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Information Asymmetry and Its Effect on Firm Value: Insights from Jordanian Industrial Firms (2015-2023)

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Abstract:

This study aimed to test the impact of information asymmetry on firm value for a sample of 20 industrial firms listed on the Amman Stock Exchange in Jordan during the period from 2015 to 2023. To achieve this goal, the study was based on building a Panel Data Models, where the model included the firm's value as a dependent variable and information asymmetry as an independent variable, in addition to some other variables affecting this relationship. The study concluded that there is a positive relationship between information asymmetry and the value of industrial firms listed on the Amman Stock Exchange in Jordan.

Keywords: information asymmetry, firm value, industrial firm, Amman Stock Exchange, Jordan.
JEL Classification: D 820 ; G320.

1. Introduction

The information asymmetry phenomenon represents one of the fundamental problems facing financial markets, especially under the ownership separation from management for firms whose shares are traded in these markets. Also in the presence of a basic hypothesis of agency theory, which is the conflict of interests among all market participants.

Information asymmetry in the stock market arises when a firm's management deliberately withholds certain information from investors in order to use it to achieve an extraordinary return from the shares they own, or when they believe that disclosing this information might affect the firm's competitive position if competitors use that information to adjust their production plans or investment decisions. Information asymmetry may also arise as a result of possessing some market participants' private information due to the presence of so-called internal sources exceeds the general information available to other market participants. This provides some informational advantages; which may include avoiding losses or achieving profits in the form of extraordinary returns.

The presence of phenomenon's information asymmetry in the stock market will drive uninformed parties to use defensive measures to protect themselves from informed parties, such as partially or completely withdrawing from the stock market, which leads to a smaller market size and increase transaction costs, thereby leads to a negative impact in trading volume and resulting decrease in stock liquidity. Additionally, the presence of information asymmetry phenomenon may lead to an increase in the level of information risk which investors bear due to their inability to accurately estimate the expected returns on their investments, prompting them to demand an additional return as compensation for these risks, thus increasing the cost of funding sources.

As a result, the problem of information asymmetry has a significant impact on a firm's investment decisions, the cost of capital, and therefore on the firm's value. Consequently, the issue of the relationship between information asymmetry and firm value has garnered considerable attention in modern literature.

1.1. Study Problem:

Based on the above, we can pose the following question: What is the impact of information asymmetry on the value of industrial firms listed on the Amman Stock Exchange in Jordan during the period from 2015 to 2023?
To address this issue, the following sub-question was posed:

- Is there a relaionship between information asymmetry and the value of industrial firms listed on the Amman Stock Exchange in Jordan during the period from 2015 to 2023?

1.2. Study Hypothesis

This study tests the following hypothesis:

- There is a statistically significant negative relationship between information asymmetry and the value of industrial firms listed on the Amman Stock Exchange in Jordan during the period from 2015 to 2023.

2. Literate review

Among the field studies that have addressed the relationship between information asymmetry and firm value, we find the following studies:

The Study of (Thai & al, 2021) examined the relationship between information asymmetry and firm value through a sample of 202 non-financial firms listed on the stock exchanges in Vietnam (Hanoi Stock Exchange and Ho Chi Minh Stock Exchange) during the period from 2017 to 2019. The study used the stock return volatility index and financial analysts' earnings forecasts index as measures of the information asymmetry variable. The study was also used as a method for statistical analysis of multiple regression for Panel Data Models. The results of the study concluded that there is a negative relationship between the variables of information asymmetry and firm value.

The Study of (Huynh & al, 2020) aimed to test the relationship between information asymmetry and firm value by applying it to a sample of 250 non-financial firms listed on two stock markets in Vietnam during the period from 2008 to 2017. In measuring the information asymmetry variable, the study relied on two variables: The index of stock return volatility degree and financial analysts' earnings forecasts index. The variable Firm value was measured using the market-to-book the variable value ratio of assets. The study employed multiple regression statistical Method for Panel Data Models and the Generalized Method of Moments (GMM) as statistical methods. The study concluded that there is a negative relationship between information asymmetry and firm value. Additionally, the results indicated that leverage levels in Vietnamese firms can play a limited role in mitigating the negative impact of information asymmetry on the value of Vietnamese firms.

The Study of (Fosu & al, 2016) aimed to evaluate the extent to which information asymmetry can be considered a main determinant for measuring firm value and the extent to which this relationship is related to the level of financial leverage in firms. It also aimed to evaluate the impact of information asymmetry on firm value before and after the global crisis (2007-2009). The study relied a sample of firms in the United Kingdom in measuring the information asymmetry variable using two indicators: the degree of stock return volatility index and financial analysts' earnings per share forecasts index. The firm value variable was also measured using the variable of market-to-book value ratio of assets. The study also employed multiple regression statistical method for Panel Data Models. The results indicate that information asymmetry negatively affects firm value. Additionally, the study showed that the relationship between information asymmetry and firm value is more pronounced in the post- global crisis period than before it.

The Study of (Cheryta & al, 2018) aimed to analyze the impact of financial leverage and information asymmetry on firm value using cash holdings as an intermediate variable. The study was conducted on a sample of 56 firms listed on the Indonesia Stock Exchange during the period from 2012 to 2015. The information asymmetry variable was measured through the price range index, while the firm value variable was measured through the market-to-book value ratio of assets. The study concluded that cash holdings can lead to information asymmetry that leads to confusion that affects firm performance. Therefore, the study concluded that there is a negative impact of information asymmetry on firm value.

The Study of (Billett & al, 2015) aimed to test the internal information asymmetry between the owners of the firm and the executive managers of departments on firm value. The study relied on 22,154 observations from 2,915 firms during the period from 1986 to 2011. The information asymmetry variable was measured through the information trading volume index. The study concluded that there is a negative relationship between internal information asymmetry and firm value. These results were observed in firms with complex informational environments and the presence of weak corporate governance mechanisms

The Study of (Joudi & al, 2019) aimed to test the relationship between information asymmetry and firm value in light of the presence of corporate governance mechanisms as an intermediate variable. The study indicated that due to differences in the quality of corporate governance mechanisms applied in different firms, it is expected that this difference will have varying effects on reducing agency problems and information asymmetry. Therefore, the purpose of this study is to examine the role of the quality of corporate governance mechanisms impact on the relationship between cash holdings and firm in case of the problem of information asymmetry. The study was applied to 106 firms listed on the Tehran Stock Exchange during the period from 2007 to 2016. The study concluded that if there is a problem of information asymmetry, increasing the quality of governance mechanisms will positively affect the relationship between firm value and cash holdings. Thus, the presence of strong and stringent corporate governance mechanisms will reduce the impact of information asymmetry on firm value.

3. Theoretical Framework of Information Asymmetry and Firm Value

The phenomenon of information asymmetry is currently one of the phenomena facing the business community and capital markets at the present time, due to the presence of an informational advantage held by some stakeholders over others. Certain parties, such as members of management, major owners, major shareholders, or some specific types of investors, may possess some information related to a firm that others do not. Therefore, they might exploit this information before disclosing it, which may prompt other parties trying to obtain this information from alternative sources, whether legally or illegally, and there is no doubt that this may be tainted by the inaccuracy of this information, in addition to its high cost.

3.1. Definition of Information Asymmetry

Paprocki and Stone (2004) defined the phenomenon of information asymmetry as the possession of the management or internal parties information about the current and future economic performance of the firm more than external parties, such as investors, creditors, analysts, and other market participants (Paprocki & Stone, 2004, p. 8).

Ravi and Hong (2014) defined it as the possession of private information by some investors that enables them to process general information available about the firm much better than the rest of investors. This asymmetry could exist between investors and each other or between the firm and investors (Ravi & Hong, 2014, p. 85).

Amiram et al. (2016) defined information asymmetry as the possession of the internal parties within the firm, such as management or closely related parties, information about the overall performance of the firm, either exceeds the possession of information by external stakeholders or withholds it from them (Amiram & al, 2016, p. 123). This concept is consistent with what was mentioned in the study by Machdar et al. (2017), who noted that information asymmetry occurs when one party of stakeholders possesses information especially about the firm’s performance without other parties, and thus the degree of benefit of the latter parties stops at general information only (Machdar & al, 2017, p. 321).

It is also defined from a global perspective as the imbalance in the stock market where one party in a current or potential transaction possesses information exceeds that of the other party in terms of quantity, quality, or timing (Moore, 2019, p. 19).

From the above, we can define the phenomenon of information asymmetry as the inability or ability of all stakeholders to obtain the same information in terms of its completeness, clarity, relevance, quality, and timing in the same quantity, quality and at the same time, which increases investment opportunities for some stakeholders and not others, which may affect the quality of the firm's disclosure process.

3.2. Problems of Information Asymmetry

The occurrence of information asymmetry phenomenon leads to two main problems (Lasdi, 2013, p. 327):

- **Moral Hazard Problem** The moral hazard problem arises when the management of the firm is entrusted to an agent acting on behalf owners, focusing on the relationship between management and owners. In the presence of a conflict of interest between management and owners and the inability of shareholders to monitor management's activities, managers might try to maximize their own interests at the expense of the owners' interests, exploiting their advantage informational superiority which results from the management's possession of internal information that external parties do not possess.

- **Adverse Selection Problem** The adverse selection problem arises due to the inability of uninformed investors to distinguish between securities of different degrees of quality levels, leading to incorrect choices. Investors lacking information may direct their investments towards low performance firms instead of good performance. This misallocation occurs because the information available to the investor does not help in accurately assessing the true value of the firm.

3.3. Measures of Information Asymmetry:

There are several commonly used measures to assess information asymmetry, the most important of which are:

- **Bid-Ask Spread Measure:** This measure calculates the difference between the highest bid price and the lowest offer price for purchasing stocks, which is one of the variables that indicate the presence of the phenomenon of information asymmetry whereby investors in the stock market protect themselves from management's actions through lower stock prices, thus increasing the bid-ask spread (Zhou, 2004, p. 13). In the absence of information asymmetry, the difference between the highest bid price and the lowest offer price should be zero, indicating that all investors have the same amount of information. Conversely, increased information asymmetry increases the bid offer spread. It should be noted that This measure is one of the most commonly used to assess information asymmetry.
- **Trading Volume Measure:** Trading volume refers to the desire of some investors to sell shares of the firm and the desire of others to buy them, and because the desire to trade is primarily linked to the availability of relevant information to all market participants, trading volume is considered one of the indicators that infer the degree of information asymmetry. There is a negative relationship between trading volume and information asymmetry. When information does not reach all participants in the stock market, it either leads to a decrease in the number of participants or their complete withdrawal from the market, resulting in lower trading volume (Chi & Wang, 2010 , p. 467)
- **Financial Analysts' Forecast Measure:** The financial analysts' forecasts measure serves as an indicator of information asymmetry based on the existence of the negative relationship between the accuracy and consistency of financial analysts' forecasts and information asymmetry. As the degree of information asymmetry increases, the accuracy of analysts' forecasts decreases, and the variation among a group of analysts' forecasts regarding a specific item increases. Conversely, as the degree of information asymmetry decreases, the accuracy of forecasts improves, leading to complete consistency among analysts' forecasts regarding that item (Strebulaev & al, 2014, p. 3). This measure also indicates that whenever there are errors in the financial errors in analysts' forecasts of a firm's earnings per share signify an increase in the problem of information asymmetry.
- **Stock Price and Return Volatility Measure:** The degree of stock return volatility is a measure of information asymmetry. It is calculated by measuring the standard deviation of a firm's daily returns over a year. This measure aims to examine stock price movements due to informational gaps between firm managers, shareholders, and the rest of investors. Changes in stock returns over a specified period of time indicate uncertainty and risk in the financial market (Ruessll, 2015, p. 197).

3.4. Effects of Information Asymmetry:

The phenomenon of information asymmetry has negative repercussions and effects on investors, the stock market, and the national economy. These negative impacts include:

- **Increased Cost of Capital Structure:** This means higher costs of obtaining financing or capital due to the degree of information asymmetry. The reason is that investors who do not have an informational advantage demand an additional return, known as a risk premium, in order to compensate for the risks, they face from other parties with an informational advantage, whether they are members of management or other external parties (Khatali, 2020, p. 78).
- **Increased Cost of Obtaining Information:** This element arises from the inadequacy of the accounting disclosure provided by the firm, which was also not characterized by the required quality. Consequently, the degree of information asymmetry between stakeholders increases, prompting those with an informational advantage to resort to financial analysts or pay for obtaining information, thus increasing the cost of information.

- **Misvaluation of Firms' Market Value:** Information asymmetry leads to incorrect valuation by some stakeholders of a firm's market value, either by overestimating or underestimating it, which can negatively affect the firm's market value and financial stability.
- **Increased Level of Earnings Management:** The study by Machdar et al. (2017) showed a positive relationship between earnings management practices and the degree of information asymmetry. Management exploits undisclosed information to mislead financial statement users and other parties by choosing accounting methods, alternatives, and estimates that do not reflect the firm's actual situation, thereby presenting earnings as higher than the truth (Machdar & al, 2017, p. 312).
- **Difficulty in Obtaining Necessary Financing:** Firms with a high degree of information asymmetry face difficulties in obtaining necessary financing, especially short-term loans from banks, because the high degree of this phenomenon of information asymmetry implies that these firms lack reliability and transparency (Abd-Elsalam & Weetman, 2017, p. 80).

3.5.The Relationship Between Information Asymmetry and Firm Value:

The relationship between information asymmetry and firm value has been discussed in various theories, including signaling theory and the pecking order theory of financing sources.

Signaling theory is based on the premise of information asymmetry that characterizes financial markets. Managers possess better information than external investors about the firm’s performance and available investment opportunities. The information disclosed by firms is not necessarily accurate and truthful. Therefore, this theory suggests that managers of well-performing firms can issue specific and effective signals that differentiate them from lower level of firm’s performance. The characteristic of these signals are difficult to imitate by weak- performing firms (Rifki & Abdessadeq, p. 18).

Signaling theory proposes a model that uses the firm’s financial structure in order to send signals to external investors in the financial market, reflecting the firm’s quality and value. Among these signals are the debt ratio in the financial structure (Ross's 1977 model) and the proportion of capital owned by managers (Leland and Pyle's 1977 model).

Ross (1977) concluded that there is a positive relationship between the firm’s value and the debt ratio in its financial structure. Meanwhile, Leland and Pyle (1977) suggested that managers can use their ownership percentage of the firm’s capital to send signals to the financial market regarding the level of firm’s performance and value. The two researchers concluded a positive relationship between the firm’s value and the capital percentage owned by managers. The rationale is that managers have information about the firm’s future cash flows. From a diversification perspective to reduce financial risks, managers do not retain a significant ownership percentage of the capital unless they expect the firm to achieve high future cash flows (Croquet & Heldenbergh, 2008, p. 65).

As for the pecking order theory of financing sources, Myers and Majluf (1984) assume the existence of information asymmetry between managers and external investors regarding available investment opportunities. Obtaining information is costly, and managers work in the interest of existing (current) shareholders (Myers & Majluf, 1984, p. 189).

Myers and Majluf (1984) expect that information asymmetry will lead to the incorrect valuation of the firm’s common stock by the market due to the financial signals sent by issuing new shares.

Myers and Majluf concluded that when managers have private information and ordinary shares are issued to finance new investment, the firm’s stock prices are expected to decline, assuming other factors remain constant (since issuing shares in this case conveys bad news to the financial market). However, if the firm issues risk-free debt to finance the proposed investment, stock prices in the market will not decline, which aligns with the interests of current shareholders. Therefore, not issuing new ordinary shares sends good news to the market, which can affect the price investors are willing to pay for those issues, ultimately impacting the firm’s financing and investment decisions (Myers & Majluf, 1984, p. 220).

Consequently, if managers have internal information that drives them to act in the interest of current shareholders, they will refrain from issuing new ordinary shares, even if it means rejecting good investment opportunities. The misvaluation of stock prices may reach a point where new investors can acquire more than the net present value of the

new project, resulting in losses borne by current (old) shareholders, which would lead managers to reject the new project, even if its net present value is positive. In this case, the cost of adverse selection forces firms to make suboptimal investments, which reflects negatively on the firm's value.

4. Applied Study

After we presented in the theoretical aspect of this study, the theoretical framework of information asymmetry and firm value, and to present the results of previous studies that examined the relationship between the two variables. And in order to answer the research problem and test its hypotheses, an applied study will be conducted on a sample of 20 industrial firms listed on the Amman Stock Exchange in Jordan.

4.1 Study Population and Sample:

The study population consists of all industrial firms listed on the Amman Stock Exchange in Jordan during the period from 2015 to 2023, amounting 29 industrial firms. A sample of 20 industrial firms was selected for the study. Data for the study were collected from the financial reports published on the Amman Stock Exchange for the sample firms during the period from 2015 to 2023.

4.2 Study Variables and Their Measurement

4.2.1 Dependent Variable:

Firm value is the dependent variable in this current study, which will be measured using Tobin's Q variable, which is considered as one of the most important measures of firm value. Tobin's Q is calculated using the following formula:

$$\text{Tobin}'\text{s Q}_{it} = \frac{\text{M V}_{it}}{\text{B V}_{it}}$$

where:

- $\text{Tobin}'\text{s Q}_{it}$: is the value of firm i during period t.
- M V_{it} : is the market value of the total assets of firm i during period t.
- B V_{it} : is the book value of the total assets of firm i during period t.

4.2.2 Independent Variables:

Information asymmetry is the independent variable in this current study, in addition to other control variables (setting) that are presumed to also affect the value of the firms in the sample.

a- Information Asymmetry: The information asymmetry variable (the independent variable) will be measured according to price range through the differences prices of stock bid Supply and demand, which is considered one of the most commonly used measures for assessing the problem of information asymmetry. This measure represents the difference between the highest price the investor is willing to pay for buying a stock and the lowest price the investor is willing to accept for selling it. As bid Supply and demand differences price increase indicates an increase in the problem of information asymmetry as a result of investors who have more information exploiting that information to increase the price difference to maximize their gains from exchanging shares trading with less-informed investors. This measure is calculated using the following formula:

$$\text{ASY}_{i.t} = \frac{\sum_{t=1}^{n} \frac{\text{BD}_{i.t} - \text{AK}_{i.t}}{\text{P}_{i.t}}}{n}$$

where:

$ASY_{i.t}$: is the annual average of the daily bid-ask spreads divided by the daily closing prices for firm i in year t.

$BD_{i.t}$: is the highest price for firm i on day t.

$AK_{i.t}$: is the lowest price for firm i on day t.

$P_{i.t}$: is the closing price for firm i on day t.

N : is the number of trading days for the stock during the year.

b - Return on Assets (ROA): ROA is measured by dividing net profit by total assets.

c - Leverage (LEV): Leverage is measured by dividing the total financial debt (long-term and short-term loans and creditor banks) by the total assets of the firm.

d -Size (SIZE): We will use the natural logarithm of total assets as a measure of firm size.

4.3. Statistical Methods and Tools Used:

The statistical method used in the current study to measure the impact of information asymmetry (independent variable) on firm value measured by Tobin's Q (dependent variable) involves applying the Panel Data Model during the period from 2017 to 2021, using the Eviews.9 software.

Accordingly, the econometric model to be estimated takes the following form:

$$\text{Tobin's Q}_{it} = \beta_0 + \beta_1 ASY_{i.t} + \beta_2 ROA_{it} + \beta_3 LEV_{it} + \beta_4 SIZE_{it} + \varepsilon_{it}$$

Tobin's Q_{it}: The value of firm i during period t.
$ASY_{i.t}$:Information asymmetry for firm i during period t.
ROA_{it}: The return on assets for firm i during period t.
LEV_{it}: The leverage for firm i during period t.
$SIZE_{it}$: The size of firm i during period t.
ε_{it}: The random error term.

4.4 . Study Results

4.4 .1. Estimation of the Study Model

We will attempt to estimate the impact of information asymmetry (ASY) on firm value, measured by Tobin's Q, using three longitudinal panel data models: the pooled model, the fixed effects model, and the random effects model. We will estimate the parameters of the models and then conduct the necessary tests to choose between the three models. The results are shown in Table (01).

Table 01: The results of estimating the Panel Model

Variables	Aggregation model	Fixed model	Random model
C	0.489831	(*) 4.549825	1.337910
ASY	-5.059536	(*) 8.069153	5.153688
ROA	(*) 3.657622	(*) 2.274905	(*) 2.357092
LEV	(*) 1.222950	0.687026	(*) 0.777394
SIZE	0.024253	(*) -0.225240	-0.031777
R^2	0.314316	0.756067	0.163674

(*) Significant parameter at 0.05.
Source: made by the author based on the outputs of Eviews 9

4.4 .2. Test for Fixed Individual Effects:

For comparison to choose the best model, we use the test provided by Eviews 9, known as the Redundant Fixed Effects Tests, which also relies on the restricted Fisher test. From Table (02) in the appendix, we observe that the test probability is less than 0.05 and the calculated F value is 14.868822, which is higher than the tabulated F value $F_{tab}(0.05,19,156) = 1.653616$, This means rejecting the null hypothesis zero and accepting the hypothesis of fixed individual effects, indicating that the fixed effects model is better compared to the pooled model.

4.4 .3. Test for Random Individual Effects:

For this comparison, we use the Breusch-Pagan test provided by Eviews 9. The results are shown in Table (03) in the appendix, where we notice that the probability of the Breusch-Pagan test is less than 0.05, meaning we reject the null zero hypothesis and accept the hypothesis of random individual effects. Thus, the random effects model is better than the pooled model.

After conducting both the Breusch-Pagan Test and the Redundant Fixed Effects Test, it is clear that the model with either random or fixed individual effects is better than the pooled model. We will now compare both of the fixed effects model and the random effects model.

4.4 .4. Hausman Test for Choosing Between Random Effects and Fixed Effects Model:

The Hausman test is conducted to choose between the random effects model and the fixed effects model. The results are shown in Table (04) in the appendix, where we observe that the calculated χ_2= 13.862799 is higher than the table value χ_2= 9.487729 and the significance level is less than 0.05. Therefore, we reject the null hypothesis and conclude that the appropriate model for the current study is the fixed effects model.

4.5. Discussion of Results

The results of the fixed effects model analysis revealed three statistically significant independent variables affecting firm value in their impact on firm value measured by Tobin's Q: information asymmetry variable, return on assets, and firm size. These variables explain 75.60% of the changes in the dependent variable (firm value). The analysis also indicated the existence of a non-statistically significant relationship between leverage and the dependent variable (firm value), suggesting that leverage does not explain the dependent variable.

The analysis results showed a statistically significant positive relationship between information asymmetry and firm value, measured by Tobin's Q. This means that as the level of information asymmetry increases in industrial firms listed on the Amman Stock Exchange in Jordan, the firm value also increases. According to signaling theory, firm managers, who possess information not available to all market participants, use this information to send signals to the financial market about the firm's financial performance. These signals lead to an increase in the firm's market value, and consequently, an increase in firm value.

Based on the above, we reject the study hypothesis which states that there is a negative relationship between information asymmetry and the value of industrial firms listed on the Amman Stock Exchange in Jordan. The result of this study differs from those of Thai et al. (2021), Huynh et al. (2020), and Fosu et al. (2016), which found a negative relationship between information asymmetry and firm value.

The analysis results also revealed the existence of a statistically significant positive relationship between return on assets (ROA) and firm value. This implies that as the return on assets increases in industrial firms listed on the Amman Stock Exchange in Jordan, the firm value also increases. This can be explained by the fact that increased profits can reduce the predictability of future returns and minimize the impact of information asymmetry on firm value.

Additionally, the analysis indicated a statistically significant negative relationship between firm size and firm value. This suggests that as the size of industrial firms listed on the Amman Stock Exchange in Jordan increases, the firm value decreases, indicating that smaller firms perform better in the market, which positively reflects on their value. Previous studies have pointed out that larger firms often face communication problems and an inability to make timely decisions, which negatively impacting their performance and value.

5. Conclusion

This study aimed to test the impact of information asymmetry on firm value for a sample of 20 industrial firms listed on the Amman Stock Exchange in Jordan during the period from 2015 to 2023. This was achieved through an empirical study and by building a Panel Data Model using Eviews 9.

The study found a positive relationship between information asymmetry and the value of industrial firms listed on the Amman Stock Exchange in Jordan. This indicates that as the level of information asymmetry increases in these firms, the firm value also increases. This can be attributed to managers having better information than external investors about the firm’s performance and investment opportunities. According to signaling theory, managers of well-performing firms issue specific and effective signals that distinguish them from less-performing firms, which leads to an increase in their stock prices and thus an increase in firm value.

Based on the findings regarding the impact of information asymmetry on firm value, which focused on industrial firms listed on the Amman Stock Exchange in Jordan during the period from 2015 to 2023, and using the price range of the bid-offer spread to measure earnings quality, the study recommends conducting similar studies using other measures of information asymmetry, such as stock return volatility, financial analysts' earnings forecasts, and trading volume measures.

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Appendices

Table 02: the results of the Redundant Fixed Effects test

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	14.868822	(19,156)	0.0000
Cross-section Chi-square	186.033808	19	0.0000

Source: made by the author based on the outputs of Eviews 9

Table 03: the results of the Breusch-Pagan test

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-sectio...	Time	Both
Breusch-Pagan	181.3541 (0.0000)	0.205026 (0.6507)	181.5591 (0.0000)
Honda	13.46678 (0.0000)	-0.452798 --	9.202273 (0.0000)

Source: made by the author based on the outputs of Eviews 9

Table 04: the results of the Hausman test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	13.862799	4	0.0077

Source: made by the author based on the outputs of Eviews 9