Investigating the Relationship between Manager and Shareholder Using game theory: Applying Accounting Conservatism and Financial Reporting Quality

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Abstract: The decision-making of managers in today's organizations is crucial due to increased complexity of internal and external influential factors and increased competition among organizations. Game theory attempts to model the mathematical behavior of a strategic situation. This situation arises when the success of one side of the game depends on the strategies selected by other side. The present study aims at finding a strategy to maximize the balance interests of managers and shareholders by applying strategic characteristics of accounting information and accounting conservatism. The statistical population of study included 132 companies listed on the Tehran Stock Exchange during a period of seven years (2012-2018). The data analysis method is inferential and SPSS software was used to prepare the data and estimate the models. Pooled data model was used to test the research hypotheses. The results of testing the research hypotheses show that the combination of strategies of manager low reporting quality-shareholder low reporting quality (m1, S1), manager high reporting quality- shareholder high reporting quality (m2, S2), manager low conservatism - shareholder low conservatism (m3, S3), manager high conservatism - shareholder high conservatism (m4, s4), were selected as poor Nash equilibrium. The study results show that game theory plays a major role in the relationship between managers and shareholders and finding equilibrium points of game can play an effective role in the decisions of game parties (managers and shareholders). Accordingly, it informs the parties of game of the strategy that has highest utility for them.

Keywords: Accounting Conservatism, Financial Reporting Quality, Game Theory, Nash Equilibrium.

INTRODUCTION

The success of companies depends on investors and creditors to invest in companies, and since financial statements are one of the most important sources of information for companies, they have a special place in the decisions made by investors and creditors. Thus, managers try to make the financial statements that are beneficial for investors, and it is due to the profit-seeking motivations of company managers, because many of their fees are determined and paid based on the performance of company. In this regard, the earning reported in the firm has a special importance and is mostly considered by investors and is the basis for evaluating the management performance and future cash flows of company. Over-emphasis of the capital market on earnings on the one hand and the existence of opportunities for management to apply this figure through optionality of some accounting procedures on the other hand reveal the need to investigate ownership structures of companies and the effects of these structures on the financial reporting environment to find solutions to balance these effects (Janafazaei & Hasani, 2015).

Also, the financial statements reflect the accounting information of the business units and the investors, as the main suppliers of resources of the business units, demand accounting information. Investors usually use accounting information uniformly and consistently and do not pay attention on the way of calculating the information and changes in accounting methods. Business unit managers to use non-conservative accounting

methods to show the growth of company and it will increase shareholder expectations of the business unit in next years (Navidi Abbaspour & Orhan, 2018).

Theoretical foundations of research

According to agency theory, when managers have good information about profitable investment opportunities, they may sometimes not pursue it, due to ethical risk problems caused by ownership of cash by management and inappropriate design and selection and shortage of funds due to costly external financing. Conservatism reduces the problems of incorrect selection and improves the company investment policies by facilitating access to foreign funds and reducing the cost of these funds. In general, it can be stated that information asymmetry will have a significant effect on the cost of financing. In other words, information asymmetry between the company and investors is an important stimulus to increase the cost of financing companies that seek to finance their investment opportunities. The results of studies conducted on conservatism and information asymmetry confirm the usefulness of conservatism as one of the qualitative characteristics of financial information and the role of information asymmetry between investors in conservatism actions in financial reporting. Hence, it can be stated that conservatism is created in response to information asymmetry and as information asymmetry and conservatism increases by increasing information asymmetry among investors. It should be noted that increasing conservatism also leads to reducing information asymmetry and its negative consequences for debt and equity and increasing the control of managers. High-quality accounting information increases investment efficiency by eliminating information asymmetry between managers and investors. Thus, despite high information asymmetry, conservatism increases future investment by reducing information asymmetry and low investment problems, leading to investment efficiency (Khodamipour & Panahi Gonharani, 2017).

Game theory

When a player earning does not depend solely on its own behavior and is influenced by the behavior of one or more other players, and other decisions have a positive and negative effect on its profit, a kind of game is formed between two or more players (Saei et al., 2018). Game theory attempts to model the mathematical behavior of a strategic position (conflict of interest). This situation is caused when a one's success depends on the strategies that others select. The ultimate goal of this knowledge is to find the optimal strategy for players. Accordingly, the audit process is considered as a game against the business owner and the auditor behavior is defined as the player. Thus, the behavior of shareholders at all levels should be subject to principles of game and based on the strategy of managers. Predicting behavior of managers, evaluating what managers expect from shareholders' behavior and adopting surprising and hidden behaviors, keeping tactics secret and so-called not playing are one of the most important principles (Saei et al., 2018) Also, the question is what the relationship is between game theory and economics. (Ronen & Yaari, 2002) defines economics as "the study of human behavior concerning the relationship between scarce resources that have a variety of uses and the end product" (Eskandari et al., 2013).

Conservatism and characteristics of accounting information

Conservatism is defined as requirement to have a high degree of confirmation to distinguish good news such as profit from bad news such as loss. This definition describes conservatism from a profit and loss perspective (Basu, 1997). Another definition considers conservatism from a balance sheet perspective. Based on this view, in cases where there is a real doubt in making a selection between two or more reporting methods, the method that has the least favorable and optimal effect on shareholders' equity should be selected (Feltham & Ohlson, 1995) The third definition is about conservatism based on the combined view of balance sheet and profit and loss. In the third view, conservatism is an accounting concept that leads to reduction in reported accumulated profits through later recognition of revenue and faster recognition of cost, lower valuation of assets, and higher valuation of debt (Givoly & Hayn, 2000).

Another classification has been presented for defining conservatism: conditional conservatism and unconditional conservatism. Conditional conservatism is conservatism that is required by accounting standards. It means that recognizing loss timely in the case of presence of bad and unfavorable news and not recognizing profits when there is good and desirable news. For example, application of rule of minimum cost or sale net value in evaluating inventory is a form of conditional conservatism. This type of conservatism is also called loss and profit or retroactive conservatism. However, unconditional conservatism is not required by accepted accounting standards. This type of conservatism is defined as lower representing the net book value of assets due to predetermined accounting procedures. This conservatism is also known as balance sheet conservatism or prospective conservatism (Ryan, 2006). Based on theoretical concepts of financial reporting, conservatism is defined as application of a degree of care required in making judgments to make estimates in conditions of ambiguity so that revenues or assets are not presented more than reality and costs or liabilities."

Conservatism moderates the stock price fall risk for two reasons:

1) When the manager hides the bad news about the company, the stock price fall risk of company increases due to the accumulation of such news in the company and its sudden publication. In such a situation, conservatism prevents the manager from hiding the bad news.

2) Conservatism is a warning mechanism and helps shareholders and board of directors to identify and stop losing projects in a timely manner by recording losses timely (Li & Shroff, 2010).

Shareholder conservatism

Asadi & Bayat proposed the agency theory in 2017. They defined company managers as brokers and shareholders as brokers. In their analysis, a shareholder is in opposite to managers. In other words, decision-making is delegated to managers. However, the problem here is that brokers do not necessarily make decisions in favor of brokers. One of the main hypotheses of agency theory is that employers and agents have a conflict of interest. According to them, management motivations are personal, which are in contrast to maximizing the wealth of shareholders (Asadi & Bayat, 2017). In fact, the present study, uses unconditional conservatism index, has tried to find a balance in the interests of both parties by using a special model of game theory and examine the interests of managers and shareholders, so that both parties achieve satisfaction.

Financial reporting quality

There is no clear framework to define quality of financial reporting in the accounting literature (Xu, 2018). The quality of financial reporting from the perspective of some researchers has several definitions and type of definition depends on the perspective of the person. In one case, the Auditing Standards Board asked guidance from Financial Accounting Standards Board in defining the quality of financial reporting, which the Financial Accounting Standards Board cited in Concept Statement 2 (Arab Kiasari & Abdi, 2015). The Financial Accounting Standards Board in Concept Statement 2 states that quality should be defined in terms of the general objectives of financial reporting, that is, providing useful information to users for investment decisions, giving credit, and so on (Concept Statement 2). This board defines the qualitative characteristics necessary to achieve the stated objectives. According to the board model, qualitative characteristics include relevance (predictive value, confirmability value and timeliness), reliability of accountability, honest and non-biased expression), consistency of procedure, and comparability. The board acknowledges that this is a subjective evaluation and balance must often be created between relevance and reliability (Bashiri Manesh & Mehri Kamroud, 2018).

Research literature

In an article entitled "Investigating the relationship between accounting conservatism and the quality of financial reporting with the efficiency of future investments and changes in the company future debts", (Rezghi Shirsavar & Nabavi Chashmi, 2017) examined 93 companies listed on the Tehran Stock Exchange from 2010 to 2015 and concluded that there is a significant inverse relationship between accounting conservatism and the efficiency of future investments, but there is a direct relationship between accounting conservatism and changes in the company future debts. Also, there is a significant and direct relationship between the quality of financial reporting and the efficiency of future investments, but there is an inverse relationship between the quality of financial reporting and changes in the company future debts. In a study entitled "Accounting conservatism, business strategy and ambiguity", (Hill & McDonnell, 2015) concluded that accounting conservatism increases the timeliness of bad news, which is related to conservative decision-making rules and thus helps managers and investors to enforce them and companies with more ambiguity in their financial statements are reporting more conservatively. In a study entitled "The relationship between major shareholder involvement in stock commitment and accounting conservatism in Chin during 2008-2015",

(Wan, 2014) concluded that information asymmetry leads to competitive motivations according to financial reporting. The major shareholders' involvement in stock commitment has a negative effect on accounting conservatism. (Myerson Roger, 1991) investigated the relationship between institutional ownership and conservative reporting. They concluded that higher levels of institutional ownership were associated with less conservative reporting. (Sun et al., 2011) that if institutional investors have a long-term view of investing in a company, the level of company conservatism will be higher.

Development of research hypotheses

Hypothesis 1: in the combination of strategies of high reporting quality by the shareholder (s2) and high conservatism by manager (m4) in the manager-shareholder game, Nash equilibrium is dominant.

Hypothesis 2: in the combination of strategies of high reporting quality by the shareholder (s2) and high reporting quality by manager (m2) in the manager-shareholder game, Nash equilibrium is dominant.

Hypothesis 3: in the combination of strategies of high conservatism quality by the shareholder (s4) and high conservatism quality by manager (m4) in the manager-shareholder game, Nash equilibrium is dominant.

Hypothesis 4: By selecting a strategy of low reporting quality (s1) by the shareholder, the mean interest of managers in selecting any of the low reporting quality strategies (m1) and high reporting quality (m2), low conservatism (m3) and high conservatism (m4) is different.

Hypothesis 5: By selecting a strategy of high reporting quality (s2) by the shareholder, the mean interest of managers in selecting any of the low reporting quality strategies (m1) and high reporting quality (m2), low conservatism (m3) and high conservatism (m4) is different.

Hypothesis 6: By selecting a strategy of low reporting quality (s3) by the shareholder, the mean interest of managers in selecting any of the low reporting quality strategies (m1) and high reporting quality (m2), low conservatism (m3) and high conservatism (m4) is different.

Hypothesis 7: By selecting a strategy of high reporting quality (s4) by the shareholder, the mean interest of managers in selecting any of the low reporting quality strategies (m1) and high reporting quality (m2), low conservatism (m3) and high conservatism (m4) is different.

Hypothesis 8: By selecting a strategy of low reporting quality (m1) by manager, the mean interest of shareholders in selecting any of the low reporting quality strategies (s1) and high reporting quality (s2), low conservatism (s3) and high conservatism (s4) is different.

Hypothesis 9: By selecting a strategy of high reporting quality (m2) by manager, the mean interest of shareholders in selecting any of the low reporting quality strategies (s1) and high reporting quality (s2), low conservatism (s3) and high conservatism (s4) is different.

Hypothesis 10: By selecting a strategy of low reporting quality (m3) by manager, the mean interest of shareholders in selecting any of the low reporting quality strategies (s1) and high reporting quality (s2), low conservatism (s3) and high conservatism (s4) is different.

Hypothesis 11: By selecting a strategy of high conservatism (m1) by manager, the mean interest of shareholders in selecting any of the low reporting quality strategies (s1) and high reporting quality (s2), low conservatism (s3) and high conservatism (s4) is different.

MATERIALS AND METHODS

The subject area of this study is in the framework of financial-accounting theories of management. The sample was selected based on the list of companies listed on the Tehran Stock Exchange. Data were collected from the annual reports of each company registered in the official sources of the Tehran Stock Exchange (Codal site, Rahavard-e Nowin software, etc.). Companies that their financial information was incomplete during the analysis period were excluded. Thus, after systematic elimination, for a sample of 132 companies for years 2012 to 2018, a total of 924 observations were obtained:

1- Elimination of companies that have listed in stock exchange during research interval;
2- Elimination of companies that their fiscal year does not final day of the desired year
3- Elimination of non-manufacturing companies;
4. Elimination of companies with restated financial statements.

Research variables and models

Research variables are considered based on the interests of managers and shareholders, which are calculated as follows:

Interests (utility-outcome) of shareholders (U^s)

The company's annual return from eight months before the start of fiscal year to four months after that a criterion is considered for shareholder utility.

Interests (utility-outcome) of managers (U^m)

The result of dividing the board of directors' bonus by the net profit of the desired company for each company-year, which will be published in the financial statements of the following year

Financial reporting quality

This variable is a prominent characteristic of accounting information and the reason to select it is that all of its information relates to accounting and financial statements. It is also used in many foreign and domestic studies to measure the quality of accounting information. (Hsieh et al., 2019) quality of accruals is used to measure the quality of financial reporting.

$$\Delta WC_t = \alpha + \beta_1 CFO_{t-1} + \beta_2 CFO_t + \beta_3 CFO_{t+1} + \beta_4 \Delta REV_t + \beta_4 PPE_t + \varepsilon_t \quad (1)$$

In this equation:

ΔWC_t or working capital changes is accounts receivable (ΔAR) plus changes in inventory $(\Delta Inventory)$ and other current assets $(other\ Assets)$, minus changes in accounts payable (ΔAP).

$$\Delta WC_t = \Delta AR + \Delta Inventory - \Delta AP + otherAssete\left(net\right) \tag{2}$$

CFO is cash from operations that can be extracted from financial statements

$\Delta REVt$: Changes in sales of current year.

PPE_t : Amount of equipment, property and machinery of the current period.

All of the above variables are standardized using the average sum of assets. The standard deviation of the residual error of the mentioned model indicates the quality of accruals and lower number indicates the higher quality of financial reporting.

Accounting conservatism

In the present study, to measure accounting conservatism index, (Givoly & Hayn, 2000) model was used. The reason for selecting it was that the information of this model is all accounting information and is easily available in Iran and most of the studies conducted abroad (Abdoli, 2011) and (Hermalin & Weisbach, 2014) have also used this model. The conservatism index is calculated based on the model as follows:

$$\text{conservatism index} = \frac{\text{Operational accruals}}{\text{Total assets in the first period}} \times (-1) \tag{3}$$

According to (Givoly & Hayn, 2000), growth of accruals can be an index of a change in the degree of accounting conservatism over a long period of time. In other words, if accruals increase, conservatism decreases, and vice versa. Hence, to determine the direction of conservative changes, accruals multiply by -1.

Method of analysis

The 4x4 manager-shareholder matrix model, inspired by (Scott, 2003) manager-investor model, is presented in the following (Table 1):

Table 1. primary matrix of manager-shareholder game

Row		Shareholder (S)			
		Low reporting quality (s1)	High quality reporting (s2)	Low conservatism (s3)	High conservatism (s4)
Manager (M)	Low reporting quality (m1)	$(U^M_{m1s1} , U^S_{m1s1})$	$(U^M_{m1s2} , U^S_{m1s2})$	$(U^M_{m1s3} , U^S_{m1s3})$	$(U^M_{m1s4} , U^S_{m1s4})$
	high reporting quality (m2)	$(U^M_{m2s1} , U^S_{m2s1})$	$(U^M_{m2s2} , U^S_{m2s2})$	$(U^M_{m2s3} , U^S_{m2s3})$	$(U^M_{m2s4} , U^S_{m2s4})$
	Low conservatism (m3)	$(U^M_{m3s1} , U^S_{m3s1})$	$(U^M_{m3s2} , U^S_{m3s2})$	$(U^M_{m3s3} , U^S_{m3s3})$	$(U^M_{m3s4} , U^S_{m3s4})$
	High conservatism (m4)	$(U^M_{m4s1} , U^S_{m4s1})$	$(U^M_{m4s2} , U^S_{m4s2})$	$(U^M_{m4s3} , U^S_{m4s3})$	$(U^M_{m4s4} , U^S_{m4s4})$

In this model, manager (M) considers the strategies of low reporting quality (m1), high reporting quality (m2) and low conservatism (m3), high conservatism (m4) and shareholder (S), the strategies of low reporting quality (s1) and high reporting quality (s2), low conservatism (s3) and high conservatism (s4) and U^M represents manager utility (outcome) and U^S represents shareholder utility (outcome). The intersection of each of strategies forms a combined strategy that includes an outcome (return on utility or interest) for each player.

Step 1: Examining each player best response function

The first hypothesis, the second hypothesis, the third hypothesis, and the fourth to eleventh hypotheses of the research are analyzed by the method of the best response function and Mann-Whitney test, respectively. In general, the strategy $^*a$ is Nash equilibrium of each game, if the action of each player is the best response to the action of other players (a^*_{-i}). In other words, in any Nash equilibrium, each player is satisfied with its performance according to the selected strategy of others and has no motivation to violate (Fatemi Ardestani, 2012).

Finding the Nash equilibrium by Osborne two-step method (2002) will be possible as follows.

The function of the best response of player is in fact the best reaction of each player (to maximize utility) against the strategy selected by the other players. In other words, in any strategic game, the player i best response (BR) function is a function that is obtained for the strategy of other players based on the following equation:

$$BR_i\left(a_{-i}\right)=\left\{a_i\in A_i:u_i\left(a_i,a_{-i}\right)\geq u_i\left(a_i',a_i\right);\quad\forall a_i'\in A_i\right\} \qquad (4)$$

In general, the above algebraic definition shows the best response of player i to any strategy combination of the opposing player with $BR_i\left(a_{-i}\right)$. It implies that if competitors select a_{-i} or player i believes that competitors select a_{-i}, the best reaction of player i to it is the reaction that is manifested in the selection of player i. It is natural that the best response is to select the strategy that has the most outcomes for it (Abdoli, 2011).

Step 2: Examining the combination of strategies (Finding Nash Equilibrium)

Any combination of strategies in which Equation 2 applies is Nash equilibrium. At this stage, by focusing on outputs of the game, the motivation of each player to violate is examined based on the strategy of the opposing player. If the players are satisfied with their outcome in each outcome of the game or do not have a motivation to violate, Nash equilibrium is established.

$$a_i^*\in BR_i\left(a_{-i}^*\right)\qquad for\, i=1,...,N \qquad (5)$$

To compare the means of two independent groups, if the data of at least one of the groups are abnormal or the data are collected in ranks, the non-parametric test of Man-Whitney U is performed, although this test is also used when the data is normal. Due to the high power of the independent t-test, this test is performed to test the second to fifth hypotheses in SPSS software.

RESULTS

Descriptive statistic

(Table 2) presents the results of descriptive statistics of research variables for each hypothesis. The number of observations of each variable varies due to classifying levels of accounting conservatism and the quality of financial reporting in different states. Number of years- companies that are in the combination of (m1, s1), (m1, s2), (m2, s1), (m2, s2) strategies are 165, 274, 230 and 255, respectively. It means that most managers and shareholders have selected a combination of second and fourth strategies. For example, managers and shareholders in 165 companies-years have simultaneously selected m1 (low conservatism) and s1 (low reporting quality) strategies. The maximum interests obtained from this strategy combination are 391.2% for shareholders and 85.9% for managers. Also, the minimum interests obtained from this strategy combination are 3.8% loss for shareholders and 0% for managers. In all combinations, according to mean data, the highest shareholder interests belonged to the combined strategy of low conservative - high reporting quality (m1, s2) with an efficiency of 20.4% and the highest interests of managers belonged to combined strategy of high conservative - low reporting quality (m2, s1) with efficiency of 37.7%. The standard deviation also shows the rate of changes relative to the mean for each variable.

Table 2. Descriptive statistics of research variables

hypothesis	Strategy combination	mean	median	min	max	SD	Number of observations
Fourth	$U^M(m_1,s_1)$	185.0	146.0	0	912.3	305.0	165
	$U^M(m_2,s_1)$	204.0	142.0	0	743.6	462.0	274
	$U^M(m_3,s_1)$	285.0	106.0	0	805.2	205.0	225
	$U^M(m_4,s_1)$	135.0	246.0	0	523.5	501.0	175
Fifth	$U^M(m_1,s_2)$	098.0	046.0	0	295.4	328.0	230
	$U^M(m_2,s_2)$	145.0	073.0	0	875.5	496.0	255
	$U^M(m_3,s_2)$	105.0	123.0	0	105.5	396.0	232
	$U^M(m_4,s_2)$	145.0	051.0	0	025.5	286.0	255
Sixth	$U^M(m_1,s_3)$	245.0	151.0	0	125.3	206.0	255
	$U^M(m_2,s_3)$	105.0	241.0	0	042.3	386.0	320

	$U^M(m_3,s_3)$	075.0	081.0	0	005.4	156.0	225
	$U^M(m_4,s_3)$	095.0	041.0	0	015.2	154.0	165
Seventh	$U^M(m_1,s_4)$	195.0	041.0	0	013.4	254.0	274
	$U^M(m_2,s_4)$	175.0	142.0	0	215.4	352.0	175
	$U^M(m_3,s_4)$	104.0	201.0	0	025.3	151.0	230
	$U^M(m_4,s_4)$	087.0	072.0	0	415.2	206.0	165
Eighth	$U^S(m_1,s_1)$	232.0	131.0	038.0	773.0	282.0	165
	$U^S(m_1,s_2)$	102.0	251.0	051.0	703.0	182.0	230
	$U^S(m_1,s_3)$	325.0	148.0	018.0	779.0	152.0	255
	$U^S(m_1,s_4)$	289.0	115.0	032.0	701.0	189.0	274
Ninth	$U^S(m_2,s_1)$	202.0	151.0	161.0	773.0	182.0	274
	$U^S(m_2,s_2)$	262.0	242.0	077.0	814.0	194.0	255
	$U^S(m_2,s_3)$	326.0	311.0	127.0	859.0	197.0	175
	$U^S(m_2,s_4)$	331.0	215.0	087.0	809.0	297.0	165
Tenth	$U^S(m_3,s_1)$	336.0	301.0	187.0	850.0	357.0	225
	$U^S(m_3,s_2)$	326.0	325.0	047.0	809.0	557.0	232
	$U^S(m_3,s_3)$	306.0	412.0	077.0	812.0	751.0	225
	$U^S(m_3,s_4)$	277.0	173.0	107.0	982.0	318.0	230
Eleventh	$U^S(m_4,s_1)$	316.0	421.0	057.0	950.0	357.0	230
	$U^S(m_4,s_2)$	357.0	351.0	077.0	850.0	307.0	255
	$U^S(m_4,s_3)$	306.0	371.0	102.0	150.0	587.0	165
	$U^S(m_4,s_4)$	331.0	481.0	121.0	550.0	675.0	165

Inferential statistics

At this stage of study, Mann-Whitney U test was used to test the research hypotheses. The result of the Mann-Whitney U test is presented in (Table 3).

Table 3. Testing research hypotheses

Hypothesis	Strategy combination	Number of observations	Sum of ranks	Mean of ranks	Mann-Whitney U	Statistic Z	Probability of statistic z	Result
Fourth	(m_1,s_1)	165	31.224	37010	21894	552.-0	0.000	Confirmed
	(m_2,s_1)	274	14.223	39285				
	(m_3,s_1)	225	25.219	43087				
	(m_4,s_1)	175	41.217	59569				
Fifth	(m_1,s_2)	230	45.244	56224	28991	61631	0.000	confirmed
	(m_2,s_2)	255	241	61631				
	(m_3,s_2)	232	239.15	63025				
	(m_4,s_2)	255	238.05	59241				
Sixth	(m_1,s_3)	255	31.153	25329	11634	560.-6	001.0	confirmed

	(m_2,s_3)	320	92.148	52881				
	(m_3,s_3)	225	35.146	55321				
	(m_4,s_3)	165	37.143	50321				
Seventh	(m_1,s_4)	274	43.219	60124	22449	108.-7	008.0	confirmed
	(m_2,s_4)	175	45.217	63125				
	(m_3,s_4)	230	03.216	64028				
	(m_4,s_4)	165	49.214	67128				
Eighth	(m_1,s_1)	165	48.247	37045	25448	105.-6	581.0	rejected
	(m_1,s_2)	230	05.246	35125				
	(m_1,s_3)	255	25.243	34021				
	(m_1,s_4)	274	49.240	30128				
Ninth	(m_2,s_1)	274	48.267	54872	15432	142.-8	501.0	Rejected
	(m_2,s_2)	255	264.58	52809				
	(m_2,s_3)	320	261.76	49235				
	(m_2,s_4)	175	260.98	47185				
Tenth	(m_3,s_1)	225	40.247	58871	27432	235.-6	721.0	Rejected
	(m_3,s_2)	232	244.51	56804				
	(m_3,s_3)	225	241.56	51237				
	(m_3,s_4)	230	239.92	49187				
Eleventh	(m_4,s_1)	175	42.227	62705	20435	207.-7	523.0	Rejected
	(m_4,s_2)	255	224.55	59687				
	(m_4,s_3)	165	221.59	56041				
	(m_4,s_4)	165	219.97	53215				

The fourth to eleventh hypotheses are first analyzed. Then, using the results of the analysis of the fourth to eleventh hypotheses, the first, second and third hypotheses are analyzed.

Results of the Hypothesis 4

Hypothesis 4: By selecting a strategy of low reporting quality (s1) by the shareholder, the mean interest of managers in selecting any of the low reporting quality strategies (m1) and high reporting quality (m2), low conservatism (m3) and high conservatism (m4) is different.

The probability of statistic z is 0.000 as shown in (Table 4) and the null hypothesis of this test on equality of mean interests of managers is rejected given that the shareholder strategy is fixed. In other words, the research hypothesis that there is a difference in the mean interests obtained from selecting manager strategies in the presence of low reporting quality is confirmed. In fact, if the shareholder selects a low reporting quality strategy, the strategy of manager to report high or low quality and high or low conservatism will be different since significant difference will be observed in interests. Therefore, the value of gaining interests from $U^M m1s1$, $U^M m2s1$, $U^M m3s1$, $U^M m4s1$ strategies for manager is considered to be 2, 1, 1, and 1, respectively, to allow quantitative comparisons among strategies by the best response (BR) method.

$$U^M_{m1s1} = 2 \qquad U^M_{m2s1} = 1$$
$$U^M_{m3s1} = 1 \qquad U^M_{m4s1} = 1$$

Results of hypothesis 5

Hypothesis 5: By selecting a strategy of high reporting quality (s2) by the shareholder, the mean interest of managers in selecting any of the low reporting quality strategies (m1) and high reporting quality (m2), low conservatism (m3) and high conservatism (m4) is different.

The probability of statistic z is 0.000 as shown in (Table 4) and the null hypothesis of this test on equality of mean interests of managers is rejected given that shareholder strategy is fixed. In other words, the research hypothesis that there is a difference in the mean interests obtained from selecting manager strategies in the presence of high reporting quality is confirmed. In fact, if the shareholder uses a low reporting quality strategy, the strategy of manager to report high or low quality and high or low conservatism will be different since significant difference will be observed in interests. Therefore, the value of gaining interests from U^M_{m1s2}, U^M_{m2s2}, U^M_{m3s2}, U^M_{m4s2} strategies for manager is considered to be 1, 2, 1, and 1, respectively, to allow quantitative comparisons among strategies by the best response (BR) method.

$$U^M_{m1s2}=1 \qquad U^M_{m2s2}=2$$
$$U^M_{m3s2}=1 \qquad U^M_{m4s2}=1$$

Results of hypothesis 6

Hypothesis 6: By selecting a strategy of low reporting quality (s3) by the shareholder, the mean interest of managers in selecting any of the low reporting quality strategies (m1) and high reporting quality (m2), low conservatism (m3) and high conservatism (m4) is different.

The probability of statistic z is 0.001 as shown in (Table 4) and the null hypothesis of this test on equality of mean interests of managers is rejected given that shareholder strategy is fixed. In other words, the research hypothesis that there is a difference in the mean interests obtained from selecting manager strategies in the presence of low conservatism is confirmed. In fact, if the shareholder uses a low conservatism strategy, the strategy of manager to report high or low quality and high or low conservatism will be different since significant difference will be observed in interests. Therefore, the value of gaining interests from U^M_{m1s3}, U^M_{m2s3}, U^M_{m3s3}, U^M_{m4s3} strategies for manager is considered to be 1, 1, 2, and 1, respectively, to allow quantitative comparisons among strategies by the best response (BR) method.

$$U^M_{m1s3}=1 \qquad U^M_{m2s3}=1$$
$$U^M_{m3s3}=2 \qquad U^M_{m4s3}=1$$

Results of hypothesis 7

Hypothesis **7:** By selecting a strategy of high reporting quality (s4) by the shareholder, the mean interest of managers in selecting any of the low reporting quality strategies (m1) and high reporting quality (m2), low conservatism (m3) and high conservatism (m4) is different.

The probability of statistic z is 0.008 as shown in (Table 4) and the null hypothesis of this test on equality of mean interests of managers is rejected given that shareholder strategy is fixed. In other words, the research hypothesis that there is a difference in the mean interests obtained from selecting manager strategies in the presence of high reporting quality is confirmed. In fact, if the shareholder uses a high conservatism strategy, the strategy of manager to report high or low quality and high or low conservatism will be different since significant difference will be observed in interests. Therefore, the value of gaining interests from U^M_{m1s4}, U^M_{m2s4}, U^M_{m3s4}, U^M_{m4s4} strategies for manager is considered to be 1, 1, 1, and 2, respectively, to allow quantitative comparisons among strategies by the best response (BR) method.

$$U^M_{m1s4}=1 \qquad U^M_{m2s4}=1$$
$$U^M_{m3s4}=1 \qquad U^M_{m4s4}=2$$

Results of hypothesis 8

Hypothesis 8: By selecting a strategy of low reporting quality (m1) by manager, the mean interest of shareholders in selecting any of the low reporting quality strategies (s1) and high reporting quality (s2), low conservatism (s3) and high conservatism (s4) is different.

The probability of statistic z is 0.581 as shown in (Table 4) and the null hypothesis of this test on equality of mean interests of shareholders is rejected given that manager strategy is fixed. In other words, the research hypothesis that there is a difference in the mean interests obtained from selecting shareholder strategies in the presence of low reporting quality is rejected. In fact, if the manager uses a low conservatism strategy, the strategy of shareholder to report high or low quality and high or low conservatism will not be different since significant difference will not be observed in interests. Therefore, the value of gaining interests from U^M_{m1s4}, U^M_{m2s4}, U^M_{m3s4}, U^M_{m4s4} strategies for shareholder is considered to be 1, 1, 1, and 1, respectively, to allow quantitative comparisons among strategies by the best response (BR) method.

$$U^S_{m1s1}= 1 \qquad U^S_{m1s2}=1$$
$$U^S_{m1s3}= 1 \qquad U^S_{m1s4}=1$$

Results of hypothesis 9

Hypothesis 9: By selecting a strategy of high reporting quality (m2) by manager, the mean interest of shareholders in selecting any of the low reporting quality strategies (s1) and high reporting quality (s2), low conservatism (s3) and high conservatism (s4) is different.

The probability of statistic z is 0.501 as shown in (Table 4) and the null hypothesis of this test on equality of mean interests of shareholders is rejected given that manager strategy is fixed. In other words, the research hypothesis that there is a difference in the mean interests obtained from selecting shareholder strategies in the presence of high reporting quality is rejected. In fact, if the manager uses a low conservatism strategy, the strategy of shareholder to report high or low quality and high or low conservatism will not be different since significant difference will not be observed in interests. Therefore, the value of gaining interests from $U^S m2s1$, $U^S m2s2$, $U^S m2s3$, $U^S m2s4$ strategies for shareholder is considered to be 1, 1, 1, and 1, respectively, to allow quantitative comparisons among strategies by the best response (BR) method.

$$U^S_{m2s1} = 1 \qquad U^S_{m2s2} = 1$$
$$U^S_{m2s3} = 1 \qquad U^S_{m2s4} = 1$$

Results of hypothesis 10

Hypothesis 10: By selecting a strategy of low reporting quality (m3) by manager, the mean interest of shareholders in selecting any of the low reporting quality strategies (s1) and high reporting quality (s2), low conservatism (s3) and high conservatism (s4) is different.

The probability of statistic z is 0.721 as shown in (Table 4) and the null hypothesis of this test on equality of mean interests of shareholders is rejected given that manager strategy is fixed. In other words, the research hypothesis that there is a difference in the mean interests obtained from selecting shareholder strategies in the presence of low conservatism is rejected. In fact, if the manager uses a low conservatism strategy, the strategy of shareholder to report high or low quality and high or low conservatism will be not different since significant difference will be observed in interests. Therefore, the value of gaining interests from $U^S m3s1$, $U^S m3s2$, $U^S m3s3$, $U^S m3s4$ strategies for shareholder is considered to be 1, 1, 1, and 1, respectively, to allow quantitative comparisons among strategies by the best response (BR) method.

$$U^S_{m3s1} = 1 \qquad U^S_{m3s2} = 1$$
$$U^S_{m3s4} = 1 \qquad U^S_{m3s3} = 1$$

Results of hypothesis 11

Hypothesis 11: By selecting a strategy of high conservatism (m1) by manager, the mean interest of shareholders in selecting any of the low reporting quality strategies (s1) and high reporting quality (s2), low conservatism (s3) and high conservatism (s4) is different

The probability of statistic z is 0.523 as shown in (Table 4) and the null hypothesis of this test on equality of mean interests of shareholders is confirmed given that manager strategy is fixed. In other words, the research hypothesis that there is a difference in the mean interests obtained from selecting shareholder strategies in the presence of high conservatism is confirmed. In fact, if the manager uses a high conservatism strategy, the strategy of shareholder to report high or low quality and high or low conservatism will not be different, since significant difference will not be observed in interests. Therefore, the value of gaining interests from $U^S m4s1$, $U^S m4s2$, $U^S m4s3$, $U^S m4s4$ strategies for shareholder is considered to be 1, 1, 1, and 1, respectively, to allow quantitative comparisons among strategies by the best response (BR) method.

By testing the fourth to eleventh hypotheses, the conditions to analyze first, second and third hypotheses are provided. Before examining the best function of each player, a matrix model is presented.

Table 4. The final matrix of the manager-shareholder game

Row		Shareholder (S)			
		Low reporting quality (s1)	High reporting quality (s2)	Low conservatism (s3)	High conservatism (s4)
Manager (M)	Low reporting quality (m1)	1),(2	1),(1	1),(1	1),(1
	High reporting quality (m2)	1),(1	1),(2	1),(1	1),(1
	Low conservatism (m3)	1),(1	1),(1	1),(2	1),(1
	High conservatism (m4)	1) ,(1	1),(1	1),(1	1),(2

Step 1: Function of each player best response

1- In accordance with the fourth hypothesis of the study, if s1 (low reporting quality) is selected by the shareholder, m1 will be appropriate for the manager.

$$BR_m(s_1) = \{m_1\} \qquad (6)$$

2- In accordance with the fifth hypothesis of study, if s2 (high reporting quality) is selected by the shareholder, m2 will be appropriate for the manager.

$$BR_m(s_2) = \{m_2\} \qquad (7)$$

3- In accordance with the sixth hypothesis of study, if s3 (low conservatism) is selected by the shareholder, m3 will be appropriate for the manager.

$$BR_m(s_3) = \{m_3\} \qquad (8)$$

4-In accordance with the seventh hypothesis of study, if s4 (high conservatism) is selected by the shareholder, m4 will be appropriate for the manager

$$BR_m(s_4) = \{m_4\} \qquad (9)$$

5-In accordance with the eighth hypothesis of study, if m1 (low reporting quality) is selected by manager, S1, S2, S3, and S4 will be appropriate for shareholder.

$$BR_s(m_1) = \{s_1, s_2, s_3, s_4\} \qquad (10)$$

6-In accordance with the ninth hypothesis of study, if m2 (high reporting quality) is selected by manager, S1, S2, S3, and S4 will be appropriate for shareholder.

$$BR_s(m_2) = \{s_1, s_2, s_3, s_4\} \qquad (11)$$

7- In accordance with the tenth hypothesis of study, if m3 (low conservatism) is selected by manager, S1, S2, S3, and S4 will be appropriate for shareholder.

$$BR_s(m_3) = \{s_1, s_2, s_3, s_4\} \qquad (12)$$

8-In accordance with the tenth hypothesis of study, if m4 (high conservatism) is selected by manager, S1, S2, S3, and S4 will be appropriate for shareholder.

$$BR_s(m_4) = \{s_1, s_2, s_3, s_4\} \qquad (13)$$

Step 2: Investigating the combination of strategies (Finding Nash Equilibrium)
Any strategy combination in which Equation 5 applies is Nash equilibrium. Based on the final matrix, each strategy combination is examined:
1- Combination of strategies s1 and m1:

$$(m_1, s_1): m_1 \in BR_M(s_1) \, and \, s_1 \in BR_S(m_1) \qquad (14)$$

In this strategy combination, Equation 5 has been established. This type of strategy combination is called poor Nash equilibrium, because if the manager changes the strategy from m1 to m2 or m3 or m4 based on the shareholder strategy (s1), his interests will be less. Also, if the shareholder changes strategy from s1 to s2 or s3 or s4, his interests will remain unchanged, so he will not have motivation to violate his selected strategy.
2-Combinition of strategies s1 and m2:

$$(m_2, s_1): m_2 \in BR_M(s_1) \, and \, s_1 \in BR_S(m_2) \qquad (15)$$

In this combination, the strategy of Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m1 to m2 or m1 or based on the shareholder strategy (s1), his interests will be more. Also, if the shareholder changes strategy from s1 to s2 or s3 or s4 based on the shareholder strategy (s1), his interests will remain unchanged, so he will not have motivation to violate his selected strategy.
3-Combinition of strategies s1 and m3:

$$(m_3, s_1): m_3 \in BR_M(s_1) \text{ and } s_1 \in BR_S(m_3) \qquad (16)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m3 to m1 based on the shareholder strategy (s1), he will gain more interests, so he will have motivation to violate his selected strategy. Also, if shareholder changes strategy from s1 to s2 or s3 or s4 based on the shareholder strategy (s1), his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

4-Combinition of strategies s1 and m4

$$(m_4, s_1): m_4 \in BR_M(s_1) \text{ and } s_1 \in BR_S(m_4) \qquad (17)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m3 to m1 based on the shareholder strategy (s1), he will gain more interests, so manager will have motivation to violate his selected strategy. Also, if shareholder changes strategy from s1 to s2 or s3 or s4 based on the shareholder strategy (s1), his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

5-Combinition of strategies s2 and m1

$$\left(m_1, \ s_2\right): \ m_1 \in BR_M\left(s_2\right) \ and \ s_2 \in BR_S\left(m_1\right) \qquad (18)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m1 to m2 based on the shareholder strategy (s2), he will gain more interests, so manager will have motivation to violate his selected strategy. Also, shareholder changes strategy from s2 to s1 or s3 or s4 based on the manager strategy (m1), his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

6-Combinition of strategies s2 and m2

$$(m_2, s_2): m_2 \in BR_M(s_2) \text{ and } s_2 \in BR_S(m_2) \qquad (19)$$

In this strategy combination, Equation 5 has been established and this type of strategy combination is considered poor Nash equilibrium, because if the manager changes the strategy from m2 to m1 or m3 or m4 based on the shareholder strategy (s2), he will gain less interests, so manager will have motivation to violate his selected strategy. Also, if shareholder changes strategy from s2 to s1 or s3 or s4 based on the manager strategy (m1), his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

7-Combinition of strategies s2 and m3

$$(m_3, s_2): m_3 \in BR_M(s_2) \text{ and } s_2 \in BR_S(m_3) \qquad (20)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m3 to m2 based on the shareholder strategy (s2), he will gain less interests, so manager will have motivation to violate his selected strategy. Also, if shareholder changes strategy from s2 to s1 or s3 or s4 based on the manager strategy (m1), his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

8-Combinition of strategies s2 and m4

$$(m_4, s_2): m_4 \in BR_M(s_2) \text{ and } s_2 \in BR_S(m_4) \qquad (21)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m4 to m2 based on the shareholder strategy (s2), he will gain more interests, so manager will have motivation to violate his selected strategy. Also, if shareholder changes strategy from s2 to s1 or s3 or s4, his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

9-Combinition of strategies s3 and m1

$$(m_1, s_3): m_1 \in BR_M(s_3) \text{ and } s_3 \in BR_S(m_1) \qquad (22)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m1 to m3 based on the shareholder strategy (s2), he will gain more interests, so manager will have motivation to violate his selected strategy. Also, if shareholder changes strategy from s3 to s1 or s2 or s4, his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

10-Combinition of strategies s3 and m2

$$(m_2, s_3): m_2 \in BR_M(s_3) \, and \, s_3 \in BR_S(m_2) \qquad (23)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m2 to m3 based on the shareholder strategy (s2), he will gain more interests, so manager will have motivation to violate his selected strategy. Also, if shareholder changes strategy from s3 to s1 or s2 or s4, his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

11-Combinition of strategies s3 and m3

$$(m_3, s_3): m_3 \in BR_M(s_3) \, and \, s_3 \in BR_S(m_3) \qquad (24)$$

In this strategy combination, Equation 5 has been established and this type of strategy combination is considered poor Nash equilibrium, because if the manager changes the strategy from m3 to m1 based on the shareholder strategy (s3), he will gain more interests, so manager will not have motivation to violate his selected strategy. Also, if shareholder changes strategy from s3 to s1 or s2 or s4, his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

12-Combinition of strategies s3 and m4

$$(m_4, s_3): m_4 \in BR_M(s_3) \, and \, s_3 \in BR_S(m_4) \qquad (25)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m4 to m3 based on the shareholder strategy (s3), he will gain more interests, so manager will have motivation to violate his selected strategy. Also, if shareholder changes strategy from s3 to s1 or s2 or s4, his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

13-Combinition of strategies s4 and m1

$$(m_1, s_4): m_1 \in BR_M(s_4) \, and \, s_4 \in BR_S(m_1) \qquad (26)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m1 to m4 based on the shareholder strategy (s4), he will gain more interests, so manager will not have motivation to violate his selected strategy. Also, if shareholder changes strategy from s3 to s1 or s2 or s4, his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

14-Combinition of strategies s4 and m2

$$(m_2, s_4): m_2 \in BR_M(s_4) \, and \, s_4 \in BR_S(m_2) \qquad (27)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m2 to m4 based on the shareholder strategy (s4), he will gain more interests, so manager will not have motivation to violate his selected strategy. Also, if shareholder changes strategy from s3 to s1 or s2 or s4, his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

15-Combinition of strategies s4 and m3

$$(m_3, s_4): m_3 \in BR_M(s_4) \, and \, s_4 \in BR_S(m_3) \qquad (28)$$

In this strategy combination, Equation 5 has not been established and this type of strategy combination is not considered Nash equilibrium, because if the manager changes the strategy from m3 to m4 based on the shareholder strategy (s4), he will gain more interests, so manager will not have motivation to violate his selected strategy. Also, if shareholder changes strategy from s3 to s1 or s2 or s4, his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

16-Combinition of strategies s4 and m4

$$(m_4, s_4): m_4 \in BR_M(s_4) \text{ and } s_4 \in BR_S(m_4) \qquad (29)$$

DISCUSSION

In this strategy combination, Equation 5 has been established and this type of strategy combination is considered poor Nash equilibrium, because if the manager changes the strategy from m4 to m1 based on the shareholder strategy (s4), he will gain more interests, so manager will not have motivation to violate his selected strategy. Also, if shareholder changes strategy from s3 to s1 or s2 or s4, his interests will remain unchanged, so he will not have motivation to violate his selected strategy.

Given what was stated above, a strong Nash equilibrium is expected to be established between manager and shareholder, considering account accounting information and accounting conservatism. By examining the hypotheses and the final matrix of game, combining strategies of manager low quality reporting - shareholder low reporting quality (s1, m1), manager high reporting quality- shareholder high reporting quality (s2, m2), manager low conservatism- shareholder low conservatism (s3, m3), manager high conservatism –shareholder high conservatism (s4, m4) were selected as poor Nash equilibrium.

Results of examining first, second and third hypotheses. Since there was no Nash equilibrium in the combination of strategies of shareholder high reporting quality- manager high conservatism (s2, m4), the first hypothesis of the research is rejected. Since there is poor Nash equilibrium in combination of the strategies of shareholder high reporting quality and manager high reporting quality (s2, m2), the second hypothesis of the research is rejected. Since there is poor Nash equilibrium in combination of the strategies of shareholder high conservative - manager high conservatism (s4, m4), the third hypothesis of the research is rejected.

CONCLUSION

The aim of this study is to investigate the application of game theory in the interaction of accounting information characteristics and accounting conservatism and manager and shareholder reporting quality in the Tehran Stock Exchange. According to theoretical background of this study, conservatism is a limitation that reduces the opportunistic ability and willingness in managers. Conservatism in financial reporting can be an effective alternative to some of the c governing factors of company, since conservatism in managers' optimistic behavior reduces agency problems and neutralizes the manager biased behavior and limits the manager opportunistic payments and divides the value of company among all groups (manager and shareholder) and increases welfare of each group. Understanding the conservatism effect on earnings management through financial reporting is important for business managers. Moreover, its impact on the transparency of accounting information in the capital market also has a high importance. In the present study, we concluded that combination of strategies of manager low quality reporting- shareholder low reporting quality (s1, m1), manager high reporting quality- shareholder high reporting quality (s2, m2), manager low conservatism-shareholder low conservatism (s3, m3), manager high conservatism- shareholder high conservatism (s4, m4) were selected as poor Nash equilibrium, because, if the manager changes the strategy, his interests will reduce. However, if the shareholder changes strategy, his interests will remain unchanged. By examining the hypotheses in any of strategy combinations, manager and shareholder do not gain complete satisfaction, meanings that a strong Nash equilibrium has not been observed .The results of inferential statistics show that in contrast to prediction of game in Tehran Stock Exchange, most managers and shareholders select a combination of strategies (s1, m1), (s2, m2), (s3, m3) and (s4, m4) and with the cooperative appearance of relationships, each seeks to maximize personal interests. However, in other combinations, Nash equilibrium is not established. Based on the results of this study, the conflicts and balances of game in accordance with the view of (Wan, 2014) and (Arab Kiasari & Abdi, 2015) confirms the cooperative nature of game. It is related to studies conducted by (Hill & McDonnell, 2015) and (Meshki & Fattahi, 2011) on the use of accounting conservatism to provide high reporting, to help managers and investors to implement them.

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