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Article

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The relationship between board characteristics and social responsibility with firm innovation

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Abstract

Purpose – The present study aims to assess the potential impacts of board members' characteristics, including connectedness and independence, on the level of the firm's involvement in innovation and corporate social responsibility (CSR).

Design/methodology/approach – Variables of board members' interlock and independence are selected for measuring the board characteristics and their association with innovation. The range of disclosure of social responsibility (SR) of the firms inside and outside the industries is also analyzed through descriptive-correlational. The selected sample includes 280 firm-years listed firms on Iraq Stock Exchange during 2012–2017 and 1,026 firm-years on the Tehran Stock Exchange. The hypotheses are examined using multivariate regression models and panel data.

Findings – The observations show that board interlock and independence in both countries are willing to improve firms' innovation. Moreover, having controlled the industry index, the authors find that business environment innovation is willing to be transmitted into the firms through outside industry sources in Iran. In the Iraq country, regardless of industry index, the positive association between interlocked boards and firm innovation is established. Further analyses also articulate that board interlock is not considered a mechanism to transmit information and experiences about CSR activities.

Originality/value – This paper is a pioneer study to assess the relationship between board member characteristics and the firms' innovation and SR both in Iran and Iraq. Also, it extends the literature by considering the industry index as a significant source of knowledge and experience to gain more precise results. Therefore, the current paper may contribute to the development of knowledge in this field of study.

Keywords Board interlock, Board independence, Firm innovation, Social responsibility

Paper type Research paper

1. Introduction

The only survival way for organizations in today's turbulent environment is to get along with environmental changes. Innovation for embracing changes and sometimes modifying changes is a useful and modern tool for current organizations. The current situation for firms is far more complicated than before, so organizations should be innovative for developing markets, attracting customers and entrepreneurship (Aghion *et al.*, 2013). Innovation is a

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basic factor in creating competition because it would lead to firm growth and future success (Tian and Wang, 2014).

On the one hand, business firms frequently promote innovation in products and processes to survive the competition. In today's competitive world, firms' survival relies on paying special attention to innovation (Seru, 2014). Hsu *et al.* (2014) defines the current business setting as a dynamic platform such that failure in planning and performing innovation would lead to a decrease in firm competitiveness (Atanassov, 2013; Balsmeier *et al.*, 2014), gaining information seems essential for innovation development (Drucker, 1993; Hall *et al.*, 2005).

There is a conflict of interest between managers and owners. Therefore, the presence and establishment of an effective and efficient board of directors would align managers' and owners' interests, enhancing operational performance and firm development (Masulis and Mobbs, 2014). The board of directors' members can be interlocked, simultaneously serving on many boards in different firms. Having an interlocking board of directors might have several knock-on effects proposed by the previous literature. For instance, on the light side, Pfeffer and Salancik (2003) articulate that interlocked directors may transmit additional resources such as legitimacy, skills, information into the firm and provide some worthy links, including customers, suppliers, capital providers and other stakeholders for their companies.

Companies suffering from market pressures may be engaged in corporate social responsibility (CSR) activities to address their activities to society, leading to competitive advantages (Dhaliwal *et al.*, 2011). The director's Interlock characteristic may generate experience for companies in CSR activities and reporting to decline external pressures. Such a measure has led to the boards of directors' demands to voluntarily disclose additional and non-financial information in their annual report in recent decades. To obtain the most efficient results, the board are supposed to check the retrospective and prospective consequences of these reports (Perry and Peyer, 2005; Villiers *et al.*, 2011; Hafsi and Turgut, 2013; Boulouta, 2013).

Considering the above discussions, it is observed that this line of the literature proposes mixed findings related to the knock-on effects of the interlocked board of directors. Therefore, first, the present study attempts to provide a clear picture of the exact consequences of having interlocked directors. Second, one of the pioneer studies assessing the effects of board interlock and independence on the firms' innovation and engagement in social responsibility (SR) activities, especially in emerging economies, including listed firms on Iran and Iraq Stock Exchange. Since the former studies mostly evaluate the other aspects of board interlocks, including resource seeking (Chin-Huat *et al.*, 2003), signaling (Luffarelli and Awaysheh, 2018), monitoring (Carpenter and Westphal, 2001), accessing human capital (Johnson *et al.*, 2011) and social cohesion (Burris, 2005). Thirdly, we discriminate between directors interlocked inside and outside the industry since it is expected that relative information to the domain of a firm's activity must contribute greatly to the firms' performance (Chang *et al.*, 2006; Belenzon and Berkovitz, 2010). Hence, the present study seeks to answer the question of "whether the board interlock and independence can lead to an increase in innovation level and improve the social responsibility in firms or not." Moreover, the comparison between the two countries' findings may contribute to the literature due to different institutional settings governing the business environments.

2. Theoretical principles, literature review and hypothesis development

2.1 An interlock between board members and firm innovation

The analyses of internal and external users of financial statements about the economic consequences of research and development (R&D) costs show there is a significant relationship between R&D costs and future operational efficiency (Drucker, 1993; Hall *et al.*, 2005). The frequent growth and change in markets, the decrease of products' lifecycle, the

necessity for organizational flexibility and such changes give rise to the issue (Tian and Wang, 2014). Hsu *et al.* (2014) declares that the reported profit and loss from adjusted R&D costs indicate such expenditures' resultant interests. Hope *et al.* (2017) conclude that technical innovation, product efficiency, external supervision and managerial motivational plans, due to competition increase, lower China's systematic economic uncertainty.

An interlocking directorate occurs when a director of one firm's board also sits on another company's board. A firm can have one or more directors who sit on the boards of other firms. While firms can also be connected through social ties between directors based on executives' shared educational background or past employment, our data do not allow us to identify such potential connections (Helmers *et al.*, 2017). According to the network theory specifications, it is argued that a firm's network position partially allocates the limitations and opportunities that the firm might face. This may influence strategic alternatives, information processes, corporate risk-taking and sheltering and provision of rare resources (Audretsch and Feldman, 1996; Storper and Venables, 2004). Therefore, the extended network capabilities might help firms have greater access to worthy information that might be considered to improve the firm's performance by operating innovatively (Chuluun *et al.*, 2017) and keeping pace with their competitors (Ahuja, 2000). To the extent that network connection, which may explain the level of innovation, incrementally plays a part as a channel for transmitting and facilitating the flow of skills, expertise, technology, R&D and other similarities (Andersson and Karlsson, 2007; Weterings and Ponds, 2009). Chuluun *et al.* (2017) show that network connectedness's different characteristics affect firm innovation input and output, particularly firms in relatively intangible industries. Helmers *et al.* (2017) find that board interlocks have significant positive effects on both R&D and patenting. Considering the above discussion, we expect that board interlock is likely to transmit knowledge, expert, innovation, etc. into the firms. Thus the first hypothesis is conducted as follow:

H1. Having an interlocked board plays an ameliorating role in firm innovation.

H2. Having an interlocked board within the industry plays an ameliorating role in firm innovation.

H3. Having an interlocked board outside industry plays an ameliorating role in firm innovation.

2.2 Board independence and firm innovation

Board composition can contribute to the financial performance of the firms. If most board members were unbounded managers, the board would be more efficient (Bathula, 2015). If the board members are executive managers, they are less concerned about their primary duty and role in the firm as members of the board, namely supervision on executive managers and controlling them, so this significant role is less evident (Bathula, 2015).

Innovation is a leading factor for empowering firms to create value and preserve competitive advantage in the complicated and ever-changing environment (Fan and Wang, 2012). Hence, decision-makers should understand the significance of innovation and apply that in their organizations. In this regard, Kim and Luo (2017) argue that board independence will create economic added value and innovation. Lu and Wang (2018) document a positive effect of board independence on corporate innovation. One side of the literature argues that independent boards are likely to improve a firm's performance by investing in R&D expenditures.

In contrast, some believe that firms adopting innovative strategies tend to select one or more measures that the customers in the industry recognize as an important item, which makes them posit themselves to respond to these demands for such important measures by producing innovative products (Porter, 1985), employing such a strategy requires companies

to invest heavily in R&D activities (Mia and Clarke, 1999). It also suggests that managers pursue creative and innovative action freely to thrive and succeed in the long run. Therefore, the boards' strict monitoring activities may limit managers from achieving these goals since such restrictions might reduce the manager's ability to make wise decisions vital for the firm's performance in the long run (Robinson and Mcdougall, 2001; Simerly and Li, 2000). As a result, managers are less likely to invest in risky projects, such as R&D investments, which have long-run outcomes (Baysinger and Hoskisson, 1990; Zahra, 1996). Gani and Jermias (2006) confirm that board independence has a more positive effect on performance for firms pursuing a cost-efficiency strategy than innovation. Coles *et al.* (2008) argue that firms with R&D investment must have a large representation of inside directors on their board. These members possess firm-specific knowledge that is crucial for the firm to succeed in a competitive environment.

According to the above discussions, we expect that board independence may improve the firm's innovation through more efficient manager monitoring. In this regard, the fourth hypothesis is conducted as follows:

H4. Having an independent board plays an ameliorating role in firm innovation.

2.3 Board members' interlock and social responsibility growth

Managers tend to show their optimal performance and extensively reflect the news, media and related events. CSR disclosure methods of the firm rely on the effects of economic activities of the society. The type of industry is among the factors that affect the SR disclosure of the firms. For example, in export-oriented industries, international clients' pressure is a significant factor for SR disclosure. To show a favorable picture at the international level, these firms embark on CSR disclosure and not regulating, leading to missing the contracts (Belal and Owen, 2007; Islam and Deegan, 2008).

According to network theory, firms may imitate good (Srinivasan *et al.*, 2018) and bad (Khanna *et al.*, 2015) procedures from other firms in the same board network. One of the firm's motivations to follow CSR activities might fulfill social expectations (Aguilera *et al.*, 2007). Firms usually engage in CSR activities and reporting to alleviate external pressures and prevent social sanctions. One view, which is based on the institutional level, argues that regulations and laws form the firms' social behaviors through mandatory power (Ali *et al.*, 2017; Gallego-Alvarez and Quina-Custodio, 2017). In turn, forcing companies to legitimize their activities based on social requirements and SCR disclosure might be recognized as a reaction to cultural–cognitive and normative impact pressures (Cormier *et al.*, 2005; Rupley *et al.*, 2012). The other view suggests that CSR reporting could help firms protect their reputations for achieving business success (Graafland, 2018), motivating firms to engage in CSR activities (Chih *et al.*, 2010). Therefore, CSR reporting aids firms to gain strategic resources and establish a competitive advantage reduces firms' equity capital cost (Dhaliwal *et al.*, 2011, 2014), provides positive capital among communities and stakeholders related to moralities, improves firms protection and reduces business risks (Luo and Bhattacharya, 2009). And reduce risks from the capital market, such as stock price crash risk (Kim *et al.*, 2014).

Accordingly, interlock boards may help firms in two ways: (1) interlocked directors transmit other firms' experiences in CSR activities and strategies to rectify the external pressures based on a mimetic view; (2) based on the communication mechanism view, they may transmit information, intelligence, knowledge, expertise and skill to issue CSR reports effectively. Therefore, board connectedness is an important mechanism to transfer knowledge in CSR activities and reporting into the firms and may play an allocative role in establishing corporate governance practices (Del Vecchio, 2010). Un *et al.* (2019) find that board interlocks positively affect firms' CSR reporting. According to the above discussions, it

is expected that interlocked boards are more likely to be engaged in CSR activities and reporting. Thus the following set of hypotheses is conducted in this sense.

H5. Having an interlocked board plays an ameliorating role in firm CSR activities.

H6. Having an interlocked board inside the industry plays an ameliorating role in firm CSR activities.

H7. Having an interlocked board outside the industry plays an ameliorating role in firm CSR activities.

2.4 Board independence and social responsibility growth

According to previous findings, board independence may affect CSR activities through improved manager-monitoring quality. Since independent directors are not engaged in the firm's daily activities, they can develop more objective advice. They do not possess financial interests as dependent directors (Coffey and Wang, 1998). Comparing internal and external directors, the former ones who usually consider the short-run financial objectives, the latter show different motivations, such as values and time horizons (Donnelly and Mulcahy, 2008; Post *et al.*, 2011). They are more likely to take a long run horizon and follow stable development (Johnson and Greening, 1999). Thus, it is expected that independent directors take into account CSR activities compared to internal directors since such activities provide long-run benefits. Bahar Moghadam *et al.* (2013) showed that corporate governance mechanisms, except the manager's dual role in the board, positively and significantly associated with CSR. The level of disclosure in the selected firms is low.

As mentioned earlier, unbounded board members supervise executive managers' decisions, and board composition can influence the firms' financial performance. On the other hand, being independent would lead to more reliance on SR, which is likely to create a positive and significant relationship with SR. Huang *et al.* (2016) perceive that increased independence causes quality improvement as a criterion for CSR and decreases presenting auditors' adjusted statements via increasing audit fees. Moreover, Eshleman and Lawson (2016) also show that increasing board independence, CSR and earnings quality will increase. Besides, Rodriguez *et al.* (2017) declare that the main determiner in creating costs is different credits obtained from different firms, although such a measurement may defect. Given the abovementioned fact, the eighth hypothesis is as follows:

H8. Having an independent board plays an ameliorating role in firm CSR activities.

3. Research methodology

Since the present study is conducted for 6 years, it is longitudinal in terms of time horizon. Since the user data are real and historical, it can be classified as a retrospective study. The main reason for choosing such a period is data availability. In this paper, the documentary method is used to collect information. The information of sampling companies was extracted from electronic archives of the Iraqi and the Tehran Stock Exchange's official websites and the Website of the Comprehensive Database of all listed companies. Then, the extracted raw information is prepared in the Excel spreadsheet.

The study's statistical population comprises all listed firms on the Tehran Stock Exchange and Iraq Stock Exchange. The statistical data and information related to listed firms in the statistical sample were collected during 2012–2017 for the Tehran Stock Exchange and Iraq Stock Exchange. Sample companies were selected using the systematic elimination method among the affiliated firms in the statistical population with the following exclusions:

(1) Since the financial and operational structures of banks, financial institutions, investment firms, intermediaries and holdings, are different from manufacturing companies, the mentioned industries are excluded.

(2) They should be active in the Tehran or Iraq Stock Exchange during the period of study; such a restriction is applied to the prevention of missing data and;

(3) The required financial information, especially the annexed notes to the board's financial statements and general assembly annual reports, should extract required data.

It is worth mentioning that by considering the above-said conditions (171*6 = 1,026) and (46*6 = 276), firm-years remained for Tehran Stock Exchange and (46*6 = 276) firm-years for Iraq Stock Exchange, which are indicative of the real statistical population. This study hypothesized that selected firms are a random sample from a time interval, so the results are generalizable to similar Stock Exchange markets. Finally, an unbalanced panel data is employed in this study to analyze the data.

3.1 Fitted patterns for hypothesis testing and variables of the study

In this paper, multivariate regression models are used to analyze the research parameters as follows:

3.1.1 Model 1 (First, second and third hypothesis testing). To assess the impact of boards interlock on the firm innovation, the variables including $\beta_1 \text{Interlocks}_{it}$, general measurement of interlock feature regardless of industry effect, $\beta_2 \text{Interlocks\_IND}_{it}$, considering the inside industry impact, and $\beta_3 \text{Interlocks\_OutIND}_{it}$, considering the outside industry effect, are employed in the Model 1.

$$\begin{aligned}\text{Innovation}_{it} = {} & \beta_0 + \beta_1 \text{Interlocks}_{it} + \beta_2 \text{Interlocks\_IND}_{it} + \beta_3 \text{Interlocks\_OutIND}_{it} \\ & + \beta_4 \text{Growth}_{it} + \beta_5 \text{INST}_{it} + \beta_6 \text{B\_IND}_{it} + \beta_7 \text{ROA}_{it} + \beta_8 \text{LEV}_{it} + \beta_9 \text{Size}_{it} \\ & + \varepsilon_{it}\end{aligned}$$

3.1.2 Model 2 (Fourth hypothesis testing). To assess the impact of board independence on firm innovation, the variable $\beta_1 \text{INDEP}_{it}$, is employed in Model 2.

$$\begin{aligned}\text{Innovation}_{it} = {} & \beta_0 + \beta_1 \text{INDEP}_{it} + \beta_2 \text{Growth}_{it} + \beta_3 \text{INST}_{it} + \beta_4 \text{B\_IND}_{it} + \beta_5 \text{ROA}_{it} \\ & + \beta_6 \text{LEV}_{it} + \beta_7 \text{Size}_{it} + \varepsilon_{it}\end{aligned}$$

3.1.3 Model 3 (Fifth, sixth and seventh hypothesis testing). To assess the impact of boards interlock on the firm CSR, the variables including $\beta_1 \text{Interlocks}_{it}$, general measurement of interlock feature regardless of industry effect, $\beta_2 \text{Interlocks\_IND}_{it}$, considering the inside industry impact, and $\beta_3 \text{Interlocks\_OutIND}_{it}$, considering the outside industry effect, are employed in the Model 3.

$$\begin{aligned}\Delta\text{CSRD}_{it} = {} & \beta_0 + \beta_1 \text{Interlocks}_{it} + \beta_2 \text{Interlocks\_IND}_{it} + \beta_3 \text{Interlocks\_OutIND}_{it} \\ & + \beta_4 \text{Growth}_{it} + \beta_5 \text{INST}_{it} + \beta_6 \text{B\_IND}_{it} + \beta_7 \text{ROA}_{it} + \beta_8 \text{LEV}_{it} + \beta_9 \text{Size}_{it} + \varepsilon_{it}\end{aligned}$$

3.1.4 Model 4 (Eighth hypothesis testing). To assess the impact of board independence on firm CSR, the variable $\beta_1 \text{INDEP}_{it}$, is employed, which is in Model 4.

$$\Delta CSRD_{it} = \beta_0 + \beta_1 INDEP_{it} + \beta_2 Growth_{it} + \beta_3 INST_{it} + \beta_4 B\_IND_{it} + \beta_5 ROA_{it} + \beta_6 LEV_{it} + \beta_7 Size_{it} + \varepsilon_{it}$$

3.2 Dependent variables

The firm's social responsibility growth (ΔCSRD): This is calculated using the social disclosure checklist for each firm in the year *t*. This checklist is designed for decoding qualitative information on the annual reports. SR is in six dimensions: environmental issues, products and services, human resources, customers, society responsibilities and energy. Content analysis of such disclosures is classified in the context of financial statements notes and board reports.

Firm innovation: market value to book value ratio is used to measure innovation in the firms under study.

3.3 Independent variables

Board members' interlock (Interlocks): a virtual variable is used to measure the interlock of board members, equal to one of two firms having a common member on the board; otherwise, it will be zero.

Board members' interlock inside the industry (Interlocks_IND): is 1 if two firms have a common member in the board inside the industry; otherwise, it will be zero.

Board members' interlock outside the industry (Interlocks_OutIND): is 1 if two firms have a common member on the board in two different industries; otherwise, it will be zero.

Board independence (INDEP): this variable is calculated by dividing the number of unbounded members into total members. The board's unbounded member or non-executive manager in the stock companies is a manager who is only responsible for membership in the board and is not physically present in the firm with no executive responsibility. Unbounded managers are only present at the board meeting times, mostly as senior managers' consultants and have no other firm work relationships. Such managers are like lawyers who perform the firm's authorities following the Regulations and Articles of Association.

3.4 Control variables

Firm growth (Growth): This is measured based on the firm's sales changes in proportion to the previous year.

Return on assets (ROA): operational profit to the firm's total assets.

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

Institutional ownership (INST): the percentage of stock held by the insurance firms, financial and investment institutes, banks, state-owned firms and other sections of the state, which is calculated by dividing the number of institutional ownership stocks into total normal stocks of the firm at the beginning of the period.

Operational leverage (LEV): total liabilities of the firm to total firm assets.

Board size (B_IND): number of board members of the firm.

4. Research findings

First, to analyze and better understand the information, some central and data dispersion indices were studied, depicted in Tables 1 and 2. These tables illustrate Iraqi firms' descriptive statistics during six years of study and 35 firms and the Iranian firms' information during this period with 114 firms.

Table 1.
Descriptive statistics of non-indicative variables

	Iranian stock exchange firms						Iraqi stock exchange firms					
Sign	No. obs	Mean	Median	Std. dev	Max	Min	No. obs	Mean	Median	Std. dev	Max	Min
ΔCSRD	1,026	0.153	0.100	0.095	0.305	0.000	276	0.104	0.111	0.085	0.351	0.000
Innovation	1,026	2.551	2.324	3.822	4.081	1.024	276	2.301	2.061	3.625	4.162	1.100
INDEP	1,026	0.451	0.428	0.161	0.888	0.091	276	0.408	0.416	0.139	0.857	0.142
Growth	1,026	0.234	0.249	0.366	1.241	−0.356	276	0.189	0.241	0.359	0.935	−0.287
ROA	1,026	0.123	0.112	0.172	0.639	−0.784	276	0.056	0.058	0.207	0.635	−0.785
size	1,026	13.229	13.320	1.702	18.053	5.940	276	7.156	7.010	1.957	15.09	3.213
INST	1,026	0.241	0.260	0.541	0.950	0.060	276	0.209	0.230	0.497	0.910	0.000
LEV	1,026	0.608	0.634	0.518	0.952	0.187	276	0.629	0.640	0.585	0.922	0.207
B_IND	1,026	5.119	5.000	7.024	11.000	3.000	276	4.527	3.000	5.624	9.000	3.000

	Iranian stock exchange firms			Iraqi stock exchange firms		
Indicators	Interloks	Interloks_IND	Interloks_OutIND	Interloks	Interloks_IND	Interloks_OutIND
Numbers of 1 observations	88	38	50	93	4	88
Numbers of zero observations	955	1,005	993	187	276	192
Total observations	1,043	1,043	1,043	280	280	280
The percentage of 1 to total observations	0.084372	0.036433	0.047939	0.332143	0.014286	0.314286
The percentage of 0 to total observations	0.915628	0.963567	0.952061	0.667857	0.985714	0.685714
Std. dev	0.278078	0.187456	0.213739	0.471825	0.118879	0.465062

As can be seen in the Table, the average SR growth in listed firms on Iraq Stock Exchange is 0.104, which shows, on average, in these firms among the defined indices in the checklist of SR disclosure in each year, about 10% is added to the score of the previous year. In contrast, the average SR growth for listed firms on the Tehran Stock exchange is 0.153, which shows that about 15% is added to the previous year's rank among the related indices each year. The results reveal that recent developments of the industry in Iran and the needs related to managers' responsibility in different groups of stakeholders recently have caused the Iranian firms to be inclined toward more disclosure of SR reporting. Moreover, the innovation of Stock Exchange firms in Iraq and Iran has a mean of 2.301 and 2.551, respectively, indicating higher average innovation in the Iranian firms. On the other hand, the mean board members' interlock in the Iranian and Iraqi firms is 0.181 and 0.104, respectively, which shows board members in the Iranian Stock Exchange firms about 18 and 10% a similar board.

4.1 Linearity test

The variance inflation factor (VIF) test is applied to estimate the linearity problem between explanatory variables. According to the reported statistics in Table 2, as the VIF indices of all variables are less than 10, there is no linearity problem for regression variables. It is noticeable that, according to the VIF test, if the results were more than 10, there would be a linearity problem in the variables.

4.2 Preferential model

This paper employs two-sided F-Limer and Hausman tests to select the most suitable statistical model for hypotheses testing. The obtained results are depicted in Table 3.

4.3 Hypothesis testing

Since panel data are used to test the hypotheses, it is necessary to assess the model fitting tests before model estimation; the results are presented in the tables. The results of hypotheses 1–3 (model 1) for sample firms are depicted in Table 4.

This Table shows that coefficients for the variable (interlocks) in the model for the Iranian and Iraqi firms are equal to 0.921*** and 0.286***, respectively, which shows that there is a significant relationship between this variable and innovation, so the first hypothesis is confirmed for both groups of Iranian and Iraqi firms. Such findings mean that having interlocked directors lead to greater innovation inside the firms. In line with the underlying theory and previous studies, it argues that interlocked directors are supposed to transmit

	Iran		Iraq	
Variable	VIF	1/VIF	VIF	1/VIF
roa	1.09	0.919146	1.6	0.625719
inst	1.09	0.919769	1.19	0.839477
Size	1.08	0.926005	1.09	0.91884
Indep	1.07	0.93534	1.12	0.890845
Growth	1.06	0.947571	1.01	0.989727
Bind	1.04	0.956985	1.17	0.856818
lev	1.04	0.961006	1.53	0.652562
Interlocks	1.01	0.986871	1.08	0.922486
Interlocks-d	1.02	0.983917	1.09	0.920102
Interlocks-t	1.01	0.991297	1.03	0.974199
Mean VIF	1.05		1.19	

Table 2. The results of the variance inflation factor

Table 3.
The results of the statistical method preferential tests

Description	Hausman Statistic	Hausman Prob	F-Limer Statistic	F-Limer Prob	Iran result
Iran preferential model tests					
Model 1	37.95	0.000	5.18	0.000	Panel with fixed effects
Model 2	39.07	0.000	4.60	0.000	Panel with fixed effects
Model 3	6.10	0.6356	22.92	0.000	Panel with random effects (GLS)
Model 4	4.29	0.8916	20.39	0.000	Panel with random effects (GLS)
Iraq preferential model tests					
Model 1	19.94	0.0106	3.72	0.000	Panel with fixed effects
Model 2	400.88	0.000	3.30	0.000	Panel with fixed effects
Model 3	13.19	0.1055	0.88	0.5367	Panel with random effects (GLS)
Model 4	22.72	0.0069	0.81	0.6042	Panel with fixed effects

Table 4.
The results of board interlock on innovation (Model 1)

Variables	Iran Obs	Iran Coef	Iran Std. Err	Iran *p*-value	Iraq Obs	Iraq Coef	Iraq Std. Err	Iraq *p*-value
Interlocks	1,026	0.921	0.225	0.000	276	0.286	0.025	0.000
Interlocks_IND	1,026	−1.192	0.502	0.017	276	−0.348	0.061	0.000
Interlocks_OutIND	1,026	1.323	0.211	0.000	276	0.216	0.040	0.000
Growth	1,026	0.869	0.401	0.031	276	0.191	0.098	0.051
inst	1,026	−4.879	2.593	0.060	276	0.387	1.083	0.721
Bind	1,026	−2.255	1.694	0.183	276	0.584	0.256	0.005
roa	1,026	2.40872	1.726	0.163	276	1.589	1.427	0.267
Ley	1,026	2.0872	0.767	0.007	276	0.241	0.048	0.000
Size	1,026	2.461	0.598	0.000	276	−1.581	0.544	0.004
_cons	1,026	−17.424	12.02	0.147	276	13.733	12.351	0.983
Coefficient of determination of the model (R^2)		0.2555					0.2055	
F Statistic of the model		5.180					3.720	
The *p*-value of the *F* statistic		0.000					0.0004	

information, knowledge, expert, skill and experiences into the company, which in turn increase the level of firms' investment in innovative projects as well as R&D expenditures (Storper and Venables, 2004; Weterings and Ponds, 2009; Helmers *et al.*, 2013, 2017; Eshleman and Lawson, 2016; Huang *et al.*, 2016; Chuluun *et al.*, 2017).

Moreover, the second and third hypothesis testing results for the Iranian and Iraqi firms are presented in Table 3. This Table contents show that coefficients for the variable of board interlock inside the industry (Interlocks_IND) in the Iranian firms' model are equal to −1.192** and Iraqi firms are −0.348*** for outside the industry, respectively. This denotes a negative and significant relationship between the interlock board inside the industry and firm innovation in our full sample. In contrast, the findings of the (Interlocks_OutIND) variable show a positive and statistically significant association between out-of-industry interlocked directors and firms' innovation due to the coefficients of 1.323*** and 0.216***, respectively. This means that only the companies listed outside the same industry allow their board directors to share information, knowledge, expertise and experience with firms in other industries. Whereas interlocked boards inside the industry are not likely to transmit innovation into the companies. One potential reasoning for such findings might be the firm's protection of their classified information, such as innovative ideas, which are

expected to provide them competitive advantages. The results of the first model's R^2 suggest that relatively 0.25 and 0.20 of the dependent variable's changes are explained with independent and control variables, respectively, for Iran and Iraq populations. The models' p-value demonstrates that at the 0.05 level, both countries' models are statistically significant.

Furthermore, according to the reports of Table 5, it is illustrated that the coefficients of the variable (indep) in the model for both the Iranian and Iraqi firms are equal to 1.467*** and 0.484*, respectively.

This shows a significant relationship between this variable and firm innovation, so the study's fourth hypothesis is confirmed for both Iranian and Iraqi firms. It denotes that board independence plays an efficient role in rectifying agency problems. According to previous findings, the efficient manager-monitoring by independent board's members motivates the CEOs to make wise decisions in line with stakeholders interests, leading to firm's innovation, as a result of considering long-run benefits of firms (Duchin *et al.*, 2010; Brown *et al.*, 2013; Knyazeva *et al.*, 2013; Kim and Luo, 2017). The results of the second model's R^2 suggest that relatively 0.28 and 0.24 of the dependent variable's changes are explained with independent and control variables, respectively, for Iran and Iraq populations. The models' p-value demonstrates that at the 0.05 level, both countries' models are statistically significant.

According to Table 6, coefficients for the variable of board interlock in the Iranian and Iraqi firms' models are equal to 0.096*** and 0.340***, respectively. This shows a positive and significant relationship between this variable and CSR in the Iranian and Iraq Stock Exchange. Therefore the fifth hypothesis is accepted for both Iranian and Iraqi firms. Such findings explore that interlocked directors are also motivated to obtain further information from other companies' CSR reporting and are likely to transmit such information in the firm's form of knowledge and experience. In this regard, Hazar and Dardour (2015), Graafland (2018) and Un *et al.* (2019) find that board interlocks positively affect firms' CSR reporting.

Further analyses show that the Iranian and Iraqi firms' variable (Interlocks_IND) coefficients are equal to −0.347** and −0.037**. The results for outside the industry (Interlocks_OutIND) are 0.021*** and 0.015*** for both countries listed firms, suggesting a positive and significant relationship between the interlock board in the outside industry firm CSR activities. The overall finding means only the companies competing outside the same industry allow their boards' members to share information, knowledge, expertise and

	Iran				Iraq			
Variables		Coef	Std. Err	p-value	Obs	Coef	Std. Err	p-value
Indep	1,026	1.467	0.651	0.024	276	0.484	0.964	0.000
Growth	1,026	0.8707	0.402	0.031	276	0.176	0.205	0.394
inst	1,026	−4.877	2.595	0.061	276	0.381	1.087	0.726
Bind	1,026	−2.252	1.695	0.184	276	0.584	0.206	0.050
roa	1,026	2.406	1.730	0.164	276	1.513	0.169	0.000
lev	1,026	2.897	0.768	0.007	276	0.582	0.241	0.015
Size	1,026	2.463	0.598	0.000	276	−1.589	0.544	0.004
_cons	1,026	−17.46	12.03	0.147	276	13.968	12.43	0.262
Coefficient of determination of the model (R^2)		0.2766				0.2387		
F Statistic of the model		4.60				3.30		
The p-value of the F statistic		0.000				0.0008		

Table 5.
The results of board independence on Innovation (Model 2)

Variables		Iran Coef	Std. Err	*p*-value	Obs	Iraq Coef	Std. Err	*p*-value
Interlocks	1,026	0.022	0.002	0.000	276	0.027	0.0105	0.01
Interlocks_IND	1,026	−0.347	0.015	0.021	276	−0.037	0.016	0.024
Interlocks_OutIND	1,026	0.021	0.004	0.000	276	0.015	0.008	0.05
Growth	1,026	0.018	0.036	0.000	276	0.001	0.0006	0.004
inst	1,026	−0.006	0.004	0.208	276	0.065	0.046	0.155
Bind	1,026	−0.002	0.002	0.298	276	0.004	108	0.656
roa	1,026	−0.002	0.001	0.310	276	0.031	0.062	0.607
Ley	1,026	0.055	0.012	0.000	276	0.009	0.0034	0.004
Size	1,026	0.088	0.005	0.000	276	0.035	0.017	0.047
_cons	1,026	0.03	0.021	0.158	276	0.433	0.257	0.093
Coefficient of determination of the model (R^2)		0.2341				0.2101		
F Statistic of the model		169.59				3.920		
The *p*-value of the *F* statistic		0.000				0.8645		

Table 6.
The results of board interlock on CSR (Model 3)

experience with firms in other industries in case of CSR activities. While interlocked boards inside the industry are not likely to transmit CSR experiences to other companies. The results of the first model's R^2 suggest that relatively 0.23 and 0.21 of the dependent variable's changes are explained with independent and control variables, respectively, for Iran and Iraq populations. The models' *p*-value demonstrates that at the 0.05 level, the Iranian companies' model is statistically significant.

Finally, the observations reported in Table 7 illustrates that the coefficients of the variable (indep) in the model for both Iranian and Iraqi firms are equal to 0.003** and 0.25***, respectively. This shows a positive and significant relationship between this variable and CSR, so the study's eighth hypothesis is confirmed for Iranian and Iraqi firms. It denotes that board members' independent monitoring significantly helps firms be involved in CSR activities and reporting. Since CSR reporting provides long-run benefits for companies and improves their reputation in front of public eyes, the independent board plays an alleviating role in decreasing agency conflicts through efficient manager-monitoring and considering firms' long-run objectives. These results also conform to that of Maran Jori and Ali Khani (2014), who found a significant and positive relationship between board independence and

Variables		Iran Coef	Std. Err	*p*-value	Obs	Iraq Coef	Std. Err	*p*-value
Indep	1,026	0.003	0.002	0.043	276	0.25	0.001	0
Growth	1,026	0.009	9E−04	0.313	276	0.005	0.007	0.47
inst	1,026	−0.005	0.004	0.208	276	0.098	0.042	0.02
Bind	1,026	−0.002	0.002	0.313	276	−0.002	0.007	0.748
roa	1,026	−0.002	7E−04	0.010	276	0.065	0.051	0.201
Ley	1,026	0.009	0.003	0.004	276	0.023	0.008	0.004
Size	1,026	0.008	0.004	0.055	276	0.03	0.000	0.06
_cons	1,026	0.030	0.022	0.166	276	−0.257	0.446	0.566
Coefficient of determination of the model (R^2)		0.2497				0.272		
F Statistic of the model		466.15				0.810		
The *p*-value of the *F* statistic		0.000				0.6042		

Table 7.
The results of board independence on CSR (Model 4)

CSR activities. The results of the first model's R^2 suggest that relatively 0.25 and 0.27 of the dependent variable's changes are explained with independent and control variables, respectively, for Iran and Iraq populations. The models' p-value demonstrates that at the 0.05 level, the Iranian companies' model is statistically significant.

5. Discussion and conclusion

The present study is concerned about the influence of board members' characteristics, including connectedness and independence, on the firm's innovation and CSR activities.

The obtained results from hypothesis testing show that board interlock and independence in both countries are willing to improve firms' innovation. It means that in emerging economies, companies are likely to share their knowledge, experience, skills, and generally, the items that might be applicable to improve firms' innovation through their common boards' members. Moreover, having controlled the industry index, we find that business environment innovation is willing to be transmitted to firms through outside industry sources in Iran and Iraq. However, competitors inside the same industry are demotivated to share their innovative information and CSR sources because they are likely to provide comparative advantages. Such findings mean that the board of directors' characteristics determine firms' performance through two channels. First of all, interlocked board members transmit innovative ideas and novel production procedures and are willing to improve firms' performance. Second, independent boards also establish efficient manager-monitoring strategies and improve firms' outcomes.

Further analyses also articulate that board interlock might be considered a mechanism to transmit information and experiences about CSR activities. The findings suggest a significant and positive association between board interlock and CSR activities in the two countries. Supportively, after controlling the industry index, the results show that Iranian and Iraqi firms' interlocked boards are likely to improve CSR activities based on their observation throughout outside industry sources. Finally, the results determine a positive relationship between board independence and CSR activities in both countries. These findings also denote that the independent board plays an alleviating role in reducing agency conflicts between stakeholders and managers. According to the literature, such a role is established through efficient manager-monitoring policies (Knyazeva *et al.*, 2013; Kim and Luo, 2017). They are more likely to take a long run horizon and follow stable development (Johnson and Greening, 1999; Liao *et al.*, 2015) and make a proper balance between short-run and long-run objectives, resulting in a positive rectifying impact of CSR and financial performance (Liao *et al.*, 2015).

The current study provides implications for equity owners, the board of directors' members and society. Equity owners may increase their wealth by establishing efficient corporate governance by appointing interlocked and independent board members. They can improve the companies' financial performance by transmitting innovation from other companies and establishing an efficient manager-monitoring policy. The board members can enhance their knowledge, experience and reputation by working in several companies simultaneously, improving companies' financial and operational performance under their supervision. According to our findings, individual practitioners can improve production at the macroeconomic level by sharing knowledge, experience, and generally, innovative ideas, from which the whole society can benefit.

The main limitation of this study comes from data unavailability from market companies. We expect that if the data of other companies competing out of Stock Exchange markets were available, the different results might become to a conclusion.

The current paper recommends that future researchers investigate the interlock board's potential effect on establishing internal control functions appointing audit firms.

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