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THE ASSOCIATION BETWEEN CORPORATE GOVERNANCE AND TAX AGGRESSIVENESS: EMPIRICAL EVIDENCE FROM PAKISTAN

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ABSTRACT

In the current times, corporate governance and tax aggressiveness is an important area for discussion of government and tax authorities. In Pakistan tax is most potential source and key pillar for regulatory bodies and government revenue. So, there is a need to extend the literature on tax aggressiveness in the context with corporate governance mechanism (board size, proportion of female directors and outside directors). The objective of this research investigates long-term relationship between corporate governance mechanism and tax aggressiveness of 200 companies listed on PSX. The frequency of data is annual basis from 2001 to 2015 fifteen years. This study used Cash ETR (cash tax paid / pre-tax income) to measure the tax aggressiveness. Study use Johnson and Julius (1990) multivariate co-integration analysis. The results of JJ (1990) approach shows that co-integration exist between corporate governance and tax aggressiveness. In addition, this study used firm characteristics (leverage, ratio of intangible assets, capital intensity and firm profitability) as control variables. This study theoretically contributes by examining the agency theory and legitimacy theory as context with tax aggressiveness, and very helpful for regulatory bodies, government and stakeholders. This study also encourages new researchers and practitioners for development of knowledge about the relationship between the corporate governance and tax aggressiveness.

KEYWORDS

Corporate Governance, Tax Aggressiveness, Multivariate Co-integration, PSX.

1. INTRODUCTION

In previous studies, researchers have given particular attention to corporate governance and tax aggressiveness (Desai et al., 2007). Tax aggressiveness is getting more consideration in the modern research literature (Ortas et al., 2020). The objective of tax aggressiveness is to decrease the taxable income and increase the after-tax income (Frank et al., 2009). Tax aggressiveness can be used in other terms like tax management, tax avoidance, tax evasion (Seiler et al., 2021; Vâlsan et al., 2020; Whait et al., 2018). The

managers taking actions to consolidate their tax liabilities and that liabilities increase the most significant cost experienced by the companies. The literature on tax aggressiveness is not defined properly in history as a context of long-term relationships with corporate governance and tax aggressiveness. So, a reason behind this, there is no works on the association between the corporate governance structure and tax aggressiveness in emerging economies (Steijvers & Niskanen, 2014). In addition, the model of tax aggressiveness has been formulated based on individual taxpayer's compliance (Slemrod, 2004). Therefore, researchers have investigated tax aggressiveness in the context of agency prospective (Desai & Dharmapala, 2006). As it is more suitable and explains the relationship of principal and agent in corporate governance environment (Nguyen et al., 2021; Sunarto et al., 2021).

Earlier studies like Lanis et al. (2012) investigate the association between board of directors and tax aggressive from an Australian perspective and link the association of stakeholders and legitimacy theory. The researcher documented that without legitimize the organizations could not be sustained, irrespective of their strong financial conditions(Gray et al., 1995). Legitimacy theory is the tool that firms pursue to legitimize and endure their association in the wider corporate, political and social environment in which organizations operate. Therefore, CSR in which comprises the payments of income tax to safeguard the public goods through better financing decision. Conferring by Friese et al. (2008) that are the important aspects of the sustainability and success of any organization. Researchers investigate those organizations that adopt corporate tax aggressiveness practices that may have a negative association with society (Landolf, 2006; Slemrod, 2004). In addition, Christensen and Murphy (2004) investigate for purposes of legitimizing their presence well-organized and well-governed firms should reduce their tax aggressiveness.

Corporate governance is a structure or system of practices, rules, and methods used to control the organizations (Hromei, 2021). Corporate governess is essential to balance the interest in stakeholders, including management, customers, government, shareholders, community, and the financiers (Annuar et al., 2014). Corporate governance is a big range of participants which is explained as a network of relationships including company owner and also all other networks such as stakeholders, employees, customers, people, and the public (Abdelfattah et al., 2020). Researchers have found that companies are not conforming to laws through the governance for tax paid purposes. Tax aggressiveness is a method to evading or reducing the taxable income amount which need to be paid (Annuar et al., 2014). By reducing the tax liability, companies get many other benefits like increase cash flows, maintenance of favorable credit ratings. According to Lanis et al. (2012) Tax aggressiveness is lawful practice of the tax regime through this companies decrease the tax amount that will be payable. The policies that apply for tax aggressive build a negative impact on the performance of governments, however, taxpayers and most firms consider that tax is a burden and responsibility for both organization and its stakeholders. Lanis et al. (2012) documented those firms that use tax shelters (tax shields) are socially irresponsible, as the payments of tax revenues are very helpful to ensure the financing goods. Therefore, the firm's tax aggressiveness policies influence negatively the corporate society.

Previous studies have investigated a connection among corporate governance and tax aggressiveness (Lanis et al., 2011, 2012) and did not consider the major components of

corporate governance with firm characteristics. Study is initial to examine a long-term relationship of corporate governance mechanism in developing country (board size, female directors, outside directors) with tax aggressiveness by using the co-integration approach presented by Johnson and Julius (1990). Besides, firm characteristics such as leverage, intangible assets, capital intensity, and firm profitability use as control variables. This research extended the literature by investigating the long-term association between corporate governance and tax aggressiveness. Research has inspected that women on board are negatively associated with tax aggressiveness, whereas board size, and outside directors is positively related with tax aggressiveness. This research provides some valuable insights into tax aggressiveness in the context of corporate governance mechanisms that can be very useful for regulatory bodies, government, policies makers, shareholders, and other stakeholders.

2. LITERATURE REVIEW

2.1 Board Size & Tax Aggressiveness

The board size of any company is the total number of directors ranging from 3 to 31 numbers who are responsible to govern the company (Ibrahim et al., 2003). The board size of any organization is a very vital component in the characteristics of the directors (Terjesen et al., 2016). Effective board size controls the agency problems between the shareholders and managers and can help to reduce tax aggressiveness (Zemzem et al., 2013). Large board sizes perform better decision-making that separates the management (implementation and initiation) and control (monitoring and ratification) at all levels of the organization (Fama & Jensen, 1983). The board of directors bears all the responsibilities for taxation of the firms and is accountable through shareholders and stakeholders (Erle, 2008; Hartnett, 2008). The board of directors in large size reduces the functional activities of managers in different activities and decisions (Lanis et al., 2011). The big size of the board positively impacts the tax aggressiveness for personal incentives, they are possible to increase tax aggressive over financial gambling in addition the existence of legal gaps (Lanis et al., 2011). Hence, following the all discussion on board size this study hypothesis that:

H_1: *All else being equal, there is a positive association between Board Size and Tax Aggressiveness*

2.2 Proportion of Females on Board & Tax Aggressiveness

Women make a better understanding of the decision-making process rather than men (Vacca et al., 2020). Singh et al. (2008) investigated the human capital profiles of haring women as directors on board and found that they are more probable to bring international diversity. In the US 500 companies are highly qualified of actual women directors as male directors. Srinidhi et al. (2011) examined 94 firms' sample selection from corporate library's Board Ana-list, and IRRC databases with time horizon 2001–2007 and found that female directors on corporate board will significantly encourage the transparency of financial reporting and decrease the tax aggressiveness. So, women can integrate into a board of directors at a faster rate than male complements (Hillman et al., 2002). Richardson et al. (2015) nominated 300 Australian firms from 2006 to 2010 and documented that gender diversity on board reduced tax aggressiveness, elsewhere women on board has a

positive relationship with tax aggressiveness. Therefore, following the discussion on gender diversity, this study hypothesis that:

H_2: *All else being equal, there is a negative association between gender diversity and Tax Aggressiveness*

2.3 Outside Independent Directors & Tax Aggressiveness

In evidence by Minnick and Noga (2010) the influence of corporate governance factors, including board independence has an insignificant relationship with tax aggressiveness. They have stated that tax planning and uncertainty are not beneficial for organizations but these long-term investments. On the other hand, Lanis et al. (2011) give empirical evidence from an Australian study that a higher level of outside independent directors on board has a significant relationship with a low influence on tax aggressive. Rego and Wilson (2012) also found the mixed results about the link between outside directors and tax aggressiveness. Researchers investigated the outside independent directors as a market-persuaded and low-cost mechanism for internal control of an organization from its shareholders to management (Fama et al., 1983). Therefore, this study examines that outside independent directors are connected with tax aggressiveness, or at extremes have a marginal effect on tax aggressiveness, but the results seem unpredictable concerning the course of the relationship. Hence, the literature review provides mixed results of outside independent directors and tax aggressiveness, this study hypothesis that:

H_3. *All else being equal, there is a positive association between outside independent directors and Tax Aggressiveness*

3. AGENCY THEORY

In first time agency theory drive by Ross (1973). He explains that agency relationship has arisen among two or more parties. First considered as agent and act as representative of other, second considered as principal, in a specific domain of decision making. Researchers documented the level of agency problems can affect a level of tax aggressiveness (Schulze et al., 2001). Some cost of tax are not related such as those cost are hidden from the managers actions (Zemzem et al., 2013). The decision of tax aggressive by managers is embedded in an agency context, in which managers may be enjoy private benefits of control at the expense of other shareholders (Desai & Dharmapala, 2006). Therefore, given the private ownership, it creates lack of discipline for corporate control, so agency cost could be high (Schulze et al., 2001). Desai et al. (2007) investigate shareholders and directors make the strategies for taxations. When the decision of directors cannot alien with shareholder's then agency conflict arises and make the tax issue complicated (Garbarino, 2011). Therefore, increase the ability of corporate governance such as monitor management by board size, separation of ownership by outside directors and add gender diversity through female directors to reduce agency problem and it can be helpful to decrease the tax aggressiveness.

4. LEGITIMACY THEORY

The agency theory only explains the relationship among principal or owners and agent or managers (Khan et al., 2021). On the other hand, legitimacy theory investigates

corporate governance issue beside that its highlight the circumstance of other stakeholders such as customers, public, political party influence, unions, employees, society, buyers, suppliers and all workers in the corporation (Barry, 2002). It's a mechanism that support the corporation through developing and implementing voluntary social and environmental revelation for fulfilment of their social responsibility. So they legitimize their behavior to their stakeholders group by qualify the objective and survival turbulent environment (Burlea & Popa, 2013). For legitimization purposes companies performs social activities within the society and groups like customers, general public, unions and political groups (Lanis et al., 2011). Those groups have much degree of power and impact on firms generally (Archel et al., 2009). Firms gain legitimacy with the society and maintain better links with tax authorities by following the rules and regulation from tax policymakers and acting with their fundamental laws (Ostas, 2003; Schön, 2008). The legitimacy theory suggests that firms discharge their CSR and gain legitimacy, firms should be less tax aggressive. Through tax laws, good corporate governance maintains its mechanism and promote compliance.

4.1 All Control Variables

In addition, a particular study uses control variables to control other effects. According to Richardson et al. (2015) and Graham and Tucker (2006) presented that the ratio of leverage is lower in tax aggressive firms. While other researchers documented that, tax aggressiveness is related with high borrowing costs (Hasan et al., 2014). So, these researchers documented that leverage has a negative relationship with tax aggressiveness because leverage control for tax-related differences in debt usage (Kubick & Lockhart, 2016).

Prior researchers investigated that intangible assets represent additional opportunities for tax planning through transfer pricing (Dunbar et al., 2010). In this study, intangible assets are used as the control variable (Heltzer et al., 2012) because this variable is systematically associated with tax aggressiveness (Rego & Wilson, 2012). Hoi et al. (2013) examined intangible assets that resemble lower firm effective tax rates and higher tax aggressiveness. Therefore, intangible assets have a negative relationship with tax aggressiveness due to tax-deductible intangible expenditure (Laguir et al., 2015).

Capital intensity uses as control and alien in past studies (Annuar et al., 2014; Heltzer et al., 2012; McClure et al., 2018). Researchers documented that capital intensity increases in overall tax planning opportunities (Dunbar et al., 2010). (McClure et al., 2018) reported that capital intensity is a constraint for shifting profits and daily vise operations. Besides, previous studies investigate those firms that have lowest effective tax rates tend to be highly capital intensity (Omer et al., 1993; Stickney et al., 1982) so the capital intensity has a negative relationship with tax aggressiveness.

Researchers reported a firm profitability has a positive related with tax aggressiveness (Richardson et al., 2015). While researchers discovered a positive relationship of firm profitability with effective tax rates as those firms have much more incentives due to large potential tax savings (Zemzem et al., 2013). In addition, firms have more resources available to engage in tax aggressive operations. Minnick and Noga (2010) reported that firm profitability has a positive with tax rates which is consistent with the expectation sense that tax rates may be progressive with earnings before interest and tax.

5. METHODOLOGY

5.1 Data Description

The study uses a time-series data approach and data was collected from reference documents, balance sheet analysis (BSA) State Bank of Pakistan, the website of firms, and annual reports of firms that are listed on Pakistan Stock Exchange PSX. The sample size of data is 300 firms with 25 different sectors. This particular study excluded financial and utility firms because these firms have significant tax regulation differences. The financial sector has specific advantages of tax rules and high regulated disclosure policies so these regulation and tax policies specified to them (Boussaidi & Hamed-Sidhom, 2020). Those firms are also excluded from the sample due to delisted, merged or acquired, and liquated at the end of 2015. For controlling the influence of tax change and economy the study uses non-probability sampling with 15 years data observations. The final sample size for data analysis of the study consists of 200 firms (9154 firm years' observations) from the years 2001 to 2015.

5.2 Empirical Methodology and Econometric Modeling

This study uses several statistical techniques to analyze the data and test hypothesis. The descriptive statistics technique provides level of consistency and reasonable normality of variable distributions. Further research techniques use in this study as correlation analysis, unit root test, co-integration analysis, pairwise granger causality test, variance decomposition and impels response analysis. All details of these techniques show along with their results.

5.3 Measurement of Variables

This study used established and validated proxies to measure these variables. All measurement and abbreviation of variables shown on Table 3.1.

Table 3.1
Measurement of Variables

Factors	Contraction	Measures
Tax Aggressiveness	CETR	Cash tax paid / pre-tax income (Ortas et al., 2020; Vacca et al., 2020)
Board Size	BS	Log (no of total directors on board) (Armstrong et al., 2015)
Female Directors	FD	Total female directors on board / board size (Chen et al., 2010)
Outside Directors	OUTSD	Percentage of outside directors on board divide board size (no of OUTSD /BS) *100 (Lanis et al., 2011, 2012; Richardson et al., 2015)
Leverage	LEV	Long-term borrowing to total asset LEV/TA (Kubick & Lockhart, 2016)
Intangible Assets	INT	Total intangible assets / total assets (Duan et al., 2018)
Capital Intensity	CAP	Sum (Equipment, Plant, Property)/total assets (Annuar et al., 2014)
Firm Profitability	FP	EBT/TA (Laguir et al., 2015; Zheng, 2017)

6. EMPIRICAL FINDINGS

For testing the hypothesis co-integration technique is used, further unit root analysis demonstrates the stationarity of time series data.

6.1 Descriptive Statistics and Correlation Analysis

This study carried out the pairwise coefficient of correlation analysis to investigate where there was a significant association between corporate governance mechanism and tax aggressiveness. Table 6.1 shows the board size, outside directors, capital intensity, and firm profitability have a positive relationship with Cash ETR while female directors, leverage and intangible assets have a negative association. Table showing all relationship values is less than 0.3 so it means multi-collinearity does not exist between the variables.

Table 6.1
Descriptive Statistics and Correlation Analysis

S#	Variables	Mean	Std. Dev.	1	2	3	4	5	6	7	8
1	Board Size	7.762	1.810	1							
2	Female Directors	1.114	1.169	-0.057	1						
3	Outside Directors	0.819	1.261	0.006	-0.033	1					
4	Leverage	0.216	0.263	-0.006	0.062	-0.058	1				
5	Intangible Assets	0.014	0.064	-0.040	-0.092	0.008	-0.082	1			
6	Capital Intensity	0.457	0.216	-0.038	0.090	-0.013	0.116	-0.049	1		
7	Firm Profitability	0.095	0.093	-0.001	0.087	-0.004	-0.046	0.045	-0.118	1	
8	Cash ETR	0.490	0.949	0.036	-0.030	0.026	-0.033	-0.045	0.0014	0.222	1

6.2 Unit Root Test

This study used time series data and numerous economic, and financial secondary data, displays trending before non-stationary behavior. A data is stationary when covariance, mean and variance of the variable do not depend on time in other words it is time-invariant. To resolve the trending behavior of data, researchers apply a unit root test. This technique can be used to regulate if trending behavior data should be the first difference $I(1)$. So, the finance and economic theory often advised the existence of a long-term equilibrium relationship among trending or non-stationary time series variables. If all variables are stationary or equal to $I(1)$, then the co-integration statistical technique can be used to investigate these long-term relationships between the variables (Khan et al., 2021). The null hypothesis is strongly rejected when particular time series are the stationary with the same specific level or first difference. The example of non-stationary variable is shown in equation form:

$$y_t = y_{t-1} + \epsilon_t$$
$$\epsilon_t : WN\ (0, \sigma^2)$$

whereas unit root test is not covariance stationary so this statistical technique requires some special treatments to identify unit the root exists or not. Two other techniques to identify the trending behavior of data. The Augmented Dickey Fuller Test ADF (1979) and second one is (Perron, 1988) Test PP (1988). For AR auto-regressive model ADP check the level of data stationarity or level of integration of time series. The equation form of AR auto-regressive is as follow:

$$y_t = \varphi y_{t-1} + \epsilon_t$$

where as "y_t"is a dependent variable "t" being the time series and "ϵ_t" represented the error term of equation. In above equation researcher want to test whether the φ is equal to 1. When y_{t-1} take away from both side, then the equation AR model is written as follow;

$$\Delta(y_t) = y_t - y_{t-1} = (\varphi - 1)y_{t-1} + \epsilon_t$$

In above equation Δ signify the difference operator and the following equation estimates the ADF for checking the stationarity of data. Generally speaking, the power of ADF (1979) is low against the unit root test so it is not always easy to tell the unit root is exists. According to (Aamir Shah et al., 2012) the ADF test is a little bit inflexible test for checking stationarity of data. The reason is, it depends on two assumptions. The ADF test is the homoscedastic and the second one the error term of this model is independent. On the rest of this issue, researchers apply the PP (1988) test to resolve the trending behavior of time series data. Under the assumption of PP (1988), it is the heteroskedastic, and the second one the error term of PP (1988) is weekly and dependent. The equation of PP (1988) is as follows.

$$\Delta y_t = \acute{\beta} D_t + \pi y_{t-1} + \mu_t$$

In above equation the "μ_t" is level *I (0)* and may be heteroskedastic.

To analysis the co-integration analysis it is assumed that all-time series should be stationary at the same level. Therefore, in Table 6.2, the results of ADF and PP clearly show all-time series variables are stationary at same level i.e. I (0). The PP test also supports the results of ADF which confirms co-integration technique can apply in this data.

Table 6.2
Unit Root Analysis

Variables	ADF (Level)	Prob.**	PP (Level)	Prob.**
Board Size	-15.58399	0.0000	-43.50586	0.0001
Female Directors	-42.52018	0.0000	-42.80916	0.0000
Outside Directors	-42.5215	0.0000	-42.59663	0.0000
Leverage	-40.52057	0.0000	-40.64482	0.0000
Intangible Assets	-41.74172	0.0000	-41.74882	0.0000
Capital Intensity	-18.61262	0.0000	-44.57358	0.0001
Firm Profitability	-4.728129	0.0001	-51.35302	0.0001
Cash ETR	-3.933063	0.0018	-50.15891	0.0001
Critical Value				
1% level	-3.433570		-3.433570	
5% level	-2.862849		-2.862849	
10% level	-2.567513		-2.567513	

6.3 Co-integration Analysis

According to finance and economic theory when time series variables are stationary with the same level of difference, then Johnson and Julius co-integration approach is applying to examine the long-term association amongst the variables. The JJ co-integration technique consists of two likelihood ratio tests first one is Trace Statistics and the another is Max-Eigen Value Statistics. These two-test use to identify the vector of co-integration and analyze the long-term connection between the variables this particular research applies both tests. The null hypothesis of max Eigen-value is rejected when the p-value of all variables is less than 0.05. Besides that, the co-integration vector "v" having an alternative of the "$v + 1$" vector. Max-Eigen equation form is as below.

$$X\ (r) = \ -N\Sigma ln(1 - X_{r+1})$$

whereas N is number of observations, $X_{\mathrm{r+1}}, X_{\mathrm{r+2}} \ldots X_{\mathrm{n+1}} \ldots \mathrm{X}_n$ demonstrate $(n - r)$ lowermost squared recognized correlation. Second test of JJ co-integration technique is trace statistics. The null hypothesis is rejected when trace statistics all variables p-value is less than 0.05. Besides that, co-integration vector "r" having alternative vector of "r" in other words, more co-integration vector. In equation form of trace statistics as follows.

$$X\ (r) = \ -N\Sigma \ln(1 - X_i)$$

Table 6.3 and 6.4 represented the multivariate co-integration analysis by using JJ (1990) approach. The trace statistics table show there exists a co-integration vector at the 5% level. The probability value is less than 0.05 ($p < 0.05$). For the conformation of co-integration, max eigen-value test also applies. The result of the max eigenvalue

conforms to the results of the trace statistics test that co-integration exists at a 5% vector level (Khan et al., 2021). Therefore, based on multivariate co-integration analysis, researchers suggest that there is long term relationship exists between major components of corporate governance, firm-specific factors, and tax aggressiveness in emerging economies like Pakistan.

Table 6.3
Multivariate Co-Integration Test DMS (Trace Statistics)

Hypothesized Lag Length=1	Eigenvalue	Trace Statistics	Critical Value 5%	Prob.**
None *	0.2400	652.2500	159.5300	0.0000
At most 1 *	0.2200	513.3800	125.6200	0.0000
At most 2 *	0.1900	393.0700	95.7500	0.0000
At most 3 *	0.1800	290.9400	69.8200	0.0000
At most 4 *	0.1500	190.9000	47.8600	0.0000
At most 5 *	0.1100	113.0200	29.8000	0.0000
At most 6 *	0.1000	53.5100	15.4900	0.0000
At most 7 *	0.1000	2.4300	3.8400	0.0000

Trace test indicates 7 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 6.4
Multivariate Co-integration Test DMS (Max-Eigen Value Statistics)

Hypothesized Lag Length=1	Eigenvalue	Trace Statistics	Critical Value 5%	Prob.**
None *	0.2400	138.8700	52.3600	0.0000
At most 1 *	0.2200	120.3100	46.2300	0.0000
At most 2 *	0.1900	102.1200	40.0800	0.0000
At most 3 *	0.1800	100.0400	33.8800	0.0000
At most 4 *	0.1500	77.8900	27.5800	0.0000
At most 5 *	0.1100	59.5100	21.1300	0.0000
At most 6 *	0.1000	51.0800	14.2600	0.0000
At most 7 *	0.1000	2.43000	3.8400	0.0000

Max-eigenvalue test indicates 7 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

6.4 Pairwise Granger Causality Test

According to Engle and Granger theorem when co-integration exists between two quantitative time series variables then one-way or two-way granger causality must exist among the variables (Engle & Granger, 1987). The null hypothesis is tested when the probability value shows 0.05 while acceptance and rejection of the null hypothesis confirms through one-way or two-way granger causality.

The results of the granger causality test are shown in Table 6.5 and demonstrate two-way, one-way and no causality between the tax aggressiveness, corporate governance factors, and firm characteristics. There exists one-way causality of board independence, capital intensity, and firm profitability to tax aggressiveness while board size has two-way causality. Besides, leverage and intangible assets do not cause to tax aggressiveness.

Table 6.5
Pairwise Granger Causality Tests DMS (Lags: 1)

Null Hypothesis:	Obs	F-Statistic	Prob.	Inference
CETR does not cause BS	1954	8.4503	0.0000	Two-way Causality
BS does not cause CETR		2.6925	0.0447	
CETR does not cause FD	1954	0.4021	0.7515	No Causality
FD does not cause CETR		0.4786	0.6972	
CETR does not cause OUTSD	1954	0.8860	0.4476	One-way Causality
OUTSD does not cause CETR		2.4319	0.0634	
CETR does not cause LEV	1954	1.8996	0.1276	No Causality
LEV does not cause CETR		0.3538	0.7864	
CETR does not cause INT	1954	0.4747	0.6999	No Causality
INT does not cause CETR		0.6039	0.6125	
CETR does not cause CAP	1954	2.1056	0.0976	One-way Causality
CAP does not cause CETR		0.7899	0.4995	
CETR does not cause FP	1954	1.0915	0.3515	One-way Causality
FP does not cause CETR		3.8011	0.0099	

6.5 Variance Decomposition

According to Aamir Shah et al. (2012) variance decomposition is a statistical technique that investigate a particular change of variables in specific time period. As dependent variable these changes may be due to its own dynamic forces or influence and may be other control variables in the model. The variance decomposition summarize in mathematical form as follows:

$$Var\ (Y) = E(Var[Y|X]) + Var\ (E[Y|X])$$

whereas

$E\ (Var\ [Y|X]) =$ The shocks or change directly explained due to change in X.

$Var(E[Y|X]) =$ Unexplained shocks or change comes from control or explanatory variables other than X.

The results of variance decomposition test for tax aggressiveness show in Table 6.6 Results show the variation in tax aggressiveness exist due to its own dynamic behavior, therefore, it is reported that tax aggressiveness looks like exogenous. The variation of board independence is 0.529 with tax aggressiveness. So, outside directors have more variation with tax aggressiveness rather than other factors of corporate governance.

Table 6.6
Variance Decomposition Tests of CETR

Periods	S.E.	BS	FD	OUTSD	LEV	INT	CAP	FP	CETR
1	0.923	0.003	0.025	0.195	0.002	0.256	0.111	5.296	94.111
2	0.936	0.003	0.028	0.517	0.011	0.249	0.137	5.785	93.269
3	0.951	0.259	0.067	0.523	0.053	0.282	0.177	6.754	91.885
4	0.953	0.269	0.068	0.530	0.057	0.284	0.178	6.901	91.712
5	0.954	0.281	0.070	0.529	0.060	0.290	0.180	6.987	91.603
6	0.954	0.282	0.071	0.529	0.060	0.291	0.180	7.006	91.582
7	0.954	0.283	0.071	0.529	0.060	0.291	0.180	7.013	91.574
8	0.954	0.283	0.071	0.529	0.060	0.291	0.180	7.015	91.572
9	0.954	0.283	0.071	0.529	0.060	0.291	0.180	7.015	91.571
10	0.954	0.283	0.071	0.529	0.060	0.291	0.180	7.015	91.571

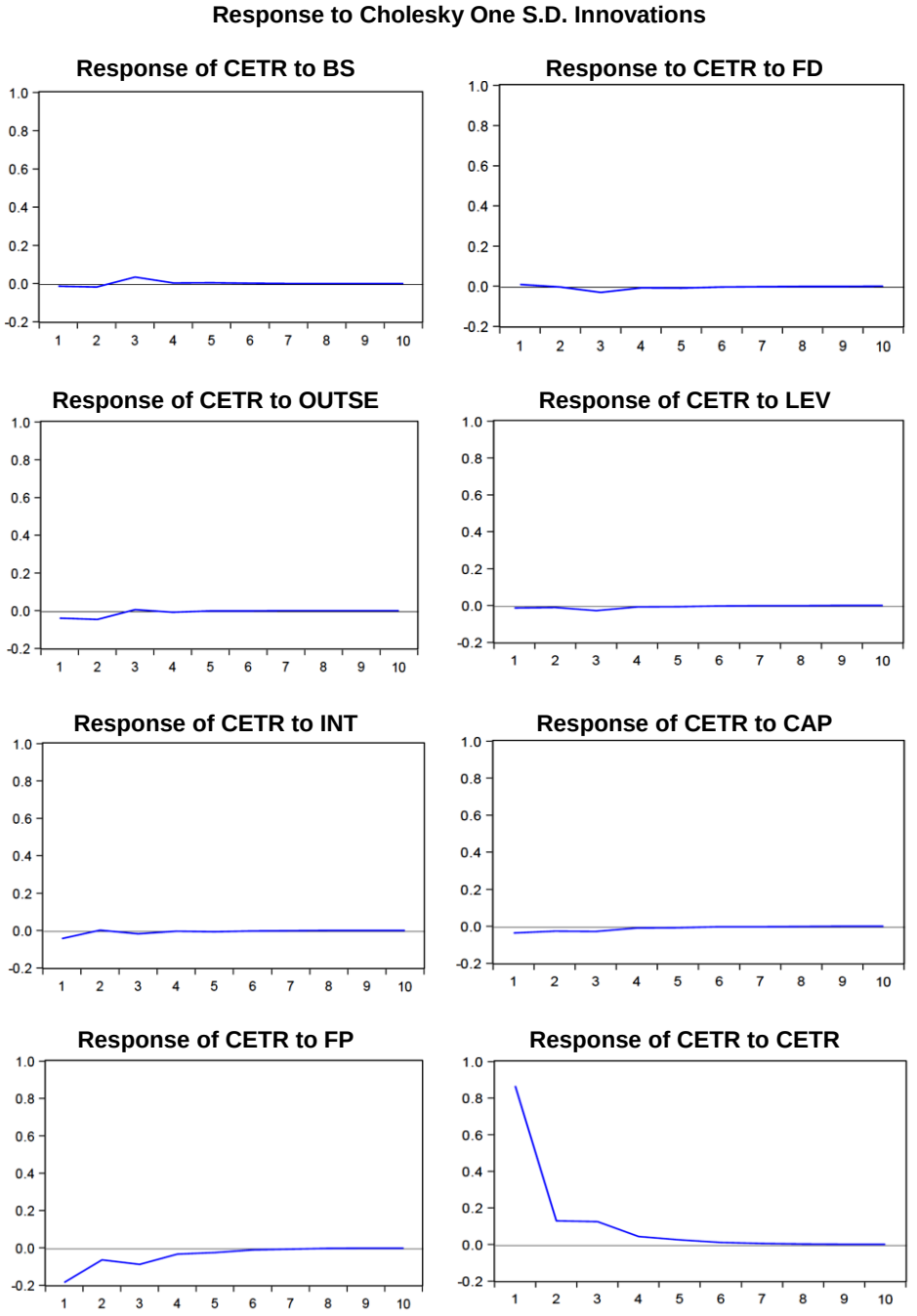

Figure 1: Impulse Response Analysis of CETR

6.6 Impels Response Analysis

It's a graphical representation of change in one variable due to change in another variable. The particular study analyzes impel response analysis. This particular statistical technique comes from Lütkepohl and Poskitt (1991) is known as impels response analysis. A technique demonstrates how financial time series transmuted to other time series (Aamir Shah et al., 2012). The equation form of impels response analysis as follows:

$$Yt = \varphi Yt - 1 + ut$$

The results of impels response analysis for tax aggressiveness is shown in Figure 1. The results of IRF discuss the structural information of corporate governance components, specific firm characteristics, and tax aggressiveness. Besides IRF show the graphical representation for tax aggressiveness and speed of adjustment (Khan et al., 2021). Based on exogenous behavior, tax aggressiveness shows major shocks in Figure 1. Moreover, other factors generate positive and negative influences by tax aggressiveness.

7. CONCLUSION OF THE STUDY

This research investigated the long-term relationship between corporate governance and tax aggressiveness based on the sample of 200 firms publicly listed on PSX from 2001 to 2015 fifteen years. This study is initial to use the JJ (1990) approach to analyze the long-term relationship between corporate governance and tax aggressiveness. The results of JJ (1990) indicated that there is a long-term relationship between the corporate governance mechanism and tax aggressiveness that support all hypothesis of this study.

This study found that board size and outside directors have a positive while female directors have a negative association and statistically significant relationship with the tax aggressiveness. Besides that, leverage and intangible assets also have a negative relationship with tax aggressiveness. This study has extended the literature by providing unique insights into the long-term relationship between corporate governance and tax aggressiveness. The findings of this study are valuable for government, regulatory bodies, and tax policymakers to develop the policies for smooth implication of tax aggressiveness avoidance by companies. Finally, this research provides empirical evidence for developing economies' research paradigm concerning corporate governance mechanisms and tax aggressiveness.

This research has few limitations as it uses internal factors of corporate governance board size, female directors, and outside directors rather than external factors like a political takeover, market competition, external auditors, etc. Also, this study uses non-probability sampling and selected only PSX-listed firms without financial sectors.

The future recommendations of this study include that researchers should analyze the association between external corporate governance and tax aggressiveness. The interaction term i.e. firm size, national culture can also be valuable between the association of corporate governance and tax aggressiveness. The role of corporate governance in making corporate tax policies requires as future research.

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