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The impact of Corporate Governance on voluntary disclosure of R&D expenditure of USA Pharmaceutical firms

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Abstract
This research examines the impact of corporate governance on voluntary disclosure of R&D expenditure of USA pharmaceutical firms. Most of the previous studies focus on the relationship between corporate governance and performance of the firms but this research explores the impact of corporate governance on voluntary disclosure of R&D expenditure of USA Pharmaceutical firms as well as the impact of firm size, leverage, firm profitability, liquidity and firm growth on research and development expenditure of Pharmaceutical firms' of USA. The sample of this study consists of forty-three USA pharmaceutical listed firms from 2017 to 2020. To examine research questions, the methodology is based on Generalize method of movement (GMM). Results showed that overall R&D disclosure has a significant impact on corporate governance variables including audit committee quality, managerial ownership, role duality, and board independence. Furthermore, research also found that firm profitability, firm size, and as well as liquidity ratio have positive and significant impacts on R&D development expenditure.

Keywords: research and development expenditure; voluntary disclosure, corporate governance
JEL Codes: O30, G30

1. Introduction

Research and development activities are economic investments, which plays a significant role in improving products and process and creating values that may benefit the company over many years, as well as its valuable source of world economic growth (Zhao, 2002; Gelb, 2002). Research and development activities are an important part of intellectual capital, but it's not recognized in financial statements, enhancing the reporting model to meet the information required for a company's transparency (Beattie et al., 2004). Therefore, investigating corporate disclosure and enhancing a company's transparency regarding intellectual capital and particularly Research and development activities is a rich and productive research area. Progressively, researchers are taking interest in voluntary disclosure of non-financial, financial, and strategic information in annual reports to satisfy the shareholder regarding investment decisions. For listed companies, the annual report is a more viable medium to widely circulate and attract more investors to take investment (Lev & Zarowin, 1999). Two main reasons could explain this problem. The first reason is due to the unique and risky nature of R&D activities, these have been highlighted by many researchers (e.g. Chauvin and Hirschey, 1993; Aboody and Lev, 2000; Munari et al., 2010). The second reason is the insufficient information required by the accounting regulations, this has been emphasized by others (e.g. Lev and Zarowin, 1999 and Lev, 1999). A similar conclusion is put forward by Merkly (2014) who argued that the inadequate mandatory disclosure requirements of R&D activities and its accounting measures do not reflect the performance of R&D activities.

R&D activities are a necessary part of intellectual capital, which is not acknowledged in financial statements, raises the call for improving the reporting model to meet the information needs of the market by introducing the important information required for a company's transparency (Beattie et al., 2004). Consequently, investigating corporate disclosure and enhancing firms' transparency regarding intellectual capital and especially R&D activities is a rich and productive research area. Research & Development is a process intended to create new or improved products & technology that can provide a competitive advantage for a firm product or process over another. Due to rapid growth and innovation in products and industry, it becomes necessary for every company to do research and development. Research and development affect the performance of firms and are a means for improving a firm's performance. The firms which assign higher R&D expenditure are expected to earn more than those that do not. (Chao-Hung Wang, 2011). The performance of a firm will outweigh the costs of research and development. After achieving a breakeven point, costs on R&D will be compensated by the benefits received. Nowadays, in a rapidly increasingly competitive environment, research and development have become the most needed activity for survival. R&D expenditures allow the firms to prevent imitation by rivals and earn supra normal or above average returns (Erickson and Jacobson, 1992). The performance level of a firm will be a function of its resources for research and development activities. These are the means of improving firm performance in this era of innovation and technology. This study aims to find out the effects of research and development on the performance of the firm with context to the pharmaceutical sector of the USA. The study aims to see how the research and development expenditure can influence the performance of the pharmaceutical sector of the USA. Firm Performance is measured through firm size, Leverage Ratio, Firm Profitability, Liquidity ratio, and firm

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growth. Research and development results are not predictable. Its reward can be very high and there is a chance of unsuccessful or early termination by management.

Research and Development play a vital role in the innovation process. It's an investment in technology and future capabilities which will transform into new products, processes, and services. If we discuss the current pandemic situation of Corona Virus all over the world, where every country and each human is looking for corona Medicine or Corona Vaccines. From China to the USA, to Germany to England, scientists are working around the clock to find a vaccine against Covid-19. While the expert cautions that the process will take time and some researchers said the vaccine will be available by end of this year. Some countries provide funding to pharmaceutical companies for the development of the vaccine. Now, we will acknowledge the effectiveness of the R&D department in firms and their spending in R&D in pharmaceutical companies, because due to the current world situation, the risks belong to the life/survival of Humans. Now only those companies can do an effort to develop a vaccine that already has some budget for R&D spending and have a proper team and department of R&D. When we talk about its R&D impact on profitability, we must know when the vaccine or medicine will be ready to sell, it will be most demanding product in the world. This will not even cover R&D costs but boost the company's profitability. On 31 March 2020, Johnson & Johnson[3] CEO Alex Gorsky announced that they have planned to start **COVID-19 vaccine** human trials by September this year. As a result, on 31 March 2020 shares of the world's largest healthcare company gained as much as 9% after the company statement. They also make the statement that the company is expanding its manufacturing capacity to produce the vaccine quickly to reach the goal of 1 Billion doses. This research study is distinguished from the previous studies because most of the research had carried out to find the relationship between corporate governance and the profitability of the firm. But in this study, The research found the Impact of corporate governance on voluntary disclosure of R&D expenditure of USA pharmaceuticals firms' and secondly in this study it is investigated the impact of firm size, leverage, firm profitability, liquidity, and firm growth on research and development expenditure of USA pharmaceuticals firms' from 2017 to 2020.

2. Literature Review

Agency theory defines the relationship between the principals (such as shareholders of the company) and agents (such as directors of the company). According to this theory, the principals of the company hire agents to perform work. The principals delegate the work of running the business to the directors or managers, who are agents of shareholders (Alchian and Demsetz, 1972; Eisenhardt, 1989). The shareholders expect the agents to act and make decisions in the best interest of the principal. The key feature of agency theory is the separation of ownership and control. The theory prescribes that people or employees are held accountable for their tasks and responsibilities. Another important theory of corporate governance is stewardship theory which is opposite to agency theory. The roots of the stewardship theory are stemmed out from organizational psychology and sociology and are defined by Davis, Schoorman, and Donaldson (1997) as "a steward protects and maximizes shareholders' wealth through firm performance because by so doing, the steward's utility functions are maximized". Stewardship theory articulates that managers are hired for handling the firm's operations in a good manner and a manager's achievement and success are measured by the satisfaction he gets from the performance of the firm; therefore, the manager's primary objective is to maximize the firm value. Better firm performance is the motivational spot for corporate managers who are stewards of the firm and consider the organizational objective as their own. Thus, managers choose pro-organizational behavior that is aligned with the wealth of shareholders rather than their self-serving objectives (Davis, et al., 1997). The major difference between agency theory and stewardship theory is that the stewardship theory replaces the lack of trust in managers whereas agency theory refers to authority and monitoring to maintain the inclination of ethical conduct. Stakeholder theory incorporated the accountability of management to a broad range of stakeholders. It states that managers in organizations have a network of relationships to serve – this includes the suppliers, employees, and business partners. The theory focuses on managerial decision making and the interests of all stakeholders have intrinsic value, and no sets of interests are assumed to dominate the others. Alkhafaji (1989) defined the stakeholder as only those people who are interested in the survival of the firm. Barry (2002) included all the members of society where the business is located, workers of the firm, and suppliers of raw material whereas Beauchamp and Bowie (2004) added employees, vendors, the local community, or even society in the definition of stakeholders. Scholl (2002) also added the terrorists and competitors because these parties also affect the profitability and positioning of the firm.

Meah and Chaudhory (2019) examined the impact of corporate governance through female Directors, the board size, Director Ownership, and family duality on a firm's profitability in the emerging market of Bangladesh. They adopted a quantitative way of study by obtaining data from one hundred and ten manufacturing companies listed on Dhaka Stock Exchange. To test the hypothesis they applied Multivariate pooled Ordinary Least Square regressions on five hundred and twelve sample-year observations from the year 2013 to 2017. The results of the

[3] https://www.bloomberg.com/news/articles/2020-03-30/j-j-surges-after-1-billion-vaccine-deal-with-u-s-government (J&J Surges After $1 Billion Vaccine Deal With U.S. Government)

study revealed that larger female Directors on board and board size had a positive and significant association with the firm's profitability. Furthermore, they found a negative relationship between family duality and shares held by Director with the firm's performance and it will reduce the firm's performance found in the earlier studies of Brickley et al. (1997), Goyal and Park (2002), and Yermack (1996). Xu and Sim (2018) measured the characteristics of corporate research and development investment in an emerging market. The research is based on China and South Korean research and development expenditures of manufacturing firms, selected the sample year 2012 to 2016. They obtained nine hundred and sixty China manufacturing companies and two hundred and eleven South Korean manufacturing companies. They also considered the impact of research and development investment on companies' performance. The result of the study showed that cash reserves and debt maturity had a positive impact on research and development investment. Furthermore, they found that in Chinese companies' internal financing, size of firm and debit ratio had restricted factors, while in South Korean companies debt ratio is the only negative determinant of research and development investment. The result also shows that in Chinese manufacturing companies, research and development had a positive time lag effect on a firm's performance. In addition, research and development intensity exhibits a strong and positive impact on the performance of companies in both countries.

Hussain et al., (2017) investigated to what extent disclosure of the information is essential to get transparency and safeguard the rights of shareholders. The study consisted of a sample period from 2003 to 2005. They had selected data from twelve banks which represented eighty-two percent share of the market. They used the corporate disclosure index as the dependent variable and board size, firm size, listing age, board composition, Auditor reputation, block holder ownership, return on assets, risk rating and institutional ownership are independent variables. The overall result of the corporate disclosure index shows the level of satisfaction for commercial banks in Pakistan. Audit size, firm age, and firm size are significantly and positively related to firm willingness to disclosure, Similar results are reported by several researchers including Ahmed & Courtis, (1999); Depoers, (2000). Mirza et al., (2017) investigated the relationship between the extent of voluntary disclosure and firm-specific variables. The research data consists of two hundred and fourteen non-financial companies listed on Pakistan Stock Exchange for the year 2013. The result of the study shows that size of the firm, firm age, and quality of Audit are important determinants of voluntary disclosures and are positively significant. In addition, they had not found any evidence which shows the leverage restricted the firm from voluntary disclosure in the annual report. They suggested that future research can be conducted on the financial sector of Pakistan. Ferdaous and Mizanur (2017) evaluated the effect of research and development expenditure on firm performance. Firm performance is measured based on financial performance, market-based performance, and market position performance. They selected data from pharmaceutical companies on the Bangladesh stock exchange from 2001 to 2015. The applied OLS pooled regression analysis on data. The result of the analysis shows positive and significant relation between R&D expenditure and a firm's market position performance and R&D expenditure and a firm's financial performance. However, negative but significant relation had found between R&D expenditure and a firm's market-based performance. They concluded that Bangladesh investors had not considered R&D expenditure to be a creator of innovation relatively it seemed to be affected negatively in their valuation of the firm's financial condition by R&D expenditure.

Mostafa (2017) explored the eight corporate governance determinants with voluntary disclosure of fifty listed firms on the Egyptian Stock Exchange from 2012 to 2016. The result indicates a negative correlation between block-holder ownership and voluntary disclosure Samaha and Dahawy, (2010); Samaha and Dahawy, (2011). There was no correlation between board size, duality in position, and the voluntary disclosure, additionally firm size, firm profitability, firm leverage, Independent Directors on Board, and Auditor type were found to be correlated positively with voluntary disclosure. Samaha and Dahawy, (2011); Alsaeed; (2002). Panditharathna and Kawshala (2017) explored the relationship between corporate governance attributes and firm performance in financial sector companies listed on the Colombo stock exchange in Sri Lanka. They mainly focused on fifty-six registered companies in the banking sector, insurance, and finance for the year 2012 to 2015. The total number of observations is two hundred and twenty-four. They applied the ordinary Least Square test to data. They had not found a strong relationship between corporate governance and firm performance. There was no significant relationship between Board size, the proportion of female Directors on board, and the proportion of independent directors with firm performance. But there was a positive relationship between return on equity and board effectiveness. Bahadur (2016) evaluated the inter-connection between corporate governance, capital structure, firm performance, and ownership structure in India. The research employs panel data of all CNX fifty companies from 2008 to 2012. The research finding shows a positive and significant relationship between the number of Board Committee, Board independence, and director remuneration, while larger board size, financial leverage, and ownership by promoters had a negative relationship with performance. Furthermore, findings revealed that corporate governance practices implemented by the listed companies depend on their ownership structure. Babatunde and Akeju (2016) investigated the impact of corporate governance on firms' profitability in Nigeria. This research had been performed by using a sample of sixty firms listed on the Nigeria Stock Exchange during

the period 2004 to 2014. They observed the relationship between Audit Committee, the board size, board characteristics, firm growth, profitability, and board independence with firms' profitability. The result of the multiple regression model shows a significant level of 0.05. The overall findings of the study established that corporate governance mechanisms enhance firms' profitability in Nigeria. They suggested that companies should be responsive to corporate governance mechanisms to improve profitability.

Arora and Sharma (2016) investigated the impact of corporate governance on the firm's performance of Indian manufacturing companies. The empirical study focused on twenty major industries of the Indian manufacturing sector for the period 2001 to 2010. The result findings revealed that large board size is related to intellectual knowledge. Moreover, the result shows profitability and return on equity were not related to corporate governance. They had not found significance between CEO duality and firm performance, the results are consistence with the work of Ghosh, (2006). They concluded that companies complying with best corporate governance practices could achieve higher market and account performance. Uchenna et al. (2016) explored the corporate governance impact on profitability in the banking sector of Nigeria. Their finding shows a negative but significant impact of capital adequacy ratio on return on asset and returns on equity. Furthermore, the result also observed an improvement in the quality of assets suggested by the positive effect of corporate governance on banking sector profitability. There is a positive and significant effect of liquidity ratio on return on equity but they found a negative impact in the case of return on asset. Lastly, inflation had not any significant impact on banking sector profitability. They concluded that there is an indication that corporate governance had significantly affected the performance of the Nigerian banking sector over the period. They recommended that the Nigerian regulatory authorities should diligently exercise their lapse in functions to ensure strict compliance with extended regulations in corporate governance. Kipkoech and Rono (2016) established the effect of experience on a firm's performance and Audit committee size. They conducted a study on companies listed on Nairobi Stock Exchange from 2006 to 2011. They applied multiple regression analysis to data to test the hypothesis. Research findings showed that Audit Committee size and Audit Committee experience had a positive and significant effect on firm performance. Furthermore, they explained that the presence of huge experienced Audit members would also reduce financial misreporting. There should be an Audit committee that is not too small and has lack expert advice. Their study also argued that the huge size of the Audit Committee could protect and control the process of accounting and finance thus firm's performance increase. Moses (2016) examined the impact of corporate governance mechanism and Audit committee size on the quality of financial reporting. He selected the data for five years from 2010 to 2014 of fifteen banks traded on the Nigerian Stock Exchange. Earning management was used as a representation of the quality of financial reporting. The researcher hasn't found any significant impact of Audit Committee size on earning management. Duqi, Jaafar, and Torluccio (2015) examined whether research and development intensive firms earn a higher stock return as compared to the matched size and book-to-market portfolios across several financial markets in Europe. Mispricing and risk could be arising if the shareholder was not able to estimate the long-term benefit of research and development investment. The final sample was selected to conclude research consisting of four thousand seven hundred and fifty-five observations. In the sample, seventy-nine Finnish, two hundred seventy-eight French, two hundred and ninety-three German, one hundred and twenty-two Swedish, and four hundred and forty-four UK firms were selected. The result of the data shows that higher innovation in the firm will result in excess returns in the future. Research and development in High tech companies can predict higher future returns.

Nekhili et al. (2015) investigated the impact of Research and development narrative disclosure on the market value of equity. They selected a sample of ninety-eight French firms for the period 2000-2004. The result of the study reveals the positive but insignificant association between the market value of equity and Research and development voluntary disclosure. Research and development intensity and capitalization lead French companies to disclose more Research and development information. Furthermore, they found a positive and significant association when they control the research and development capitalization, but they found a negative association when they control the research and development intensity. Zaman et al., (2015) investigated the relationship between transparency, disclosure, and firm performance. They focused on the banking sector of Pakistan and selected a sample of thirty banks operating in Pakistan during the period 2007 to 2011. They investigated the structural change in transparency and disclosure and to what extent it affects the firm performance. For the conclusion of the results, they applied the ordinary least square regression model. The result of the study shows a positive association of firm performance with transparency and disclosure, but ownership structure disclosure has a negative association with return on assets and returns on equity. They concluded that the transparency and disclosure level in the Pakistani banking sector is above average. Lee and Choi (2015) investigated the impact of determinants of research and development investment in the Pharmaceutical industry. Research data was based on Korean listed companies from the period of 2000 to 2012. Results of the study showed that the current ratio had a positive impact on research and development investment, while the debt ratio hurt research and development investment and they did not find any significant influence of return on investment and net sales on research and development investment. They concluded that the higher the liquidity ratio, the greater the research and

development investment. There finding of the study is consistent with the prediction that if a firm faces financial risk, it will be passive in research and development investment due to its financial difficulties. Iqbal and Kakakhel (2015) examined the relationship between corporate governance and the profitability of the national and multinational pharmaceutical companies in Pakistan. Their research study investigated corporate governance dimensions in terms of independent Directors, the board size, board committees, firm size, and board remuneration. while the profitability of the pharmaceutical companies was measured in terms of return on assets, return on sales, and return on equity. The result of the study exhibits that board committees, board size, board remuneration, firm size, and Independent directors were found significantly and positively associated with corporate performance. Their finding concluded that corporate governance has a strong significant impact on the profitability of pharmaceutical companies in Pakistan.

Rajangam et al., (2014) investigated the relationship between corporate governance and firm performance variables of companies listed on the Malaysian stock exchange during the period 2010 to 2012. They applied a structural equation and a data analysis tool was used in maximum likelihood estimation. The dependent variables liquidity, profitability, and gearing were used as a representative of financial performance, whilst independent variables, Board size, percentage of independent Directors, ownership retention, percentage of Non-Executive directors, and percentage of Executive directors were used as a representative of corporate governance. They estimated that there is a regularity through all components of board structure and ownership in terms of the relationship. They found that in this study except for Non-Executive Directors, all other components of board structure seem to have an impact on the gearing of companies. They concluded that the company's Board of Director and ownership structure that represent the shareholder had a major focus on the gearing of companies compared to other financial indicators, as the level of gearing of a company had significant and continuing effects on the profitability and liquidity of companies. Aotaibi (2014) investigated the impact of corporate governance mechanism was voluntary disclosure for the purpose he selected a sample of one hundred and fifty-five listed companies of Kuwaiti. To evaluate the level of voluntary disclosure a self-constructed index was developed. He found a significant relationship between voluntary disclosure and firm size, firm age, Audit firm, Non-Executive Director and Audit Committee. Arslan et al. (2014) investigated the relationship between CEO duality and the Audit committee with a firm performance by taking a return on equity and return on assets as the measurement of firm performance. Their finding reveals that there is a significant positive relationship between firm performance and Audit Committee, while they did not find a significant relationship between firm performance and CEO duality. Hong and Nguyen (2014) conducted empirical research on listed companies in Vietnam to investigate the relationship between corporate governance and firm performance during the period 2008 to 2012. In their research study, corporate governance was proxied following variables; Board size, CEO duality, ownership concentration, and board independence. On the other hand, firm performance was measured by using the following variables: return on equity and return on asset. One hundred and seventy-seven listed companies' data set was selected from Ho Chi Minh City Stock Exchange. The finding of the study concluded that there is a positive relationship between Board independence, CEO duality, and firm performance. Furthermore, evidence had no proof significant relationship between Board Size and Firm performance.

Qu et al., (2013) investigated the stakeholder power and to what extent it affects a firm's disclosure decision. A total number of two hundred and ninety-seven companies', twelve-year data from 1995 to 2006 were obtained to conduct analysis. To examine the influence of stakeholder power changes over the year on voluntary disclosure, and researcher had been used a voluntary disclosure checklist. Checklist data was obtained from annual reports of firms. The finding of the study shows that different stakeholders exert a different degree of influence on firms' decision-making regarding the value of information disclosure throughout the different years. They had not found any relationship between state ownership and ownership of a legal person with the level of voluntary disclosures. Furthermore, they found a significant association between leverage, corporate governance, and the number of independent Directors with the level of voluntary disclosure. Abbas et al., (2013) examined the relationship between ownership structure and firm performance which had been a generally discussed issue among corporate finance scholars. Most firms had concentrated large owners; ownership concentration had been proved an important tool that supports the interest of ownership and management. To check the relationship between firm performance and large shareholders, they selected a sample of one hundred listed companies on the Karachi Stock Exchange from 2006 to 2009. They applied ordinary least square analysis to sample data; the test result revealed that there is a positive and significant relationship between large shareholders with a return on assets and return on equity. Sehar et al., (2013) examined the determinants affecting voluntary disclosures in annual reports of companies listed on the Karachi stock exchanges. To measure the impact of voluntary disclosure, they calculated an index based on Non-Financial, Strategic, and Financial information. The sample size consists of three hundred and seventy-two companies in the year 2012. They applied multiple regression techniques and the result shows a positive and significant relationship between the size of the firm, firm age, firm profitability, and size of auditors with voluntary disclosure, while leverage ratio had a significant but negative relationship with voluntary disclosure. Samaha et al., (2013) examined the relationship between the board, Audit Committee characteristics,

and voluntary disclosure. Their research sample is based on sixty-four articles published from 1997 to 2013. For the testing of data, they used the meta-analysis technique. They found a positive and significant relationship between board size, board composition, Audit Committee, and voluntary disclosure.

Juhmani (2013) examined the correlation between the three variables of ownership and voluntary disclosure, which are managerial ownership, block holder ownership, and government ownership. He selected a sample of forty-one companies listed on the Bahrain stock exchange considering the year ending 2010. The result of the study indicates a negative correlation between block holder ownership and voluntary disclosure, but there was no correlation between managerial or governmental ownership and voluntary disclosure. Additionally, leverage and firm size were included as controlled variables and found to be correlated positively with voluntary disclosure. Al-Matari et al., (2012) investigated the relationship between corporate governance mechanism and the performance of companies listed in Saudia Arabia. They had selected the Audit committee and the Board of Directors as corporate governance variables. They selected the sample of one hundred and thirty-five companies listed in Saudia Arabia excluding financial companies for the year 2010. All the data was collected from companies' annual reports. The result of the study shows that Audit Committee size had a significant relationship with firm performance. Furthermore, CEO duality, Audit Committee meeting, Non-Executive Director, Audit Committee independence, and Board size had a negative but significant relationship with firm performance. Nekhili et al., (2012) examined the association between ownership structure, firm value, and R&D disclosure. They designed a research and development disclosure consisting of thirty items. He selected a sample of eighty-four listed firms on the French stock exchange from 2000 to 2004. The result of the study is evidence that voluntary R&D disclosure has positive and significant economic consequences, as it improves the market's value of equity. Furthermore, the study also provides evidence that French firms with domestic and family institutional ownership withhold research and development information, firms with foreign investors are more likely to disclose more research and development disclosure.

Samaha et al. (2012) examined the impact of a comprehensive set of corporate governance attributes on the extent of corporate governance voluntary disclosure in Egypt. To measure the corporate governance attributes, they used board composition, Director Ownership, the board size, block holder ownership, CEO duality, and existence of Audit Committee variables. The result of the study showed that the extent of corporate governance disclosure is lower for the firms having duality in position. Furthermore, the result shows that the extent of corporate governance disclosure increases with the increase in firm size and a higher number of independent Directors on the Board. Alves, Rodrigues, and Canadas (2012) investigated the association between corporate governance variables and voluntary disclosure in Portugal and Spain. They designed a voluntary disclosure index based on information provided by firms in their annual reports. Their results indicated that the main determinants of voluntary disclosure are growth opportunities, firm size, board compensation, organizational performance, and the presence of a large shareholder. Guidry and Patten (2012) analyzed the justification of the assumption that voluntary disclosure theory is used as a tool for dropping information asymmetry between firm investors and managers. They analyzed the data of ninety-five listed companies in Continental Europe, the U.K, Malaysia, and Japan. The basis on previous recent thirteen studies, they failed to find, except for firm size, evidence that suggested systematic association. Furthermore, the study reported the negative relationship between firm performance and voluntary disclosures. Sun et al., (2012) explored the higher information irregularity between managers and directors. Researchers found that Independent Directors had not enough information to perform a function. These sample data consisted of companies listed on Shanghai and Shenzhen stock exchanges for the period 2007 to 2009. They concluded that a higher number of independent Directors in the company have a greater chance to disclose voluntary information. They also found that the higher information asymmetry between outsider and insider directors was low. Where the proportions of independent directors on the Board were higher, the firm will more likely to disclose its Internal Control consolidated audit report.

Ahmed and Gabor (2011) explored that corporate governance had become progressively important in developed and developing countries just after a series of corporate scandals and failures in several countries. This research study empirically examined the relationship between corporate governance mechanisms and the financial performance of listed companies in Bangladesh. The sample compromises twenty-five banking sector listed companies on Dhaka Stock Exchange in Bangladesh for the period 2003 to 2008. The finding of the study revealed that firms run by professional manger have no ownership interest and no duality for which they were remunerated to curb agency conflict. Some corporate governance mechanisms had not appeared to have a significant relationship with financial performances. Furthermore, they found a negative and insignificant impact of non-independent Executive Director and Independent Director on firm performance. They suggested that firms need to balance corporate governance mechanisms with the level of performance by implementing the strategic decision and risk management with the efficient use of the organization's resources. Samaha and Dahawy (2011) examined the level of voluntary corporate disclosure of firms listed on the Egyptian stock exchange and determinants of corporate governance. They used Audit committee presence, ownership structure, board independence, and board

composition as determinants of corporate governance. Their sample selection was based on the largest 100 companies listed on the Egyptian stock exchange for the year 2006. The result of the study showed that the Audit committee variable is the most significant in influencing voluntary corporate disclosure. Board independence is positively associated with voluntary corporate disclosure. They also found a negative but significant relationship between block holder ownership and voluntary disclosure. Furthermore, the type of Auditor, Board size, number of shareholders, leverage, and liquidity has insignificant relation to voluntary disclosure. Omar and Simon (2011) investigated the disclosure behavior of listed firms in Jordan after necessary changes in accounting regulation and economics. They also investigated the relationship between aggregated disclosure and company characteristics. They collected the data of one hundred and forty-five companies listed on the Amman Stock exchange for the year 2003. They applied multiple regression and ANOVA tests on data to examine the determinants of corporate disclosure. They found that there is a significant increase in the level of aggregated disclosure as compared to the previous studies conducted in Jordan. Results revealed that the extent of voluntary and mandatory disclosure was 34% and 83% respectively. Furthermore, they revealed that profitability, firm size, industry type, listing status, Audit firm, number of shareholders, and company age had a significant relationship with determinants of disclosure.

Simanjuntak and Tjandrawinata (2011) investigated the influence of research and development expenditure determinants, which are: research and development intensity, the firm's lagged profitability, and cash flow. They collected the data from six large pharmaceutical companies in the U.S from 2003 to 2010. The result of the study shows that there is a positive and significant association between a firm's lag profitability, research and development intensity, cash flow, and research and development expenditure. Adelopo (2011) studied voluntary disclosure information amongst the listed companies in Nigeria. He collected the data of fifty-two companies listed on the Nigerian Stock Exchange for the year 2007. For research studies, he based on the disclosure index of Meek et al., (1995) comprising twenty-four disclosure items. The result of multivariate and univariate shows average voluntary disclosure. Results revealed that there is a significant and positive relationship between firm size and voluntary disclosure. The study also documented a significant and positive relationship between firm performance and voluntary disclosure, while a significant and negative relationship between managerial shares, and block holder share with voluntary disclosure. Pandit et al., (2011) examined the effect of research and development on firm performance by taking three measures of research and development. They selected the sample from 1972 to 2000 and the numbers of observations were twenty thousand three hundred ninety-one. The result reveals that firms operating performance is positively correlated to their patent, productivity, and firm innovation. They contribute that relation between research and development expense and future operating performance better explains the productivity of a firm's Research and Development outlays in the form of patent counts and citations. Tang and Wang (2011) investigated the cross-sectional relationship between firm liquidity and corporate governance of companies listed on the Chinese Stock Exchange. They built a checklist to measure the quality of governance dependent on easily available data of one thousand three hundred and forty-three companies listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange for the period 1999 to 2004. They found a significant and strong relationship between corporate governance and firm liquidity. The finding of the test shows sub-indices of corporate governance which provided extra support to positive governance and liquidity relation. They suggested that findings could also have an implication on stock market regulators for dynamically promoting corporate governance restructuring. The positive association between overall corporate governance and liquidity should lighten the concern that improving corporate governance dampens liquidity.

Bohren and Strom (2010) analyzed the economic logic for board regulation in place and for introducing a new rule in the future. They related the importance of the companies to the usage of the employee, Directors, and directors with multiple designations, board independence, and gender diversity. Their sample was based on non-financial companies listed on the Oslo stock exchange during the years 1989 to 20002. The result of the study shows that the firm made new value for its shareholders when the board has no employee Directors, Directors had strong links with other boards, and when gender diversity is low. But they had not found the relationship between firm performance and board independence. Md Nor et al. (2010) study examined the relationship between corporate governance and Research and Development reporting among companies listed in the Malaysian Exchange of Securities Dealing and Automated Quotation market. The sample consists of two years 2005 and 2006 and the total number of companies was one hundred and eighty-seven. They classified research and development information by financial or non-financial, historical or forward-looking, and non-quantitative or quantitative information. The result of the study shows that increases in government ownership influenced quantitative and financial research and development disclosure. In addition family, management, institutional ownership, and foreign haven't been influenced by research and development disclosure. The result also shows that the quality of Audits represented by the big four Audit firms tends to promote research and development disclosure. Chung et al., (2010) examined the relation between stock market liquidity and corporate governance. They found that companies with good corporate governance had better market quality, lesser probability of information-based transactions, narrow spread, and minor price impact due to traders. Furthermore, they showed

that variation in liquidity measures had a significant impact on the variation of the corporate governance index from time to time. The result of the study suggested that companies could alleviate material-based trading and improve stock market liquidity by implementing corporate governance standards that mitigate informational irregularities. Their results were extraordinarily strong to alternative model specifications, across exchanges, and to a different measure of liquidity.

Hossain and Hammami (2009) examined the determinant of voluntary disclosure in the annual reports of twenty-five listed companies in the Doha Securities Market. They also found an association between voluntary disclosure and company-specific characteristics. The designed voluntary disclosure consisted of forty-four items of financial information. The total numbers of firms listed on the stock exchange were forty-two and the 2007 annual report was based on to precede research study. Multiple regression analysis was applied to statistical data. Results of the study concluded that firm age, firm size, complexity in the firm, and assets in place had significant associations while other variables' profitability was found insignificant in explaining the association with the level of voluntary disclosure. Akhtaruddin et al. (2009) investigated the association between corporate governance variables and the level of voluntary disclosure. They used five variables of corporate governance and selected a sample of one hundred and five firms listed on Bursa Malaysia stock exchanges for the year 2002. Their result suggested that there is a positive relationship between board size, independent non-executive directors with voluntary disclosure. Results support that a higher level of outside ownership leads to better corporate governance and a higher level of disclosure, while the family control variable had a negative association with disclosures of information. The limitation of the study is that researcher had selected a sample of one year only. They suggested several future kinds of research account for all listed firms under the non-financial group and assess the trend of voluntary disclosure and the quality of corporate governance over time. Yun (2009) investigated to what extent corporate governance influences firms' choice between the line of credit and cash. Investors might have disagreed about companies' liquidity selection because it differs in the distribution of ex-post control rights for the company's liquidity reserves. The research data consist of two hundred and twelve companies from 1987 to 2000 and the total numbers of observations were one thousand and sixty-six. They suggested that companies take into account the managerial opportunism and discretion associated with cash when they choose to compose their liquidity reserves. The observed evidence that it is consistent with optimizing the performance of self-centered managers, who evade control challenges from investors, will balance the private benefits of pleasure against increased oversight by the bank. Using state-level variations in takeover protection as exogenous shocks to corporate governance, they found that firms raise cash compared to lines of credit when the risk of takeover weakens. This trend would be weaker for companies with good internal governance. Overall, his findings suggested that the choice of corporate liquidity is a network through which corporate governance works. Zourarakis (2009) examined the association between corporate governance and the voluntary disclosure of intellectual capital information by British firms. They selected the final sample of ninety-seven listed companies of the FTSE 100 index for the year-end 31 December 2007. His results showed a negative association between block holder ownership and voluntary disclosures and there was no significant association between managerial ownership and voluntary disclosures.

Aljifri (2008) investigated the extent of the disclosure in the annual reports of the thirty-one listed companies in the United Arab Emirates (UAE). The researcher also identified the fundamental factors that affect the level of corporate performance. The study assumed that four major factors are affecting the extent of disclosure in the United Arab Emirates. These sector types are (Banks, insurance, industrial, and service), profitability, size (assets), and debt-equity ratio. Of the four sectors, the banking sector was found to have disclosed more than the other three sectors. His findings indicated that there is a significant correlation found among these sectors; however, findings indicate that there was an insignificant correlation between size, profitability, and debt-equity ratio with the level of disclosure. Donnelly and Mulcahy (2008) examined the relationship between corporate governance and voluntary disclosure. Results of the study show that an increase in the number of Non-Executive Directors on the board will increase voluntary disclosure. They also found an association between Non-Executive Chairman and voluntary disclosures, but results showed that there is no relationship between ownership structure and the extent of voluntary disclosure. Becker and Pain (2008) investigated that what are the factors behind the poor research and development performance of UK firms in 1990. They selected the sample of manufacturing companies from 1993 to 2000. The result of the study shows that the share of foreign research and development or the share of government-funded research and developments has a positive impact on aggregate research and development expenditure. They also highlighted the important factor of the industry which is affecting research and development expenditure that are interest rate, exchange rate, sales and profitability of firms, and product competition. Osma (2008) in his this paper examined the role of the Board of Directors in constraining research and development expenditure. The researcher extended research on earning management, which indicated that accounting accrual manipulation reduces due to the independence of Directors. He selected a sample of three thousand four hundred and thirty-eight firms of different sectors. The result of the study explained that independent boards constrained the manipulation of research and development expenditure. He also concluded

that Independent Director on the board has sufficient knowledge to identify opportunistic research and development spending and opportunistic reduction in research and development.

Ghazali (2007) investigated the influence of ownership structure on corporate social responsibility disclosure in Malaysia. He used multiple regression analysis to measure the relationship between the extent of the CSR disclosure checklist on annual reports and ownership structure. Multiple regression analysis results showed that firms where the Directors hold a higher proportion of equity shares disclosed significantly less CSR information, while firms in which the government has substantial shareholders, disclosed significantly more information. Mishra (2007) examined the influence of firms and industry-specific factors on Research and Development intensity firms. He selected a sample of four thousand and fourteen Indian firms for the year 2004. He applied Tobit model analyses and established that the firm-specific factors, such as firm size, market share, age, and human capital are considerably better than Industry-specific characteristics such as market concentration in explaining Research and Development initiatives. Patelli and Prencipe (2007) examined the relationship between Independent Directors and voluntary disclosure. He carried out an analysis of one hundred and seventy-five non-financial companies listed on the Italian stock exchange for the period 2002; regression analysis was carried out on data and tested multicollinearity among independent and dependent variables. He had found a positive correlation between Independent Director and the amount of voluntary information disclosed. Huafang and Jianguo (2007) examined the relationship between board composition, ownership structure, and the level of voluntary disclosures in China. The research sample is based on five hundred and fifty-nine firms' observations in 2002. The finding of research showed that higher block holder ownership and foreign shares ownership are significantly related to an increased degree of voluntary disclosure. However, they found that state ownership, managerial ownership, and legal-person ownership are not correlated to disclosure. They also found that an increase in independent directors directly affects an increase in corporate disclosure and CEO dualities are related to lower disclosure. Hossain and Reaz (2007) examined the empirical investigation of the extent of voluntary disclosure by thirty-eight listed banking companies in India considering the year 2002-2003. They also incorporated the results of the association between company-specific characteristics and voluntary disclosure. The result shows that a considerable amount of voluntary information was disclosed by Indian banks. The result also revealed that size and assets-in-place were positively significant and other variables such as board composition, age, multiple exchanges listing, the complexity of business, and diversification were insignificant with the level of disclosure.

Alsaeed (2006) investigated the association between firm-specific characteristics and level of disclosure in Saudi Arabia firms. His disclosure checklist consists of twenty voluntary items, developed to assess the level of disclosure in the 2003 annual reports of forty firms. The results of the study showed that the mean of the disclosure index was lower than average. The result of the study also found that firm size was positively and significantly associated with the level of disclosure. But the result reveals that ownership dispersion, debt, profit margin, age, audit firm size, and industry are insignificant in explaining the variation of voluntary disclosure. Barako et al., (2006) examined the factor influencing voluntary disclosure in a developing country namely Kenya. This obtained data on voluntary disclosure practices in the annual reports of listed companies in Nairobi Stock Exchange Kenya from 1992 to 2001. They investigated that at what extent corporate governance attributes ownership structure and company characteristics influence voluntary disclosure practices. The result of the study suggested that voluntary disclosure was influenced by a firm's corporate governance attributes, ownership structure, and company characteristics. Audit committee presence is a significant factor, while Non-Executive Directors are negatively and significantly associated with the level of voluntary disclosure. Furthermore, levels of institutional and foreign ownership have a positive and significant impact on voluntary disclosure. Barako et al. (2006) examined the association between various corporate governance variables and voluntary corporate disclosure in Kenya firms. The results showed that the existence of leverage, institutional ownership, Audit Committee, foreign ownership, and firm size have a significant and positive relationship with the level of voluntary disclosures, while shareholder concentration and voluntary disclosures have a significant negative relation. Makhija and Patton (2004) investigated the impact of ownership structure, on the extent of voluntary financial disclosure. They selected the sample of forty-three non-financial firms of Czech that was included in the PSE-50 index in 1993. Their finding revealed that the extent of disclosure is positively related to investment fund ownership. Brown and Claylor (2004) investigated using governance score with fifty-one factors and eight subcategories for two thousand and thirty-two firms, which were established on the institutional shareholder services. The result of their study concludes that those firms where corporate governance is more valuable, earn more profit and eventually pay more cash to the firm's shareholders.

Eng and Mak (2003) examined the impact of block holder ownership, governance ownership, and managerial ownership. Furthermore, they investigated the impact of board composition on corporate disclosure. The sample of the study consisted of one hundred and fifty-eight firms listed on Singapore Stock Exchange. The result of the study shows that board composition and ownership structure had a significant impact on voluntary disclosure.

Furthermore, they found that lower managerial ownership and government ownership are directly associated with an increase in a voluntary disclosure. However, they had not found any relationship between block holder ownership, growth opportunity, Auditor reputation, industry, and disclosure. Gompers et al., (2003) designed the twenty-four corporate governance factors into five main sub-categories. These categories are tactics for delaying hostile takeover, voting rights, other takeover defenses, state law, and director protection. Their result indicates that firms with fewer shareholder rights have low firm value and lower stock returns. They find that firms with stronger shareholder rights have higher firm value, higher profit, lower capital expenditure, and higher sales growth and they made corporate acquisitions.

Kothari et al., (2002) examined the relationship between research and development investment and compared the uncertainty of the future benefits arising from Research and development. The study focused on evaluating the contribution of current investment in research and development with investment in property plans and equipment to future earnings by using a sample of fifty thousand firms period of 1972 to 1997. Results of the study found a positive relationship between research and development and the standard deviation of realized future earnings. This relationship is stronger than the relationship between volatility of realized future earnings and capital expenditure. Their study will help the current discussion on accounting for Research and development and methodology would be helpful in standard setting. Chau and Gray (2002) examined the relationship between ownership structure and voluntary disclosure in listed companies in Hong Kong and Singapore. They selected sixty companies from Hong Kong and sixty-two companies from Singapore. They are based on the Meek et al. (1995) voluntary disclosure checklist, whose results showed that there is a positive and significant relationship between the extent of outside ownership and voluntary disclosure. They also found a negative association between insider or family ownership and voluntary disclosure.

Percy (2000) investigated that discretionary choice is available to Australian companies regarding disclosure and financial reporting. A sample of one hundred and fifty-two Australian-listed firms was taken. The researcher specifically focused on research and development companies for the period ended 1993. Results supported that three aspects of information asymmetry are important in explaining the discretionary capitalization of research and development expenditure. The result shows that research incentive and information asymmetry are important variables to explain voluntary disclosure of research and development expenditure. Hossain et al., (1995) investigated to what extent voluntary disclosure was disclosed by New Zealand firms. For that purpose, researchers selected data from fifty-five firms listed on the New Zealand stock exchange. Researchers derived five firm characteristics from agency theory and for financial information they developed a voluntary discourser index. They found the empirical relationship between voluntary disclosure and firm size, leverage, and foreign listing. They suggested that voluntary disclosures are used as a means to reduce agency costs and increase leverage. Ho and Wong (2001) investigated the relationship between corporate governance mechanisms and the extent of voluntary disclosures. They selected a sample of ninety-eight listed firms on the Hong Kong stock exchange. For that purpose, they used four major mechanisms of corporate governance Audit committee, role duality, director independence, and percentage of family members on board. They used voluntary disclosure and the twenty most important items were perceived by financial analysts. The results indicated a positive and significant relationship between the Audit Committee and the extent of voluntary disclosure. They also found a negative relationship between the percentage of family members on the board and the extent of voluntary disclosure. Ruland, Tung, and George (1990) measured ownership structure by the percentage of voting stocks owned by officers and Directors. They examined whether the probability of firms' management making earnings forecasts is explained by analysts' forecasts error, firm making a debt or equity offering, absolute analysts error, and ownership structure. The results of the study explained that when inside ownership increases then firms were less likely to provide a management forecast of earnings.

Driffield (2001) examined the relationship between R&D expenditures by foreign-owned firms in the UK and R&D expenditures by UK-owned firms at the industry level. His results provide evidence that foreign firms are more involved in R&D expenditure which results in capturing more market share or competitive advantage over the domestic seller. Investment spillover has an insignificant effect on inter-industry. Industry characteristics, which are the elasticity of demand, as proxies by advertising intensity, and the availability of funds, proxies by profits, are found to have significant and positive effects. Brickley et al., (1997) explored the impact of separating the designated role of CEO and Chairman. The stockholder activities and regulators had pressured US firms to separate the post of CEO and Chairman of the board. They selected the sample from Wall Street Journal Article containing the keyword Chairman and Chief Executive officer. Their research yield consisted of two thousand articles. They also argued that separating the designation would reduce agency costs in corporations and improve performance. The presented empirical evidence appeared to carry this view. They argued that this separation has potential costs, as well as potential benefits. They find that many firms used the post of CEO, Chairman, and President as part of their succession plan for CEO. They found that firms separated the titles; the Chairmen have almost always people with comprehensive knowledge of the firms and comparatively high stock ownership. They

found few Chairmen who were not former officers of the firms; tend to own more shares and have longer affiliations with the company. Eng and Mak (2003) investigated the relationship between board composition, ownership structure, and voluntary disclosures. For measurement of board composition, they considered the percentage of Independent directors. The ownership structure is categorized by block-holder, managerial, and government ownership. Companies listed on the Singapore stock exchange at the end of the year 1995, were selected as a sample. Their findings revealed a significant and negative relationship between managerial ownership and the level of voluntary disclosure, and also found a significant and positive relationship between government ownership and voluntary disclosure. However, they found no significant association between block-holder ownership and voluntary disclosures. Cheng and Courtaney (2006) found that Non-Executive and Independent Directors show a significant and positive association with voluntary disclosures. The result of the study also shows that the majority of Independent Directors in firms have a significantly higher level of voluntary disclosure than in firms with balanced boards. Furthermore, board size and CEO duality are not associated with the level of voluntary disclosure. Their study was based on one hundred and four firms listed on the Singapore Stock Exchange in the year 2000.

3. The Model

The current study investigates two major issues, firstly, the impact of corporate governance on research and development of voluntary disclosure practices in Pharmaceutical companies in the United State of America. Secondly, examines the impact of firm size, leverage, firm profitability, liquidity, and firm growth on research and development expenditure of USA pharmaceuticals firms. In research studies, there are mainly two approaches used: inductive approach and deductive approach. In the inductive approach, research move from data to theory, it starts with data collection then research look for a pattern of data and analyses, and at the end develops a theory. It might be possible to construct generalized relationships and even theories (Gray, 2009). In the Deductive approach, it starts by developing a hypothesis, drawing on existing theories, and after that testing them. At last, the hypotheses accept or reject depending on the result of the study. (Gray, 2009). The deductive approach is considered to be more appropriate to achieve the objective of the current study. Following the existing literature (Ali and Naeem, 2017; Ali, 2011; Ali, 2015; Ali, 2018; Ali and Bibi, 2017; Ali and Ahmad, 2014; Ali and Audi, 2016; Ali and Audi, 2018; Ali and Rehman, 2015; Ali and Senturk, 2019; Ali and Zulfiqar, 2018; Ali et al., 2016; Ali et al., 2021; Ali et al., 2021; Ali et al., 2015; Arshad and Ali, 2016; Ashraf and Ali, 2018; Audi et al., 2022; Audi and Ali, 2017; Audi and Ali, 2017; Audi et al., 2021; Audi and Ali, 2016; Audi et al., 2021; Audi et al., 2021; Audi et al., 2021; Haider and Ali, 2015; Kaseem et al., 2019; Roussel et al., 2021; Sajid and Ali, 2018; Senturk and Ali, 2021; Mehmood et al., 2022; Ali et al., 2022; Ahmad et al., 2022; Sulehri and Ali, 2020; Ali et al., 2021; Audi et al., 2020; Alim et al., 2022) the linear relationship of variables can be examined. The first research question of the study is to investigate the impact of corporate governance on voluntary disclosure of R&D expenditure of USA pharmaceuticals firms from 2017 to 2020.

$Y = \alpha + \beta 1X_{1(it)} + \beta_2X_{2(it)} + \beta_3X_{3(it)} + \beta_4X_{4(it)} + \beta_5X_{5(it)} + \varepsilon i$
Where Y = Research and Development Disclosure (dependent variable)
X_1 = Board Size (independent variable)
X_2 = Role Duality (independent variable)
X_3 = Management Ownership (independent variable)
X_4 = Board Independence (independent variable)
X_5 = Audit Committee Quality (independent variable)
i= Cross Section
t= Time Series
α = Constant
εi = Error arising due to other variables
$RDD = \alpha + \beta_1BS_{it} + \beta_2DUL_{it} + \beta_3MNO_{it} + \beta_4BI_{it} + \beta_5AUQ_{it} + \varepsilon i$

The second research question of the study is to investigate the impact of firm size, leverage, firm profitability, liquidity, and Firms growth on research and development expenditure of USA pharmaceuticals firms from 2017 to 2020. For that research question the Equations are the following:

$Y = \alpha + \beta 1X_{1(it)} + \beta_2X_{2(it)} + \beta_3X_{3(it)} + \beta_4X_{4(it)} + \beta_5X_{5(it)} + \varepsilon i$
Where Y = Research and Development Expenditure (dependent variable)
X_1 = Firm Size (independent variable)
X_2 = Leverage (independent variable)
X_3 = Firm Profitability (independent variable)
X_4 = Liquidity (independent variable)
X_5 = Firm Growth (independent variable)
i= Cross Section

t= Time Series
α = Constant
Ɛi = Error arising due to other variables
$RDE=\alpha+ \beta_1 FS_{it}+ \beta_2 LEV_{it}+ \beta_3 PROF_{it}+ \beta_4 LIQ_{it}+ \beta_5 GWT_{it}+ Ɛi$

a. Measures of Independent Variables

Variable	Measurement	Data Source
Independent Variables		
Board size	Number of Directors on the board	Annual Report
Role Duality	Dummy variable equal to (1) if CEO is also Chairman, (0) otherwise.	Annual Report
Board Independence	The number of independent Directors on the board is divided by the total number of Directors on the board. (%)	Annual Report
Management Ownership	Percentage of ordinary shares held by substantial shareholders, owning (5 %) or more of the firm's share capital. (%)	Annual Report
Audit Committee Quality	Dummy variable equal (1) if the Audit Committee is established at least three independent Non-Executive Directors and one of them at least has recent and relevant financial experience, and there were no fewer than three meetings held during the year, (0) if otherwise.	Annual Report
Firm size	Total assets	Annual Report
Leverage	The percentage of total debt to total assets.	Annual Report
Firm Profitability	Return on assets.	Annual Report
Liquidity	Current Ratio	Annual Report
Firm's Growth	Total assets growth (1-year annual growth)	Annual Report

3.2 Econometric Model

For this study, we use a feasible generalized method of movement to estimate the model. Keeping in view a large number of companies in data as compared to several years' feasible model for data is the GMM model.

4. Results and Discussion

Table A-1: Descriptive Analysis

	RDD	BS	BI	MONR	AUQ	DUL
Mean	64.18779	9.953488	8.761628	3.903663	0.947674	0.534884
Median	65.38000	10.00000	9.000000	1.785000	1.000000	1.000000
Maximum	92.31000	19.00000	13.00000	22.00000	1.000000	1.000000
Minimum	23.08000	5.000000	3.000000	0.050000	0.000000	0.000000
Std. Dev.	18.22896	2.175929	2.194127	4.443689	0.223333	0.500238
Skewness	-0.248198	0.251052	-0.407532	1.382949	-4.020737	-0.139876
Probability	0.035241	0.032371	0.090017	0.000000	0.000000	0.000001
Sum	11040.30	1712.000	1507.000	671.4300	163.0000	92.00000
Sum Sq. Dev.	56822.47	809.6279	823.2267	3376.630	8.529070	42.79070

The result of the Descriptive analysis of the first research question was shown above in Table A-1. In Table A-1, RDD (research and development disclosure) has a mean value of 64.18 and a median value is 65.38, the data appear to be skewed to the left (Negative Skewed), which explains that the mean is less than the median. Where the minimum value is 23.09 and the maximum value is 92.31, which explains the highest and lowest figure in this variable. Standard deviation is used to determine how to spread out the data from the mean here the SD value is 18.22. In Table A-1, BS (Board Size) has a mean value of 9.95 and a median value is 10.00, the data appear to be skewed to the left (Negative Skewed), which explains that the mean is less than the median. Where the minimum value is 5.00 and the maximum value is 19.00. In Table A-1, BI (Board Independence) has a mean value of 8.76 and a median value is 9.00, the data appear to be skewed to the left (Negative Skewed), which explains that the mean is less than the median. Where the minimum value is 3.00 and the maximum value is 13.00. In Table A-1, MONR (Managerial Ownership) has a mean value of 3.90 and a median value is 1.78, the data appear to be skewed to the right (Positively Skewed), which explains that the mean is greater than the median. Where the minimum value is 0.05 and the maximum value is 22.00. In Table A-1, AUQ (Audit Committee Quality) has a mean value of 0.94 and a median value is 1.00, the data appear to be skewed to the left (Negative Skewed), which explains that the mean is less than the median. Where the minimum value is 0.00 and the maximum value is 1.00. In Table A-1, DUL (Role Quality) has a mean value of 0.53 and a median value is 1.00, the data appear to be skewed to the left (Negative Skewed), which explains that the mean is less than the median. Where the minimum value is 0.00 and the maximum value is 1.00. The normal value of skewness is 0 here RDD is negatively fairly symmetrical

skewed, BS is positively normally skewed, and BI is negatively normally skewed. MONR is highly but positively skewed. AUQ is highly negatively skewed. DUL if negatively normally skewed.

Table A-2: Descriptive Analysis

	RDE	FS	LEV	GWT	PROF	LIQ
Mean	8.387674	9.788140	53.55634	19.81721	2.954327	2.804477
Median	8.305000	9.790000	50.35500	5.525000	4.390000	2.085000
Maximum	10.03000	11.24000	421.9900	348.3300	142.0400	12.07000
Minimum	6.470000	7.800000	2.210000	-31.58000	-284.6100	0.660000
Std. Dev.	0.887878	0.938205	35.65600	49.63063	29.70115	2.007686
Skewness	0.187191	-0.306572	6.481440	3.284778	-5.209136	1.760768
Probability	0.033879	0.007295	0.000000	0.000000	0.000000	0.000000
Sum	1442.680	1683.560	9211.690	3408.560	505.1900	482.3700
Sum Sq. Dev.	134.8039	150.5190	217400.9	421207.1	149966.9	689.2677

The result of the Descriptive analysis of the second research question was shown above in Table A-2. In Table A-2, RDE (research and development expenditure) has a mean value of 8.38 and a median value is 8.30, the data appear to be skewed to the right (positively Skewed), which explains that the mean is greater than the median. Where the minimum value is 6.47 and the maximum value is 10.03, which explains the highest and lowest figure in this variable. Standard deviation is used to determine how to spread out the data from the mean here the SD value is 0.88. In Table A-2, FS (Firm Size) has a mean value of 9.78 and a median value is 9.79, the data appear to be skewed to the left (negatively Skewed), which explains that the mean is less than the median. Where the minimum value is 7.80 and the maximum value is 11.24. In Table A-2, Leverage (Leverage) has a mean value of 53.55 and a median value is 50.35, the data appear to be skewed to the right (positively Skewed), which explains that the mean is greater than the median. Where the minimum value is 7.80 and the maximum value is 11.24. In Table A-2, GWT (Growth) has a mean value of 19.81 and a median value is 5.52, the data appear to be skewed to the right (positively Skewed), which explains that the mean is greater than the median. Where the minimum value is -31.58 and the maximum value is 348.33. In Table A-2, PROF (Profitability) has a mean value of 2.95 and a median value is 4.39, the data appear to be skewed to the left (negatively Skewed), which explains that the mean is less than the median. Where the minimum value is -284.61 and the maximum value is 142.04. In Table A-2, LIQ (Liquidity) has a mean value of 2.80 and a median value is 2.085, the data appear to be skewed to the right (positively Skewed), which explains that the mean is greater than the median. Where the minimum value is 0.66 and the maximum value is 12.07. The normal value of skewness is 0 here RDE is positively fairly symmetrical skewed, FS is fairly negatively symmetrical skewed, and LEV is highly skewed. GWT is highly but positively skewed. PROF is highly negatively skewed. LIQ is highly skewed.

4.1 Justification for Using GMM model

To examine the relationship between dependent and Independent variables of our study we have employed the Generalised Method of Moments (GMM). E-views have been used to calculate GMM. In our sample data Number of cross sections are greater than time, as there are 43 pharmaceutical companies with 4-year data and total observations are 172. So GMM is the most appropriate method to test the data. Another reason for using GMM is that Panel data has been taken for this study and panel data has an Endogeneity problem. This problem overcomes by using GMM only. The correlation between independent variables and the error term is called endogeneity. Ordinary Least Square (OLS) is the regression analysis that is inefficient as outliers exist in data and if there are one or two outliers found in data then they can seriously affect the results. Moreover, there are fewer model validation tools for the detect outlier in data. So OLS is not appropriate regression for panel data estimation. The capital Asset Pricing Model is used to analyze the relationship between expected return and systematic risk. It is a calculation between the expected value of return and the given level of risk for the calculation of asset pricing and cost of Capital. CAPM is not appropriate for calculation as CAPM is based on expected values of risk and return which can never be negative.

Table 1. Model Summary

Dependent Variable: RDD

Test	Result
R-Square	0.259
Prob (J-Statistic)	0.000

The R Square and probability value for the model are presented in Table 1. R-Square is 25.9% which means that nearly 26% of changes in research and development disclosure are due to independent variables (Board Size, Role duality, board independence, Managerial ownership, and audit committee quality). The probability value is less than 5% which means, the overall model is significant. Therefore, we accept an alternative hypothesis that states

that role duality, board independence, managerial ownership, and Audit committee quality have a significant impact on the research and development of voluntary disclosure of pharmaceutical firms in the USA.

Table 2. Generalized method of movement

Co-efficient of Independent Variable

Variable	Co-efficient Value	Probability
BS	-2.067	0.21
DUL	6.690	0.01
BI	5.676	0.00
MNO	0.693	0.04
AUQ	-19.646	0.00

The empirical evidence derived from the generalized method of movement model in Table 2, indicates that there is a positive and significant impact at the 0.01 level (P Value < 5%), between role duality and research and development voluntary disclosure. The finding supports USA pharmaceutical companies and had a focus on role duality and the same will be disclosed in the annual report. However, the GMM model indicates that there is an insignificant negative impact between board size and research and development voluntary disclosure of selected pharmaceutical companies in the USA. Our result is consistent with those of Nekhili et al. (2015), Ho and Wong (2001), and Cheng and Courtenay (2006). The model indicates a positive and significant impact between role duality and R&D disclosure. However, the GMM model indicates that there is a highly significant and positive impact between board independence and research and development voluntary disclosure. Finding support that a higher number of independent Directors on the board will play a vital role in voluntary disclosure of research and development. Independent Directors are free from any kind of internal influence so they will also focus on shareholders' interests and the overall company's performance. The results of table 2 indicate that there is a positive and significant relationship between managerial ownership and research and development voluntary disclosure at a level of (P Value) 5%. Our result is consistent with Nekhili et al. (2012). Also, the result shows that there is a significant and negative relationship between Audit committee quality and research and development voluntary disclosure. Our result is consistent with Ho and Wong (2001) and Samaha et al. (2014).

Table 3. Model Summary

Dependent Variable: RDE

Test	Result
R-Square	0.834
Prob (J-Statistic)	0.000

The R Square and probability value for the model are presented in Table 3. R-Square is 83.4% which means that 83.4% of changes in research and development expenditures are due to independent variables including Firm Size, Leverage, Firm Profitability, Liquidity, and Firm Growth. The probability value is less than 5% which means the overall model is significant. Therefore, we accept the alternative hypothesis which states that the log of firm size, leverage, firm profitability, liquidity, and firm growth has a significant impact on the log of research and development expenditures of pharmaceutical firms in the USA.

Table 4. Generalized method of movement

Co-efficient of Independent Variable

Variable	Co-efficient Value	Probability
FS	0.941	0.00
LEV	0.003	0.00
PROF	-0.002	0.00
LIQ	0.076	0.00
GWT	-0.000	0.41

The empirical evidence derived from the generalized method of movement model in Table 4, indicates that there is a significant positive impact at the 0.00 level between firm size and research and development expenditure. Firm size has a positive and significant impact on the log of research and development expenditure of pharmaceutical firms in the USA. The findings support that as firm size increases, their investment in research and development expenditure will also increase. However, the GMM model indicates, that there is a significant positive impact at the 0.00 level, between Leverage and research and development expenditure. Companies were also increasing their total assets to pay off their debt and maintain their leverage ratio. However, the GMM model indicates that there is a highly significant negative impact between firm profitability and research and development expenditure. Finding support that firm profitability has a direct impact on research and development expenditure. It's a real-life scenario, whenever firms/companies' expense will increase, it will directly affect the company's profitability. There is a positive and significant relationship between firm liquidity and research and development expenditure, after making their expenditure on R&D companies are in a position to cover their obligations. Also, the result shows that there is an insignificant and negative relationship between a firm's growth (in Assets) and

research and development expenditure. The result of the model explains that a firm's assets growth during the year has no relationship with research and development expenditure.

5. Conclusion and Policy Suggestions

The distinct nature of R&D expenditures and the limitation of mandated explanatory disclosure requirements concerning research and development activities make an information problem (Lev, 1999; Merkley, 2014). Furthermore, managers had to take difficult decisions to determine the type and the level of R&D disclosure, reliant on the trade-off between the benefit and costs of disclosure. Therefore, working on research and development disclosure in a firm's annual reports is considered a useful research area. This study investigated the impact of corporate governance on R&D disclosure in annual reports of a sample of USA pharmaceutical firms. Furthermore, in this study, the impact of firm size, leverage, firm profitability, liquidity, and Firms growth on research and development expenditure is investigated. Overall the result of the study reveals the significant impact of corporate governance on research and development voluntary disclosure. The higher number of independent and Non-Executive Directors will result in disclosure of R&D, also found that when there is shareholding of management in the company, they will prefer to disclose information, as find a significant impact of the variable on R&D disclosure. Audit committee quality and role duality had a significant impact, it means it plays a vital role in the disclosure of information. But in the study, no significant impact of board size on R&D disclosure is found. The second part of the study concluded that firm size, leverage, firm profitability, and liquidity have an impact on research and development expenditure and there is a significant impact between them. Furthermore, Firm size, the company's ability to pay off its current debt (liquidity ratio), and company total debt as compared to total assets (leverage ratio) had a significant impact on R&D expenditure. The study result shows that firm growth (change in total assets) is calculated on yearly basis and R&D is a long-term process that's why there is an insignificant impact of the total assets of the company on R&D expenditure. The study findings may provide useful guidance for entrepreneurs, management for pharmaceutical firms, and general investors. This paper has investigated the impact of R&D voluntary disclosure on the market value of the firm. This was motivated by the observation that several empirical studies demonstrate a positive impact of CG on R&D voluntary disclosure in the UK (Ahmed, Howida, Shehata, and Mohamed, 2015), a positive association between R&D voluntary disclosure and the market value and corporate governance (Nekhili et al. 2015) positive relationship between a firm's market value and increasing R&D expenditure (Chan et al., 2001; Hall and Oriani, 2006), and a positive association between voluntary information and market value (Haggard et al., 2008; Hassan et al., 2009).

The result of this study provides better insight into research and development practice in USA pharmaceutical companies to the financial market regulator and is helpful to other managers to improve reporting regarding R&D disclosure. Disclosure of this type of information will lead to greater transparency. If we discuss the current pandemic situation of Corona Virus all over the world, where every country each human is looking for Corona Medicine or Corona Vaccines. On 31 March 2020, Johnson & Johnson CEO Alex Gorsky announced that they have planned to start COVID-19 vaccine human trials by September this year. As a result on 31 March 2020, shares of the world's largest healthcare company gained as much as 9% after the company's statement. They also make the statement that the company expanding its manufacturing capacity to produce the vaccine quickly, to reach the goal of 1 Billion doses. Companies that had assigned budgets for research and development activities and have the proper departments and teams to work with can now participate and earn huge profits in the future. This research study is based on USA pharmaceutical companies, future research can be conducted by all other companies involved in research and development activities i.e. Aero Space, Chemical, Computer, and Electronic Product. The researcher can research cross-section analysis of pharmaceutical companies between the countries i.e USA, China, and Germany. In addition, the relationship between R&D voluntary disclosure and firm market value, it could be further extended by using the rate of returns in addition to market value.

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