restaurant industry in USA, Rhou, Li, and Singal (2019) analyzed the relationship between managerial structure and firm's performance. Degree of franchising as a dependent variable was measured by the ratio of number of franchised units to total units of a firm, while managerial ownership was measured by percentage of equity ownership shares held by all directors and executive officers owned in the firm. A negative correlation was found between management ownership and franchise level of firms.

Farooq and Pashayev (2019) employed the quantile regression to investigate the relationship between capital structure and structure of board in six European countries, namely, Austria, Belgium, France, Germany, Luxembourg and Netherlands. The study showed that the firms where CEO sits in the board, the debt ratio remains found lower, as compared to the firms where CEO does not sit in the board. Similarly the firms where ex-CEOs chairs the boards have significantly lower debt ratios as compared to the firms where ex-CEOs does not chair the board.

The non-financial firms in the perspective of agency costs and investment decisions are analyzed by Jadiyappa, Hickman, Jyothi, Vunyale, and Sireesha (2020). They measured the Tobins Q as a ratio of market values of assets of a firm to book value of assets and found the negative impact of debt diversification on value of the company. The study further revealed that inadequate supervision led to decrease in the company's accounting performance due to agency costs.

The literature reviewed covers a variety of areas related to firm performance, but none of the studies has focused on Pakistani listed firms for efficiency analysis through stochastic market value frontier and profit frontier, i.e., long-run and short-run efficiency.

METHODOLOGY

Theoretical Foundation for Measuring the Efficiency

To gauge the competency of a firm, we consider a series of firms, and each firm faces a similar set of opportunities. Owing to the specificity of different firms and advantages of management, technology competency, the different firms tend to take the opportunity of specificity in different ways and create business values. It explains that the market is taking those firms more efficient which produce more value per unit of assets. On the other hand, the firms which rarely take advantage of their assets are considered as less efficient firms. In a business portfolio sample, we can estimate the optimal value function or its bounding capabilities by changing the set of opportunities and business characteristics. In the Stochastic Frontier Analysis (SFA) the points at the forefront represent the maximum that a particular firm can get from its foundations and efficiencies. The inadequacy of each firm to reach at the forefront is perceived as inefficiency of the firm. The firms are assumed more efficient when the gap between frontier and actual value is smaller. Before estimating the best value or limit, one should know the points given by Nguyen and Swanson (2009) and Quader and Dietrich (2014), i.e. firstly, the optimal value firm can obtain the frontier, so that, a firm may lie on or below the frontier, and it cannot lie above the frontier; secondly, the most successful firms taking a particular set of opportunities give the highest possible value of the benchmark attainable. However, the real best value is not yet attained by a particular firm; and thirdly, regardless of the specific cause of the business, the lack of better management causes the inefficiency rather than the best achievable value due to random walk.

Consequently, it is imperative to be capable of differentiating between the real inefficiencies and random factors which are beyond the control of the firm's principals or agents. As discussed above, the efficiency scores are determined by SFA, so by using SFA, we can estimate the measurement of the net inefficiency and can distinguish between inefficiency and random walk. To distinguish between the two, the SFA assumes an error term consisting of two components. First is symmetric arbitrary component which captures measurement errors, stochastic effects, and omitted variables bias, and the second is an asymmetric component which represents the lack or inefficiency of the system from the frontier. Unfortunately, the standard Ordinary Least Squares (OLS) method has a non-active component, and it is included in the OLS intercept, so it cannot recognize and distinguish between them.

On the other hand, the asymmetric inefficiency of SFA can be calculated for each firm and corresponding ranking. Therefore, SFA is more appealing to proxy inefficiencies and agency cost analysis. By using the traditional panel data notation, Y can be represented as an interpretation set (1× K) of the variable X function, which finds the position of the boundary line and the composite error element, where Y represents the market value or profit to be optimized.

$$y_{it} = x_{it}\beta + \varepsilon_{i}{}^{t}$$
$$\varepsilon_{it} = v_{it} - u_{it}$$

As a condition that these effects are same, the two-stage estimation processes the specification and estimation of the stochastic frontier function and the prediction of the effect on efficiency distribution. The second step is the arrangement of a regression model that predicts the effect of inefficiency and contradicts assuming a low-efficiency effect of the same distribution on the stochastic frontier. These two-stage procedures have been adopted by several empirical studies and are considered good procedures (Pitt & Lee, 1981). However, for its hypothetical independence, this procedure was also criticized - the inefficiency effect of the two estimated phases. The above estimation process is doubtful to provide an estimate that is valid as an available estimate using a one-step estimation process. Kumbhakar (1991) presented a probabilistic cross-sectional frontier model that have an efficiency effect (U_{it}) represented as a specific function of a firm-specific variable random error vector. For proper distribution assumptions, the parameters of the stochastic and low yield models are estimated at the same time. Battesse and Coelli (1995) have proposed a similar panel data model, according to its model specifications, which assume that the error terms (U_{it}) are obtained by truncating $N(m_{i}{}^{t}, \delta_u^2)$ at zero.

$$U_{it} = z_{it}\delta + \omega_{it}$$
$$m_{it} = z_{it}\delta$$

Among them, Zit is a set of (1×P) variables that can affect the inefficiency of the firm, so the ω_{it} is taken by the truncated $N(m_{i}{}^{t}, \delta_u^2)$ so the truncation point is Zit. An unknown coefficient (Px1) of the presumed vector and wit represents an unexplained component of the U_{it}. If the inefficiency effect is random, Zit may contain input variables within the arbitrary limit. Over time, U_{it} and its determinants are changed by adapting to changes in the relative limits of the firms involved in the frontier and capturing the dynamics of conflict between managers and shareholders.

Battese and Coelli (1995) model uses parameterization of Battese and Corra (1977), that is, $\delta^2 = \delta_v^2 + \delta_U^2$ and $\gamma = \frac{\delta^2}{(\delta_v^2 + \delta_u^2)}$. Maximum likelihood estimation is used for estimation of

simultaneous equations for estimation of stochastic frontier model of parameters and model of technical efficiency effect. From the discussion, it is clear that if a firm is on the frontier, or in other words, a U_{it} = 0, it will maximize Y. If U_{it}= 0 is all i and t, then $\delta_U^2 = 0$. Thus, the validity function of the SFA specification is the same as the OLS probability function. However, if $U_{it} > 0$ is enough for i and t, OLS incorrectly restricts $\delta_U^2 = 0$, so the SFA specification is a preferred technique as compared to others. The Gamma parameter facilitates the comparison between random shock (U_{it}) and inefficiency term (v_{it}) and Gamma must be between 0 and 1, facilitating the comparison of random variables. If Gamma is zero, the variance of the inefficiency term δ_U^2 is zero, and the model is simplified to the traditional mean response function. This indicates that the U_{it} term should be removed from the model, leaving the specification to be able to systematically estimate the parameters using the standard least-squares method. Conversely, if the Gamma is close to one, the deviation from the boundary is characterized by inefficient or cost of the agency than white noise. The likelihood ratio test can also be estimated to ensure for inefficiencies and unilateral errors that essentially correspond to OLS and SFA testing capabilities. Since this measure is based on the composite error element and the compound error is affected by estimating the parameters of the marginal function, the enterprise and time-specific effects in the boundary model are probably made of stochastic panels. In the stochastic frontier model of the panel, especially when the low-efficiency measurement evolves during the parameterization process, the problem of measuring the effectiveness becomes complex with the specific effect of individual avoidance (Chen, Schmidt, & Wang, 2014).

Therefore, the composite error term becomes in the form of the expression given as:

$$\varepsilon_{it} = v_{it} - u_{it} + f_i + T_{\ddot{\imath}}$$

When parameters are predictable and the position of the frontier is determined, the calculation of the efficiency score becomes straightforward. Specifically, for each firm, the relative distance of the frontier or the efficiency of a firm, at time t, can be measured by the expression given as:

$$EFF = \frac{E(y_{it}|u_{it} > 0, x_i t)}{E(y_i t|u_i t = 0, x_i t)}$$

In the case of model hypotheses, the forecast of validity is based on conditional expectation. The EFF efficiency score is a normalized measurement between 0 and 1.

Model Specification

Market Value Frontier

Tobin's Q shows a growing opportunity for firms to invest in the future, so the firm works to optimize Tobin's Q or its market value. The firms focus on advanced methods of financial management to maximize the prospect of growth that can be considered as sustainable performance. If the purpose of a business manager is to optimize the market value of the business through excellent operational and investment decisions, the firm will have to attain the optimum value of Tobin Q. The market will consider it useful if it reduces the dislocation of interests between managers, shareholders, and creditors and considers the firm's long-term growth goals, that is the estimated value of the validity. It is described as a long-term operational efficiency. A set of characteristics of a firm and the opportunity of the reference value managed by each firm determines the frontier of market value expressed in Equation 1.

$$\ln TobinQ_{it} = \alpha_0 + \alpha_1 Size_{it} + \alpha_2 Size_{it}^{\ 2} + \alpha_3 Intangibility_{it} + \alpha_4 Dividend_{it} + \alpha_5 Leverage_{it} + \alpha_6 Capitalexp_{it} + \alpha_7 Firmrisk_{it} + \alpha_8 Profit_{it} + \alpha_9 Assetbase_{it} + \alpha_{10} Year_{it} + v_{it} - u_{it} + f_i + T_{\ddot{\imath}} \quad (1)$$

Log conversions are commonly used in SFA and are expected to reduce the skewness of the sample. As there are a total of 360 firms, the frontiers are estimated by the sector dummy, assuming that the characteristics are not included in the firm's frontier which are similar within the 24 sectors listed in Pakistan Stock Exchange. Dummies for the year are included to capture year-specific effects.

Profit Frontier

The efficiency of profit maximization can be referred as short-term effects to improve efficiency. It is expressed in Equation 2.

$$Profit_{it} = \alpha_0 + \alpha_1 Size_{it} + \alpha_2 Size_{it}^{\ 2} + \alpha_3 Intangibility_{it} + \alpha_4 Dividend_{it} + \alpha_5 Leverage_{it} + \alpha_6 Capitalexp_{it} + \alpha_7 Firmrisk_{it} + \ln TobinQ_{it} + \alpha_9 Assetbase_{it} + \alpha_{10} Year_{it} + v_{it} - u_{it} + f_i + T_{\ddot{\imath}} \quad (2)$$

Inefficiency

The inefficiency equation associated with frontier expression of the appropriate distribution hypothesis is given in Equation 3.

$$U_{it} = \delta_0 + \delta_1 Size_{it} + \delta_2 Size_{it}^{\ 2} + \delta_3 Leverage_{it} + \delta_4 Firmrisk_{it} + \delta_5 Firmrisk_{it} + \delta_6 Firmrisk_{it} + \delta_7 Year_{it} + \omega_{it} \quad (3)$$

Definitions of the Variables

Tobin Q (Tobin Q): Tobin Q is measured by the ratio of the market value of assets to the book value of assets.

Size (Size): The natural logarithm of the sales measures the size of the firm.

Leverage (Leverage): The firm's long-term borrowings divided by the firm's total assets.

Capital expenditure (Capital exp): Capital expenditures include the increase in expenditures on property, plant, and other equipment.

Intangible asset (Intangibility): The ratio of intangible assets to total assets.

Dividend (Dividend): The ratio of dividends to total assets.

Firm risk (Firmrisk): Firm risk is measured by the standard deviation of profit.

Asset base (Assetbase): The log of the book value of assets to total assets.

Profit margin (Profit): The ratio of earnings (without paying interest, tax, and depreciation) to the total assets.

Year (Year): The year as a variable in the inefficiency equation explains why the effects of inefficiencies change linearly over time.

Age (Age): The date of establishment of the firm determines the age of the firm.

Data and Descriptive Statistics

The data has been collected from the "Balance Sheet Analysis of Joint Stock Companies Listed in Pakistan Stock Exchange" published by State Bank of Pakistan. The descriptive statistics are given in Table 1. We have an unbalanced panel data consisting of 360 firms for the time period of 2010 to 2018. The variables included in the analysis have the observations of at least three

consecutive years up to nine years, so the data captures 6480 firm years. All regression variables are winsored at a level of 1 percent and 99 percent. By doing so the outlier is removed from the sample. Table 1 represents the mean and dispersion measures of the variables.

Table 1: Summary Statistics of the Variables

Variables	Mean	SD	Min	Max	25th percentile	Median	75th percentile
Size	15.03	1.80	8.01	20.25	13.90	15.02	16.21
Age	36.11	17.51	3	156	24	32	48
Leverage	.19	.46	0	10.80	.05	.13	.25
Capital exp	.46	.24	0	.99	.29	.45	.64
Divdend	.034	.18	0	7.36	0	.01	.032
Profit	.13	.25	-1.54	8.94	.06	.12	.18
Tobin Q	.34	5.78	-13.7	183.75	.18	.81	1.11
Asset Base	15.01	1.79	8.01	20.24	13.88	14.99	16.19
Firm risk	09	.18	-3.17	-3.17	.03	.08	.15
Intangibility	3.17	474684 2	0	9.52e+07	0	0	5782

The firm's size is captured by the natural logarithm of sales. Its mean value of 15.03 gives the impression that average size of the firm is considerable and significant for analysis. A typical firm is capital intensive, as it invests 75 percent of the median of investments of total assets. This sample includes leveraged firms with a maximum leverage of 10.80 percent. Some firms have a negative profit, but the average and median are 13 and 12 percent respectively. The risk is measured by the standard deviation of the profit. It acts as a stationary variable, with an average of 9, and a median of 8.

EMPIRICAL ESTIMATION

Market Value Frontier

The market value frontier results are shown in Table 2, where most of the variables have expected signs. The frontier is estimated with the sector and year dummies. The market value is negatively influenced by firm size and positively by firm size squared. The U-shaped relationship gives the impression that market value does not react positively to sales always. It is important consideration that firm's motivations to maximize long-term value is related with higher levels of sales or sustained growth rate.

The impact of intangible investments on the firm's market value is negative and may be related to the non-optimal expenditure of intangible assets that shareholders may consider overlapping.

The capital expenditures have shown negative impact on market value, which explains that physical and capital strength put a negative impact on firm's value. We have seen that the firms in the sample are capital intensive. The dependence on capital assets leads to increase in operating leverage resulting into decreased market value. Quader and Dietrich (2014) have found the negative impact of capital expenditure on firm value. The firm's risk has shown negative impact on market value. Leverage positively influences the firm value because the increase in debt dominates discretionary management behavior. Managers generate cash flow quickly and pay off debts to avoid liquidation and boost business value.

Table 2: *Results of Market Value Frontier*

Panel A: Frontier	Co-efficient	Std-err	t-ratio	p-value
Size	-.34	0.08	-3.98	0.00
Size2	0.01	0.002	3.88	0.00
Intangibility	-0.70	0.38	-1.83	0.06
Dividend	1.05	0.28	3.76	0.00
Leverage	0.21	0.12	1.79	0.07
Capital exp	-0.42	0.08	-5.07	0.00
Firm risk	-0.62	0.21	-3.04	0.00
Profit	1.54	0.15	9.78	0.00
Asset base	-0.01	0.02	-0.57	0.57
Constant	2.65	0.69	3.83	0.00
Panel B: Inefficiency				
Size	-2.48	1.53	-1.62	0.10
Size2	0.06	0.05	1.12	0.26
Leverage	-63.35	30.66	-2.07	0.03
Firm risk	0.06	0.20	0.30	0.76
Lnage	-8.43	10.56	-0.80	0.42
Lnage2	1.12	1.51	0.82	0.41
Year	0.01	0.30	0.04	0.96
Constant	0.44	600.21	0.00	0.99

The dividends and profit positively impact the market value of the firm. As the shareholder evaluates the increase in fixed assets, the higher dividends and profit margins boost the firm's success. Such prospects increase the firm's market value.

The analysis also describes the regression model's specifications, which predicts the effect on average inefficiency. The firm size and the leverage negatively affect the inefficiencies. The inverse relationship between inefficiency and leverage supports the assumption cost of external capital, which predicts that the higher leverage effect forces the managers to maximize firm value. It promotes agency cost issues among managers and shareholders.

As expected, the firm's age first reduces inefficiency, but later on increases inefficiency. The degree of inefficiency also increases over time.

Diagnostic for market value are reported in Table 3 which indicates that 95 percent error discrepancy occurs due to inefficiency or agency costs rather than white noise. Hypothesis that Gamma is zero may be rejected, indicating that the inefficiency effect is random and that the SFA specification leads to a likelihood gain.

Table 3: Diagnostics for Market Value Frontier

Panel A: Frontier	Coefficient
δ^2	6.23
γ	0.95
No. of firms	360
No. of observations	2880

The LR test also supports the above argument by rejecting the hypothesis that the inefficiency effect does not exist and is independent of the selected explanatory variable.

Table 4: Market Value Frontier

	Mean	SD	Min	Max	25th percentile	Median	75th percentile
Market Value efficiency	0.7405	0.14	0.02	0.95	0.70	0.77	0.82

Table 4 shows the mean inefficiency predicted by market value frontier at 74.05 percent, which shows that the average firm has a value of 25.95 below of its best practicing peers. The difference between best practice peers is due to agency costs.

Profit Frontier

The frontier of profit differs from the frontier of market value in terms of business scale, physical properties, and leverage. The managers may tend to increase profits at any cost, in order to give a positive impression of their working efforts or their ability among shareholders and, in hopes of grabbing a better package compensation. This short-term strategy can enhance the interests of the agents

The reference variables are included in the profit frontier equation in which the firm maximize the profit. The results are

shown in Table 5. The relationship between the profit and the size of the firm is U-shaped.

The dividends and leverage have shown encouraging effect on profit frontier while intangibility, capital expenditure and firm risk have shown negative impact on profit frontier.

For the inefficient regression. It is found that the efficiency of low profit is negatively correlated with the increase in the firm size. The leverage has shown negative impact on inefficiency. Though, the consequences of leverage are different, it may encourage shareholders and managers with limited liability to engage in harmful actions and thereby increase the cost of external debt agencies.

Table 5: Results of Profit Frontier

Panel A: Frontier	Coefficient	Std-err	t-ratio	p-value
Size	-.34	0.08	-3.98	0.00
Size2	0.01	0.002	3.88	0.00
Intangibility	-0.70	0.38	-1.83	0.06
Dividend	1.05	0.28	3.76	0.00
Leverage	0.21	0.12	1.79	0.07
Capital exp	-0.42	0.08	-5.07	0.00
Firm risk	-0.62	0.21	-3.04	0.00
Tobin Q	1.54	0.15	9.78	0.00
Asset base	-0.01	0.02	-0.57	0.57
Constant	2.65	0.69	3.83	0.00
Panel B: Inefficiency				
Size	-2.48	1.53	-1.62	0.10
Size2	0.06	0.05	1.12	0.26
Leverage	-63.35	30.66	-2.07	0.03
Firm risk	0.06	0.20	0.30	0.76
Lnage	-8.43	10.56	-0.80	0.42
Lnage2	1.12	1.51	0.82	0.41
Year	0.01	0.30	0.04	0.96
Constant	0.44	600.21	0.00	0.99

The results of diagnostic for profit frontier are expressed in Table 6. Since the estimated value of the Gamma variance parameter is close to one, the effect of inefficiency is significant and clearly random.

Table 6: Diagnostics for Profit Frontier

Panel A: Frontier	Coefficient
δ^2	5.12
γ	0.77
No. of firms	360
No. of observations	2880

CONCLUSION

The institutional theory models are generally value-based, not profit-maximizing. The current study has used both models on PSX listed firms in Pakistan. The two stochastic frontier models give very fascinating results and the results are consistent with the previous theory and empirical research on the agency cost. The average sample firm is estimated to have reached 74.05 paercent to the peer of the best performance of the market value, or the market value is reduced by 25.95 percent lower than its best performance peer. On the other hand, the firm's profit margin is 28.8 percent lower than the most highly performing competitors. It is found that the effects of the inefficiency of the two predictions are significant. The effect is random and has a significant relationship with the selected explanatory variables. As the scale of business increases over time, short-term efficiency, and long-term efficiency initially decrease and then increase. The case of Pakistan confirms that there is a conflict of degree inefficiency whether the firm is being driven by the manager for growth in short or long term.

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