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Impact of board of directors attributes on real-based earnings management: further evidence from Egypt

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Abstract

This paper aims at investigating the effect of board of directors attributes on real earnings management (REM). A panel data of 78 Egyptian listed companies was collected over the period 2008–2017 to test the hypotheses. The results of the system generalized method of moment model revealed that the board size is negatively and significantly correlated with REM proxies, except for abnormal cash flows from operations (ABCFO) measure. Whereas, board meetings are positively and significantly related to REM except for ABCFO. Furthermore, board independence and chief executive officer duality provided varying results due to different REM proxies that have been used in this paper. The results of this study highlight the fact that there is no unified corporate governance (CG) system that fits all countries; therefore, each country should form its CG code in a way that takes into consideration its economic, political, legal, and institutional needs. Furthermore, regulators have the motivation to enhance relevant regulations and rules and maintaining a well-organized regulation system, where this would help in improving the effectiveness of the board as well as protect the investors by reducing the level of earnings manipulation. In investment activities, investors should take into account the attributes of a company's board to avoid investing in firms that are more liable to conduct earnings management; consequently they could maximize the benefits of investments.

Keywords: Board of directors, Real earnings management, System GMM, Endogeneity, Egypt

Introduction

The BOD is described as one of the most essential mechanisms in a corporation. It holds the responsibility for monitoring, supervising and advising top management as well as leading and directing organizational affairs to safeguard the interests of the shareholders [4, 10]. More specifically, the BOD has assigned several responsibilities and tasks; such as shaping and choosing the most appropriate strategy for the organization and evaluating the progress in its implementation [8]; directing and monitoring the manager performance; hiring and firing underperformed mangers; linking the organization to the internal and external environment circumstances; accountable for whether the firm manager followed the formal procedures and policies; hiring and compensating senior managers; designing and overseeing organizational internal control, transmitting critical information to the managers and enhancing firm legitimacy and fairness in the business [20, 51]. For instance, both the Sarbanes–Oxley Act and the recent stock market rules on CG assumed that board with more independent members have a lower incidence of accounting fraud and EM [8]. On the contrary, other literature suggested that the board of director may be the reason for the corporate failure and scandals worldwide, as a result of ineffective decision making and monitoring, lack of accountability regarding the stakeholders in the society, ineffective direction and control functions, leading to greater information

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asymmetry and a general erosion of confidence in the firm [11, 15, 19, 20].

Following Jensesn and Meckling's [58] seminal work, BOD plays an important and critical role in CG mechanisms, especially in addressing shareholders and managers' agency problems, encompassing policies, rules, regulations, processes and people to satisfy stakeholders' needs and promote directing and controlling of management activities with good business practices, integrity, transparency and objectivity. CG structure encompasses a set of internal and external mechanisms [3]. The BOD attributes is one of the keys of CG mechanisms, which can enhance the alignment between the interest of the shareholders and the managers and mitigate the inherent agency problems [21, 75].

Therefore, investigating the BOD attributes such as independent board, CEO duality, and the board size bring new approaches and perspectives for researchers and regulators on the relationship between the board of directors and earning quality [46]. Despite the proliferation of studies, there is still much inconclusive results on the relationship between the BOD, EM practices, and firm performance. A stream of researchers found that BOD characteristics have positive and negative impacts on financial reporting quality [4, 10]. On the contrary, another stream of researchers found that BOD characteristics, firm performance and financial reporting quality are not related [23, 92]. To reconcile these inconsistencies, this study purposes to analyze the relationship between BOD attributes and financial reporting quality.

Studies on the relationship between CG and different types of EM practices in the Middle East and those in developed countries, such as the UK and the US, differ significantly in coverage and findings. Consequently, this paper may provide intriguing, primary evidence from one of the developing countries with a different business environment and regulations; Egypt. It may be described as a representative country of the Middle East and the Arab countries; where the financial reporting has a great value for users of financial statements and would help in making sound decisions. Consequently, research on EM practice is expected to be significant and critical to existing and potential users. Hence, the current paper contributes to the EM literature by examining the extent to which one of the CG mechanisms; BOD attributes would mitigate the REM practices in the specific context of an emerging market economy with a well-established stock market.

This paper contributes to the current research [11, 15, 19, 20, 83, 97], where, first, this paper addresses real-based EM activities to examine whether REM approaches are influenced by CG mechanisms, where research in this particular area is scarce, especially in the Egyptian context. Several previous literature has focused exclusively on the practice of discretionary accruals. Therefore, recent research should focus more on real-based EM activities to have a better understanding of EM practice [32]. Second, to the best of our knowledge, this study is the first to detect the earnings manipulation practice (EM) in the Egyptian context using several models of real-based EM using the six models suggested by Roychowdhury [82] to be confirmed from the validity, reliability and robustness of the study findings. Third, limited research has thoroughly investigated the influence of CG mechanisms on EM approaches. Thus, this paper postulates further evidence on the extent of internal CG mechanisms in Egyptian setting to mitigate real-based EM practices. As the Egyptian country is considered as one of the biggest emerging market in the Middle East (MENA countries), the findings would support the policy agenda of several organizations, such as the World Bank, the IMF and the Egyptian Capital Market Authority (CMA), to encourage the government to promote CG standards as a broad CG reform. Fourth, substantial evidence regarding the REM practice in most organizations is available. However, most academic research focused on accrual-based EM. Several studies such as El-Kalla [41], and Enomoto and Yamaguchi [44] suggested that switching the organizations between accrual-based and real EM is ignored by investors, making regulators pay significant attention to investigate those EM practices. Therefore, this paper focuses on investigating how CG mechanism can reduce real earnings manipulations. Fifth, it extends the existing research concerning the impact of the CG qualities on REM using sophisticated research methods in the analysis to control efficiently for several econometric problems that are observed in previous empirical literature, such as the dynamic endogeneity problem, individual and time-invariant heterogeneity and autocorrelations in panel data. Hence, this study uses sophisticated analysis called (System Generalized Method of Moment) to tackle these problems and thus can report consistent and robust findings. Most previous studies related to CG and EM (e.g. [2, 42, 55, 64, 80, 94] used pooled regression analysis and static panel data analysis (GLS). These techniques are considered to be not appropriate due to the dynamic endogeneity and unobserved firm heterogeneity that appeared in the relationship between CG and EM. Hence, this paper employs one of the most sophisticated models, that is, a system generalized method of moments (GMM) estimator, to control the dynamic endogeneity issues and unobserved firm heterogeneity and thus improve the validity and reliability of results. Hence, this paper investigates and compares

whether methodological choice can potentially influence research findings and evaluates the influence of potential endogeneity issues on findings.

The rest of this paper is structured as follows. "The Egyptian socio-economic context: institutional setting" section provides a background on the socio-economic context of Egypt. "Literature review and hypotheses development" section presents the literature review and hypotheses development. "Research method" section describes the research method. "Data analysis and discussion of results" section is the data analysis and discussion of the results. The conclusions, limitations and suggestions for future research are presented in "Conclusions, limitations and suggestions for future research" section.

The Egyptian socio-economic context: institutional setting

Egypt is an important and influential country in the Middle East; that is, the country has a central role in politics in the region due to its influential culture, geographic location and economic development. Egypt has different characteristics and institutional contexts compared with countries such as the UK and the US [79]. Egypt is regarded as an ideal example for the present study to examine the emerging capital markets due to several reasons. First, Egypt has an emerging economy with many foreign investment opportunities. Second, the Egyptian business environment has undergone a fundamental change in recent years. Third, the Egyptian situation has been dynamic and developing through many economic, financial, legal, cultural and political frameworks that have influenced CG implementation. Fourth, Egypt can be taken as a good example for similar countries experiencing economic and political reform and promising investment prospects [52, 90].

In 2006, the Ministry of Investment and International Cooperation, the Egyptian Institute of Directors [39, 40] (EIoD) and the General Authority for Investment and Free Zones introduced the Egyptian code of corporate governance (ECCG). The ECCG presents CG guidelines and standards to be implemented in joint-stock EGX-listed companies [35]. However, the ECCG lacks enforcement that negatively impacts its enactment, transparency and disclosure. ECGC[1] is neither mandatory nor legally binding, as it is not legislatively mandated and compliance is voluntary, making the benefits of compliance limited [2, 35, 81].

The ECCG presents several rules on various CG aspects (BOD, audit committee, external and internal audit and social and environmental policy disclosure). With regard to the BOD, the ECCG presents the responsibilities, tasks and roles that should be dedicated to the board (Rules: 3–7 and 3–19). In terms of board composition and meetings, the ECCG determines that the board should be comprised of a majority of non-executive directors with an appropriate mix of technical and analytical skills and experience. The board meetings should be held at least once every three months (Rule 3–17), and independent directors can meet the management without the attendance of executive members at any time for consultation of any task (Rule 3–18). The ECCG (2011 and 2016) identified that the board size should not be less than 5 members. The majority of the board should be independent or at least two-third of the board should be independent and have technical and analytical skills.

Literature review and hypotheses development

This study follows the work of Abdou et al. [3], Habbash [51], where it employs a blend of existing theories rather than an individual theory. Hence, a multi-perspective approach makes it relevant to understand and explain the complex nature between CG mechanisms and the quality of the financial reporting. In practice and the empirical literature, there were inconsistent results regarding the impact of CG on EM. Notably, several researchers have shown a positive relationship between CG mechanisms and earnings manipulation practice. Nevertheless, others have revealed that CG indicators have a negative effect on the EM practices, while, other results have revealed a nonlinear relationship between CG indicators and the quality of the financial reporting, proving the predictions of agency theory, stakeholder theory and resource dependency theory.

The BOD is described as one of the most important mechanisms in a corporation. It holds the responsibility of monitoring, supervising and advising top management as well as leading and directing organizational affairs to protect the interests of the company's shareholders [8, 20, 51]. Both the Sarbanes–Oxley Act and the recent stock market rules on CG assumed that board with more independent members have a lower incidence of accounting fraud and EM [8]. On the contrary, other literature suggested that the BOD may be the reason for the corporate failure and scandals worldwide, as a result of ineffective decision making, lack of accountability regarding the stakeholders in the society, ineffective direction and control functions, leading to greater information asymmetry

[1] The code itself states that: "These rules should be taken into account as an addition to the corporate-related provisions stated under various laws, the executive regulations and decrees concerning their application. Yet, these rules are considered as unique and different from all others stated under the abovementioned laws is that the rules governing CG are neither mandatory nor legally binding; rather, they promote and regulate responsible and transparent behavior in managing corporations according to international best practices and means that strike equilibrium between various party interests" [84] (UNCTAD 2007).

and a general erosion of confidence in the firm [11, 15, 19, 20].

According to Amer [20], AlGhamdi [11], Alessandro [15], Amador [19], the literature suggested that board characteristics (board size, CEO duality, board composition, and board diversity) have different influence on the board involvement in the strategic directions, monitoring and advising potential of the board, in the implementation of CG, and in enhancing the organization performance. Most prior studies such as Basiruddin [23] and Fama and Jensen [46] noted that there are various characteristics of a board that might contribute to influencing their effectiveness in their monitoring role. These characteristics might include the board size, the duality of the CEO, the structure of the board, and the board composition of non-executive directors, the financial expertise and meeting frequency.

Despite the proliferation of studies, there is still much debate/inconclusive results concerning the relationship between the directors, EM practices, and the firm performance. A stream of research found that BOD characteristics have positive/negative impacts on the financial reporting quality [4, 10]. On the contrary, another stream of research found that BOD characteristics, the firm performance and the financial reporting quality are not related [23, 92]. Hence, this paper extends prior studies by investigating the relationship between BOD characteristics and the financial reporting quality based on theoretical and empirical perspectives.

The board size

The board size is the magnitude of the directors serving on the board of a company. Although the board size is viewed as the most crucial dimension of board attributes, there is a debatable issue and conflicting views in the CG literature regarding the optimal size of the board. One issue that always debatable among renowned scholars such as Jensen [57] is how to determine the appropriate board size for a firm in order to function effectively. Accordingly, some studies that aspired to enhance the earning quality, the firm value, the disclosure and transparency advocated for the small size of the boards [4, 57, 69, 86]. Agency theory recommended that the number of members within the board should not be numerous, which is consistent with the British code due to different reasons (such as increased scope for malfeasance and empire-building). In this perspective, all directors are regarded as trustworthy members of the firm who should, consequently, be motivated as well as committed to its values. Agency theory reckons that large board size increases the information cost, and disturb the decision-making process which results in less effective decisions due to the increased conflicting opinions, reduced coordination, and communication among the members, managers, and shareholders and more incidence of severe free rider problems. This perspective is consistent with resource dependence theory [15, 20, 51].

Whereas others suggested that the larger boards would best aid in improving the firm performance and eliminating opportunistic behaviour [10, 12, 20, 33, 77, 85, 88]. They support the idea of having large board sizes; where this would increase its capabilities and interests in interacting with the environment and in satisfying all stakeholders` needs. Thus, CG can be implemented in an effective way which in turn improves the firm value [10, 92]. These results contradict the agency theory and are consistent with the perspectives of both stakeholder theory and resource dependence theory. Moreover, large board sizes do not provide an opportunity for the CEO dominance, thereby reducing agency costs and problems and provide a great room for the different stakeholders to be represented in the firm and to enhance the effectiveness of oversight over management [20]. Small board sizes have fewer tendencies to make strategic changes as a result of their inefficiency in providing more alternatives for firm growth. This perspective is not supported by both theories due to their limited director capacity and capabilities, which affect negatively on an exceptional level of high-quality advice and counsel to the CEO [20]

Unexpectedly, some empirical studies did not find any significant relationship between board sizes, the quality of financial reporting, and firm performance, such as Fooladi [47], who revealed that there is non-significant relationship between the board size and performance (ROA and ROE) based on a sample of companies listed on Bursa Malaysia. This result is consistent with Issarawornrawanich [55], Horváth and Spirollari [54], Aljifri and Moustafa [17] who found no significant association between the board size and the firm performance. Thus, it is concluded from the previous studies that there is no specified code used to identify the exact numbers of directors within the BOD due to the different institutional environment around the world. Not all theories completely agree with codes [43, 45, 49, 76]. Based on the above discussion, the first hypothesis is formulated as follows:

H1 There is a negative relationship between the board size and the real-earnings manipulations.

The board independence

The board independence refers to a corporate board with a majority of outside/non-executive directors who are entrusted by the shareholders to represent them in making appropriate decisions. The domination of

independent directors is more vigilant in monitoring behaviors and decision making of the company [57]. Most CG codes advocate balancing between executive and non-executive directors on the board, especially shedding light on the independent members [48]. However, codes do not provide any specific number of executives and non-executive directors. CG theories do not support an agreement regarding the importance of inclusion independent director on the board [59].

The agency theory reinforces the crucial role of including the independent non-executive directors on the board; where they play a significant role in avoiding the opportunistic behavior of the management and devote their capacity to minimize the agency cost either moral hazard or adverse selection to resolve any conflict between the management and shareholders` interest [68, 92]. There is a consistency in various studies on CG and the EM relationship with the perspective of agency theory [24, 66, 74, 76, 80, 91, 95]. Agency theory is also consistent with the resource dependence theory notion. It holds that outside directors provide the board with external resources, such as skills, expertise, knowledge, and links to external networks. This protects the firm from the external environment by choosing the suitable resources, minimizing the uncertainty of external influence, and confirming availability of resources necessary for its survival and development [20, 63]. Outside directors are supported to provide four major types of resources, namely: (i) advice, counselling and know-how; (ii) validity, legitimacy and reputation; (iii) linking information between external organizations and the firm; and (v) preferential access to commitments or support from important factors outside the firm.

In contrast, other studies suggested an opposite perspective, suggesting that monitoring by independent directors is unnecessary in light of the fact that the agents are both credible and good stewards of the resources delegated to them [34, 37]. The managers' main objective is acting at the best interest of the shareholders, and putting the firm objectives at a higher status than that of their personal interests. They support the idea of giving the managers excessive autonomy based on trust to reduce the monitoring costs that may be incurred largely by outside directors and control their manners. Thus, their results are supporting the approach of the stewardship theory. This theory advocates that the inside directors are sufficiently conscious to understand the business better than outsiders, they have the technical expertise, information, accessibility to critical information, commitment, trust, confidentiality to protect the shareholder wealth. While the outsiders lack the information, work as part-time and do not devote the required time and effort in applying the organizational functions effectively [36, 37]. Therefore, the theory expects that outside director may worsen the firm performance due to the increased agency costs and high costs of protecting the proprietary position of the firm [22]. The theory proposes that the responsibility and authorization should be given to managers make them as best employed to achieve firm objectives and implement the operational decisions, leading to more effective corporate governance. This means that agency theory has a strong resistance to the stewardship theory. It is argued that managers cannot be work or act to align their interests with the shareholders' interests, and the dominance of independent directors on the board is very critical for the organization to prevent managers from committing any frauds. The role of the independent director is supported and developed by the Council of Institutional Investors in the US and the UK, CG codes and existing professional directors [20].

However, there is mixed and inconclusive evidence on the effectiveness of board compositions for monitoring managers, protecting the interest of stakeholders and enhancing organizational performance. Accordingly, the second hypothesis to be formulated as:

H2 There is a negative relationship between the board composition and the real-earnings manipulations.

CEO duality

CEO duality occurs when an individual is holding two top positions; CEO and chairperson [58]. There are two conflicting views regarding the separation of powers between the chairman and the CEO based on the agency theory and the stewardship theory [4]. On one hand, the agency theory suggests that the separation between the two roles of CEO and chairman is vital to ensure the efficiency and effectiveness of tasks performed by the board over management. For instance, Cadbury and Hampel's report recommended CEO non-duality because the separation between the non-executive chairman and the CEO make them more capable of making effective decisions, and proposing objective opinions on firm plans and potentials proposals. Hence, this improves the functions of monitoring, evaluating systems and support shareholders' interest [7, 84].

On the contrary, the idea that CEO duality or a combination between the two roles is very important for the organization in enhancing the decision-making process. This view is consistent with proponents of stewardship theory and the resource dependency theory. As the duality allows the CEO to perform the firm strategic vision with minimum interference from the board. The duality enhances the performance as it allows the CEO to have unified authority and power

in planning, directing and controlling, and coordinating the organization' operations in a timely and effective manner [20, 51]. However, the Cadbury Committee supposes the duality practice as needless because it potentially provides one person with too much power in decision-making (Cadbury 1992). According to SEC Code of CG (2003) as well as the Egyptian code of CG of 2016, it is very important to have a separation of the positions of the chairman and CEO which gives a great chance to provide essential checks and balances over management performance. According to literature such as Yang and Zhao [96], Merendino [70] and Issaraworn-rawanich [55] who argued against consolidated leadership. The justification for their arguments based on three points which are closely connected control system, independence of the board, and decision making.

Some studies revealed that the relationship between CEO duality and the firm performance depends on some internal and external factors surrounding the firm. For instance, Al-Shammari and Al-Sultan [13], Alessandro [15], and Bouaziz [27] suggested that the potential benefits and costs are to be assessed ex-ante as a result of the conflicting results concerning the potential costs (information asymmetry, inconsistent decisions, and extra compensation in maintaining two directors) and benefits (separation of management and control) of non-duality system. Consequently, the namely organizational and ownership structure, the board size, the firm size, industry and business environment, and decision environment are the several factors on which the board leadership structure depends. Also, Boyd [28] discovered that the conditions of environmental uncertainty determine the importance of the CEO duality in improving the quality of financial reporting and the speed of the decision-making process. Extant literatures such as [4, 9, 13, 62, 87, 93] revealed non-significant association between the CEO duality and the firm performance as a result of the external factors (such as economic and political instability and internal factors (such as expertise, experience, professional and educational background. From an organizational behavior perspective, Boivie et al. [26] claimed insignificant association between CEO duality and performance as a result of the difficulty in measuring some elements such as CEO personality, beliefs, values priorities, personal characteristics, and principles. Based on the above discussion and the mixed results regarding the impact of role duality on the quality of financial reporting, the third hypothesis to be formulated as:

H3 There is a negative relationship between the CEO duality and the real- earnings manipulations.

Board meetings

The number of meetings represents one of the characteristics of the board of directors. Several studies supported the importance of board meetings in monitoring the management and in safeguarding the quality of accounting information, although few studies concentrated on examining the impact between board meetings and discretionary accruals (DAs).

The results of empirical studies in developed and developing countries regarding the relationship between board meetings and the quality of the financial reporting are mixed and they did not agree on an exact number of meetings. For instance, Xie et al. [95] and Gonzalez and Garcia-Meca [49] emphasized the importance of board activity in enhancing the monitoring functions and in reducing the magnitude of the discretionary accruals. Using the evidence from developing countries, the results of Kharashgah et al. [65] in Jordan revealed a significant and negative link between board meetings and REM. In Tunisian context, Chouaibi et al. [31] reported a negative relationship between board meetings and REM (abnormal cash-flow proxy), thereby, ensuring the reliability of financial information provided to company stakeholders. Almarayeh [18] used a sample of 915 firm-year observations for the period of 2007–2017 and found that board meeting plays a crucial role in alleviating earnings management in MENA countries.

On the contrary, several studies argue in favor of a small number of board meetings. Qinghua et al. [78] in both Shenzhen and Shanghai stock markets revealed that increasing the number of board meetings would reduce the quality of the financial reporting. While, Kankanamage [61] used the performance adjusted the discretionary accrual model to measure the EMs in Sri-Lankan listed companies and found that there is an opposing view regarding the role of board meetings in constraining the earnings manipulations. This result is not consistent with the agency and the resource dependency theories, because the increase in the number of board meetings allows more monitoring on the performance of top-level management and reduces agency costs. While, several studies revealed non-significant relationship between board meetings and the quality of the financial reporting such as Basiruddin [23], Chemweno [30], Aleqab and Ighnaim [14]. The justification behind such result may be explained on the ground that board members may attend only to reach to the minimum number of meetings stipulated to the governance guide in their home countries.

In the Egyptian context, Amer [20] founded a non-significant relationship between board meetings and Tobins'Q as a proxy of the firm value. While Salem et al. [83] suggest a positive and significant relationship between board meetings and the firm value both in

Egypt and the US. They revealed that frequent meetings provide more opportunities for directors to discuss and deliberate the firm' strategies between directors and to reduce misunderstanding issues that may arise between them, which in turn can enhance monitoring and controlling functions over the management which indirectly improve the degree of transparency and integrity of the financial reporting. This result is consistent with the ECCG of 2016 that recommends that the board members should be met once every three months. The ECCG code recommends disclosing in the annual reports the number of meetings, and members who do not attend the board or audit meetings. Based on the above discussion, the fourth hypothesis formulated as follows:

H4 There is a positive relationship between the board meetings and the real-earnings manipulations.

Research method

Data and sample selection

To build our database, we used data of the firms listed on the Egyptian Stock Exchange (EGX). Following an economic reform program and privatization, the EGX has again grown. In 2017, there were 226 firms listed on the Stock Exchange. We involve the firms listed on the EGX (226 listed firms), particularly, those in Cairo and Alexandria, classified by total market capitalization as the top Egyptian firms. The CG mechanisms were recommended by the Egyptian CG Codes (2005, 2011, and 2016) to be implemented by all listed companies, whereas SMEs are not obligated to implement CG recommendations. This paper targeted these firms in particular due to its wide range of industrial and commercial activities they include. Besides, they account for a significant portion of the Egyptian economic output.

A 12-year reporting period has been covered by this study from 2006 to 2017; where this selection can be justified based on the followings: (i) the study requires two years before 2008 to be capable of measuring the proxies of REM based on production cost and discretionary expenditures, and (ii) the time span has to be limited to ten years to make the task viable; where CG data are manually collected.

Many industrial sectors are excluded from the sample such as financial, regulated and mining industries (as shown in Table 1). Regulated industries, if compared to other industries, appear to have more motives to follow conservative accounting practices as a result of their revenues that are set at fixed accounting rates of return, they are more likely to defer income recognition. Therefore, it is difficult to detect the manipulations of earnings. Moreover, there are several reasons behind the omission of financial institutions where they are complying with special accounting practices, disclosure requirements, accruals, and EM incentives and the models used for measuring discretionary accruals proxies are likely to be different from those of firms in other industries as recommended in previous empirical studies (e.g. Yang et al. 2009; Al-Fayoumi et al. 2010; Habbash 2012; Yasser and Soliman 2018). Besides, the exclusion of the companies in the mining industry is based on their different practice of income recognition and the fact that their market value differs from that of other firms [51].

Table 1 The study sample

Sample	*N*	%
Firms listed on the Egyptian Stock Exchange	226	100
Less: financial, insurance, and investment firms	(47)	21
Less: firms that do not have information for at least 3 years	(30)	13
Less: industry sectors that do not have homogeneity	(5)	1
Less: sectors that do not have at least 7 firms	(18)	8
Less: firms with missing DataStream information	(23)	10
Less: firms with missing corporate governance data	(25)	11
Total firms included in the sample	78	36

Additionally, we concentrate on the industries with sufficient firm observations to ensure unbiased estimation and to accurately calculate EM proxies. According to DeFond and Jiambalvo (1994), Subramanyam (1996), industry groups with less than seven firms should be also excluded from the sample. Some of CG variables have mainly been missed due to the lack of disclosure by some of the sample firms. Thus, the final sample comprises 78 firms with a total 780 firm-year observations. Table 1 summarizes the study sample.

Variables measurement

The variables of this study are three categories; the dependent, the independent and the control variables. The dependent variable is the REM, the main independent variable is BOD attributes and the control variables are firm size, liquidity, firm performance, capital structure, leverage, assets tangibility, operating cycle, and earnings management flexibility.

The dependent variable (REM) measurement models

The REM represents the dependent variable in this study. Since the accrual-based EM is exposed to a greater investigation from regulators and auditors more than real based activities [32, 99]. Therefore, firms are having a growing inclination to conduct real-activities based earnings. Roychowdhury [82] demonstrated that REM can be performed through manipulating

operating cash flows, the overproduction of inventory to decrease the cost of goods sold, cutting discretionary expenditures such as advertising and R&D, and the general selling and administrative costs. However, there are many models that would help to detect the practices of REM as follows [32, 67, 82]:

Model (1). REM through operating cash flow

This model depends on the cash flows from operations (OCF) that are described as a linear function of sales and change in sales in the current year. This model can be expressed as follows:

$$\mathrm{CFO}_{it}/A_{it-1} := \beta_1(1/A_{it-1}) + \beta_2(\mathrm{Sales}_{it}/A_{it-1}) + \beta_3(\Delta\mathrm{Sales}_{it}/A_{it-1}) + \varepsilon \quad (1)$$

where CFO_{it} Cash flow from the operations of firm i in period t; A_{it-1} Total assets of the previous year; Sales_{it} Sales in the current year; $\Delta\mathrm{Sales}_{it}$ changes in Sales; ε_{it} Residual term.

The estimate coefficient from the above regression equation is calculated to get the normal level of OCF. Then, the abnormal cash flow is driven by subtracting the actual cash flow from the normal cash flow from operations.

Model (2). REM through production costs

One of the most distinguished well-known types of REM is the level of production costs that is considered an abnormal one. The extent to which the cost of goods sold through the overproduction of stock has been estimated since the fixed cost per unit is decreased, the volume of production is increased. The normal level of production is estimated using the cross-sectional analysis for each industry. The estimated residual from the equation can be used to calculate the abnormal level of production cost. Increasing the level of inventory over-production leads to a reduction in the cost of goods sold; consequently, this raises the residual and the reported earnings of the company. The normal production level can be measured through the following model.

$$\mathrm{PROD}_{it}/A_{it-1} = \beta_1[1/A_{it-1}] + \beta_2[\mathrm{Sales}_{it}/A_{it-1}] + \beta_3[\Delta\mathrm{Sales}_{it}/A_{it-1}] + \beta_4[\Delta\mathrm{Sales}_{it-1}/A_{it-1}] + \varepsilon_{it} \quad (2)$$

where PROD_{it} The sum of the cost of goods sold and change in inventory of firm i in year t; A_{it-1} Total assets of the previous year; Sales_{it} Sales of firm i in year t; $\Delta\mathrm{Sales}_{it}$ Sales of firm i in year t less sales of firm i in year t-1; $\Delta\mathrm{Sales}_{it-1}$ Sales of firm i in year t-1 less sales of firm i in year t-2; ε_{it} A residual terms.

Model (3). REM through discretionary expenses

The reduction of discretionary expenses represents the third proxy for REM practice. The cross-sectional approach is used to get the estimated residuals which represent the abnormal level of discretionary expenses. Roychowdhury's [82] model is used to estimate the normal of discretionary expenses:

$$\mathrm{DISEXP}_{it}/A_{it-1} = \beta_1[1/A_{it-1}] + \beta_2[\mathrm{Sales}_{it-1}/A_{it-1}] + \varepsilon_{it} \quad (3)$$

where DISEXP_{it} The total of selling and marketing expenses and general and administrative expenses, advertising expenses, and research and development expenses of firm i in year t.

Models (4), (5) and (6).

In addition to the above three proxies extracted from these models, further three comprehensive proxies for REM activities are also developed to compute the total effect of REM, compatible with Kuo et al. [67] as follows, The first aggregate model RM1 is determined by multiplying abnormal cash flow from operations (ABCFO) by (− 1) and then adding abnormal production costs (ABPROD). So that, higher levels of RM1 signify a higher level of REM (upward REM) as proposed by Cohen and Zarowin [32] and Braam et al. [29].

$$\mathrm{RM1} = (-)\text{Abnormal cash flows from operations} + \text{Abnormal production costs} \quad (4)$$

The second aggregate model RM2 is calculated by adding abnormal discretionary expenditures (ABDISCX) to ABCFO after multiplying ABCFO by − 1. As a result, the larger the value of these aggregate proxies, the higher sales manipulation and decline in discretionary expenditures for manipulating earnings are. It is proposed by Cohen and Zarowin [32] and Braam et al. [29] as follow:

$$\mathrm{RM2} = (-)\text{Abnormal cash flows from operations} + \text{Abnormal discretionary expenditures} \quad (5)$$

The third aggregate proxy RM3 is recognized by adding (ABDISX), (ABPROD) and (ABCFO) together after multiplying ABCFO and ABDISX by-1 [99]. The higher the value of each of the three aggregate measures, the more likely the firm is engaged in REM.

$$\mathrm{RM3} = (-)\text{Abnormal cash flows from operations} + \text{Abnormal production costs}(-) \text{Abnormal discretionary expenditures} \quad (6)$$

Independent variables and control variables

The BOD attributes represent the independent variables, where board size, board composition, board diversity and board meetings is measured based on proxies that are discussed in the extant literature. The board size (BRDSIZE) is measured by the total number of the directors on the board, as presented in the annual report at the end of each fiscal year. The board of director's composition (independence) as the percentage of non-executive directors (outsider) scaled by total number of directors on the board at the end of the financial year. The board of directors' meetings is considered by the total number of board of directors' meetings held during the year. CEO duality is measured using dummy variable which takes the value of 1 if the roles of chairperson and CEO are combined at the end of its financial year, and 0 otherwise [1, 4, 51, 62, 85, 92, 95].

Additionally, this paper employs several control variables to mitigate the influence of the BOD attributes on the dependent variables EM. Several control variables are included to dilute the causal association between the independent and dependent variables and to eliminate the predicament of endogeneity. According to Habbash [51], Khemiri and Noubbigh (2018), Emile et al. [43], Samaha et al. [85], Al-Najjar and Clark [12], Zalata et al. [98], EL Kalla [41], we include these control variables such as leverage, operating cycle, firm size, profitability, gearing, liquidity, asset tangibility, and earnings management flexibility.

Table 2 summarizes all variables employed in this paper.

The real-based EM model

The empirical model investigates the impact of BOD attributes on the REM. The proposed regression model is defined as the following:

$$\begin{aligned} \mathrm{REM}_{it} = {} & \beta_0 + \beta_1 \mathrm{BRDSIZE}_{it} + \beta_2 \mathrm{BRDIND}_{it} \\ & + \beta_3 \mathrm{BRDMEET}_{it} + \beta_4 \mathrm{CEODUL}_{it} \\ & + \beta_5 \mathrm{ROA}_{it} + \beta_6 \mathrm{ROE}_{it} + \beta_7 \mathrm{LIQ}_{it} \\ & + \beta_8 \mathrm{Lev}_{it} + \beta_9 \mathrm{Gear}_{it} + \beta_{10} \mathrm{Size}_{it} \\ & + \beta_{11} \mathrm{AT}_{it} + \beta_{12} \mathrm{OC}_{it} + \beta_{13} \mathrm{EMFLEX}_{it} + \varepsilon_t \end{aligned} \tag{7}$$

Data analysis and discussion of results

Descriptive statistics

Table 3 reports the descriptive statistics of the real-based EM model variables. The descriptive statistics of REM show the minimum, maximum, and mean of the six models used for measuring REM (ABCFO; ABPROD; ABDISX; RM4; RM5; and RM6). ABCFO and ABDISX are multiplied by − 1, so that high levels of EM proxies signify higher levels of upward REM behavior. Hence, a larger mean value signifies a higher degree of REM on average.

Furthermore, positive values of mean, signify income-increasing REM on average. As shown in Table 3, it appears that the sample of Egyptian listed firms undertakes a greater degree of real earnings manipulations through the overproducing inventory at a lower cost of goods sold that results in high abnormal production costs compared to other proxies of REM.

With regard to BOD attributes, the percentage of board independence shown in the sample is relatively high; approximately 73.2%. This percentage highly complies with the CG recommendations in Egypt, which called for maintaining a board to be mainly composed of non-executive directors. The average number of board meetings was approximately 10 times per year (mean = 9.59), which is just above the minimum number of meetings recommended by the ECCG. Moreover, the results show that 71% of the sample had the chairman and the CEO positions held by the same person, which is against the Egyptian CG recommendation that both positions should be held by two different persons. This result is very close to the findings of Amer [20] and Nasr and Ntim [71].

In most of the firms in the sample, executives do not have significant ownership, with a mean of 16.79%. This is not considered a relatively higher percentage. As for the board size, 8 directors is shown to be the average size (mean = 7.9) on the board. This result is consistent with those of Amer [20] who found that the average board size is 9.33 for a sample of 1005 firm-year observations. This indicates that boards in Egypt are quite different from those in the US. Meaning that the number of directors in Egypt seems to be smaller than those in the US, which has a mean size of 11.45 [25]. However, board size in Egyptian context is larger than the boards in Australia, which has a mean size of 6.6 [72] and similar to those in the UK which have a mean board size of around 8 members [76].

Furthermore, Variance Inflation Factor (VIF) and Tolerance values are employed to examine the problem of multicollinearity. As shown in Table 4, the maximum and mean VIFs computed for the variables of the real-based EM models are presented which indicate that the VIFs and Tolerance values for the six accruals models are within acceptable limits. Gujarati [50] suggested that a value of less than 10 shall be accepted. All models suggest that the VIF values as presented are between 1.00 and 5.6 and none of the variables have a VIF value higher than 10 or a tolerance value lower than 1. This suggests that there is no problem of multicollinearity.

Table 2 Summary of variables and measurement

	Label	Measure	Source
Dependent variable			
Real earnings management			
REM1	RM_CFO	Abnormal levels of cash flow from operations	Data stream and financial statements
REM2	RM_DISX	Abnormal levels of the sum of selling and marketing expenses and general and administrative expenses of the firm (i) in the year (t)	Data stream and financial statements
REM3	RM_PROD	Abnormal levels of the sum of the cost of goods sold and change in the inventory of the firm (i) in the year (t)	Data stream and financial statements
REM4	RM1	ABCFO is multiplied by − 1 and then ABPROD are added to it	Data stream and financial statements
REM5	RM2	ABDISX is added to ABCFO after multiplying ABCFO by − 1	Data stream and financial statements
REM6	RM3	ABCFO is multiplied by − 1 and then ABPROD is added to it, and then ABDISX is added to them after multiplying it by − 1	Data stream and financial statements
Independent variables			
Board of directors attributes			
Board size	BRDSIZE	The number of directors on the board at the end of the financial year	Annual Disclosure Books By EGX, ownership structure reports and BOD reports
Board independence	BRDIND	It is the number of the independent directors scaled by the total number of directors on the board at the end of its financial year	Annual Disclosure Books By EGX, ownership structure reports and BOD reports
CEO duality	CEODUL	Binary number that takes 1 if the roles of chairperson and CEO are combined at the end of its financial year, 0 otherwise	Annual Disclosure Books By EGX, ownership structure reports and BOD reports
Board meetings	BRDMEET	The yearly number meetings held by the board of directors	Annual Disclosure Books By EGX, Ownership Structure reports and BOD reports
Control variables			
Firm size	SIZE	Natural log of the book value of a firm's total assets at the end of its financial year	Data stream and financial statements
Liquidity	Liquid	It is the ratio of current assets to current liabilities	Data stream and financial statements
Performance	ROA	The ratio of net income to total assets at the beginning of the year	Data stream and financial statements
Performance	ROE	It is net income scaled by the total equity at the beginning of the year	Data stream and financial statements
Capital structure (Gearings)	GEAR	It is total debt scaled by total equity at the end of the fiscal year	Data stream and financial statements
Leverage	LEV	It is the book value of total debt scaled by total assets at the end of its financial year	Data stream and financial statements
Assets Tangibility	AT	It is total of net property, plant and equipment scaled by total assets	Data stream and financial statements
Operating Cycle	OC	The logarithm of the sum of the inventory and the receivables period	Data stream and financial statements
Earnings Management Flexibility	EMFLEX	It is a total inventories and receivables scaled by total assets	Data stream and financial statements

Empirical results from system generalized method of moment (SGMM) and feasible generalized least square (FGLS)

We test the impact of BOD attributes on the REM using different proxies for EMs based on SGMM. As shown in Tables 5 and 6, the results indicate the extent to which the BOD attributes are statistically related to REM, where the dynamic nature of the relationship is considered. The dynamic nature of the BOD-EM relationship is controlled by using the lagged REM as an explanatory variable. The dependent variable now refers to the REM using six proxies, which are the three main models (ABCFO), (ABPROD), (ABDISX) which are used separately, as well as, each of the three aggregate proxies which are

Table 3 Descriptive statistics

	N	Minimum	Maximum	Mean	SD	Skewness	Kurtosis
ABCFO	780	− 0.1161	0.3152	0.063246	0.109628	0.622	− 0.033
ABPROD	771	− 0.3129	0.9497	0.15093	0.3463521	0.889	− 0.085
ABDISX	780	− 0.0001	0.1245	0.046524	0.0356111	0.742	− 0.45
RM1	780	− 0.5193	0.9232	0.091336	0.3780786	0.535	− 0.286
RM2	780	− 0.3813	0.0752	− 0.112051	0.1188598	− 0.659	− 0.152
RM3	780	− 0.61	0.9132	0.041996	0.3932643	0.479	− 0.237
BRDSIZE	780	3	15	7.87	2.615	0.596	− 0.052
BRDIND	780	0	1	0.737874	0.1712428	− 0.937	0.609
CEO Duality	779	0	1	0.71	0.455	− 0.913	− 1.169
BRDMEET	780	1	18	9.59	4.077	0.184	− 1.149
ROA	780	− 0.0398	0.2163	0.051876	0.0650379	0.957	0.472
ROE	780	− 0.0688	0.374	0.100429	0.1185833	0.813	− 0.089
LIQU	780	0.5147	5.0461	1.833757	1.1885192	1.375	1.141
LEV	780	0.0182	0.6098	0.232505	0.1724446	0.618	− 0.626
GEAR	780	0.0195	2.0804	0.518018	0.5552779	1.554	1.667
AT	780	0.0089	0.78	0.356718	0.2437437	0.134	− 1.156
OC	780	4.0974	6.8154	5.351267	0.7572294	0.219	− 0.776
EMFLEX	780	0.0799	0.8734	0.400584	0.2238405	0.557	− 0.596
FIRM-Size	780	4.6774	6.9666	5.691671	0.6958374	0.374	− 1.037
Valid N (listwise)	770						

This table presents the descriptive statistics for REM Models variables. The mean, median, standard deviation, minimum, and maximum values are presented in the columns for the CG characteristics, and firm-level characteristics on accrual-based EM for firms in the Egyptian context from 2008 to 2017

BRDSIZE board size, *BRDIND* Board independence, *CEO.DUL* CEO duality, *BRDMEET* Board meetings, *ROA* Return on assets, *LIQ* Liquidity, *LEV* Leverage, *Gear* Gearing, Size; *AT* Asset Tangibility, *OC* Operating Cycle, *EMFLEX* EM-flexibility, *FIRM-Size* Firm size

Table 4 VIF and tolerance values of variables

Variables	VIF	1/VIF
ROE	5.6	0.178505
ROA	5.51	0.181503
GEAR	3.51	0.284554
LEVERAGE	3.13	0.319064
OPERAING CYCLE	1.78	0.562315
LIQUIDITY	1.66	0.603080
ASSET TANGIBILITY	1.64	0.609605
FIRM SIZE	1.03	0.966736
EM FLEXIBILITY	1.58	0.633835
BOARD MEET	1.36	0.735099
BOARD SIZE	1.35	0.742942
BOARD INDEPDNECE	1.24	0.805691
CEO DUALITY	1.24	0.808814
MEAN VIF	2.10	

Table 5 The Breusch-Pagan test for Heteroskedasticity

Model	Obs	*F*-Statistic	Pro > *F*
Model 1: ABCFO	779	45.42	0.0000
Model 2: ABPROD	770	102.36	0.0000
Model 3: ABDISX	779	15.57	0.0001
Model 4: RM1	779	36.97	0.0000
Model 5: RM2	779	36.63	0.0000
Model 6: RM3	779	19.88	0.0000

RM1, RM2, and RM3. This study develops many models to examine each mechanism of BOD separately with six proxies of the real activity-based EM models after controlling the firm-level determinants. Consistent with REM models, the analysis begins with examining each BOD attributes separately and the firm-level determinants of REM models as shown in the following Equations

$$\begin{aligned}\mathrm{REM}_{it} = {} & \beta_0 + \beta_1 \mathrm{REM}_{it-1} + \beta_2 \mathrm{BRDSIZE}_{it} + \beta_3 \mathrm{ROA}_{it} + \beta_4 \mathrm{ROE}_{it} \\ & + \beta_5 \mathrm{LIQ}_{it} + \beta_6 \mathrm{LEV}_{it} + \beta_7 \mathrm{Gear}_{it} + \beta_8 \mathrm{Size}_{it} + \beta_9 \mathrm{AT}_{it} \\ & + \beta_{10} \mathrm{OCIt} + \beta_{11} \mathrm{EMFLEX}_{it} + \varepsilon_t \end{aligned} \tag{8}$$

$$\begin{aligned}\mathrm{REM}_{it} = {} & \beta_0 + \beta_1 \mathrm{REM}_{it-1} + \beta_2 \mathrm{BRDIND}_{it} + \beta_3 \mathrm{ROA}_{it} + \beta_4 \mathrm{ROE}_{it} \\ & + \beta_5 \mathrm{LIQ}_{it} + \beta_6 \mathrm{LEV}_{it} + \beta_7 \mathrm{Gear}_{it} + \beta_8 \mathrm{Size}_{it} + \beta_9 \mathrm{AT}_{it} \\ & + \beta_{10} \mathrm{OCIt} + \beta_{11} \mathrm{EMFLEX}_{it} + \varepsilon_t \end{aligned} \tag{9}$$

$$\begin{aligned}\mathrm{REM}_{it} = {} & \beta_0 + \beta_1 \mathrm{REM}_{it-1} + \beta_2 \mathrm{CEODUL}_{it} + \beta_3 \mathrm{ROA}_{it} + \beta_4 \mathrm{ROE}_{it} \\ & + \beta_5 \mathrm{LIQ}_{it} + \beta_6 \mathrm{LEV}_{it} + \beta_7 \mathrm{Gear}_{it} + \beta_8 \mathrm{Size}_{it} + \beta_9 \mathrm{AT}_{it} \\ & + \beta_{10} \mathrm{OCIt} + \beta_{11} \mathrm{EMFLEX}_{it} + \varepsilon_t \end{aligned} \tag{10}$$

$$\begin{aligned}\mathrm{REM}_{it} = {} & \beta_0 + \beta_1 \mathrm{REM}_{it-1} + \beta_2 \mathrm{BRDmeeting}_{it} \\ & + \beta_3 \mathrm{ROA}_{it} + \beta_4 \mathrm{ROE}_{it} \\ & + \beta_5 \mathrm{LIQ}_{it} + \beta_6 \mathrm{LEV}_{it} + \beta_7 \mathrm{Gear}_{it} \\ & + \beta_8 \mathrm{Size}_{it} + \beta_9 \mathrm{AT}_{it} \\ & + \beta_{10} \mathrm{OCIt} + \beta_{11} \mathrm{EMFLEX}_{it} + \varepsilon_t \end{aligned} \tag{11}$$

where Governance indicators include; BRDSIZE = board size; BRDIND = board independence; CEO.DUL = CEO duality; BRD meeting = board meetings Xit; control variables include ROA = return on assets; ROE = return on equity; LIQ = liquidity; Lev = leverage; Gear = gearing; Size = firm size; AT = Asset Tangibility; OC = operating cycle; EMFLEX = EM-flexibility. REM is measured by six proxies (ABCFO, ABPROD, ABDISX, RM1, RM2, RM3).

System generalized method of moment

This study finds that OLS and GLS models are not effective when heteroskedasticity and serial correlation problems are present. As shown in Table 5, the results from The Bresch-Pagan test indicated that the significant chi2 statistic indicates that the null hypothesis should be rejected and the alternative hypothesis should be accepted indicating that the variance is not homogenous across the six models. In addition, this study tests the serial correlation, as shown in Table 6, where we use the Wooldridge to test nonexistence of autocorrelation of errors.

In this context, the literature indicated that FGLS and panel-corrected standard error (PCSE) techniques can be used to address such problems, thereby generating unbiased and consistent results (Baltagi 2008). However, extant literature (Nguyen et al. 2014; Thrikawala et al. 2017; Schultz et al. 2017) claimed that most of findings regarding the association between CG mechanisms and REM suffer from the dynamic endogeneity problem. Consequently, they favored using the System GMM estimator to deal with this problem (Khemiri and Noubbigh 2018).

Table 6 The Wooldridge test for serial autocorrelation results

Model	Obs	*F*-Statistics	Pro > *F*
Model 1: ABCFO	779	7.70	0.0069
Model 2: ABPROD	770	29.619	0.0000
Model 3: ABDISX	770	32.276	0.000
Model 4: RM1	770	22.006	0.0000
Model 5: RM2	770	9.884	0.0024
Model 6: RM3	770	28.290	0.0000

Based on the literature of CG mechanisms and EMs practice as presented and discussed above, the BOD attributes are presented and included in four hypotheses (H1, H2, H3, and H4) to investigate how the BOD attributes results in differences in the mitigation of managers' opportunistic behavior.

An important characteristic of CG that may influence EM is the board size. Yet, there is no consensus regarding the opstimal board size. Based on the results as shown in Tables 7, 8, 9, 10 and 11, this study partially supports the hypothesis (H1) which suggests a significant and negative relationship between board size and REM. Evidence for the effectiveness of board size is inconclusive. The results revealed a significant and negative association between the board size and REM across ABPROD, RM1 and RM3 models at a 1% significance level and insignificantly related to RM5. This result is consistent with Kang and Kim [60] who found that REM is reduced when the number of boards of directors is large. Alternatively, there is a significant and positive association between the board size and REM based on ABCFO and insignificantly related to RM2. Oh and Jeon [73] revealed that board size does not constrain REM (ABCFO, ABPROD, ABDISX as proxies of REM). Abdul Rahman and Ali [4] and Gonzalez and Garcia-Meca [49] found a positive correlation between board size and REM. These results are in line with prior studies of Abubakar and Ishak [6], Adamu et al. (2017), and Alhadab and Clacher [16] who revealed an irrelevant link between board size and REM based on ABCFO, ABPROD, ABDISX, and the aggregate REM.

With regard to board independence, Tables 7, 8, 9, 10 and 11 show the results and summary of six regression models. A significant and negative relation is detected between the proportion of independent directors and (ABCFO) as a proxy for REM at 10%.

This finding is consistent with the studies such as Klein [66], Park and Shin [75], Abdul-Rahman and Ali [5], Siregar and Utama [89], and Alhadab and Clacher [16], who found that the proportion of external director's influence REM negatively and significantly through abnormal real activities. The system GMM analysis revealed that the relationship link between board independence and REM based on (ABPROD, RM2, and RM3) is insignificantly and negatively associated. Furthermore, these findings are consistent with Hassan and Ibrahim [53] who found that characteristics of the BOD, such as outside directors were non-effective in restraining real-based activities manipulations based on the ABCFO of listed manufacturing firms in Nigeria. Qinghua et al. [78] also found a non-significant association between the proportion of independent directors and the EM. However, they found

Table 7 Governance Indicators and ABCFO: System GMM Estimation Results

Variables	ABCFO	ABCFO	ABCFO	ABCFO
L.ABCFO	− 0.155***	− 0.153***	− 0.156***	− 0.153***
	(0.014)	(0.015)	(0.016)	(0.014)
BRDSIZE	0.003**			
	(0.001)			
BRDIND		− 0.082***		
		(0.019)		
CEO duality			− 0.012**	
			(0.005)	
BRDMEET				− 0.005***
				(0.001)
ROA	0.020	0.019	0.051	0.140
	(0.128)	(0.119)	(0.124)	(0.125)
ROE	0.232***	0.188***	0.263***	0.193***
	(0.049)	(0.054)	(0.050)	(0.050)
Liquidity	0.014***	0.015***	0.015***	0.014***
	(0.003)	(0.003)	(0.003)	(0.003)
Leverage	0.071*	0.086**	0.070**	0.067*
	(0.037)	(0.035)	(0.034)	(0.036)
Gear	− 0.028***	− 0.034***	− 0.022**	− 0.027**
	(0.010)	(0.010)	(0.010)	(0.010)
Size	0.058***	0.040**	0.029*	0.060***
	(0.015)	(0.016)	(0.017)	(0.015)
Ass.Tangibility	− 0.329***	− 0.344***	− 0.308***	− 0.351***
	(0.042)	(0.041)	(0.033)	(0.040)
OC	− 0.095***	− 0.139***	− 0.114***	− 0.072***
	(0.018)	(0.020)	(0.018)	(0.015)
EM.Flex	0.126***	0.158***	0.140***	0.097***
	(0.026)	(0.028)	(0.029)	(0.025)
Constant	0.234***	0.651***	0.508***	0.201**
	(0.082)	(0.142)	(0.120)	(0.085)
Observations	702	702	702	702
Number of firms	78	78	78	78
Number of instruments	60	64	60	60
AR2 test (*p*-value)	0.244	0.257	0.243	0.249
Hansen test (*p*-value)	0.174	0.176	0.098	0.183

This table presents the results from System-GMM estimations for dynamic panel-data models. The dependent variable is the REM based on abnormal cash flow from operations model. The sample consists of 780 observations during period 2008–2017. Two-step results and Hansen J tests never reject the validity of the over-identifying restrictions. Second order autocorrelation (AR2) of residuals is always rejected. Standard errors are reported in parentheses. ***, **, and * represent significant at the 1%, 5% and 10% levels, respectively

Table 8 Governance Indicators and ABPROD: System GMM Estimation Result

Variables	(1) ABPROD	(2) ABPROD	(3) ABPROD	(4) ABPROD
L. ABPROD	0.117***	0.125***	0.122***	0.163***
	(0.036)	(0.036)	(0.036)	(0.037)
BRDSIZE	− 0.004*			
	(0.002)			
BRDIND		− 0.032***		
		(0.011)		
CEO duality			0.007	
			(0.007)	
BRDMEET				0.005***
				(0.002)
ROA	− 0.744***	− 0.801***	− 0.782***	− 0.894***
	(0.203)	(0.201)	(0.200)	(0.189)
ROE	0.247***	0.257***	0.256***	0.295***
	(0.074)	(0.073)	(0.071)	(0.068)
Liquidity	− 0.001	− 0.001	− 0.001	0.002
	(0.004)	(0.004)	(0.004)	(0.004)
Leverage	− 0.232***	− 0.222***	− 0.223***	− 0.188***
	(0.040)	(0.035)	(0.042)	(0.037)
Gear	0.083***	0.078***	0.081***	0.077***
	(0.012)	(0.008)	(0.009)	(0.008)
Size	− 0.014	− 0.011	− 0.017	− 0.008
	(0.012)	(0.013)	(0.012)	(0.012)
Ass.Tangibility	0.148***	0.127***	0.144***	0.108**
	(0.051)	(0.048)	(0.048)	(0.043)
OC	0.067**	0.055**	0.053*	0.055**
	(0.027)	(0.027)	(0.028)	(0.027)
EM.Flex	0.287***	0.302***	0.311***	0.291***
	(0.055)	(0.054)	(0.051)	(0.055)
Constant	− 0.278*	− 0.243	− 0.239	− 0.357**
	(0.155)	(0.152)	(0.152)	(0.154)
Observations	702	702	702	702
Number of firms	78	78	78	78
Number of instruments	60	61	61	61
AR2 test (*p*-value)	0.425	0.425	0.446	0.327
Hansen test (*p*-value)	0.326	0.525	0.445	0.633

This table presents the results from System-GMM estimations for dynamic panel-data models. The dependent variable is the REM based on abnormal production cost model. The sample consists of 780 observations during period 2008–2017. Two-step results and Hansen J tests never reject the validity of the over-identifying restrictions. Second order autocorrelation (AR2) of residuals is always rejected. Standard errors are reported in parentheses. *, **, *** significance levels at the 10%, 5% and 1% levels respectively

that outside directors may be effective use in promoting the quality of financial reporting if the percentage of independent directors increased to be more than one-third of the board size. Jaggi, Leung, and Gul [56] conducted a similar study in Hong Kong and reported that independent directors have a low tendency in mitigating earnings manipulations, especially in family-controlled firms. The insignificance of the effect of independent directors may be due to the weakness of regulatory systems in countries with less investor protection or the dominance of family ownership. Another plausible justification is

Table 9 Governance Indicators and ABDISX: System GMM Estimation Results

Variables	ABDISX	ABDISX	ABDISX	ABDISX
L. ABDISX	− 0.155***	− 0.164***	− 0.162***	− 0.137***
	(0.008)	(0.018)	(0.013)	(0.009)
BRDSIZE	− 0.000			
	(0.001)			
BRDIND		0.099***		
		(0.027)		
CEO duality			− 0.041***	
			(0.015)	
BRDMEET				0.001
				(0.001)
ROA	0.162***	0.183**	0.117	0.131**
	(0.058)	(0.079)	(0.083)	(0.058)
ROE	− 0.065**	− 0.064*	− 0.038	− 0.052*
	(0.029)	(0.036)	(0.038)	(0.028)
Liquidity	− 0.001	− 0.000	− 0.000	− 0.000
	(0.001)	(0.001)	(0.002)	(0.001)
Leverage	0.004	− 0.009	− 0.010	− 0.004
	(0.010)	(0.016)	(0.011)	(0.010)
Gear	− 0.008**	− 0.001	− 0.007	− 0.004
	(0.003)	(0.005)	(0.005)	(0.003)
Size	− 0.004	0.004	− 0.004	− 0.002
	(0.005)	(0.007)	(0.006)	(0.005)
Ass.Tangibility	− 0.004	0.030	− 0.013	− 0.003
	(0.016)	(0.021)	(0.013)	(0.018)
OC	0.081***	0.104***	0.063***	0.084***
	(0.016)	(0.017)	(0.021)	(0.018)
EM.Flex	− 0.024*	− 0.053***	− 0.011	− 0.024*
	(0.012)	(0.015)	(0.017)	(0.014)
Constant	− 0.351***	− 0.592***	− 0.229*	− 0.395***
	(0.090)	(0.095)	(0.119)	(0.099)
Observations	702	702	702	702
Number of firms	78	78	78	78
Number of instruments	33	33	32	32
AR2 test (*p*-value)	0.245	0.246	0.246	0.230
Hansen test (*p*-value)	0.143	0.098	0.099	0.113

This table presents the results from System-GMM estimations for dynamic panel-data models. The dependent variable is the REM based on abnormal discretionary expenditure model. The sample consists of 780 observations during period 2008–2017. Two-step results and Hansen J tests never reject the validity of the over-identifying restrictions. Second order autocorrelation (AR2) of residuals is always rejected. Standard errors are reported in parentheses. *, **, *** significance levels at the 10%, 5% and 1% levels respectively

that a non-executive director may be under the authority and the power of executive directors, and thus, they are not in positions that restrict managers from exercising opportunistic behavior. As a result, independent directors have a limited influence on crucial corporate issues or outsiders may lack the financial sophistication or access to relevant information that helps them to spot earnings manipulations. They may be uninterested directors in monitoring and controlling firm activities due to lack of ownership interest of the firm they monitor. The labor market for board independence is under-developed in Egypt. The existence of controlling owners may reduce the tendency of directors to reduce earnings manipulations. On the contrary, the empirical results revealed a positive and significant relationship between board independence and REM based on ABDISX and RM1. These outcomes are in line with Oh and Jeon [73] who found a significant and positive relationship between board independence and REM (ABCFO, ABPROD, ABDISX). This partially confirms (H2) which proposes that the number of independent directors is negatively and significantly related to the extent to which REM is exercised.

With regard to CEO duality, as shown in Tables 7, 8, 9, 10 and 11, the outcome of this study reveals a statistically significant and negative relationship between CEO duality and REM (ABCFO and ABDISX proxies) at a 1% significance level. This finding is coherent with the stewardship theory, which suggests that such a leadership structure enhances the proper CEO activities and counter against agency theory, which argues that such a leadership structure leads to moral hazard and adversely impacts the firm performance. On the contrary, CEO duality is positively and significantly correlated with REM based on RM2 and RM3 at a 1% significance level and insignificantly related to RM4 and ABPROD. These results are consistent with the agency theory argument that CEO duality is likely to weaken the firm's board monitoring role [4, 11, 64, 78, 95]. Furthermore, Chouaibi et al. [31] also revealed a positive and insignificant relation between dual executive leadership and abnormal cash flow as a proxy of REM in Tunisian listed firms. They suggested that the duality gives the CEO more power to extract rents for themselves at the expense of shareholders and take the actions that reduce personal risks and entrench themselves. These results indicate the necessity of following CG mechanisms regarding CEO duality. While the code restricts managers from holding two positions, duality persists in practice leading CEOs to become more concerned with earnings management. The mixed result regarding the impact of CEO duality may have resulted from the culture surrounding the organizations, type of ownership concentration, different organizational objectives. These findings partially support (H3); where there is a negative link between CEO non-duality and REM.

With regard to board meetings, Tables 7, 8, 9, 10 and 11 demonstrate that board meetings have significant and positive relationships across the models of REM at a 1%

Table 10 Governance indicators and RM4, RM5, RM6: system GMM estimation results

Variables	RM1				RM2				RM3			
L. RM_i	0.302***	0.313***	0.334***	0.328***	− 0.00945	0.242***	0.234***	0.236***	0.206***	0.238***	0.265***	0.228***
	(0.037)	(0.026)	(0.075)	(0.070)	(0.0117)	(0.023)	(0.022)	(0.016)	(0.036)	(0.035)	(0.062)	(0.037)
BRDSIZE	0.285***	0.158**	0.274***	0.271***	− 0.00172	0.001			0.004**			
	(0.030)	(0.073)	(0.085)	(0.063)	(0.00107)	(0.001)			(0.002)			
BRDIND	0.005***						0.003			− 0.025		
	(0.002)						(0.012)			(0.027)		
CEO duality		− 0.023						− 0.001			− 0.027**	
		(0.028)						(0.005)			(0.013)	
BRDMEET			0.004									0.005***
			(0.016)									(0.001)
ROA				0.006***	− 0.671	− 0.326**	− 0.335**	− 0.283**	− 1.086***	− 1.561***	− 1.584***	− 1.158***
				(0.001)	(0.434)	(0.150)	(0.145)	(0.140)	(0.188)	(0.391)	(0.349)	(0.407)
ROE	− 1.045***	− 2.086***	− 1.669***	− 1.290***	0.0507	− 0.148**	− 0.133**	− 0.185**	0.136	0.177	0.357**	0.125
	(0.195)	(0.416)	(0.419)	(0.411)	(0.163)	(0.069)	(0.066)	(0.070)	(0.102)	(0.186)	(0.166)	(0.190)
Liq	0.076	0.359*	0.239	0.219	− 0.00253	− 0.012***	− 0.011***	− 0.010***	− 0.014***	− 0.012**	− 0.009	− 0.008
	(0.094)	(0.191)	(0.205)	(0.182)	(0.00528)	(0.003)	(0.003)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)
Lev	− 0.005	− 0.009	− 0.009	− 0.003	0.0383	− 0.071*	− 0.052	− 0.056	− 0.372***	− 0.306***	− 0.259***	− 0.178*
	(0.004)	(0.006)	(0.007)	(0.006)	(0.0315)	(0.038)	(0.039)	(0.036)	(0.056)	(0.098)	(0.080)	(0.098)
Gear	− 0.240***	− 0.218**	− 0.200*	− 0.156*	0.0732***	0.022*	0.017	0.020	0.127***	0.123***	0.103***	0.087***
	(0.046)	(0.100)	(0.105)	(0.089)	(0.0116)	(0.013)	(0.013)	(0.012)	(0.019)	(0.032)	(0.029)	(0.031)
Size	0.087***	0.075***	0.085***	0.068***	− 0.141***	− 0.032**	− 0.036***	− 0.028**	− 0.088***	− 0.066**	− 0.054**	− 0.082***
	(0.014)	(0.028)	(0.031)	(0.025)	(0.0178)	(0.013)	(0.013)	(0.013)	(0.015)	(0.029)	(0.023)	(0.029)
Asstan	− 0.089***	− 0.062**	− 0.077***	− 0.080***	0.324***	− 0.053***	− 0.044**	− 0.037**	0.097***	0.062	0.086*	0.125**
	(0.013)	(0.026)	(0.025)	(0.026)	(0.0561)	(0.018)	(0.020)	(0.015)	(0.030)	(0.055)	(0.046)	(0.058)
OC	0.080**	0.022	0.050	0.125**	0.205***	0.029**	0.032**	0.022*	0.141***	0.099***	0.104***	0.139***
	(0.032)	(0.061)	(0.064)	(0.058)	(0.0329)	(0.012)	(0.013)	(0.012)	(0.014)	(0.029)	(0.029)	(0.031)
Emflex	0.137***	0.135***	0.129***	0.140***	0.00752	0.024	0.032	0.042**	0.102***	0.158***	0.145***	0.159***
	(0.012)	(0.027)	(0.028)	(0.026)	(0.0542)	(0.022)	(0.023)	(0.020)	(0.026)	(0.055)	(0.042)	(0.048)
Constant	0.119***	0.097*	0.085	0.134***	− 0.235	− 0.001	0.000	0.003	− 0.245**	− 0.137	− 0.234**	− 0.385***
	(0.026)	(0.054)	(0.061)	(0.048)	(0.176)	(0.040)	(0.045)	(0.038)	(0.107)	(0.146)	(0.117)	(0.139)
Observations	702	702	702	702	702	702	702	702	702	702	702	702
Number of firms	78	78	78	78	78	78	78	78	78	78	78	78
Number of instruments	72	45	42	45	46	46	46	46	72	46	54	46
AR2 test (*p*-value)	0.311	0.426	0.282	0.392	0.468	0.458	0.458	0.455	0.877	0.977	0.967	0.876
Hansen test (*p*-value)	0.532	0.358	0.603	0.413	0.403	0.587	0.375	0.736	0.541	0.216	0.628	0.374

This table presents the results from System-GMM estimations for dynamic panel-data models. The dependent variable is the REM based on RM1 model. The sample consists of 780 observations during period 2008–2017. Two-step results and Hansen J tests never reject the validity of the over-identifying restrictions. Second order autocorrelation AR2 of residuals is always rejected. Standard errors are reported in parentheses. *, **, *** significance levels at the 10%, 5% and 1% levels respectively

significance level except for (ABCFO). Thus, these findings may constitute evidence to support the hypothesis (H4) regarding the positive relationship between board meetings and REM. These findings are consistent with Abubakar and Ishak (2017) and Kang and Kim [60] who revealed that board meetings influence adversely the quality of earnings. Conversely, the empirical results of this study reveal that there is a negative and significant association between board meetings and ABCFO as a proxy for REM. This finding is consistent with Gonzalez and Garcia-Meca [49] and Bala and Gugong [22]. They revealed a significant and negative correlation between frequency of board meeting and EM. Furthermore, Additional work of literature such as Xie et al. [95] and Al-Ghamdi [11] revealed that the frequency of board meetings leads to reduced levels of earnings manipulations. The non-significant relationship between board meetings and the quality of financial reporting is consistent with Ebrahim [38], Qinghua et al. [78] and Habbash [51].

Robustness check: one regression model

The impact of CG mechanisms on the REM using different proxies for EMs based on SYSTEM GMM is reflected in the following Table 12. The result summarized the extent to which CG attributes together, are statistically related to real-based EM models, taking into considerations the dynamic nature of the relationship. Hence, the dynamic nature of the governance-EM relationship is controlled by using the lagged REM as an explanatory variable.

Consistent with REM models, the analysis examines BOD mechanisms simultaneously and firm-level determinants of REM models as shown in the following Equation.

$$\mathrm{EM}_{it} = \beta_0 + \beta_1 \mathrm{EM}_{it-1} + \beta_2 \mathrm{Governance}_{it} + \beta_j \sum_{j=4}^{13} X_{it} + \varepsilon_{it} \tag{12}$$

When the CG variables are regressed together with different proxies of REM models; in terms of REM using the proxy of ABCFO; the results as indicated in Table 12 are similar and consistent with those of SGMM as there is a significant and positive association between the board size and REM based on ABCFO. While, there is significant and negative association between the board independence, CEO duality and Board meetings and REM using ABCFO at a 1% significance level. In terms of REM using production cost (ABPROD) model, there is a significant and negative association between the board size, and board independence and REM based on ABPROD, while, there is insignificant and negative association between the CEO duality and REM. However, there is a positive relationship between board meetings and REM based on APROD using ABPROD at a 10% significance level. In terms of REM using discretionary expenditures (ABDISCX) model, there is a significant and negative association between the board size, and CEO duality, and board meetings and REM based on ABDISX. While, there is significant and positive association between the board independence and REM.

In terms of REM using RM 1 model, there is a significant and negative association between the board size, and CEO duality, and REM based on ABDISX. While, there is a positive association between the board independence and board meetings and REM based on RM1. In terms of the REM using RM2 model, there is a significant and negative association between the board size, and REM based on RM2. While, there is significant and positive association between the CEO duality and board independence and REM and non-significance in relation with board independence. In terms of the REM using RM3 model, there is a significant and negative association between the board size, and board independence and REM based on RM3. While, there is significant and positive association between the CEO duality and board meetings and REM based on RM3.

To sum up, the study analyses each independent variable separately with REM using the SYSTEM GMM analysis as the main model. The results of the sensitivity analysis are mainly consistent with the key findings. The consistency in the results enhances the validity of the results and the recommendations derived.

Robustness check: feasible generalized least square

Several further checks are carried out to ascertain the credibility of the primary findings. The first set of tests, comprising the main results, is reported by the main model with alternative proxies for REM. Also, feasible generalized least square (FGLS) analysis, pooled ordinary least square (OLS) with robust standard error and fixed/random effect panel data analysis is conducted as a robustness check for the findings.

In terms of board size, similar to the main results concluded using ABCFO, ABPROD, ABDISX, RM2. FGLS reveals a similar direction between board size and REM across those models, but with a lower significance level. Arguably, the coefficient and the significance level between board size and REM based on (RM1 and RM2) are not consistent with the main test.

Table 11 Summary of CG mechanisms on real earnings management practices

	Expected sign	ABCFO	ABOPRO	ABDISX	RM1	RM2	RM3
BOD characteristics							
Board size		+ve sig at 1%	−ve sig at 10%	+Ve non-sig	−Ve sig at 1%	−Ve non-sig	−Ve sig at 1%
Board independence	−	−ve sig at 10%	−ve non-sig	+ve sig at 1%	+Ve sig at 5%	−ve non-sig	−ve non-sig
CEO duality	+	−ve sig at 10%	+ve non-sig	−ve sig at 1%	+ve non-sig	+ve sig at 1%	+ve sig at 1%
Board meetings	−	−ve sig at 10%	+ve sig at 1%	+ve non-sig	+ve sig at 1%	+ve sig at 1%	+ve sig at 1%

With regards to the board independence, FGLS analysis across the six regression models indicates an insignificant and negative relationship between the proportion of independent directors and the different measures of REM except ABDISX. The coefficient between board independence and REM in this analysis is consistent with the main test except for RM1. Similarly, with other previous variables discussed, the significance level in the SGMM test is higher than the degree of significance in the FGLS test.

With regards to CEO duality, the results reveal that there is a negative and insignificant relationship between CEO duality and REM based on the ABCFO and ABPROD except the ABDISX model that is significantly related to CEO duality at the 1% significance level. On the contrary, CEO duality is positively and insignificantly correlated with REM based on RM1 and RM2 except RM3 at 10%. The coefficient of these findings is consistent with the main test except the ABPROD model. The degree of the significance level in this test is lower than the significance of the main test.

With regards to BRD meetings, even if the board meeting does not demonstrate any significant effect on the REM across the six models, the direction and coefficient in both analyses remain the same. However, the main analysis shows a highly significant association between a board meeting and REM models compared with the sensitivity analysis.

As shown in Table 12, the results indicate that firms with a high proportion of independent outside directors tend to have lower levels of REM (based on ABCFO). While independent directors are non-effective in restraining real-based activities manipulations based on the other proxies. In terms of BRD size, the findings provide support for the benefits of large board size. Moreover, our results show that statistically significant and negative relationship between CEO duality and REM (ABCFO and ABDISX proxies), This finding is coherent with the stewardship theory which suggests that such a leadership structure enhances the proper CEO activities and counter against agency theory which argues that such a leadership structure leads to moral hazard and adversely impacts the firm performance. On the contrary, CEO duality is positively and significantly correlated with REM based on RM2 and RM3 at a 1% significance level and insignificantly related to RM1 and ABPROD. Firms with a high proportion of board meeting tend to have higher levels of REM, however, the empirical results reveal that there is a negative and significant association between board meetings and ABCFO as a proxy for REM.

Conclusions, limitations and suggestions for future research

The question of how the board's structure and activities can influence real earnings management in the Egyptian context, as one of the emerging markets, has been investigated in this paper over a 10-year period; where four features of the BOD, namely: as board size, board independence, CEO duality, and board meetings have been considered.. Since the existing and recent studies documented that there is no perfect model for measuring the magnitude of EM. It is not adequate to depend only on one single model to detect earnings manipulations [41, 51], Doukakis (2014). Consequently, it is more effective and feasible for the study to employ several alternative models to accurately validate the detection of the magnitude of earnings manipulations [76] (Charfeddine et al. 2013) since the quality of models varies according to the nature of EM practices and bias that can affect the estimation. Accordingly, this study favored to employ the most widely used models in the EMs literature, hence, the six REM models that used are ABCFO; APROD; ADISX; and three aggregate proxies of REM.

The empirical results of this paper revealed that the board size is negatively and significantly correlated with REM proxies, except for abnormal cash flows from operations (ABCFO) measure. Whereas, board meetings are positively and significantly related to REM except for ABCFO. Furthermore, board independence and chief executive officer (CEO) duality provided varying results due to different REM proxies that have been used in this

Table 12 Governance indicators and REM models: system GMM estimation results

Variables	(1) ABDCFO	(2) ABDPROD	(3) ABDDICX	(4) RM1	(5) RM2	(6) RM3
L.BD	− 0.152***	0.255***	− 0.131***	0.319***	0.233***	0.463***
	(0.015)	(0.072)	(0.009)	(0.031)	(0.010)	(0.020)
BRDSIZE	0.005***	− 0.004*	− 0.001	0.005**	0.001**	0.004**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
BRDIND	− 0.013	− 0.045	0.060***	0.022*	− 0.006	− 0.068***
	(0.030)	(0.027)	(0.009)	(0.012)	(0.008)	(0.010)
CEO duality	0.058***	− 0.031**	− 0.010**	0.017**	− 0.006**	− 0.025**
	(0.017)	(0.014)	(0.004)	(0.008)	(0.003)	(0.011)
BRDMEET	− 0.006***	0.005***	0.001	0.004***	0.002***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
ROA	0.024	− 0.536**	0.129***	− 0.916***	− 0.092	− 0.636***
	(0.118)	(0.221)	(0.048)	(0.230)	(0.078)	(0.173)
ROE	0.202***	0.177**	− 0.042**	0.056	− 0.263***	0.055
	(0.043)	(0.083)	(0.020)	(0.115)	(0.039)	(0.100)
Liquidity	0.013***	0.003	0.000	− 0.006	− 0.013***	− 0.010***
	(0.003)	(0.005)	(0.001)	(0.004)	(0.002)	(0.003)
Leverage	0.018	− 0.165***	− 0.009	− 0.189***	− 0.087***	− 0.317***
	(0.042)	(0.048)	(0.008)	(0.041)	(0.023)	(0.030)
Gear	− 0.024***	0.057***	− 0.007***	0.073***	0.032***	0.109***
	(0.009)	(0.011)	(0.003)	(0.014)	(0.008)	(0.013)
Firm size	0.047***	0.035**	− 0.007	− 0.092***	− 0.025***	− 0.071***
	(0.016)	(0.016)	(0.005)	(0.015)	(0.007)	(0.012)
ASS.TAng	− 0.354***	0.087	0.022**	0.111***	− 0.043***	0.128***
	(0.044)	(0.055)	(0.009)	(0.035)	(0.007)	(0.025)
OC	− 0.090***	0.099***	0.109***	0.143***	0.019**	0.103***
	(0.018)	(0.027)	(0.012)	(0.014)	(0.007)	(0.010)
EMFLEx	0.127***	0.183***	− 0.045***	0.098***	0.031**	0.083***
	(0.026)	(0.054)	(0.010)	(0.025)	(0.013)	(0.018)
Constant	0.312***	− 0.666***	− 0.515***	− 0.317***	− 0.001	− 0.163**
	(0.095)	(0.159)	(0.067)	(0.078)	(0.025)	(0.072)
Observations	701	692	701	701	701	701
Number of firms	78	78	78	78	78	78
Number of instruments	60	62	59	75	76	78
AR2test (*p*-value)	0.226	0.172	0.262	0.316	0.458	0.687
Hansen test (*p*-value)	0.316	0.869	0.449	0.457	0.292	0.258

*, **, and *** represent significance at the 1%, 5% and 10% levels, respectively.

paper. It can be noted that the results of this study are mostly mixed which is consistent with the multi-theoretical framework, which relies on insights from the agency, stewardship, resource dependence, and stakeholder theories. These results were determined after controlling for a number of variables, namely firm size, liquidity, ROE, ROA, capital structure, leverage, asset tangibility, operating cycle, earnings flexibility.

Although there is a careful treatment regarding the variables used in the analysis and methodology applied, this study is subject to some limitations. *First*, although this study has used several alternative DAs models and different measurement error-related variables, the results are not totally free of the measurement errors. Besides, there is an on-going debate regarding the inefficiency of the existing accrual models to classify the DAs and non-DAs components. *Second*, classifying directors into executive and non-executive members is based on the information available in the financial reports of the sample firms and that gathered from the Egyptian Stock Market or from the EGID. Consequently, the reliability and validity of information collected depends upon the reliability of its

sources. *Third*, the CG index could also be extended to involve the CG external mechanisms. Nevertheless, the current Egyptian guidelines include recommendations that relate only to internal mechanisms besides that the implementation of the Egyptian CG guidelines is partially voluntary. *Fourth*, this study aims at including several independent variables (such as corruption, law enforcement and mismanagement) in order to investigate their impact on the practices of EMs. However, this was not possible due to the difficulty in collecting such data in the Egyptian context, especially if it relates to the aforementioned factors. *Fifth*, as the findings relate to listed large and publicly traded firms in Egypt, generalization beyond those limits may not be warranted. Additional research would be needed to replicate the results in private firms or firms outside Egypt.

However, this study contributes to the existing literature in two main ways. *Firstly*, using a customized dataset that imitates different CG structures and settings, this helps us shed further light on the institutional features of developing countries that describe the relation between BOD and EM. *Secondly*, the analysis of this study also offers more insights into the monitoring usefulness and the role of BOD mechanisms.

There are several important implications of our study. *First*, this study suggests that the inclusion of independent director on the boardroom specifically in the emerging countries where there is lack of complementary legal infrastructure, is very critical, where independent directors can prompt the monitoring mechanism in mitigating the practices of management manipulation. *Second*, the findings of this study enhance the credibility and reliability of financial statement for its users in the Egyptian Stock Market, since they provide empirical evidence that BOD attributes play important responsibility in reducing EM practices. The results of this study highlight the fact that there is no universal/unified CG system that fits all countries; therefore, each country should form its CG code in a way that takes into consideration its economic, political, legal, and institutional needs. The findings also provide signals for the regulators and policy makers that corruption that might occur in Egypt has a hidden impact on earnings management practices. Consequently, they should work hardly on controlling any forms of corruption.

This study needs to be expanded to include more countries in the MENA region and extend additional years of data to provide additional insights into different market responses to CG, external audit and EM. Future studies may consider other CG mechanisms such as the role of gender diversity in detail when designing or amending the provision of CG code and take into account external CG mechanisms. Future research is also needed to consider the role of ethics in CG. That is, business ethics are recently demanded by most institutions and individual investors, particularly after the increasing corporate scandals, extremely high compensation of directors and managers and recent financial crisis. Future research may be directed to study the impact of CG role in reducing levels of corruption in emerging countries.

Abbreviations

BOD: Board of directors; REM: Real earnings management; SGMM: System generalized method of moment; ABCFO: Abnormal cash flows; CEO: Chief executive officer; EM: Earnings management; CG: Corporate governance; CMA: Capital market authority; ECCG: Egyptian code of corporate governance; EIoD: Egyptian institute of directors; DAS: Discretionary accruals; EGX: Egyptian stock exchange; EGID: Egypt for information dissemination; ABPROD: Abnormal production costs; ABDISCX: Abnormal discretionary expenditures; VIF: Variance inflation factor; FGLS: Feasible generalized least square; PCSE: Panel-corrected standard error.

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Author contributions

EA developing the original draft, collected the data, analyzed the results. TI reviewing the literature, helped in methodology, edited and reviewed the draft and made constructive changes to the draft. MM adds substantial contributions to the conception of the work and interpretation of data. All authors have read and approved the manuscript.

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Competing interests

The authors declare that they have no conflict of interest.

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