

## **The Impact of Audit Committee and Its Characteristics on the Firms' Information Environment**

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(Received: April 16, 2017; Revised: July 27, 2017; Accepted: August 5, 2017)

### **Abstract**

The present study aims at investigating the impact of the presence of audit committee and its characteristics on the corporate information environment. These characteristics include independence, financial expertise, size, and the gender of the audit committee. Although several methods have been discussed for measuring information environment in the accounting and finance literature, this research is pioneer in developing a comprehensive index using mathematical method to measure information environment. Given this fact, the impact of the presence of audit committee on information environment during 2008-2015, which was the period before and after the approval of the internal control guidelines, was investigated. The results of analyzing the data collected from 41 firms using panel data technique point to a positive relationship between the presence of audit committee and information environment. In addition, the impact of the audit committee characteristics on information environment during 2012-2015 and after the approval of guidelines was examined. The results of analyzing 121 firms using panel data technique indicate that independence and financial expertise are positively associated with information environment. However, no significant relationship was found between other characteristics and information environment.

### **Keywords**

Audit committee, Audit committee characteristics, Comprehensive index of information environment, Corporate governance, Firms' information environment.

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This article is derived from P.H.D candidate student thesis.

## **Introduction**

Information environment (IE) includes public and confidential information that is available to the capital market through mandatory and voluntary disclosure (Siregar & Utama, 2008; Beyer et al., 2010; Armstrong et al., 2012; Robin & Wu, 2015). If IE of a firm does not have enough transparency, some individuals like managers are likely to enjoy more information advantages than others (Bhattacharya et al., 2013). On the other hand, the importance of information environment for investors persuade firms to seek to improve it.

To provide a strong information environment and improve information transparency, various mechanisms like promoting corporate governance were offered in the financial and accounting literature. Therefore, the ongoing research aims at presenting an appropriate index for information environment and then investigating the role of audit committee, as a corporate governance mechanism, in improving it. Thus, the current research seeks to know whether audit committee has triggered any reduction in information asymmetry among firms, and thereby improving their information environment. In that case, what was the impact? And, do the characteristics of audit committee have any significant effects on the information environment of the firms? The results reveal that audit committee plays a key role in improving the transparency of information environment and promoting the financial information transparency, which in turn enhance market liquidity. Moreover, the researchers found evidence of the influence of audit committee on the improvement of IE.

This study plans to employ the multi-criteria decision-making model to offer a new index for evaluating the information environment of firms. This index is expected to capture all factors affecting the IE of firms. Also, it helps the stakeholders and investors to understand IE of firms as well as the quality of IE to manage to establish an optimal portfolio.

In response to the research questions, given the intangibility of information environment, financial literature introduces various

criteria to proxy for information environment of firms (Clarke & Shastri, 2000). In an attempt to develop a comprehensive criterion that encompasses all the indices, this research is the first of its kind to employ mathematical methods to present a unique and comprehensive index for IE. Given the novelty of the debate over presenting a comprehensive index for information environment of firms and the recent establishment of audit committees, very little research has been reported on this issue. This research is the first of its kind in Iran to offer an index for firms' information environment. Having applied the obtained index, the researchers try to identify the information environment of the selected firms and, given that audit committee is a novel issue, especially in Iran (less than 4 years old), finally investigate the role of audit committee in improving this environment. It also provides a reexamining tool for previous studies on information environment and paves the way for scholars to find evidence about corporate governance and audit committee's effects on the emerging markets such as Iran. Taking into account this purpose, the rest of this paper is arranged as follow: Section 2 discusses how to describe the previous literature related to a problem and also presents the theoretical foundations. The research methodology is presented in Section 3, which is followed by a discussion of how to state the main technical results in Section 4. Section 5 gives insights on how to discuss the results provided in the previous section and then provides some final conclusions. The final parts are devoted to recommendations for future studies and research limitations.

## **Theoretical Framework and Literature Review**

### **Information Environment**

Transition from industry age to information age has emphasized the importance of information in the decision-making process. Therefore, information is considered a valuable asset that generates competitive advantage for its owners (Bellver & Kaufmann, 2005). Weick (1969) calls the external environment an "information environment" in which organizations try to explain and interpret available ambiguities.

The aim of establishing accounting information systems is to offer an environment to provide necessary information and eliminate information error risk. Although accounting standards and auditors are the essential elements for eliminating the information gap between managers and owners, filling this gap is not easily accomplished, and for this reason, the researchers expect transparent IE to help fill this gap and improve financial reporting which finally attract potential investors and reduce the cost of capital. As a result, the reduction of the cost of capital improves the growth and profitability of firms. Firms' effort to improve their IE leads to reducing information gap between the informed and uninformed investors. According to the new theory, the conflict of interests between managers and owners results from separation of ownership and management and leads to agency cost, thereby creating a weak information environment in firms (Watts & Zimmerman, 1986). The higher the conflict of interests is, the greater the information asymmetry and the weaker information environment are. Improper information environment, together with asymmetric information, discourage investors to participate in capital market, prevent optimal resource allocation and finally increase the cost of capital. Therefore, understanding how much a firm's information environment is asymmetric is of paramount importance.

### **Information Environment and Audit Committee**

Undoubtedly, one of the important changes in the industrial revolution in the world was the emergence of big corporations and separation of managers and owners. As a result, the corporations have become a place for assembling of stakeholders and stockholders. The results of these changes have led to the creation of regulated market, and finally the concentration of capitals and directing them to the big firms was facilitated. With respect to the above discussion, according to the contract theory, conflict of interests was created and finally the issue of corporate governance was brought up. In order to increase the credibility and transparency of financial information and reports, as well as to help managers, different rules for corporate governance were issued in Europe in the 90s. In 2004, the Organization for Economic Cooperation and Development (OECD) released revised

principles for corporate governance. These principles include: 1. fairness, 2. transparency, 3. accountability, and 4. responsibility. The centrality of corporate governance is monitoring the performance of the company. In addition, transparency in the market means the ability of the market to oversee the real activities of firms. Therefore, transparency is one of the elements of corporate governance which shows the responsibility of managers. Also, to have a strong IE and improve information transparency, several methods have been presented in the accounting and finance literature, among which promotion of corporate governance has attracted a lot of attention. According to this reasoning, audit committee is considered one of the vital parts.

The role and relationship among audit committee members, auditor and board of directors indicate how they try to protect their shareholders. In this regard, board of directors communicates with audit committee and try to fulfill their duties. On the other hand, audit committee monitors the firms' control activities, and with these critical views, it questions the management judgment in their performance. With these duties, it can improve the independence of the external auditor and the position of internal auditor. The process is expected to improve the usefulness of information in all of the organization. Moreover, audit committee is one of the corporate governance mechanisms which is expected to protect the interests of various users of accounting information. This committee can help prevent illegal activities, improve financial reporting and present transparent and reliable financial reports and information. On top of these in the accounting literature, the audit committee is called a monitoring tool to improve providing information about financial positions, financial performance, financial flexibility, and information environment. According to previous studies, researchers found that the presence of the audit committee can increase the accuracy and quality of financial and accounting information, and developing transparent financial information allows for better controlling of manager's accountability in appropriate disclosure and improving financial reporting quality (Pucheta-Martinez & De Fuentes, 2007). Generally,

an audit committee is an operating committee which is mostly composed of the members of the company's board of directors, but specifically, in Iran, it consists of three to five non-executive directors to guarantee and enhance shareholders and investors' interests and acts as a controlling mechanism to lessen the information asymmetry between shareholders and other stakeholders (Takhtayi et al., 2011; Wang et al., 2016). On the other hand, various characteristics of audit committee such as independence, financial expertise, committee size, and gender of audit committee are expected to make this committee more effective and they cause to decrease the information asymmetry and improve the IE. These characteristics will be discussed in the following:

**Audit committee independence.** Audit committee independence is one of the most important characteristics of an audit committee, necessarily influencing the effectiveness of the committee in controlling financial reporting. The importance of audit committee independence is rooted in regulatory codes requiring an audit committee to be composed of non-executive directors, because independence of audit committee member increases the effectiveness of audit committee.

**Financial expertise.** The financial expertise of the audit committee members is closely related to the effectiveness of the committee and has drawn a lot of attention. Previous studies indicate that financial skills and experience of audit committee members directly influence the effectiveness of the audit committee (Pucheta-Martinez & De Fuentes, 2007), and finally improve the IE.

**Audit committee size.** The audit committee size can greatly affect the audit committee so that large audit committees with different expertise impose more effective control over financial reporting (Fakhari et al., 2015). When the size of audit committee increases, the effectiveness of audit committee improves.

**Gender of audit committee.** according to the agency theory, difference in gender can decrease the effectiveness of audit committee. In contrast, the opponents believe the existence of women in the audit committee decreases the opportunistic behaviors and

financial misstatements (Gul et al., 2011). The prior research about gender shows that women are concentrative and riskless and more ethical (Levin et al., 1993; Powell & Anisc, 1997).

As stated before, very little attention is paid to the issue of finding a comprehensive index for information environment of firms and empirical investigation of the effects of audit committee on this environment. Nevertheless, a stream of research which have separately employed the variables of the current study are presented as follow:

Leuz and Verrecchia (2000) in their study of “Economic Consequences of Increased Disclosure” employed bid-ask spread and share turnover indices to measure the information Asymmetry. Richardson (2000) studied “Information Asymmetry and earning Management” and used bid-ask spread and distribution of analysts’ earnings forecast to measure information asymmetry. Abbott et al. (2004) examined the relationship between audit committee characteristics and financial misstatement. Their findings revealed that audit committee independence and the number of audit committee meetings held at least four times per year have an inverse association with financial restatement. They also found that lack of financial expertise among audit committee members is directly associated with financial reporting restatement. Petersen and Plenborg (2006) examined the effect of voluntarily disclosure on information asymmetry of the industrial firms listed in Copenhagen Stock Exchange. This study also employed bid-ask spread and turnover ratio to measure the information asymmetry. In an article named “Does Good Corporate Governance Reduce Information Asymmetry around Quarterly Earnings Announcements?”, Kanagaretnam et al. (2007) used bid-ask spread to measure the information asymmetry. Bhattacharya et al. (2013) examined the relationship between earnings quality and corporate information asymmetry. They used bid-ask spread to measure the information asymmetry.

Armstrong et al. (2011) investigated the effect of information asymmetry on the cost of capital. They employed five different variables, two of which are market oriented, two of which are

accounting-oriented and the last one is analysts to compute the information asymmetry. Armstrong et al. (2012) studied “When Do Independent Directors Improve Firms’ Information Environments?” In summary, their results are consistent with the interpretation that an exogenous increase in the proportion of independent directors results in improvements in transparency. Fu et al. (2012) examined the effect of financial reporting frequency on information asymmetry and the cost of equity. They used bid-ask spread and share illiquidity to compute the information asymmetry. El-Mahdy et al. (2013) studied the connection between audit-committee expertise and independence and asymmetric information in the U.S. equity market. They reported consistent and strong evidence that independence of audit-committee members is significantly and negatively associated with information asymmetry for large accelerated filers. Likewise, they found that the existence of an audit committee with financial expertise is negatively associated with information asymmetry and therefore, both of them have a positive relationship with the firm’s information environment. Hisham et al. (2014) considered the effect of audit committee characteristics on voluntary disclosure of 146 firms listed in the Malaysia Stock Exchange. Having employed variables like audit committee independence, number of committee meetings and its size, they detected a significant relation between committee independence and voluntary disclosure, yet number of committee meetings and committee members’ expertise had no effect on voluntary disclosure.

Abernathy et al. (2014) investigated whether audit committee characteristics, audit committee chairs, and accounting expertise are associated with financial reporting timeliness. They considered audit committee independence, its expertise and size as the committee characteristics. Their results indicate a significant relationship between audit committee characteristics and financial reporting timeliness, while no significant association was proved between audit committee chairs with accounting expertise and financial reporting timeliness. De Vlaminc and Sarens (2015) conducted a research on “the Relationship between Audit Committee Characteristics and Financial Statement Quality: Evidence from Belgium” during the



years 2004-2009. The results of their study carried out on 60 firms point to a significant relationship between audit committee characteristics including committee independence, its size and number of meetings with financial reporting quality. Wang et al. (2016) carried out a study entitled "Relations among Audit Committee Establishment, Information Transparency and Earnings Quality: Evidence from Simultaneous Equation Models". Their findings reported a significant relation between establishment of audit committee and information transparency and earnings quality. The results of simultaneous equations model suggest positive and interactive effects resulting from establishment of audit committee, information transparency and earnings quality. Cai et al. (2015) examined the impact of firms' asymmetric information on its choice of three mechanisms of corporate governance including the intensity of board monitoring, the exposure to market discipline, and CEO pay-for-performance sensitivity. In their study, the information asymmetry index is considered in ranking form and based on firm size, Tobin's Q, number of firm's analysts, analysts forecast error, R&D expenses and number of shareholders. They found that firms encountering greater asymmetric information are more likely to use less intensive board monitoring but rely more on market discipline and CEO incentive alignment. Having considered a long history of foreign studies, the researchers present the following Iranian research to shed some insightful lights on the issue.

Babajani and Khonaka (2012) examined the necessity to establish audit committee and internal audit unit in the municipalities of the megacities to promote the accountability. Their findings indicated that establishing audit committee and internal audit unit in the municipalities of the megacities promote the financial and operational accountability level of these institutions. Kokabi et al. (2015) investigated the effect of internal audit efficiency and audit committee on financial restatements. Their findings point to an inverse relationship between internal audit efficiency and audit committee and financial restatement. Royaie and Ebrahimi (2015) examined the impact of audit committee characteristics on voluntary ethics

disclosure. Having studied various characteristics including independence, expertise, number of meetings and committee size, the researchers found that only two characteristics, namely audit committee independence and its members' expertise influence the voluntary ethics disclosure. Fakhari et al. (2015) developed a study to examine the effect of audit committee characteristics on earnings management through actual items. They documented a significant link between audit committee and earnings management through actual items.

Reviewing Iranian and foreign literature reveals that various factors are adopted to measure the information asymmetry. Additionally, audit committee is proved to be one of the most important factors of corporate governance influencing the information environment of firms. Corporate governance has a major role in promoting information environments. Strong corporate governance mechanisms such as audit committee and its characteristics will curb the managerial opportunistic behaviors, fortify effective internal control and ensure the reliability of financial reporting and accounting information. The quantity and quality of the information disclosed is influenced by firms' governance structure and mechanisms. A strong corporate governance system can hinder managers in their effort to commit agency problems and opportunistic financial reporting behaviors, improve the effectiveness of internal control and external monitoring, and ensure the transparency and reliability of information disclosure (Bhagat & Bolton, 2008; Lo et al., 2010; Song et al., 2010). Regarding the novelty of audit committee in Iran, this study aims to measure the information environment index of the listed firms and then test the influence of audit committee and its characteristics on this environment. Accordingly, the following main hypothesis is formulated:

**H:** Audit committee influences the information environment of the firms listed in the TSE.

And sub hypotheses are:

**H<sub>1</sub>.** The existence of audit committee affects the information environment of the firms listed in the TSE.

**H<sub>2</sub>**. Characteristics of audit committee affect the information environment of the firms listed in the TSE.

And sub hypotheses of second hypothesis (Characteristics) are:

**H<sub>2a</sub>**. Independence of audit committee affects the information environment of the firms listed in the TSE.

**H<sub>2b</sub>**. Financial expertise of audit committee affects the information environment of the firms listed in the TSE.

**H<sub>2c</sub>**. Size of audit committee affects the information environment of the firms listed in the TSE.

**H<sub>2d</sub>**. Gender of audit committee impacts the information environment of the firms listed in the TSE.

## **Methodology**

Adopting a combination of quantitative and qualitative methods, this research is an ex-post facto and quasi-experimental study which falls within the domain of positive accounting research. The initial sample includes all the TSE databases from firm-years between 2008 and 2015 that meet the following criteria: 1. They have established their audit committee based on the internal guidelines of the TSE since 2012; 2. They were listed in Tehran Stock Exchange prior to 31 March, 2008; 3. To increase comparability, their fiscal year ended in March and there are no changes in their fiscal year or activities happened during this period; 4. Necessary information is available to compute the research variables. With these criteria, the final sample includes 328 firm-year observations from 2008 to 2015 (in 2012 audit committee was formed) to evaluate the first model, which was the period before and after the approval of the internal guidelines. Moreover, 484 firm-year observations were selected as a sample to evaluate the second model (impact of the audit committee characteristics on the IE during 2012-2015 after the approval of guideline). The required information is collected from the Rahavard Novin software and financial statements presented in the website of Tehran Stock Exchange. Analysis of the information was done with the help of Eviews and Stata software and Excel. To test the hypothesis, the multi-variable analysis of regression is used, to

examine the significance of the regression model, F-statistic is applied, and to analyze the value of the independent variables, t-statistic is employed. Dependence of the residual is evaluated by using the Durbin-Watson statistic. The used multiple regression method is the Panel Least Square data analysis which used cross sectional and time series data.

### Research Models

In this research, weighted composite index is adopted to evaluate the information environment of the firms before and after establishing audit committee, the research is conducted during an eight-year period (2008-2015), consisting of four years before establishing audit committee and four years after establishing audit committee. The research models are presented as follow:

Model 1: to test the first hypothesis

$$IE-Index_{it} = \beta_0 + \beta_1 AFTER_t + \sum_{j=2}^n \beta_j controls + \varepsilon_{it} \quad (1)$$

Model 2: Testing the second hypothesis

$$IE-Index_{it} = \beta_0 + \beta_1 ACIND_{it} + \beta_2 ACEXP_{it} + \beta_3 ACSIZE_{it} + \beta_4 ACGEN_{it} + \sum_{j=5}^n \beta_j controls + \varepsilon_{it} \quad (2)$$

where

- $IE-Index_{it}$  is equal to information environment index for firm  $i$  in year  $t$
- $AFTER$  is equal to the presence of audit committee
- $ACIND_{it}$  is equal to audit committee independence
- $ACEXP_{it}$  is equal to audit committee expertise
- $ACSIZE_{it}$  is equal to audit committee size
- $ACGEN_{it}$  is equal gender of audit committee.

### Introducing Variables

#### Dependent variable

**Information environment index.** To measure the dependent variable, that is information environment, various measures were suggested in

the literature. Since the level of information environment is qualitative and hence directly unobservable, the researchers employ some index variables to proxy for it. To do so, this study uses weighted composite index and after determining factors influencing information environment and determining their weights by experts.

The following steps are taken to provide a comprehensive index for measuring the corporate information environment.

- Examining the Iranian and foreign literature for factors affecting corporate information environment and then choosing ones which comply with the Iranian firms' information environment.
- Preparing a researcher-made questionnaire and distributing it among experts to ask about the weight and importance of the information environment criteria using multivariate decision-making model.
- Collecting the required data using databases to measure the criteria influencing the firms' information environment.
- Measuring the criteria affecting the firms' information environment and gathering the distributed questionnaires.
- Explaining the model of measuring the comprehensive index of information environment using the criteria affecting it.

To explain the information environment quality of the selected firms, 10 factors including firm size, institutional ownership, growth opportunities, age, bid-ask spread, number of shareholders, management earnings forecast errors, stock turnover, stock returns volatility and firm's stock illiquidity are employed based on the Iranian and foreign literature.

It is noteworthy that different environments and conditions may require the application of other variables, and these ten factors, as stated before, are selected with respect to Iran's conditions and information environment.

The required data were extracted from Rahavard Novin software and the website of the TSE. To weigh the mentioned criteria, experts' opinions were obtained. Accordingly, the electronic questionnaire which contained 10 questions for 10 criteria was sent to 30 academic and professional experts including faculty members, directors,

financial analysts and brokers to weigh the 10 criteria influencing the firms' information environment. Then, the questionnaires were collected and analyzed based on Shannon's Entropy technique. It should be noted that the Alpha Cronbach's coefficient of the questionnaire is 0.711, thereby verifying its validity and reliability.

**Shannon's Entropy technique.** to weigh the criteria affecting the firms' information environment, the following steps are required to be taken (Makouei, 2008):

- Step 1:** The decision matrix of the indices is determined.
- Step 2:** The data obtained from the matrix are normalized.
- Step 3:**  $E_j$  shows the entropy of the feature  $j$ .
- Step 4:**  $E_j$  is used to calculate the value of  $d_i$  for each of the characteristics.
- Step 5:** The weight of dimensions, criteria and variables are obtained.

Following the above steps, the criteria are weighed as Table 1:

**Table 1. The degree of the importance of the information environment criteria based on the entropy**

Influencing factors	Number of shareholders	Age	Institutional ownership	Earning forecast error	Stock returns volatility	Growth opportunities	Firm size	Stock illiquidity	Stock turnover	Bid-ask spread
$E_j$	0.974	0.955	0.960	0.964	0.966	0.946	0.953	0.960	0.953	0.951
$d_j=1-E_j$	0.026	0.045	0.040	0.036	0.034	0.054	0.047	0.040	0.047	0.049
$W_j$ (weighed)	0.063	0.107	0.095	0.085	0.082	0.129	0.112	0.096	0.113	0.117

Having weighed the criteria affecting the firms' information environment, the second research question regarding the development of a comprehensive index for measuring the information environment is answered.

### **The proposed model for measuring the firms' information environment**

The current research uses Weighted Composite Index to measure the firms' information environment. To do so, three hypotheses were

developed. First, the additivity principle is employed to measure the information environment, the information environment equals the sum of factors affecting it. In other words, the factors are added together based on a principle and then determine the information environment. Second, the effects of the criteria on the information environment are determined based on their weights calculated in the previous section. Third, the necessity for normalizing the effect of the criteria on the information environment is to set a maximum or minimum range for measuring the information environment. Given the above discussion, the following model is proposed for measuring the information environment.

The following model is presented to compute the information environment.

$$IEI_{it} = \sum_{s \in S} W_{s \ i \ t} \frac{P_{s \ i \ t}}{\max_{1 \leq i \leq N} \{P_{s \ i \ t}\}} + \sum_{k \in K} W_{k \ i \ t} \frac{\max_{1 \leq i \leq N} \{P_{k \ i \ t}\} - P_{k \ i \ t}}{\max_{1 \leq i \leq N} \{\max_{1 \leq i \leq N} \{P_{k \ i \ t}\} - P_{k \ i \ t}\}} \quad (3)$$

where

- IE-Index it is the information environment index of firm  $i$  in year  $t$
- $N$  is number of firms
- $S$  is index of the factors that have a direct relationship with the information environment
- $K$  is index of the factors that have an inverse relationship with the information
- $W_{j \ i \ t}$  is the weight of factor  $j$  for firm  $i$  in year  $t$ .
- $P_{j \ i \ t}$  is value of factor  $j$  for firm  $i$  in year  $t$ .

Clearly, if  $M$  is the total number of factors that affect the information environment, then  $M = |S| + |K|$ . Where  $|S|$  Monitors the number of elements of  $S$  and  $|K|$  the display elements  $K$  is set.

**Theorem 1.** Assume the followings for firms "a" and "b"

$$P_{s \ a \ t} \leq P_{s \ b \ t} \quad \forall s \in S \quad \text{And} \quad P_{k \ a \ t} \leq P_{k \ b \ t} \quad \forall k \in K$$

Then  $IEI_{at} \leq IEI_{bt}$

**Theorem 2.** Let's have for firm "a"  $0 \leq IEI_{at} \leq 1$

**Argument.** to prove Theorem (1), it is obvious that if  $P_{s \ a \ t} \leq P_{s \ b \ t}$ ,

$$\text{Then } \frac{P_{sbt}}{\max_{1 \leq i \leq N} \{P_{sit}\}} \leq \frac{P_{sat}}{\max_{1 \leq i \leq N} \{P_{sit}\}}$$

$$\text{If } P_{kat} \leq P_{kbt}$$

$$\text{Then } \max_{1 \leq i \leq N} \{P_{kit}\} - P_{kat} \leq \max_{1 \leq i \leq N} \{P_{kit}\} - P_{kbt}$$

$$\text{So } \frac{\max_{1 \leq i \leq N} \{P_{kit}\} - P_{kbt}}{\max_{1 \leq i \leq N} \{\max_{1 \leq i \leq N} \{P_{kit}\} - P_{kbt}\}} \leq \frac{\max_{1 \leq i \leq N} \{P_{kit}\} - P_{kat}}{\max_{1 \leq i \leq N} \{\max_{1 \leq i \leq N} \{P_{kit}\} - P_{kat}\}}$$

$$\text{And since } W_{jat} \geq 0$$

$$\text{So } IEI_{at} \leq IEI_{bt}$$

To prove the second theorem, it is obvious that  $IEI_{at} \geq 0$

$$P_{sat} \leq \max_{1 \leq i \leq N} \{P_{sit}\} \quad \forall s \in S \quad \text{And then } \frac{P_{sat}}{\max_{1 \leq i \leq N} \{P_{sit}\}} \leq 1$$

$$\text{On the other hand } \max_{1 \leq i \leq N} \{P_{kit}\} - P_{kat} \leq \max_{1 \leq i \leq N} \{\max_{1 \leq i \leq N} \{P_{kit}\} - P_{kit}\}$$

$$\text{So } \frac{\max_{1 \leq i \leq N} \{P_{kit}\} - P_{kat}}{\max_{1 \leq i \leq N} \{\max_{1 \leq i \leq N} \{P_{kit}\} - P_{kit}\}} \leq 1 \quad \text{and so}$$

$$\begin{aligned} IEI_{at} &= \sum_{s \in S} W_{sat} \frac{P_{sat}}{\max_{1 \leq i \leq N} \{P_{sit}\}} + \sum_{k \in K} W_{kat} \frac{\max_{1 \leq i \leq N} \{P_{kit}\} - P_{kat}}{\max_{1 \leq i \leq N} \{\max_{1 \leq i \leq N} \{P_{kit}\} - P_{kit}\}} \\ &\leq \sum_{s \in S} W_{sat} + \sum_{k \in K} W_{kat} \end{aligned}$$

$$\text{And since } \{1, 2, 3, \dots, M\} = S \cup K \text{ and also } \sum_{1 \leq j \leq M} W_{jat} = 1$$

$$\text{Then } \sum_{s \in S} W_{sat} + \sum_{k \in K} W_{kat} = 1$$

$$\text{So } IEI_{at} \leq 1$$

**Considerations.** Theorem 1 indicates that the information environment has monotonicity, that is for each firm with ordering elements, information environment is arranged based on the order of elements. This comparability of the two firms based on the elements justifies the information environment. Moreover, Theorem 2 shows that the information environment resulting from the research model is bounded, and thereby reliable for evaluating a sample of firms.

### Factors that influence the information environment

**A) Bid-ask spread.** higher levels of information asymmetry (informed transaction) is directly associated with higher bid-ask



spread (Bhattacharya et al., 2013), and that is why bid-ask spread was introduced as an inverse criterion for information environment in the previous studies (First factor).

$$SPREAD_{i,t} = \frac{1}{D_{i,t}} \sum_1^{D_{i,t}} \frac{(ASK_i - BID_i)}{(ASK_i + BID_i)/2} \quad (4)$$

**B) Share turnover.** Firms with high information asymmetry show lower share turnover since uninformed traders knowing the harmful consequences of transacting with informed traders are less likely to trade shares of these firms (Liao, 2009). Therefore, share turnover is known as a direct measure of information environment (Mohd, 2005). Typically, share turnover is calculated as follow (Second factor):

$$share\ turnover_{i,t} = \frac{1}{D_{i,t}} \sum_1^{D_{i,t}} \frac{shares\ traded_i}{Shares\ Outstanding_i} \quad (5)$$

**D) Amihud illiquidity measure.** This measure shows the daily price response associated with one Rial of the trading volume. Amihud measure intends to capture price impact through the ratio of absolute return to the trading volume. It is interesting to note that higher transparent information environment reduces the information asymmetry of market, yet increases share liquidity. Therefore, Amihud illiquidity ratio acts as an inverse measure of information environment and is computed as follow (Third factor):

$$ILLIQ_{i,t} = \frac{1}{D_{i,t}} \sum_1^{D_{i,t}} \frac{|R_i|}{VOL_i} \quad (6)$$

**E) Firm size.** according to Wasan and Boone (2010), and Attig et al. (2006), larger firms enjoy more transparent information environment due to the wider media coverage and more attention paid by market, lawmakers, and market analysts to it. On the other hand, small firms with fewer confidants try to preserve their classified information, thereby having more asymmetric information environment. Therefore, information environment is expected to

improve with increasing firm size, which is considered as a direct measure of information environment. Following Cai et al. (2015), this study employs total assets of a firm to compute firm size (Fourth factor).

**F) Growth opportunities.** Liao (2009) believed that firms with more appropriate growth opportunities enjoy more competitive advantages like unique products and major share in market. To preserve these competitive advantages and prevent startups from entering these markets or reduce competition with existing competitors, therefore, these firms do not tend to disclose their operational information. Accordingly, firms with higher growth opportunities are likely to face with more asymmetric information environment. These growth opportunities are included as an inverse measure of information environment within the firm. Following McLaughlin et al. (1998), and Frank and Goyal (2003), as well as Clarkson et al. (2007), and Cormier et al. (2009), this research uses market-to-book value ratio and Tobin's Q, respectively to measure growth opportunities and information environment of the firms (Fifth factor).

**G) Stock return volatility.** Stock return volatility is an instrument used to measure the risk of future changes in stock returns. Market makers' stocks experience more difficulties with increasing risk, thereby leading them to increase bid-ask spread to compensate the cost of preserving stocks. Accordingly, stock return volatility is positively linked to bid-ask spread, thus is regarded as an inverse measure of information environment. This study uses standard deviation of daily stock return to compute stock return volatility as follow (Sixth factor):

$$Volatility_{it} = \sqrt{\frac{1}{D_{it}-1} \sum_1^{D_{it}} (R_i - \bar{R})^2} \quad (7)$$

**H) Earnings forecast error.** As transparency increases, the accuracy of earnings forecast increases too, yet forecast errors decreases. In fact, firms with weak levels of information environment experience higher stock forecast error, thereby resulting in higher

information asymmetry. Thus, this factor is involved as an inverse measure of information environment (Krishnaswamis & Subramaniam, 1999) (Seventh factor).

$$FE = \frac{|ACT_t - EST_t|}{|ACT_t|} \quad (8)$$

**I) Institutional Ownership.** since institutional investors incur higher information-collection cost than other investors, they enjoy more information advantages and have access to more classified information. Therefore, an increase in the institutional ownership ratio may consequently enhance information asymmetry, thereby weakening the information environment of firms. This factor is an inverse measure of information environment. In this research, sum of the stocks owned by banks, insurance firms, investment firms, pension funds, financing firms, investment funds, and governmental organizations and institutions is divided by number of outstanding shares to calculate institutional ownership (Eighth factor).

**J) Number of shareholders.** Allen (1993) believes that stock market is a place where information is collected for all shareholders. Some investors cost a lot to obtain information while some decide not to invest for acquiring it. Rising number of shareholders can increase the level of information available in the market, consequently strengthening the information environment. Therefore, number of shareholders is believed to be a direct measure of information environment (Cai et al., 2015) (Ninth factor).

**K) Firm Age.** Some scholars like Leary and Roberts (2008), and Krasker (1986) consider firm age as an information environment index. It equals to the period a firm is listed in stock exchange. Needless to say, larger firms with longer period of activity in marketplace present more information to market activists. Thus, it is included as a direct measure of information environment. It is hypothesized that longer-life firms report less information asymmetry. A firm with great experience in collecting, processing and reporting information typically acts timely and discloses more transparent information (Tenth factor).

Since individual use of the above measures may cause some problems in measuring information environment, this study uses a weighted composite index for each firm. Accordingly, measures of information environment are given to experts to weigh them based on the factors affecting firms. After that, information environment is computed for each company. Applying this comprehensive index may decrease the skewness resulting from using these measures individually and provide a more accurate index for testing. Moreover, this study is the first to use this method to measure information environment.

### **Independent Variables**

**The existence of audit committee.** Since Iranian firms have been required to establish an audit committee and present their information since 2012, a dummy variable is used to measure this variable, according to which the years before 2012 are valued 0 (AFTER=0), meaning lack of audit committee while the years after 2012 are valued 1 (AFTER=1), meaning the presence of audit committee.

#### **Measurement of audit committee characteristics:**

- Audit committee independence is the proportion of independent directors of the audit committee to the total audit committee members.
- Audit committee expertise is the proportion of financial expertise of the audit committee to the total audit committee members.
- Audit committee size is total number of audit committee members.
- Gender of audit committee is a dummy variable. We measure it using an indicator variable that takes the value of one for the presence of one or more women in the audit committee, or zero otherwise.

### **Control Variables**

**Profitability.** More profitable firms tend to disclose more information to inform their investors of their appropriate performance, leading to a reduction in information asymmetry. Therefore, more profitable firms

are expected to have more transparent information and stronger information environment. This research uses return of equity to measure the profitability of firms.

**Free float.** High free float can increase stock liquidity and reduce price volatility, thereby reducing investment risk (Vakili Fard et al., 2010). As can be seen, this variable is significantly related to information environment. The dummy variable is 0 if the ratio of free float of a firm is less than the average free float of all firms, 1 otherwise.

**Financial leverage.** Financial leverage is usually defined as dividing total debt by total assets at the end of fiscal year. In case of liquidity crisis and necessity for external financing, firms begin to disclose their information voluntarily, which improves information environment of the firm (Paprocki & Stone, 2004). A significant relationship seems to be between financial leverage and information transparency (Karamanou & Vafeas, 2005) and financial leverage is ratio of total liabilities to total assets.

**Financial distress.** To measure this variable Altman adjusted model (1993) is used. This model is defined as follow (Altman, 2000):

$$Z = 0.717 X1 + 0.847 X2 + 3.107 X3 + 0.42 X4 + 0.998 X5 \quad (9)$$

where

- $Z$ , represents the adjusted Altman
- $X1$  refers to working capital divided by total assets
- $X2$  refers to retained earnings divided by total assets
- $X3$  refers to earnings before interest and taxes (operating income) divided by total assets
- $X4$  refers to book value of equity divided by total debt
- $X5$  refers to net sales divided by total assets

If the resulting value ( $Z$ ) in discriminant analysis is less than 1.23, the firm is called bankrupt while if it is greater than 2.99, the firm is able to pay its debts. If it is given a value between 1.23 and 2.99, the firm is believed to be in the grey area (before bankruptcy or financial distress), has adverse information environment and shows high information asymmetry (Paprocki & Stone, 2004). We measure it

using an indicator variable that takes the value of one in the case of financial distress, or zero otherwise.

## Data Analysis

### The First Model of Descriptive Statistics

To examine the general characteristics of the variables, and estimate and analyze the research model, one requires to be familiar with descriptive statistics. Descriptive statistics computes the parameters of population and includes central indicators, distribution of population, and so on. Table 2 represents the descriptive statistics of the research variables including mean, median, minimum, maximum and standard deviation about 328 firm-years during the 2008-2015.

Table 2. The first model descriptive statistics

Variable	Median	Mean	Maximum	Minimum	Std	Skewness	Obs
IE-Index	0.547	0.539	0.744	0.343	0.066	0.052	328
ROE	0.163	0.164	0.675	-0.959	0.148	-2.373	328
LEV	0.596	0.589	1.213	0.089	0.184	-0.137	328

As seen in Table 1, mean of firms' information environment over the 8 years was 0.539, since the average of the information index for the selected firms is higher than 50%, it is favorable. The maximum for IE was 0.744 for Iran Khodroo Company, and the minimum IE was 0.343 which is related to Bama Company. Also the mean for profitability is about %16. The following table represents the frequency and mode of the nominal variables.

Table 3. The frequency and mode of the nominal variables

Variable	Percentage of value 0	Percentage of value 1	mode	Obs
After	% 50	% 50	0,1	328
DISTRESS	%53	%47	0	328

Given the results of Table 3, most of the firms were distressed according to the adjusted Altman model.

### The first model test results

In panel data analysis, in order to distinguish the usage of pool or

panel data method, it is necessary to test Chow or F-limer, to determine the fixed effect or random method usage, Hausman test was used, and to identify heterogeneity of variance and serial autocorrelation, the Modified Wald test and Wooldridge test were employed. The Table 4 shows the results.

**Table 4. F-Limer, Hausman, modified wald and wooldridge test results**

Test	Test Statistic	Obs	Prob.
F-Limer	13.926	328	0.000
Hausman	13.729	328	0.008
Modified Wald	441.12	328	0.000
Wooldridge	3.964	328	0.053

According to Table 4, we have to use the panel method on the fixed effect. Because the Modified Wald test shows that there is a heteroscedasticity. In addition, the significance level of Wooldridge test (0.053) points to the presence of serial autocorrelation in the model. Therefore, we have to use the GLS method. Moreover, to ensure the lack of multicollinearity among explanatory variables, multicollinearity test using VIF was used, and the results were represented in Table 5.

**Table 5. Summary of statistical results of the first research model**

Variable	Coefficient	Std. Error	t-Statistic	Prob.	VIF
$\beta_0$	0.542	0.015	37.000	0.0000	---
AFTER	0.007	0.003	2.142	0.033	1.072
ROE	0.015	0.014	1.051	0.294	1.223
LEV	-0.019	0.022	-0.845	0.399	1.379
DISTRESS	0.005	0.004	1.098	0.273	1.214
F-statistic	(0.000) 26.959	Durbin-Watson stat		2.076	
R-squared	0.807	Adjusted R-squared		0.777	

The results of testing the first model are presented in Table 5. According to Table 5, whole model likelihood statistic F is 0.0000. Therefore, it can be said that total regression meaningfulness is confirmed at 95% confidence level. Regression has the statistical validity.

Positive relationship between existence of audit committee and IE is 0.007 which represents the importance of audit committee. P-value equals to 0.033 at the statistics related to the coefficient of the

independent variable that would imply a significant relationship between the independent variable existence of audit committee and IE in the 95% confidence level. Therefore, there is a significant and positive relationship between existence of audit committee and IE. On the other hand, the adjusted coefficient of determination equals to 0.777, states that over 77% of the dependent variable is explained by the independent variable.

On the other hand, multicollinearity suggests that an independent variable is a linear function of other variables. High multicollinearity of a regression equation implies high correlation among independent variables, and hence low validity of the model. Considering the last column of Table 5, VIF value is less than 10 ( $VIF < 10$ ) for all explanatory variables, hence indicating no multicollinearity among variables. Thus, the fitted model is valid.

### The Second Model of Descriptive Statistics

Descriptive statistics for the second model are presented in Tables 6.

In the sample studied, average IE-Index is about 0.536. In addition, approximately 4% of firms have women in their audit committee and the average of financial leverage is 58 percent. Regarding the size of the audit committee, it can be said that most of the firms have three members in their audit committees. Also average of profitability was about 10%. The following table represents the frequency and mode of the nominal variables.

Table 6. The second model descriptive statistics

Variable	Mean	Median	Maximum	Minimum	Std	Skewness	Obs
IE-Index	0.536	0.539	0.728	0.380	0.059	-0.044	484
ACIND	0.548	0.667	1	0	0.351	-0.606	484
ACEXP	0.599	0.667	1	0	0.504	-0.487	484
ACSIZE	2.326	3	5	3	1.361	-0.930	484
ROE	0.099	0.126	0.582	-1.316	0.189	-3.533	484
LEV	0.576	0.577	1.566	0.066	0.216	0.224	484

Given the results of Table 7, on average about 46% of the sample firms, according to Altman adjusted model, have formed distress.



**Table 7. The frequency and mode of the nominal variables**

Variable	Percentage of value 0	Percentage of value 1	mode	Obs
ACGEN	% 96.3	% 3.7	0	484
DISTRESS	%54	%46	0	484
FLOAT	%54	%46	0	484

**The second model test results**

According to Table 8, we have to use the panel method on the fixed effect. Although the modified Wald test shows that there is a heteroscedasticity, the significant level of Wooldridge test (0.464) suggests the lack of serial autocorrelation in the model. Thus, we have to use the GLS method.

The results of testing the second model is presented in Table 9.

**Table 8. F-Limer, Hausman, modified wald and wooldridge test results**

Test	Test statistic	Obs	Prob.
F-Limer	6.479	484	0.000
Hausman	29.712	484	0.000
Modified Wald	21206.67	484	0.000
Wooldridge	0.539	484	0.464

**Table 9. Summary of statistical results of the second research model**

Variable	Coefficient	Std. Error	t-Statistic	Prob.	VIF
$\beta_0$	0.495	0.009	55.374	0.0000	---
ACIND	0.028	0.011	2.495	0.013	3.992
ACEXP	0.019	0.005	3.711	0.000	2.957
ACSIZE	-0.005	0.003	-1.541	0.124	5.529
ACGEN	0.012	0.013	0.957	0.339	1.056
ROE	0.0005	0.005	0.091	0.927	1.240
LEV	0.028	0.010	2.744	0.006	1.308
DISTRESS	0.0001	0.002	0.068	0.946	1.063
FLOAT	0.001	0.004	2.248	0.025	1.033
F-statistic	(0.000) 29.556		Durbin-Watson stat	2.484	
R-squared	0.914		Adjusted R-squared	0.883	

According to Table 9, whole model likelihood statistic F is 0.0000. Therefore, it can be said that total regression meaningfulness is confirmed at 95% confidence level. Regression has the statistical validity. There is a positive relationship between independence and financial expertise of audit committee and IE. Since the p-value calculated for the coefficient of these independent variables was obtained less than 0.05 equal to 0.013 and 0.001, therefore, there is a

significant and positive relationship between independence and financial expertise of audit committee and IE. Thus, the second and third research hypotheses are confirmed and the other hypothesis is rejected. In analyzing the results, it is acknowledged that independence and financial expertise of audit committees are effective in improving the information environment. On the other hand, the adjusted coefficient of determination equal to 0.883 states that over 88% of the dependent variable is explained by the independent variables.

Considering the last column of Table 9, VIF value is less than 10 ( $VIF < 10$ ) for all explanatory variables, hence showing no multicollinearity among variables. Thus, the fitted model is valid.

### Robustness Test

The first hypothesis seeks to examine the effect of the presence of audit committee on the improvement of the corporate information environment. However, since the number of firms establishing audit committee at the same time as the internal control guidelines were approved in 2012 was 41 firms, and the small number of firms may question the reliability of the obtained results, thus, they cannot be generalized to the whole society. The research hypothesis was tested in those firms which established their audit committees during the years 2012-2015. Therefore, 121 firms that established their audit committees over the period 2012-2015 were selected. The results of testing the hypothesis based on the number of 968 firm-year observations and using generalized least squares method were illustrated in Table 10.

**Table 10. The results of testing the research hypothesis based on a different sample**

Variable	Coefficient	Std. Error	t-Statistic	Prob.	VIF
$\beta_0$	0.527	0.005	100.582	0.0000	---
AFTER	0.006	0.002	3.182	0.001	1.03
ROE	0.009	0.004	1.972	0.049	1.09
LEV	0.007	0.008	0.991	0.322	1.13
DISTRESS	-0.006	0.002	-2.686	0.007	1.06
F-statistic	(0.000) 22.579		Durbin-Watson stat	2.034	
R-squared	0.768		Adjusted R-squared	0.735	

As indicated in Table 10, Fisher-F statistics points to the significance of the fitted model. Since the probability value of the t-statistics for the presence of audit committee is 0.001, and hence lower than 0.05, H<sub>0</sub> is rejected, confirming the significance of this coefficient at 5% level. Therefore, the research hypothesis is confirmed for a different sample and thus, the obtained results can be generalized to the whole society. Accordingly, the presence of audit committee influences the firms' information environment.

### **Discussion and Conclusion**

Audit committee has several roles and functions in firms. If audit committee has a good organization status and its performance is excellent, it can help the organization operate in a good manner. Also it can help the internal audit department improve the financial reporting. Since the information environment is important for stockholders and investors and they request for disclosure of reliable information quickly and timely, so they expect that establishment of audit committee improves the information environment. Audit committee is one of the important committees which the board of directors is responsible for final monitoring of firms' activities. The characteristics of audit committee also are important. Our findings show independence and financial expertise are salient characteristics of an audit committee which affect the effectiveness of audit committee and finally improve the information environment of firms. Moreover, investors willing to invest in these firms must trust firms which have audit committee with the characteristics of independence and financial expertise. The reasoning is that firms with independence and financial experts in the audit committee are effective in a way that affect the quality of financial reporting. Our findings are compatible with the research findings of El-Mahdy (2013) and Azadi et al. (2016).

With these findings, we conclude that audit committee with independence and financial expertise can help the financial reporting systems to present transparent and valuable financial information. So we recommend boards of director to pay attention to the selection of

audit committee members who are independent and have financial expertise. Also, our findings can help the policy makers of stock exchange market when they want to set a charter of audit committee which these findings. And finally, we recommend the investors to consider these findings in selecting stocks for their portfolios.

Financial studies, particularly those seek to explain a comprehensive index always encounter limitations and problems. An example of these limitations in the current research was collecting some unissued data in the financial statements and their appendices. Also, since unlisted firms (e.g. OTC firms) mostly lacked audit committee, this research excluded them. However, caution should be exercised in generalizing the results to the firms besides those listed in the TSE. Finally, no comprehensive theory was available to the researchers to choose factors influencing the corporate information environment and this made the evaluation of the selected criteria difficult.

Our research has opened a new area of research which other researchers can follow:

1. To conduct detailed researches in each industry,
2. To examine the effects of audit committee on the information environment with Structure Equation Modeling (SEM).

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