Financial Innovation

RESEARCH

Open Access

Mediating effect of firm efficiency on the controlling shareholdings–firm performance nexus: evidence from public listed firms in Malaysia

Irene Wei Kiong Ting[1], Jawad Asif[2], Qian Long Kweh[3*] and Tran Thi Kim Phuong[4]

*Correspondence:
qlkweh@gmail.com

[1] Faculty of Industrial Management, Universiti Malaysia Pahang, Gambang, Malaysia
[2] Department of Commerce, University of Gujrat, Punjab, Pakistan
[3] School of Management, Canadian University Dubai, Dubai, UAE
[4] Faculty of Accounting, Ton Duc Thang University, Ho Chi Minh City, Vietnam

Abstract

This study examines how controlling shareholders influence firm performance through the mediating role of firm efficiency in transforming inputs into outputs. To achieve this objective, it conducts a mediation analysis with 5,000 bootstraps on a dataset of 2,849 firm-year observations of publicly listed firms in Malaysia from 2009 to 2019. The findings reveal a positive relationship between controlling shareholdings and firm performance, with both total and indirect effects having this positive relationship. Moreover, while controlling shareholdings improve firm performance, firm efficiency partially mediates this relationship. Thus, improved firm efficiency plays a critical role in understanding the relationship between governance by controlling shareholders and enhanced firm performance. In summary, this study contributes to the existing literature by expanding our understanding of the complex relationship between controlling shareholdings, firm efficiency, and firm performance. In addition, the findings shed light on the importance of indirect channels in shaping organizational outcomes. As such, this study provides a valuable direction for future research in this area.

Keywords: Controlling shareholdings, Firm efficiency, Firm performance, Mediation analysis

Introduction

The coronavirus (COVID-19) pandemic has had a significant impact on businesses worldwide, with firms facing unprecedented challenges during the crisis. As countries imposed lockdowns and social distancing measures in response to the pandemic, firms had to adapt to new ways of operating to survive (Micah et al. 2023). Many firms faced significant disruptions to their supply chains, a reduction in the demand for their products or services, and financial difficulties due to the economic downturn caused by the pandemic (Abbas et al. 2021). In recent years, researchers studying the determinants of firm performance have identified that certain factors contribute to improved firm performance, including (a) CEO characteristics (Mubeen et al. 2021; Saidu 2019), (b)

corporate social responsibility (Fu et al. 2021; Li et al. 2022), (c) product market competition (Liu et al. 2022; Mubeen et al. 2022), and (d) technology and green investment (Jiakui et al. 2023; Siedschlag and Yan 2023). Abbas et al. (2023) highlighted that the rapid pace of technological innovation has led to the emergence of new technologies that can help firms operate more efficiently and effectively. However, these factors alone will not be sufficient to achieve improved firm performance without a good corporate governance framework.

Corporate governance has consistently remained a major concern for all stakeholders in traditional and advanced economies. Corporate governance is a system that guides the conduct of people within organizations and the direction of these organizations (Brown et al. 2011). Ownership composition is a critical subject because owners drive and govern their firms in the real sense. Annuar (2015) corroborated this idea and mentioned that ownership structure is one of the important factors of corporate governance.

One of the prime concerns of good governance is to minimize issues between the principal (shareholders) and agents (managers) of a firm, who have varying interests. According to the agency theory, the primary concern of managers is to act in the best interests of shareholders (Jensen and Meckling 1976). However, actual situations are relatively different, and this agency issue becomes more severe when owners have less shareholdings. Shareholders with less shareholdings often have less control right to align the interests of shareholders and managers. In contrast, controlling shareholders have greater incentives and means to monitor the actions of managers, thereby resolving this agency conflict between managers and shareholders (Shleifer and Vishny 1986).

On the one hand, controlling shareholders are greater proponents of high firm values due to their larger equity stakes (La Porta et al. 1999). Moreover, they have long-term commitment and horizons for their firms (Anderson and Reeb 2003; Wiwattanakantang 2001), thus resolving conflicts between controlling and minority shareholders. On the other hand, controlling shareholders exploit minority shareholders while pursuing their private benefits (La Porta et al. 1999). Thus, controlling shareholders lead to both costs and benefits for firms (Courteau et al. 2017). This argument is consistent with the theoretical predictions of the agency theory, in which controlling shareholdings have two competing effects of convergence and divergence of interests.

Numerous studies have investigated the relationship between controlling shareholdings and firm performance, but no consensus has been reached. For instance, a positive relationship (Kansil and Singh 2018), negative relationship (Wiwattanakantang 2001), and nonlinear relationship (Chen et al. 2014; Tian and Estrin 2008) between controlling shareholdings and firm performance have been found. The net effect of controlling shareholders on firm performance thus remains unclear and needs further exploration. Therefore, this study attempts to examine the relationship between controlling shareholders and firm performance.

This study extends prior research that has examined the relationship between controlling shareholdings and firm performance by including firm efficiency as it is another indicator of good governance, where firms with good governance have significantly efficient businesses and vice versa. In this industrial and knowledge economy, the outcome of efficiency is no less than a miracle. Therefore, numerous studies have also investigated the phenomenon of efficiency. Specifically, extensive literature has examined the

determinants of firm efficiency, including (a) industry structure (Homma et al. 2014), (b) economic conditions, (c) corporate social responsibility (Minh and Quang 2022), and (d) controlling shareholdings (Shabbir et al. 2020). Earlier studies (Jiang et al. 2021; Peng et al. 2021; Wang et al. 2021) have also examined the concept of efficiency and found that the efficiency level of firms contributes to firm performance. Embedded in firm value creation is efficiency, in which the selection and execution of successful projects depend on the efficient allocation of firm resources (Amoah 2022). This idea implies that firm efficiency is an important consideration in improving firm performance.

To illustrate, firms should aim to improve their performance and maximize shareholder wealth by putting together requisite resources and using these resources efficiently to achieve a high level of firm efficiency (Gyan et al. 2017). The ability of firms to use the least available inputs to achieve higher outputs implies a high level of efficiency, and this would maximize firm performance. As firm efficiency may also affect firm performance, we argue that firm efficiency embedded in the governance of a firm would determine its performance. Thus, firms' efficiency levels are evident in controlling shareholdings and also affect firm performance. Therefore, this study also examines the mediating role of firm efficiency in the relationship between controlling shareholdings and firm performance.

To achieve the research objectives, the current study follows Preacher and Hayes (2008) and uses a three-step approach to analyze the mediation process. Additionally, the data envelopment analysis (DEA) approach is utilized to compute the efficiency score. Specifically, this method considers multiple inputs and outputs simultaneously, thereby enabling the depiction of all actual dimensions of organizations. Firms that are efficient in their production utilize minimum inputs to produce maximum outputs (Miller and Noulas 1996). However, the crucial phenomenon of excess inputs and shortage of outputs has been generally disregarded in other methods (Tone 2001). This study pursues the phenomenon of excessive inputs and shortage of outputs and applies the slack-based measure (SBM) (Tone 2001) and direct distance function (DDF)-based (Chambers et al. 1996) DEA models to conduct the analysis.

We select Malaysia for its rich setting of firms with high levels of controlling shareholdings, whereby ownership shareholdings in Malaysian publicly listed companies generally have highly concentrated family ownerships and significant government equity holdings (Chu et al. 2016). To elaborate, Lean et al. (2015) reported that, from 2002 to 2011, the largest and the five largest shareholdings of concentrated ownership increased to 50% and 70%, respectively. The uniquely high levels of controlling shareholdings in the Malaysian context prompted us to study a simple yet more comprehensive picture between controlling shareholdings and firm performance. Controlling shareholders should first introduce efficiency in managing resources and then improve their firm performance.

This paper contributes to the ongoing debate on examining the relationship between controlling shareholdings and firm performance in at least three aspects. First, this study extends the theoretical roots of the agency theory by investigating firm efficiency as a mediating variable in the relationship between controlling shareholdings and firm performance. It expands the existing controlling shareholding research on organizational outcomes (Hsieh et al. 2019; Wiwattanakantang 2001) by incorporating firm efficiency

as a mediating factor and empirically testing the extended theoretical framework. The current study fills in the performance measurement gap by extending firm efficiency as a mediator in the relationship between controlling shareholdings and firm performance. Second, most of the previous studies that have explored this complex relationship between controlling shareholders and organizational outcomes are yet to pursue the mediating phenomenon. To the best of the authors' knowledge, this is a novel study to analyze the intervening mechanism of firm efficiency. Third, this study improves the measurement of firm efficiency by employing SBM and DDF models to conduct the analysis. Additionally, it contributes to the methodology by employing several robustness tests (e.g., direct, indirect, and total effects) and proxies (e.g., return of asset and return on equity) to ensure the consistency of results. We also divide the sample into two groups (i.e., efficient and inefficient groups) for an in-depth analysis of the relationship among controlling shareholdings, firm efficiency, and firm performance.

The remainder of this paper is structured as follows. Sect. "Theoretical Discussion and Hypotheses Development" reviews the literature and formulates the hypotheses. Sect. "Data and Method" discusses the data and techniques used in this investigation. Sect. "Empirical Results" describes the findings. Lastly, Sect. "Conclusion" concludes this paper and presents the limitations and future research directions.

Theoretical discussion and hypotheses development

Theoretical discussion

Various actors of organizations have varying interests, and the agency theory clarifies the causes of such varying interests and generally attempts to resolve the corresponding conflict of interests. The agency theory was developed by Jensen and Meckling (1976) and focuses on the separation between control and ownership. The agency theory (Type II) highlights that controlling and minority shareholders arise because of the pursuit of the private goals of controlling owners (De Cesari 2012). Although controlling shareholders are motivated to exercise their rights for a firm's sake, controlling shareholders who prioritize their interests may seek to maximize their profits at the expense of smaller shareholders. These benefits may take various forms, including the transfer of pricing and perks suited to their personal purposes but disregard the benefits of minority shareholders.

The case of Malaysia is relatively different because of the inherent phenomenon of concentrated ownership of controlling shareholders in the country (Claessens et al. 2000). In Malaysia, controlling shareholders have the incentives and means to monitor the self-serving behavior of managers. However, the presence of controlling shareholders gives rise to conflict of interests between them and minority shareholders (Hooy et al. 2020). For example, controlling shareholders influence the major decisions of firms through greater voting powers, larger representation on company boards, substantial involvement in governance, and direct communication with management (Annuar 2015). While driving opportunistic behavior, controlling shareholders pursue their private benefits at the expense of minority shareholders (La Porta et al. 1999).

Evidently, efficiency is in contrast with the self-serving behavior of organizations. Thus, efficiency has the potential to resolve agency conflicts. Therefore, this study

applies the theoretical roots of the agency theory (Type II) to examine the relationship between controlling shareholdings and firm performance through the mediating effects of firm efficiency.

Hypotheses development

Effect of controlling shareholdings on firm performance

The nexus between controlling shareholdings and firm performance is complex because of the conflicting evidence in the past literature. For example, Wiwattanakantang (2001) used the data of Thai firms and found a positive relationship between controlling shareholdings and firm performance. However, some studies have reported an adverse effect of controlling shareholdings on organizational outcomes. Jameson et al. (2014) found a negative relationship between controlling shareholdings and Tobin's Q in India. The main reason for the low firm value from controlling shareholdings is the excess of voting rights over cash flow rights (Lins 2003). Apparently, pro-rata benefits and losses will not be proportional when there are differences between voting and cash flow rights. Additionally, some studies have broken down the relationship between controlling shareholdings and firm performance in a piece-wise manner when explaining this relationship (Benjamin et al. 2016; Morck et al. 1988). Bian et al. (2022) documented that multiple large shareholders play a relevant role in financial firms such as banks. However, they concluded that multiple large shareholders have no effect on the performance of Chinese banks.

Studies that conducted a quadratic examination of controlling shareholdings and various organizational outcomes have been undertaken recently (Hsieh et al. 2019). Surprisingly, a few studies have explored the cubic form of the relationship between controlling shareholdings and firm performance (Hoang et al. 2017). Tsafack and Guo (2021) found an inverted U-shaped relationship between controlling shareholdings and return on assets (ROA), return on equity (ROE), and Tobin's Q in Chinese public firms. This effort to study the relationship between controlling shareholdings and firm performance from different perspectives is due to the complexity of this relationship, which needs proper governance mechanisms.

The system of controlling shareholdings is considered effective from a governance perspective because of its ability to address the agency conflict between shareholders and managers. La Porta et al. (1999) highlighted that the system of controlling shareholdings prevails globally. On the one hand, controlling shareholders align their interests with those of minority shareholders and discipline managers' actions. On the other hand, controlling shareholders diverge their interests from those of minority shareholders while pursuing their private benefits. Courteau et al. (2017) confirmed these competing effects and highlighted that controlling shareholders have costs and benefits to organizations. This argument is also consistent with the convergence and divergence of the interests of controlling shareholders as per the agency theory.

In summary, there is extensive evidence about controlling shareholders and firm performance. However, there is a lack of a consistent pattern for this critical relationship. Therefore, the following hypothesis is proposed:

H1 Controlling shareholdings are significantly related to firm performance.

Effect of controlling shareholdings on firm efficiency

Firms' ownership structure is an important factor in corporate governance (Annuar 2015), and controlling shareholders are the main actors in this corporate governance (Hooy et al. 2020; La Porta et al. 1999). Undoubtedly, better-governed firms will be more efficient, and sustainable competitive advantage is only possible when continuous efficiency improvement measures are adopted. Intuitively, controlling shareholders prefer to enhance the efficiency of firms because they advocate for a better value of companies. Controlling shareholders monitor the actions of managers and improve the various efficiency measures of their firm.

Hsieh et al. (2019) found that controlling shareholdings affect intellectual capital efficiency. Anderson et al. (2012) discussed that controlling shareholders prefer to invest considerably in physical assets, thereby improving the efficiency of tangible capital. Controlling shareholders exert their control over firms' resources and are likely to affect firm efficiency. In this sense, Jameson et al. (2014) highlighted that the decisions of controlling shareholders cannot be overturned and directly contribute to firms' operations. Following these reasons, controlling shareholders can formulate policies that can address the slacks phenomenon of excessive inputs and shortage of outputs.

Certain reasons are given for why controlling shareholders strive for efficiency in firms' operations. First, controlling shareholders have the incentives and means to improve the operational efficiency of businesses. For example, controlling shareholders have remarkably invested in the equity capital of firms, thereby having long-term horizons because of their undiversified investments (Wiwattanakantang 2001). Over time, our understanding of the complex operations of firms by controlling shareholders has been enhanced, thereby increasing the efficiency of business operations. Second, controlling shareholders have substantial access to various resources and combine disintegrated units to enhance firm efficiency (Oh et al. 2018). Controlling shareholders are markedly interested in enhanced efficiency values because they have internalized their benefits with those of their firms because of their substantial ownership stakes. Third, controlling shareholders are significantly concerned with the positive image of their firms (Choi 2018), and improved efficiency leads to enhanced quality of products in the market. Thus, controlling shareholders are likely to establish positive reputational capital by improving the efficiency of their businesses. However, Boubaker et al. (2021) discovered a negative correlation between controlling shareholdings and firm productive efficiency, revealing that their private benefits of control prohibit them from supporting productive ventures. Boubaker et al. (2016) supported the preceding argument and provided strong evidence of a negative relationship between the largest controlling shareholders' control–ownership wedge and the risk-taking level of firms under their control. Hence, the following hypothesis is formulated:

H2 Controlling shareholdings are significantly related to firm efficiency.

Effect of firm efficiency on firm performance

Efficiency is one of the major concerns in the industrial organizational arena. Firms attempt to utilize minimum resources to produce maximum outputs, thereby improving

the firm efficiency of their production function. Additionally, firms face a scarcity of resources in the intensely competitive environment of the corporate world. The concurrent shortage of resources and the highly competitive environment requires simultaneously reducing input wastage and increasing output levels to achieve optimum efficiency levels. The phenomenon of usage of excessive inputs and shortage of outputs leads to inefficiency (Tone 2001). The recent wave of literature has stressed the two phenomena of input and output slacks for increasing the efficiency of underlying firms. Due to the preceding reasons, the relationship between efficiency and firm performance must be studied.

The relationship between firm efficiency and performance is not as straightforward as it appears. For example, whether efficiency is the outcome of superior firm performance or vice versa is confusing. Thus, there is a possibility of a two-way relationship between the two critical concepts. Additionally, firms that exert effort to gain efficiency may appear to generally compromise on better performance and vice versa. The main reason is that efficiency is often achieved by integrating various operations of a firm. However, efficiency may also be achieved by breaking down the critical operations of a firm. In this way, a firm can significantly understand the complex systems and overall functions of various organs of the organization. This course of action can affect the optimality of firms' resources.

Despite the preceding reasons, previous studies have found a positive relationship between efficiency and firm performance (Church and Ware 2000). Caragliu (2021) examined the impact of energy efficiency policies on productivity and profitability, and the result revealed a positive and significant impact of energy efficiency on the firm performance of Italy's paper and glass industries. Operational efficiency will increase the predictability power of firms and reduce the risks involved in their operations. The main goal of any business is to enhance its performance, which will further increase shareholder value. Therefore, firms develop appropriate strategies, assemble critical resources, and develop plans of action to improve efficiency (Baik et al. 2013; Ting et al. 2020). These actions ultimately improve firm performance. Thus, the following hypothesis is developed:

H3 Firm efficiency is significantly related to firm performance.

Efficiency is one of the prime concerns in industrial and knowledge economies. In this highly competitive business environment, developing new products and services to become a first-mover firm is only possible when a firm is efficient. Firms governed in a superior manner will be markedly efficient, which has the effects of creating value for ongoing processes and improving firm performance. For a firm to maintain its existing performance level, it should be efficient. Thus, controlling shareholders take various measures to improve the governance of firms, thereby improving efficiency (Rachagan 2010).

The efficiency of business operations can also be improved by controlling shareholders because they are the largest owners and can influence firms' major decisions, including those that affect efficiency levels. Therefore, a linkage between controlling shareholders and firm efficiency exists. This implies that controlling shareholdings affect the efficiency

of firms, and efficiency further affects firm performance. As paths exist from controlling shareholdings to firm efficiency and firm performance, firm efficiency mediates the relationship between controlling shareholdings and firm performance. To summarize, there is extensive evidence about controlling shareholdings and firm performance, although there is a lack of a consistent pattern for this critical relationship. Therefore, this paper fills in the gap in the existing studies by examining the mediating effect of firm efficiency on the relationship between controlling shareholdings and firm performance.

Data and method

Data sample

The data were retrieved from the Thomson Reuters DataStream database, which is considered a reliable source of corporate financial information across the globe, and also annual reports. The sample of this study consists of Malaysian publicly listed firms from 12 industries for 11 years (2009–2019). The sample period excludes the Global Financial Crisis in 2007–2008 as it can cause differential effects in our analysis. The industries are construction, consumer products and services, energy, health care, industrial products and services, plantation, property, real estate and trust, technology, telecommunication and media, transportation and logistics, and utilities. The sample of this study excludes financial firms from the final sample because these firms fall under different regulatory requirements and accounting fundamentals. The sample must meet the following criteria. (1) The firm needs to be listed on the Main Board of Bursa Malaysia before 2009. (2) The firm must have complete data for the 11 years (2009–2019). (3) The firm must have disclosed full information on the 30 largest shareholders in the annual report to identify ownership shareholdings. The final sample was an unbalanced panel data of 260 non-financial firms, resulting in 2,849 firm-year observations.

Variable selection

Dependent variable: firm performance

The past literature has used many indicators as a proxy for firm performance. This study particularly uses ROA as a measure of firm performance. ROA will help us to examine various stakeholders' perspectives of firm performance, which is consistent with those of prior studies (Fan et al. 2017; Wang et al. 2021).

Independent variable: controlling shareholdings

This study employs controlling shareholdings as an independent variable. Controlling shareholdings is measured as the proportion of shares owned by a firm's five largest shareholders (Hovey et al. 2003; Hsieh et al. 2019; Ting et al. 2020). The percentage of shares held by the largest controlling shareholders is obtained through a list of the 30 largest shareholders, which is available in the annual reports of companies. This study uses the five largest shareholders to represent controlling shareholdings. The reason is that ownership concentration is centralized in the hands of a few shareholders who exercise corporate control proportionately or even disproportionately to their economic stake in a firm (Kansil 2021). Moreover, the observed sample of this study reveals that the five largest controlling shareholders own 54.29% of the outstanding shares of Malaysia's publicly listed firms.

Table 1 Measurement of variables

Variables	Abbreviations	Measurements
Inputs and outputs for firm efficiency		
Inputs		
Operating expenses	OPEX	Total expenses without cost of goods sold
Cost of goods sold	COGS	Cost of sale for trading/service
Property, plant and equipment	PPE	Net worth of property, plant and equipment
Outputs		
Sales	Sales	Sales without other income
Profit after tax	PAT	Net income after taxes
Regression variables		
Return on asset	ROA	Earnings divided by total assets
Controlling shareholdings	CS5	Percentage of shareholdings held by the five largest shareholders
Firm efficiency_Slack based model	EFF_SBM	Slack-based model of DEA
Firm efficiency_Direct distance function	EFF_DDF	Directional distance function of DEA
Control variables		
Board independence	BIND	Number of independent directors on the board
Firm size	FSIZE	Natural log of total sales
Firm leverage	FLEV	Debt divided by total assets

Mediating variable: firm efficiency

The mediating variable in this study is firm efficiency, which is computed with the ratio of weighted outputs to weighted inputs. To compute efficiency, we include operating expenses (OPEX); cost of goods sold (COGS); and property, plant, and equipment (PPE) as input variables; and sales (Sales) and profit after tax (PAT) are included as output variables. This study utilizes the DEA method to compute efficiency scores (Tone 2001). DEA makes it possible to rank decision-making units as more or less efficient based on efficiency scores. We employ SBM and DDF DEA models to conduct the analysis.

Regression models

This study uses a three-step approach of mediation analysis[1] (Preacher and Hayes 2004, 2008) to identify the role of the mediator variable. We also include the following control variables (Ahmad et al. 2022):

(i) Board independence (BIND), which is measured as the number of independent directors on a board
(ii) Firm size (FSIZE), which is the natural log of total sales
(iii) Firm leverage (FLEV), which is calculated as debt divided by total assets.

Table 1 presents the summary of the variable measurement.

The relationship between controlling shareholdings and firm performance is equivocal. Therefore, there is a need to improve the model of the relationship between controlling shareholdings and firm performance to encompass new antecedents. Hence,

[1] http://quantpsy.org/pubs/preacher_hayes_2004.pdf

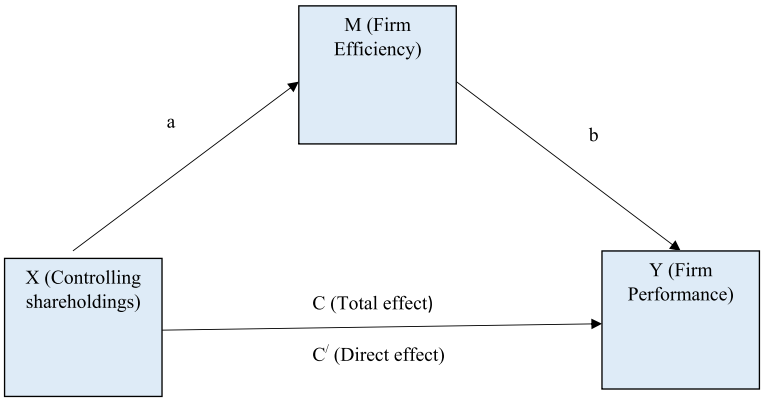

Fig. 1 Controlling shareholdings and firm performance with firm efficiency as mediator

this study incorporates the variable of firm efficiency as a mediator in the controlling shareholders–firm performance nexus, which is depicted in Fig. 1.

Mediation steps

This study is consistent with prior studies (Abbas et al. 2019, 2020) in conducting the mediation analysis. Mediation analysis involves investigating whether there exists any difference between direct and indirect effects. The mediation model is examined using the three-step approach of Preacher and Hayes (2004) in SPSS. Details of the three-step mediation are as follows:

Step 1: The direct relationship between controlling shareholdings and firm performance is analyzed. This path is called c.

Step 2: We examine the relationship between controlling shareholdings and firm efficiency, which is called path a. This step is represented by a, which treats firm efficiency (mediator) as a dependent variable corresponding to controlling shareholdings. Furthermore, we examine the relationship between firm efficiency and performance and estimate path b. Indirect effects are computed by multiplying the estimators of paths a and b.

Step 3: We examine the relationship between controlling shareholdings and firm performance by controlling for the effect of firm efficiency. This analysis will estimate path $c^{'}$. Details of the direct, indirect, and total effects are as follows:

$$\text{Total effect} = \text{Direct Effect} + \text{Indirect Effect}$$

$$\text{Path c} = \text{Path c}' + (\text{Path a} \times \text{Path b}),$$

where Path c = Total Effect; (a × b) = Indirect Effect and Path c' = Direct Effect.

To elaborate further, path c computes the direct effect. Multiplying paths a and b gives the results of the indirect effect. However, the path of c' gives the results of the direct effect. The total effect is the sum of the direct and indirect effects. The effect of controlling shareholdings on firm performance for controlling for the effect of firm efficiency will be zero for complete mediation and nonzero for partial mediation.

Table 2 Summary statistics and correlation analysis of DEA indicators

Variables	Summary statistics		Correlation analysis			
	Mean (RM'million)	SD (RM'million)	Input 1	Input 2	Input 3	Output 1
Input 1: OPEX	271	1,130				
Input 2: COGS	1,080	3,400	0.4417			
Input 3: PPE	1,580	9,120	0.4424	0.6650		
Output 1: Sales	1,480	4,440	0.6455	0.9654	0.7062	
Output 2: PAT	1,040	513	0.4634	0.7530	0.6737	0.7851

All correlation coefficients are significant at the 1% significance level

Table 3 Descriptive statistics and test of differences

Variables	Summary statistics		Mean differences test			
	Mean	SD	High_Eff (n = 1,424)	Low_Eff (n = 1,425)	Differences	*t*-stat
ROA	0.0368	0.0639	0.0562	0.0174	0.0388	− 17.0145***
EFF_SBM	0.1905	0.2279				
EFF_DDF	0.8720	0.0672				
CS5	0.5429	0.1624	0.5524	0.5336	0.0188	− 3.1006***
BIND	3.4163	1.1026	3.5850	3.2477	0.3373	− 8.2590***
FSIZE	20.3484	1.5499	21.0348	19.6625	1.3723	− 26.3488***
FLEV	0.3939	0.1971	0.3954	0.3924	0.0030	− 0.4116

***significant at the 1% level

Empirical results

Descriptive statistics and mean differences test

Table 2 presents the summary statistics and correlation analysis of the input and output variables. The input and output variables are used to compute the DEA scores. There are three inputs—OPEX, COGS, and PPE—while the two outputs are Sales and PAT. COGS and OPEX represent direct and indirect costs, respectively. Among the variables, PPE has the highest mean value of Malaysian Ringgit (MYR) 1,580 million, while OPEX has the lowest mean value of MYR 271 million. Thus, the fixed assets are 5.83 times greater than the OPEX of firms. Moreover, the fixed assets are 1.46 times greater than the COGS of the sample of Malaysia's publicly listed firms. Additionally, profit is 70% of the sales amount. Table 2 also presents the correlation analysis of the input and output variables. The correlation analysis reveals a positive relationship among all variables. For example, the highest correlation exists between COGS and Sales, with a coefficient of 0.9654, while the lowest correlation exists between OPEX and COGS, with a coefficient of 0.4417. These results suggest that the sales and direct expenses of firms are closely related to each other. However, given the different nature of direct and indirect expenses, COGS and OPEX have a weak relationship.

Table 3 presents the descriptive statistics of variables used in the regression analysis. The mean value of ROA is 0.0368, suggesting that the sample firms use assets to generate PAT of 3.68%. The mean value of EFF_SBM is 0.1905, which indicates that firms can improve their operational efficiency by 80.95%. On average, the sample of Malaysia's

Table 4 Pearson correlation coefficients

Variables	ROA	EFF_SBM	EFF_DDF	CS5	BIND	FSIZE
EFF_SBM	0.2918***					
EFF_DDF	0.3620***	0.6302***				
CS5	0.0714***	0.0408**	0.0645***			
BIND	0.0356*	0.1788***	0.1057***	−0.0241		
FSIZE	0.0325*	0.4889***	0.1883***	−0.0110	0.3737***	
FLEV	−0.2217***	0.0129	−0.0415**	−0.1035***	0.1361***	0.3045***

*, ** and *** significant at the 10%, 5% and 1% levels, respectively

publicly listed firms operates at critically low-efficiency levels. The average value of efficiency obtained by EFF_DDF is 0.8720, indicating that an improvement of only 12.80% is needed in operating efficiency. The mean value of CS5 indicates that the top five largest controlling shareholders own an average of 54.29% of the outstanding shares of Malaysia's publicly listed firms. This shareholding percentage is consistent with the results of previous studies (Hsieh et al. 2019; Lean et al. 2015). On average, there are three independent directors on company boards. The anti-logged value of 20.3484 indicates that the total assets of Malaysia's publicly listed firms are worth RM 686 million. Additionally, 39.39% of the sample firms' total assets are financed by the debt utilized.

Table 3 presents the test of difference among the explanatory variables from two groups: high-efficiency (High_Eff = 1) and low-efficiency (Low_Eff = 0) firms. The findings reveal that high-efficiency firms have higher values of profits in terms of ROA compared with low-efficiency firms (0.0562 vs. 0.0174). The test of differences also documents that the percentage of controlling shareholdings is greater in high-efficiency firms compared with low-efficiency firms (i.e., 0.5524 vs. 0.5336). The values of control variables are also marginally greater in high-efficiency firms than in low-efficiency firms.

Correlation analysis

Table 4 presents the results of the Pearson correlation. ROA is found to have a significant positive correlation with EFF_SBM, EFF_DDF, and controlling shareholdings. Additionally, controlling shareholdings are positively correlated with firm efficiency. Thus, controlling shareholders increase the efficiency of Malaysia's publicly listed firms. Regarding the control variables, the variables BIND and FSIZE are significantly positively correlated with ROA, while FLEV is significantly negatively correlated with ROA. Overall, we find that all variables have a low coefficient of correlation (below 70%), suggesting that multicollinearity is not present.

Controlling shareholdings and firm performance: mediated by firm efficiency

Table 5 presents the findings of the relationship between controlling shareholdings and firm performance by constructing a multiple mediation model with firm efficiency as a mediator. Consistent with Ting et al. (2021), this study adopts a three-step approach to analyze the mediating effects of firm efficiency on the relationship between controlling shareholdings and firm performance.

In Step 1, we examine the total effect of controlling shareholdings on firm performance. The coefficient of CS5 is significant and positive (coefficient = 0.0187, $p < 0.01$).

Table 5 Testing mediating effect of firm efficiency on the association between controlling shareholdings and firm performance (Y = ROA)

Variables	Y = ROA, X = CS5, Mediator = EFF_SBM		Y = ROA, X = CS5, Mediator = EFF_DDF	
	Coefficient	*t*-stat	Coefficient	*t*-stat
Step1: Total effect of X on Y (Path c)				
CS5	0.0187	2.6036***	0.0187	2.6036***
Step2: X to mediator (path a) and mediator to Y (path b)				
CS5	0.0448	1.9687**	0.0263	3.0978***
Firm efficiency	0.0909	16.0286***	0.3279	19.7095***
Step3: Direct effect of X on Y (path c')				
CS5	0.0146	2.1248**	0.0110	1.6271*
Partial effect of control variables on Y				
BIND	0.0020	1.8704*	0.0011	1.0651
FSIZE	− 0.0032	− 3.439***	0.0011	1.3412
FLEV	− 0.0659	− 10.9294***	− 0.0697	− 11.8867***
Adjusted R^2	0.1411		0.1761	
F-statistic	93.2496***		121.3387***	

*, ** and *** significant at the 10%, 5% and 1% levels, respectively

The result of path c suggests that controlling shareholdings is positively related to firm performance. In Step 2, the indirect effects of controlling shareholdings and firm performance are examined through paths a and b. The results of path a indicate that controlling shareholdings have a significantly positive effect on firm efficiency (coefficient = 0.0448, $p < 0.05$). Moreover, the findings of path b indicate a significant positive relationship between firm efficiency and performance (coefficient = 0.0909, $p < 0.01$). Hence, the indirect effect of this relationship is 0.0041, which is obtained as $0.0448 \times 0.0909 = 0.0041$. In Step 3, we test the direct effect of controlling shareholdings on firm performance through the mediating variable of firm efficiency. The results of path c' indicate that controlling shareholders positively influence firm efficiency, thereby further improving firm performance. However, the magnitude of the coefficient in path c' is less than that in path c. These results suggest that firm efficiency partially mediates the relationship between controlling shareholdings and firm performance.

To confirm the findings, this study further conducts robustness tests to verify the mediating effect of firm efficiency on the relationship between controlling shareholdings and firm performance by replacing EFF_DDF as an alternative firm efficiency measure. After using EFF_DDF as a robust proxy for firm efficiency, the results in Table 5 remain qualitatively the same. Thus, the relationship between controlling shareholdings and firm performance is partially mediated by firm efficiency.

Additional analysis

Apart from running the regression model to examine the relationship between controlling shareholdings and firm performance through the mediating variable of firm efficiency with the full sample, this study also divides the sample into two groups (i.e., efficient and inefficient groups) for additional analysis. The efficient (inefficient) group comprises firms with efficiency scores greater (less) than the median value of the yearly

Table 6 Comparing efficient and inefficient firms—Y = ROE, X = CS5, Mediator = EFF_SBM

Variables	Efficient group		Inefficient group	
	Coefficient	***t*-stat**	**Coefficient**	***t*-stat**
Step1: Total effect of X on Y (Path c)				
CS5	0.0051	0.4836	0.0194	2.4240**
Step2: X to mediator (path a) and mediator to Y (path b)				
CS5	− 0.0038	− 0.1032	0.0115	2.2587***
Firm efficiency	0.0576	7.8086***	0.2966	7.1946***
Step3: Direct effect of X on Y (path c')				
CS5	0.0053	0.5151	0.0160	2.0321**
Partial effect of control variables on Y				
BIND	0.0027	1.8267*	0.0026	1.8849*
FSIZE	− 0.0081	− 6.1685***	0.0008	0.6538
FLEV	− 0.0641	− 7.3713***	− 0.0549	− 7.4969***
Adjusted R^2	0.1130		0.0876	
F-statistic	36.1243***		27.2351***	

*, ** and *** significant at the 10%, 5% and 1% levels, respectively

efficiency scores. Different efficiency levels explain different firm performance. Splitting the sample into efficient and inefficient groups enables us to zoom into the role of controlling shareholders. Interestingly, similar results to the main results are only found in the inefficient group. In the inefficient group, the regression results in Table 6 indicate that controlling shareholdings positively affect firm performance through the mediating variable of firm efficiency in terms of the total, direct, and indirect effects. In contrast, the indirect effects of path a indicate that controlling shareholdings insignificantly influence firm efficiency, but the findings of path b in the inefficient group reveal a significant positive relationship between firm efficiency and performance. This result implies that controlling shareholding is ineffective and does not play a vital role with respect to firm efficiency in the efficient group. However, when firms are inefficient, controlling shareholders influence the major decisions of firms with the help of significant voting powers, large representation on company boards, and high involvement in governance to ensure that firms achieve a high-efficiency level (Annuar 2015).

Additional robustness test

This study conducts another robustness check for consistency and result confirmation. We replace the dependent variable ROA with another performance measure (i.e., ROE, which is measured as earnings divided by total equities). The current study follows Ting and Lean (2015) in using ROE as a performance measure. ROE, which represents the DuPont identity, measures management effectiveness in relation to firm profitability, as ROA does. ROE reflects the level of return on shareholders' equity, and this measure of firm performance accounts for the long-term prospects of a firm. The higher the ROE, the higher the return on investment. ROE is a vital measure of investment effectiveness and is widely used as a financial performance measure in the literature (Dženopoljac et al. 2016; Ginesti et al. 2018; Maditinos et al. 2011; Tran and Vo 2020). The estimation results in Table 7 remain qualitatively the same as those in Table 5. The empirical

Table 7 Robustness checks (Y = ROE)

Variables	Y = ROE, X = CS5, Mediator = EFF_SBM		Y = ROE, X = CS5, Mediator = EFF_DDF	
	Coefficient	*t*-stat	Coefficient	*t*-stat
Step1: Total effect of X on Y (Path c)				
CS5	0.0278	2.9789***	0.0278	2.9789***
Step2: X to mediator (path a) and mediator to Y (path b)				
CS5	0.0673	2.9549***	0.0272	3.5416***
Firm efficiency	0.1120	15.0608***	0.4579	21.5565***
Step3: Direct effect of X on Y (path c')				
CS5	0.0202	2.2525**	0.0153	1.7699*
Partial effect of control variables on Y				
BIND	0.0038	2.6915***	0.0025	1.8696*
FSIZE	−0.0018	−1.5184	0.0030	2.9585***
FLEV	−0.0380	−4.8063***	−0.0421	−5.5913***
Adjusted R^2	0.1093		0.1741	
F-statistic	68.7405***		118.1472***	

*, ** and *** significant at the 10%, 5% and 1% levels, respectively

regression results consistently indicate that the relationship between controlling shareholdings and firm performance is partially mediated by firm efficiency. According to the total effect result (Step 1), controlling shareholdings have a positive relationship with firm performance. In Step 2, controlling shareholdings have a significantly positive effect on firm efficiency. Moreover, firm efficiency has a positive impact on firm performance in the indirect effect regression test. In Step 3, the robustness check tests the direct effect of controlling shareholdings on firm performance through the mediating variable of firm efficiency. Accordingly, controlling shareholdings are confirmed to positively influence firm efficiency, thereby further improving firm performance.

Conclusion

Findings and discussion

This study is based on the data of Malaysia's publicly listed firms from 2009 to 2019 and adopts a three-step approach to analyze the mediation effects of firm efficiency on the relationship between controlling shareholdings and firm performance (Preacher and Hayes 2004 2008). The main findings suggest that controlling shareholdings have positive effects on firm performance. This implies that a firm with a higher level of controlling shareholdings performs better than its counterparts with a lower level of controlling shareholdings. Moreover, the results of the mediation analysis indicate that firm efficiency partially mediates the relationship between controlling shareholdings and firm performance. The mediation analysis reveals that while controlling shareholdings have a direct positive effect on firm performance, part of this effect is also through improved firm efficiency. The total and indirect effects also suggest that controlling shareholdings are positively related to firm performance. These findings are consistent with those of Wiwattanakantang (2001), Jameson et al. (2014), and Benjamin et al. (2016) and are also found in Sobel tests (Sobel 1982, 1986), which are briefly tabulated in "Appendix".

Moreover, the direct effect of controlling shareholdings on firm performance is partially mediated through the mediating variable of firm efficiency, which indicates that part of the effect of controlling shareholdings on firm performance is due to the improvement of firm efficiency. This study suggests that controlling shareholdings and firm efficiency likely improve governance mechanisms and performance measures concurrently. The result is consistent with that of Choi (2018), who agreed on the positive impact of controlling shareholdings on firm efficiency, and Caragliu (2021), who documented the positive impact of firm efficiency on firm performance. Furthermore, controlling shareholdings positively influence firm efficiency, thereby ultimately resulting in positive effects on firm performance. The plausible reason is that controlling shareholdings and firm efficiency lead to improved governance and positive outcomes for firms. In summary, controlling shareholders have direct and indirect effects on firm performance.

The overall results of this study suggest that the complex relationship between controlling shareholdings and firm performance is partially mediated by firm efficiency. Controlling shareholdings resolve the agency conflict between shareholders and managers and improve the governance of firms. Additionally, efficiency is a driving force for sustainable development and leads to better-governed operations of companies. Hence, the positive effects of controlling shareholdings offset the positive effects of firm efficiency on firm performance.

The findings of this study make important contributions to the academic literature on corporate governance, firm efficiency, and firm performance. This study extends our understanding of the complex dynamics that drive organizational success. In particular, the study highlights the need for improved governance structures and operational efficiency as key drivers of organizational performance. These findings provide a valuable foundation for future research in this area and offer important insights for academics, researchers, and policymakers seeking to better understand the relationship between governance, efficiency, and performance in the context of publicly listed companies in Malaysia.

Research implications

Theoretical implications

This study has several important implications. It fills the gap in the existing body of knowledge on how controlling shareholdings affect firm performance through a mediation mechanism. Accordingly, we apply the theoretical roots of the agency theory and extend the existing framework of this theory by introducing a new variable (i.e., firm efficiency) as a mediating variable. Understanding the complex relationship between controlling shareholdings and firm performance is of utmost importance because the former plays a critical role in governing firms. Malaysia has a unique feature of having a common law system, which is characterized by weak protection of shareholders and a substantial amount of private benefits of control (Benjamin et al. 2016). Thus, the findings of this study will provide an improved understanding of the conflict of interest between controlling and minority shareholders. Moreover, including firm efficiency as a mediating variable in this model will enrich our understanding of the impact of controlling shareholdings on firm performance. This study is noteworthy because it utilizes the slacks phenomenon in computing the variable of efficiency.

Managerial implications

The findings of this study have some compelling implications for managers and policymakers. For example, managers should focus on firm efficiency and other governance measures to effectively increase firm value. Particularly, firms should take practical steps to simultaneously improve efficiency and various governance measures but with a balanced approach. The reason is that the effects of efficiency and better governance by controlling shareholders are counterbalanced. Interestingly, efficiency generally contributes to organizations. Therefore, this study suggests that controlling shareholders can yield better results with respect to the totality of organizations if they focus on firm efficiency instead of directly exerting effort on firm performance. The main reason is that efficiency will definitely have ripple effects on other organs (major and minor) of an organization. To enhance firm performance through efficiency, controlling shareholders should introduce new technologies to increase efficiency, implement measures to end the wastage of resources, and increase production capacity to reach their optimal size.

Limitations and suggestions for future research

Although every study has limitations, such limitations provide further research avenues for future studies. First, this study is based on the data of Malaysia's publicly listed firms, so the findings of this study should be generalized with caution to other regional contexts. For example, Malaysia is characterized by concentrated ownership, weak legal environments, and substantial private benefits of control. This institutional setting is explicitly different from the environments of developed regions.

Second, this study is based on the SBM–DEA approach to compute the efficiency scores and disregard the dynamic aspects of organizations. See Table 8 for a brief summary of abbreviations used in this study. However, contemporary business models are based on interlinked activities, and efficiency can be measured accurately by adopting stage-based models. Thus, future studies can adopt the network-based models of the DEA method to include carry-over activities to focus on measures of efficiency in a precise manner.

Third, another limitation of this study is disregarding the identities of controlling shareholders. A well-known idea is that controlling shareholders may belong to families, institutions, or the government. Thus, future studies can significantly comprehend the framework of this paper after considering the different types of controlling shareholders because different controlling shareholders have unique preferences and goals.

Table 8 Abbreviations used in this study

Variables	Expositions
DEA	Data envelopment analysis
DDF	Direct distance function
DMU	Decision-making unit
SBM	Slack–based measure

Other abbreviations are stated in Table 1

Fourth, since early 2020, industries worldwide have been affected by the COVID-19 pandemic. Future studies may follow Ge et al. (2022), Iorember et al. (2022), and Hafeez et al. (2023) to focus on this major incident.

Fifth, the primary emphasis of the present study is on exploring how firm efficiency acts as a mediating factor between controlling shareholdings and firm performance. In future research, it would be beneficial to apply the approach introduced by Kou et al. (2021) by employing a two-stage multiobjective feature selection method. This would enable a comprehensive investigation of the impacts of controlling shareholdings and firm efficiency on firm performance.

Appendix

```
DIRECT AND TOTAL EFFECTS
           Coeff      s.e.         t  Sig(two)
b(YX)      .0270     .0072    3.7716     .0002
b(MX)      .0571     .0263    2.1742     .0298
b(YM.X)    .0789     .0049   16.1575     .0000
b(YX.M)    .0225     .0069    3.2790     .0011

INDIRECT EFFECT AND SIGNIFICANCE USING NORMAL DISTRIBUTION
          Value      s.e.    LL95CI    UL95CI         Z  Sig(two)
Effect    .0045     .0021     .0004     .0086    2.1507     .0315

********************************** NOTES **********************************

Bootstrap confidence intervals are preferred to the Sobel test for inference about indirect effects.
```

Acknowledgements
The authors would like to thank Universiti Malaysia Pahang for its financial support to this research (University Research Grant Scheme RDU223303).

Author contributions
IT wrote the findings analysis and conclusion, supervision. JA, the literature review and theoretical discussion. QL, the modelling, data methodology and running of tests, and writing and editing. TT, wrote the introduction, writing and editing. All authors read and approved the final manuscript.

Funding
Nil.

Availability of data and materials
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests
The authors declare that they have no competing interests.

Received: 14 June 2022 Accepted: 24 May 2023
Published online: 29 February 2024

References

Abbas J, Raza S, Nurunnabi M, Minai MS, Bano S (2019) The impact of entrepreneurial business networks on firms' performance through a mediating role of dynamic capabilities. Sustainability 11(11):3006

Abbas J, Zhang Q, Hussain I, Akram S, Afaq A, Shad MA (2020) Sustainable innovation in small medium enterprises: the impact of knowledge management on organizational innovation through a mediation analysis by using SEM approach. Sustainability 12(6):2407

Abbas J, Wang D, Su Z, Ziapour A (2021) The role of social media in the advent of COVID-19 pandemic: crisis management, mental health challenges and implications. Risk Manag Healthc Policy 14:1917–1932

Abbas J, Wang L, Belgacem SB, Pawar PS, Najam H, Abbas J (2023) Investment in renewable energy and electricity output: Role of green finance, environmental tax, and geopolitical risk: Empirical evidence from China. Energy 269:126683
Ahmad N, Ting IWK, Tebourbi I, Kweh QL (2022) Non-linearity between family control and firm financial sustainability: moderating effects of CEO tenure and education. Eurasian Bus Rev. https://doi.org/10.1007/s40821-021-00197-7
Amoah B (2022) Does efficiency influence firm investment size? Evidence from Ghana. Heliyon 8:e10281
Anderson RC, Reeb DM (2003) Founding-family ownership and firm performance: evidence from the S&P 500. J Financ 58(3):1301–1328
Anderson RC, Duru A, Reeb DM (2012) Investment policy in family controlled firms. J Bank Finance 36(6):1744–1758
Annuar HA (2015) Changes in ownership forms and role of institutional investors in governing public companies in Malaysia: a research note. J Acc Organ Change 11(4):455–475
Baik B, Chae J, Choi S, Farber DB (2013) Changes in operational efficiency and firm performance: a frontier analysis approach. Contemp Acc Res 30(3):996–1026
Benjamin SJ, Wasiuzzaman S, Mokhtarinia H, Nejad NR (2016) Family ownership and dividend payout in Malaysia. Int J Manag Finance 12(3):314–334
Bian W, Ren Y, Zhang H (2022) Do multiple large shareholders matter in financial firms? Evidence from China. Pac Basin Finance J 74:101805
Boubaker S, Nguyen P, Rouatbi W (2016) Multiple large shareholders and corporate risk-taking: evidence from French family firms. Eur Financ Manag 22(4):697–745
Boubaker S, Manita R, Rouatbi W (2021) Large shareholders, control contestability and firm productive efficiency. Ann Oper Res 296(1):591–614
Brown P, Beekes W, Verhoeven P (2011) Corporate governance, accounting and finance: a review. Account Finance 51(1):96–172
Caragliu A (2021) Energy efficiency-enhancing policies and firm performance: Evidence from the paper and glass industries in Italy. Energy Policy 156:112415
Chambers RG, Chung Y, Färe R (1996) Benefit and distance functions. J Econ Theory 70(2):407–419
Chen A, Kao L, Lu C-S (2014) Controlling ownership and firm performance in Taiwan: the role of external competition and internal governance. Pac Basin Financ J 29:219–238. https://doi.org/10.1016/j.pacfin.2014.04.007
Choi AH (2018) Concentrated ownership and long-term shareholder value. Harv Bus l Rev 8:53–99
Chu E-Y, Lai T-S, Song S-I (2016) Corporate governance and financial constraints in family controlled firms: evidence from Malaysia. Int J Bus Soc 17(3):429–446
Church JR, Ware R (2000) Industrial organization: a strategic approach. Irwin McGraw Hill, Homewood, pp 367–69
Claessens S, Djankov S, Lang LH (2000) The separation of ownership and control in East Asian corporations. J Financ Econ 58(1–2):81–112
Courteau L, Di Pietra R, Giudici P, Melis A (2017) The role and effect of controlling shareholders in corporate governance. J Manage Governance 21(3):561–572
De Cesari A (2012) Expropriation of minority shareholders and payout policy. Br Account Rev 44(4):207–220
Dženopoljac V, Janoševic S, Bontis N (2016) Intellectual capital and financial performance in the Serbian ICT industry. J Intellect Cap 17(2):373–396
Fan L, Pan S, Liu G, Zhou P (2017) Does energy efficiency affect financial performance? Evidence from Chinese energy-intensive firms. J Clean Prod 151:53–59
Fu Q, Abbas J, Sultan S (2021) Reset the industry redux through corporate social responsibility: the COVID-19 tourism impact on hospitality firms through business model innovation. Front Psychol 6686
Ge T, Abbas J, Ullah R, Abbas A, Sadiq I, Zhang R (2022) Women's entrepreneurial contribution to family income: innovative technologies promote females' entrepreneurship amid COVID-19 crisis. Front Psychol 13:828040
Ginesti G, Caldarelli A, Zampella A (2018) Exploring the impact of intellectual capital on company reputation and performance. J Intellect Cap 19(5):915–934
Gyan AK, Brahmana R, Bakri AK (2017) Diversification strategy, efficiency, and firm performance: insight from emerging market. Res Int Bus Financ 42:1103–1114
Hafeez A, Dangel WJ, Ostroff SM, Kiani AG, Glenn SD, Abbas J et al (2023) The state of health in Pakistan and its provinces and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet Global Health 11(2):229–243
Hoang LT, Nguyen CC, Hu B (2017) Ownership structure and firm performance improvement: Does it matter in the vietnamese stock market? Econ Pap J Appl Econ Policy 36(4):416–428
Homma T, Tsutsui Y, Uchida H (2014) Firm growth and efficiency in the banking industry: a new test of the efficient structure hypothesis. J Bank Finance 40:143–153
Hooy G-K, Hooy C-W, Chee H-K (2020) Ultimate ownership, control mechanism, and firm performance: Evidence from Malaysian firms. Emerg Mark Financ Trade 56(15):3805–3828
Hovey M, Li L, Naughton T (2003) The relationship between valuation and ownership of listed firms in China. Corp Gov Int Rev 11(2):112–122
Hsieh C-H, Ting IWK, Asif J, Le HTM (2019) The role of controlling shareholders in determining investments of intellectual capital among Taiwanese semiconductor companies. J Intellect Cap 21(1):62–86
Iorember PT, Iormom B, Jato TP, Abbas J (2022) Understanding the bearable link between ecology and health outcomes: the criticality of human capital development and energy use. Heliyon 8(12):e12611
Jameson M, Prevost A, Puthenpurackal J (2014) Controlling shareholders, board structure, and firm performance: evidence from India. J Corp Finan 27:1–20
Jensen MC, Meckling WH (1976) Theory of the firm: Managerial behavior, agency costs and ownership structure. J Financ Econ 3(4):305–360
Jiakui C, Abbas J, Najam H, Liu J, Abbas J (2023) Green technological innovation, green finance, and financial development and their role in green total factor productivity: empirical insights from China. J Clean Prod 382:135131
Jiang L, Zhou H, He S (2021) Does energy efficiency increase at the expense of output performance: evidence from manufacturing firms in Jiangsu province. China Energy 220:119704

Kansil R (2021) Ownership structure segmentation of Indian listed firms: a governance perspective. Int J Monet Econ Finance 14(3):197–211
Kansil R, Singh A (2018) Institutional ownership and firm performance: Evidence from Indian panel data. Int J Bus Emerg Mark 10(3):250–269
Kou G, Xu Y, Peng Y, Shen F, Chen Y, Chang K, Kou S (2021) Bankruptcy prediction for SMEs using transactional data and two-stage multiobjective feature selection. Decis Support Syst 140:113429
La Porta R, Lopez-de-Silanes F, Shleifer A (1999) Corporate ownership around the world. J Financ 54(2):471–517
Lean HH, Ting IWK, Qian KL (2015) Ownership concentration, family ownership and leverage: evidence from Malaysia. Malays J Econ Stud 52(2):117–133
Li Y, Al-Sulaiti K, Dongling W, Abbas J, Al-Sulaiti I (2022) Tax avoidance culture and employees' behavior affect sustainable business performance: the moderating role of corporate social responsibility. Front Environ Sci 10:1–14
Lins KV (2003) Equity ownership and firm value in emerging markets. J Financ Quant Anal 38(1):159–184
Liu Q, Qu X, Wang D, Abbas J, Mubeen R (2022) Product market competition and firm performance: business survival through innovation and entrepreneurial orientation amid COVID-19 financial crisis. Front Psychol 12(1–12):5487
Maditinos D, Chatzoudes D, Tsairidis C, Theriou G (2011) The impact of intellectual capital on firms' market value and financial performance. J Intellect Cap 12(1):132–151
Micah AE, Bhangdia K, Cogswell IE, Lasher D, Lidral-Porter B, Maddison ER et al (2023) Global investments in pandemic preparedness and COVID-19: development assistance and domestic spending on health between 1990 and 2026. Lancet Global Health 11(3):385–413
Miller SM, Noulas AG (1996) The technical efficiency of large bank production. J Bank Finance 20(3):495–509
Minh TN, Quang TT (2022) The effects of corporate social responsibility on firm efficiency: inside the matrix of corporate finance. Financ Res Lett 46:102500
Morck R, Shleifer A, Vishny RW (1988) Management ownership and market valuation: an empirical analysis. J Financ Econ 20:293–315
Mubeen R, Han D, Abbas J, Álvarez-Otero S, Sial MS (2021) The relationship between CEO duality and business firms' performance: the moderating role of firm size and corporate social responsibility. Front Psychol 12:669715
Mubeen R, Han D, Abbas J, Raza S, Bodian W (2022) Examining the relationship between product market competition and Chinese firms performance: the mediating impact of capital structure and moderating influence of firm size. Front Psychol 12:1–13
Oh W-Y, Chang YK, Lee G, Seo J (2018) Intragroup transactions, corporate governance, and corporate philanthropy in Korean business groups. J Bus Ethics 153(4):1031–1049
Peng H, Zhang J, Zhong S, Li P (2021) Corporate governance, technical efficiency and financial performance: evidence from Chinese listed tourism firms. J Hosp Tour Manag 48:163–173
Preacher KJ, Hayes AF (2004) SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behav Res Methods Instrum Comput 36(4):717–731
Preacher KJ, Hayes AF (2008) Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behav Res Methods 40(3):879–891
Rachagan S (2010) Enhancing corporate governance in listed companies with concentrated shareholdings: a Malaysian perspective. J Financ Crime 17(4):430–440
Saidu S (2019) CEO characteristics and firm performance: focus on origin, education and ownership. J Glob Entrep Res 11(1–2):197–228
Shabbir MF, Xin Y, Hafeez S (2020) Corporate governance and firm efficiency: an application of internet companies of China. Emerg Mark Financ Trade 56(12):2874–2890
Shleifer A, Vishny RW (1986) Large shareholders and corporate control. J Polit Econ 94(3, part 1):461–488
Siedschlag I, Yan W (2023) Do green investments improve firm performance? Empirical evidence from Ireland. Technol Forecast Soc Change 186(Part B):122181
Sobel ME (1982) Asymptotic confidence intervals for indirect effects in structural equation models. Sociol Methodol 13:290–312
Sobel ME (1986) Some new results on indirect effects and their standard errors in covariance structure models. Sociol Methodol 16:159–186
Tian L, Estrin S (2008) Retained state shareholding in Chinese PLCs: Does government ownership always reduce corporate value? J Comp Econ 36(1):74–89
Ting IWK, Lean HH (2015) Does government ownership matter? Comparative study between GLCs and NGLCs in Malaysia. Singap Econ Rev 60(02):1–22
Ting IWK, Lo HC, Kweh QL (2020) How do ownership concentration and family control affect R&D investments? New evidence from Taiwan. Int Rev Financ 20(1):275–291
Ting IWK, Tebourbi I, Lu W-M, Kweh QL (2021) The effects of managerial ability on firm performance and the mediating role of capital structure: evidence from Taiwan. Financ Innov 7(1):1–23
Tone K (2001) A slacks-based measure of efficiency in data envelopment analysis. Eur J Oper Res 130(3):498–509
Tran NP, Vo DH (2020) Do banks accumulate a higher level of intellectual capital? Evidence from an emerging market. J Intellect Cap 23(2):439–457
Tsafack G, Guo L (2021) Foreign shareholding, corporate governance and firm performance: evidence from Chinese companies. J Behav Exp Financ 31:100516
Wang J, Li J, Zhang Q (2021) Does carbon efficiency improve financial performance? Evidence from Chinese firms. Energy Econ 104:105658
Wiwattanakantang Y (2001) Controlling shareholders and corporate value: evidence from Thailand. Pac Basin Financ J 9(4):323–362

Publisher's Note