Information Asymmetry, Leverage Deviation and Leverage Adjustment Speed

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ABSTRACT

Manuscript type: Research paper
Research aims: This paper aims to examine whether firms' leverage deviation (i.e., actual leverage minus target leverage) and leverage adjustment speed are influenced by information asymmetry.
Design/Methodology/Approach: This paper uses archival data retrieved from firms listed on the Tehran Stock Exchange from 2004 to 2017. The static and dynamic panel data approaches are used for analysis.
Research findings: Results show that an increase in information asymmetry increases firms' leverage deviation. Results also indicate that firms with a higher (lower) level of information asymmetry tend to adjust their actual leverage towards the target, slower (faster) than that of other firms. These results are robust when using different sample periods, alternative set of leverage determinants and various estimation methods.
Theoretical contribution/Originality: This study investigates the effect of information asymmetry on leverage deviation and leverage adjustment speed in an emerging market. The results offer insights into the theoretical framework showing the relationship between the transparency of the business environment and capital structure.
Practitioner/Policy implication: The result derived from the current study should be of interest to board of directors and policymakers. The findings are significant because more transparent firms may be

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more successful in achieving the optimal leverage, consequently lowering the capital cost.
Research limitation/Implications: One limitation of the study is that the measures used for information asymmetry are based on the bid–ask spread, and the probability of informed trading. These measures may not completely reflect all of the information asymmetry among market participants. Future research could address this limitation by employing alternative proxies for information asymmetry.

Keywords: Information Asymmetry, Leverage Adjustment Speed, Leverage Deviation
JEL Classification: G32, M41

1. Introduction

One of the key questions in corporate finance is how firms finalise their financial decisions. Since Modigliani and Miller (1958), researchers have been struggling to understand firms' financing policies and have proposed four main theories to explain firms' financing behaviour. They include the trade-off theory (Miller, 1977), the agency cost theory (Jensen & Meckling, 1976), the pecking order theory (Myers, 1984; Myers & Majluf, 1984) and the market timing theory (Baker & Wurgler, 2002). Empirical studies (e.g., Leary & Roberts, 2005; Flannery & Rangan, 2006) have shown that firm-level, industry-level and country-level characteristics play an essential role in determining the firms' financing behaviour, and consequently, the firms' leverage. However, some findings (Graham & Leary, 2011) implied that firms with similar characteristics have different leverage ratios. Therefore, to explore other firm-level determinants that can explain firms' financial behaviour, further studies are required. In this paper, we examine the effect of information asymmetry on leverage deviation and adjustment speed towards the target (optimal) leverage.

Since leverage may affect firms' risk, expected returns and firms' sensitivity to micro and macro business conditions, optimising the leverage is of great importance for all firms (Cooney & Kalay, 1993). The trade-off theory assumes that firms have an optimal leverage ratio; it also assumes that by achieving an optimal leverage ratio, firm value would be maximised. Therefore, firms should quickly remove any deviations from their optimal leverage (Flannery & Rangan, 2006). Recent studies (e.g., Graham & Harvey, 2001; Leary & Roberts, 2005; Flannery & Rangan, 2006; Huang & Ritter, 2009; Faulkender, Flannery, Hankins, &

Smith, 2012; Lin, Hu, & Li, 2018) have investigated the above conjecture, and their results showed that firms in fact, have an optimal leverage.

The role of information asymmetry in firms' financing decisions can be traced back to Myers and Majluf (1984) who believed that information asymmetry causes firms to rely on internal sources of funds and prefer debt to equity. Noe (1988), however, argued that information asymmetry could lead to non-optimal leverage. In a capital market with asymmetric information caused by the adverse selection of costs, firms cannot adequately meet their financial needs through the equity market. As a result, firms tend to finance through debt markets. This will increase the role of debts in firms' leverage (Synn & Williams, 2015; Zhou, Tan, Faff, & Zhu, 2016). Information asymmetry can thus lead to a non-optimal capital structure in the form of over-leverage or under-leverage (van Binsbergen, Graham, & Yang, 2010). Although studies showing the association between information asymmetry and firms' leverage is abundant (e.g., Gao & Zhu, 2015; Petacchi, 2015; Fosu, Danso, Ahmad, & Coffie, 2016), those looking at the effect of information asymmetry on leverage deviation are few and far between.

While achieving optimal leverage has many benefits, moving towards it can be costly; it also reduces the speed of adjustment (e.g., Korajczyk & Levy, 2003; Strebulaev, 2007; Shivdasani & Stefanescu, 2010). For instance, Cook and Tang (2010) believed that the overall economic condition affects adjustment costs and reduces adjustment speed. Öztekin and Flannery (2012) had also shown that the information environment affects the adjustment speed, thereby accelerating the assumption that information asymmetry reduces the adjustment speed. Other studies such as Öztekin (2015), Halling, Yu and Zechner (2016), and Jiang, Jiang, Huang, Kim and Nofsinger (2017) noted that the adjustment speed may be influenced by macroeconomic factors. Devos, Rahman and Tsang (2017) had categorised adjustment costs into specific opportunity costs and securities issuance costs. Their results were able to show that specific opportunity costs can adversely affect adjustment speed.

To test our hypotheses, we used data retrieved from firms listed on the Tehran Stock Exchange (TSE) from 2004 to 2017. The TSE listed firms prepared their financial reports following the Iranian national accounting standards which is mostly similar to the IFRS. The firms listed on the TSE were selected because of two reasons. First, Iran is an emerging market and the second largest economy in the Middle East and North Africa (MENA) region (Soltani, Syed, Liao, & Iqbal, 2015). Second, the TSE market is a young market but its rules and regulations have not been able to decrease information asymmetry to the desired level. Further, the TSE does not have a team of official financial analysts or a professional press that is effective at reducing information asymmetry (Mashayekhi & Mashayekh, 2008).

Following Flannery and Rangan (2006), and An, Li and Yu (2016), we used market leverage and book leverage as our proxies for firms' leverage ratio. Adhering to the recommendations of Byoun (2008), Uysal (2011) and Zhou et al. (2016), we initially estimated the target leverage as fitted values from the regression of leverage ratio on the determinants of firms' leverage. We further calculated the leverage deviation by subtracting the target leverage from the total leverage ratio. We then measured information asymmetry by using the bid–ask spread (Venkatesh & Chiang, 1986) and probability of information-based trading (PIN) (Easley, Kiefer, & O'Hara, 1996). Finally, we investigated the association between information asymmetry and leverage deviation by using ordinary least squares (OLS). Following Chen, Hribar and Melessa (2018), we considered leverage determinants as control variables in the model so as to gain unbiased coefficients and standard errors. To address the possible dynamics in leverage deviation (considering a situation in which the current year information asymmetry affects the next year leverage), we incorporated one-period lag of leverage deviation in an alternative specification. For its estimation, we used Arellano and Bond (1991) difference-GMM and Blundell and Bond (1998) system-GMM estimators. To study the effect of information asymmetry on leverage adjustment speed, we followed Öztekin and Flannery (2012) and Zhou et al. (2016), where we used the partial adjustment model. To control all sources of endogeneity, we used difference-GMM and system-GMM estimators, following Zhou et al. (2016).

This paper contributes to empirical literature by showing that higher information asymmetry is associated with higher leverage deviation. There is evidence suggesting that firms with higher (lower) information asymmetry have a slower (faster) adjustment speed. The findings of this study have several implications for academics, investors and policymakers in Iran, and other similar emerging markets. First, this paper offers insights into the theoretical framework explaining the association between information asymmetry and leverage deviation. In this regard, the results would highlight the clarity of the area being analysed, hence informing the academics on how information asymmetry affects capital structure. Secondly, the results of this study may interest investors. It appears that firms with lower information asymmetry have lower leverage deviation, faster leverage adjustment speed, thereby, lowering the cost of capital. As a result, investors can be more confident in their investments. Finally, policymakers need to take steps in setting rules and regulations that can reduce information asymmetry among firms. Policymakers, for instance, can set appropriate rules and regulations emphasising the role of official financial analysts as well as offer incentives which can increase voluntary disclosure among firms listed on the TSE.

It is worth mentioning that almost all of the studies looking at optimal leverage and leverage deviations (e.g., Liao, Mukherjee, & Wang, 2015; Synn & Williams, 2015; Zhou et al., 2016) were based in developed capital markets. Therefore, the generalisability of the outcome for developing capital markets is questionable. This study extends on past studies by including a study of a developing capital market, thereby contributing to literature. The empirical evidence provided by the current study suggests that information asymmetry is significantly associated with leverage deviation and leverage adjustment speed.

The remainder of this paper is structured as follows: Section 2 explains the study's institutional setting. Section 3 presents the theoretical motivation and hypotheses. Section 4 describes the research design. Section 5 reports the empirical results. Section 6 presents the additional analysis and the robustness tests, and Section 7 concludes the paper.

2. Literature Review and Hypotheses

2.1 Institutional Setting

To better understand the institutional setting of the current study, Iran's capital market, which is similar to other developing countries, is further explained. As is the case with many Asian and Latin American countries (Heng, Ivanova, Mariscal, Ramakrishnan, & Wong, 2016), the Iranian government implemented macroeconomic policies in the late 1980s so as to liberalise its financial systems. This served as a suitable infrastructure for the Iranian capital market to thrive. Since the year 2000, the Iranian government has also been seeking ways to reduce inflation, bring foreign debts under control, and strengthen key economic and social performance indicators. These reforms had gradually increased the total market capital of the country to the GDP ratio of about 30 per cent (Hesarzadeh, 2019). The growth of the TSE is similar to many developing capital markets in Asia and Latin America (Vandenbrink &

Wei-Yen, 2005; Rotaru, 2016; Yasser Qaiser, 2016) and at the time of the study, it had more than 300 listed firms.

In the past ten years or so, institutional owners have played a significant role in improving the status of the Iranian capital market. They have tried to create a sustained demand for securities. Likewise, online stock trading and the advancement of the computerised financial reporting system have greatly enhanced the volume of transactions and efficiency of the capital market. However, previous empirical research (e.g., Oskooe, 2011; Salimifar & Shirzour, 2011) showed that the daily stock prices in the Tehran Stock Exchange follow a random pattern, and that the Iranian capital market is of the weak-form efficiency.

In financial reporting, the basics of drafting regulations on corporate reporting, corporate governance and investor protection are the same between developing and advanced capital markets (Hesarzadeh, 2019). Although Iran has its own national accounting and auditing standards, it has been trying to narrow down the differences between the national and international standards over the past decade. Its current national accounting standards are largely similar to international standards. Since 2016, many large Iranian companies and banks listed on the Tehran Stock Exchange were required to comply with international accounting standards.

2.2 Information Asymmetry and Leverage Deviation

Modigliani and Miller (1958) had contended that in a frictionless market without information asymmetry, a firm's financing policies do not affect its value. However, in a market with information asymmetry, adverse selection costs can link a firm's financing policies to its values (Myers, 1984; Myers & Majluf, 1984; Nachman & Noe, 1994). The trade-off theory suggests that the optimal leverage is determined by balancing the costs (e.g., bankruptcy costs), and benefits (e.g., tax shield) of debts. This theory suggests that market imperfections create a link between financing decisions and firm value. Consequently, firms take corrective measures to remove any deviation from the optimal leverage. However, if the cost of moving towards the optimal leverage is greater than its benefits, firms do not adjust their leverage (Flannery & Rangan, 2006).

Information asymmetry between managers and external investors create a hierarchical process in selecting the type of financial resources. In the context of severe information asymmetry, firms prefer debts to equity capital for external financing (Myers & Majluf, 1984). In particular, equity capital has the most adverse selection costs, and firms prefer to use this as a last resort. Due to this, firms with higher asymmetric information tend to have a larger leverage ratio (Gao & Zhu, 2015; Petacchi, 2015). Under severe information asymmetry conditions, the gap between the cost of debts and the cost of equity capital can be considerable. Therefore, it would seem that there should be optimal leverage in which the total cost of capital is minimised (Fosu et al., 2016). Financing frictions, which results from information asymmetry, can lead to leverage that deviates from the optimal level (van Binsbergen et al., 2010). In other words, by increasing information asymmetry, and consequently increasing financing frictions, firms tend to raise debt financing so as to reduce the adverse selection costs of information asymmetry (Gao & Zhu, 2015; Petacchi, 2015). Although higher leverage may result in tax benefits, it may also raise bankruptcy costs (Myers, 1984; Myers & Majluf, 1984). Therefore, higher leverage does not necessarily mean a lower cost of capital. In other words, in response to a rise in information asymmetry, higher debt financing diverges a firm's leverage from its optimal level (van Binsbergen et al., 2010). Therefore, our first hypothesis is as follows:

> H_1: Information asymmetry is positively associated with leverage deviation.

2.3 Information Asymmetry and Leverage Adjustment Speed

While many studies have confirmed the existence of an optimal leverage (e.g., Leary & Roberts, 2005; Flannery & Rangan, 2006; Huang & Ritter, 2009; Faulkender et al., 2012; Öztekin, 2015; Lin et al., 2018), there is no consensus on how fast firms adjust their actual leverage towards the optimal level (Lin et al., 2018). Some studies have found that firms' actual leverage slowly moves towards the target level (e.g., Flannery & Rangan, 2006; Kayhan & Titman, 2007; Lemmon, Roberts, & Zender, 2008). In comparison, Graham and Leary (2011) pointed out that the estimated adjustment speed noted in previous studies was between 10% and 40%, Frank and Shen (2013) claimed that the adjustment speed tend to be measured based on a static optimal leverage which has remained dynamic over time.

Some studies (Drobetz & Wanzenried, 2006; Cook & Tang, 2010) showed that adverse economics tend to focus on factors affecting the adjustment speed. These studies have also found that an increase in adjustment costs decreases the adjustment speed. Drobetz and

Wanzenried (2006) and Cook and Tang (2010) had shown that in a favourable economic environment, firms adjust their leverage more quickly. This was endorsed by Elsas and Florysiak (2011) who noted that the costs of deviations derived from the optimal leverage encouraged managers to quickly adjust any deviations. Öztekin and Flannery (2012) found that different business environments may impose different costs and benefits on firms, which in turn, affect the adjustment speed. They believed that lower information asymmetry would lead to faster adjustment speed. Devos et al. (2017) and Lockhart (2014) noted that a firm's credit lines and debt contracts impact on its adjustment speed. Chang, Chou, and Huang (2014) and Liao et al. (2015) also mentioned that firms with stronger corporate governance tend to adjust their leverage more quickly. The results derived from Smith, Chen and Anderson (2015) further emphasised that the capital structure of over-levered firms, as compared to under-levered firms, moved faster towards optimal leverage. Zhou et al. (2016) also observed that firms which had a higher cost of capital were comparatively more sensitive to deviations derived from optimal leverage. In this regard, they possessed faster adjustment speeds. Öztekin (2015), Halling et al. (2016) and Jiang et al. (2017) believed that better institutional conditions reduced adjustment costs and increased adjustment speed. Lin et al. (2018) stated that under-levered (over-levered) firms have slower (faster) adjustment speeds when compared to other firms. Given the above, our second hypothesis is as follows:

H_2: Firms with higher information asymmetry have slower leverage adjustment speed.

3. Data and Methodology

3.1 Data and Variable Definition (Samples)

Data were collected from the financial statements contained in several databases – CODAL[1], RDIS[2] and Rahavard Nowin[3]. We also gathered share price information from the Tehran Stock Exchange[4] from 2004 to 2017. Our initial samples comprised 6,678 observations, but subsequent

[1] www.codal.ir
[2] www.rdis.ir/CompaniesReports.asp
[3] www.mabnadp.com/rahavardnovin3
[4] http://new.tse.ir/en

screening filtered banks and financial institutions and also regulated utility firms. Next, delisted firms with industry-years of fewer than eight observations as well as those that carried firm-years with a negative equity book value were also excluded from the samples. To reduce the potential impact of outliers, we then winsorised all the variables at the 1st and 99th percentiles. This process limited the samples to 4,508 observations, which were then grouped into 15 industries, as shown in Table 1.

Table 1: Sample Selection Procedure and Industry Distribution

Panel A: Sample Selection Procedure

	Number of observations
Initial samples between 2004-2017	6678
Delisted firms	(168)
Banks, financial firms and regulated utilities	(826)
Industry-years with fewer than eight observations	(434)
Firm-years with a negative equity book value	(308)
Firm-years with missing values	(434)
Total observations in the final analysis	4508

Panel B: Industry Distribution

Industry classification	Number of observations	% Distribution
Agriculture and related services	168	3.73
Metal products	448	9.94
Non-metallic mineral	266	5.90
Equipment and machinery	210	4.66
Telecommunications	434	9.63
Automobile and parts	462	10.25
Medical tools and pharmaceutical	294	6.52
Chemical	378	8.39
Information and communication	238	5.28
Textiles	154	3.42
Rubber and plastic	350	7.76
Electrical appliances	196	4.35
Cement	364	8.07
Real estates	238	5.28
Accommodation, cafes and restaurants	308	6.83
Total	4508	100

3.2 Variable Definitions

3.2.1 The Measure of Leverage Deviation

Based on Byoun (2008), Uysal (2011) and Zhou et al. (2016), we estimated the target leverage ($TLEV_{it+1}$) as the fitted values from the regression of leverage ratio on the determinants of capital structure ($\boldsymbol{Z}_{it}$). The model is specified as follows:

$$LEV_{it+1} = \omega + \psi \boldsymbol{Z}_{it} + \zeta_{it+1} \quad (1)$$

where LEV_{it+1} is sequentially set equal to book leverage (BL), and market leverage (ML) as the dependent variable, at the end of period $t+1$. Following this, $\boldsymbol{Z}_{it}$ served as the target leverage determinant. In following An et al. (2016), we defined book leverage as the book value of total debts scaled by the book value of total assets. As recommended by Flannery and Rangan (2006) and An et al. (2016), we then defined market leverage as the book value of debt scaled by the sum of the book value of debt and the market value of equity. Although different sets of determinants have been used as a proxy for target leverage, as noted in literature (e.g., Flannery & Rangan, 2006; Öztekin & Flannery, 2012; Zhou et al., 2016), all of these determinants essentially measure the same characteristics of the firm (Zhou et al., 2016). In taking the steps of Flannery and Rangan (2006), Marchica and Mura (2010) and Zhou et al. (2016), ten variables were considered for estimating the target leverage. They include: earnings before interest and tax, earnings scaled by total assets (EBIT), market-to-book ratio (MTB), asset tangibility (TANG), depreciation expenses scaled by total assets (DEP), effective tax rate defined as the ratio of current income taxes to income before taxes (TAXR), logarithm of total assets (LNTA)[5], asset liquidity (LIQ) was defined as current assets divided by current liabilities, median industry leverage (IBL or IML), annual inflation rate was defined as growth in consumer price index (INFL), and growth in GDP (GDPG). The absolute value of the abnormal level of LEV_{it+1} is the leverage deviation ($DLEV_{it+1}$). It is calculated as the actual leverage minus the fitted values from regression (1). More specifically, the absolute value of residuals derived from model (1) was defined as the level of deviation from the target leverage (i.e. $DLEV_{it+1} = |\zeta_{it+1}|$).

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[5] Because of the high inflation rate in Iran, we also use logarithm of sales revenues and logarithm of total stock market values as two proxies for firm size. Untabulated key results remain robust to these proxies.

3.2.2 The Measure of Information Asymmetry

In this study, two metrics were used to measure information asymmetry (IASY). First, following Venkatesh and Chiang (1986), we used the bid–ask spread (SPREAD) which measures the differences between stocks bid and ask prices. Second, following Easley et al. (1996), we used the probability of information-based trading (PIN) to measure the intensity of information asymmetry across equity investor groups. In the equation, $High\_IASY_{it}$ (i.e. $High\_SPREAD_{it}$ and $High\_PIN_{it}$) were the dummy variables that referred to the firm-years with a high level of IASY. Specifically, if the firm-years belonging to the top quartile were sorted by $IASY_{it}$, then $High\_IASY_{it}$ is taken to equal to 1, and zero as otherwise.

3.3 Empirical Models

3.3.1 The Measure of Leverage Deviation

To test H_1, we estimated the following model:

$$DLEV_{it+1} = \alpha + \beta IASY_{it} + \psi \boldsymbol{Z}_{it} + \vartheta_{it+1} \tag{2}$$

where DLEV is leverage deviation and refers to book leverage deviation and market leverage deviation, and IASY is considered as SPREAD and PIN. In following Chen et al. (2018), we took ten factors ($\boldsymbol{Z}_{it}$) from model (1) and entered them into model (2) as control variables so as to gain unbiased coefficients, and standard errors. As our baseline regression model, model (2) ignored the dynamics of leverage deviation which was estimated by using the OLS. As the leverage deviation can be serially correlated, we incorporated its dynamics using $DLEV_{it}$ as an explanatory variable. Flannery and Hankins (2013) had argued that in the case of endogeneity, Blundell and Bond (1998) system-GMM estimators would provide the most reliable result for the dynamic short panels. Therefore, we estimated our new dynamic model by utilising system-GMM. We also employed Arellano and Bond (1991) difference-GMM for robustness check. Factors comprising industry and year effects were controlled by adding dummies to the regression model. To save space, we only reported the coefficient estimates, and the associated robust t-statistics (enclosed in parentheses) for leverage determinants. The t-statistics were then corrected for heteroskedasticity and firm-level clustering. According to H_1, it is expected that the coefficient on IASY would be positively significant.

3.3.2 *Information Asymmetry and Leverage Adjustment Speed*

Following Öztekin and Flannery (2012) and Zhou et al. (2016), we tested H_2 using the partial adjustment model:

$$LEV_{it+1} - LEV_{it} = \lambda(TLEV_{it+1} - LEV_{it}) + \vartheta_{it+1} \quad (3)$$

where LEV_{it} is leverage ratio at the end of period t, defined in the previous section, $TLEV_{it+1}$ is target leverage ratio that is measured as the fitted value based on model (1) and, λ is leverage adjustment speed. Substituting the fitted values from equation (1) into equation (3) produces the following dynamic regression model:

$$LEV_{it+1} = \alpha + (1 - \lambda)LEV_{it} + (\lambda\psi)\mathbf{Z}_{it} + \vartheta_{it+1} \quad (4)$$

Next, to test the significance of $IASY_{it}$ on leverage adjustment speed, we augmented model (4) with $High\_IASY_{it}$ and $High\_IASY_{it} * LEV_{it}$. Eventually, we used the following dynamic model to test H_2:

$$LEV_{it+1} = \alpha + (1 - \lambda)LEV_{it} + \beta High\_IASY_{it} + \theta High\_IASY_{it} * LEV_{it} + (\lambda\psi)\mathbf{Z}_{it} + \vartheta_{it+1} \quad (5)$$

We used the system-GMM estimator as our primary empirical approach to test H_2. We employed difference-GMM for robustness check of model (5). We also controlled industry and year effects. To save space, we omitted the coefficient estimates for industry and year dummies. The t-statistics were corrected for heteroskedasticity and firm-level clustering. According to H_2, the coefficient on the interaction term ($High\_IASY_{it} * LEV_{it}$) is expected to be positive. This means that H_2 predicts a positive θ. When compared to other firms, the coefficient on lagged leverage would be greater for firms with higher asymmetric information. As a result, $High\_IASY_{it}$ would exhibit slower leverage adjustment speed, in comparison with other firms.

4. Results and Discussion

4.1 *Estimation and Empirical Results*

4.1.1 *Descriptive Statistics*

Table 2 provides the descriptive statistics, including the mean, standard deviation, minimum, first and third quartiles, median and maximum for the main research variables.

Table 2: Descriptive Statistics for the Main Variables

Variables	#obs	Mean	SD	Min.	Q1	Median	Q3	Max
BL_{it+1}	4186	0.6027	0.2121	0.0501	0.4687	0.6337	0.7618	0.9730
ML_{it+1}	4186	0.4288	0.2299	0.0333	0.2364	0.4149	0.6080	0.9047
DBL_{it+1}	4186	0.1171	0.0906	0.0002	0.0464	0.0976	0.1667	0.5704
DML_{it+1}	4186	0.1333	0.0993	0.0001	0.0531	0.1107	0.1947	0.5780
$SPREAD_{it}$	4508	0.0835	0.0312	0.0105	0.0585	0.0832	0.1091	0.1631
PIN_{it}	4508	0.2161	0.0690	0.0398	0.1643	0.2144	0.2693	0.3953
$EBIT_{it}$	4508	0.1130	0.1485	0.4033	0.0325	0.1057	0.1930	0.5127
MTB_{it}	4508	3.4659	4.0052	0.4094	1.2933	2.2476	3.9828	6.7180
$TANG_{it}$	4508	0.2622	0.2130	0.0005	0.0996	0.2064	0.3737	0.9078
DEP_{it}	4508	0.1685	0.0573	0.0489	0.1273	0.1656	0.2070	0.3146
$TAXR_{it}$	4508	0.1021	0.0928	0.0000	0.0000	0.0946	0.1941	0.2918
$LNTA_{it}$	4508	13.3094	1.7440	9.7683	12.0772	13.1863	14.3547	18.0815
LIQ_{it}	4508	1.4047	1.3044	0.1022	0.8250	1.1242	1.4967	9.9485
IBL_{it}	4508	0.6181	0.0960	0.2858	0.5620	0.6395	0.6912	0.8151
IML_{it}	4508	0.4328	0.1553	0.0705	0.3170	0.4174	0.5636	0.8002
$INFL_{it}$	4508	0.1690	0.0729	0.0901	0.1169	0.1542	0.1983	0.3479
$GDPG_{it}$	4508	0.0267	0.0488	0.0771	-0.0020	0.0314	0.0552	0.1252

Note: This table reports the descriptive statistics. The full sample consists of 4,508 firm–year observations over the period 2004-2017.

The results show that the mean for book leverage and market leverage are 0.6027 and 0.4288, respectively. This suggests that about 60% of the corporate financial resources are provided through debts. The equity market value is about 1.33 times the debt value. The average book leverage deviation and market leverage deviation are 0.1171 and 0.1333, respectively. The average SPREAD and PIN are noted as 0.0865 and 0.2161, respectively. The results show that the stock market value is about 3.5 times the stock book value. Fixed assets are 26% of the total assets, and the depreciation cost is 16% of the total assets. The effective tax rate is 10%, and current assets are 1.4 times the current debts. In the period under review, the average inflation rate is about 17% and the average GDP growth rate is about 3%.

Table 3 reports the mean of the leverage and the leverage deviation for five annually rebalanced portfolios, based on the levels of SPREAD and PIN. These results show that the increase in information asymmetry also increases the leverage and leverage deviations. The comparison of

Table 3: The Mean for Leverage and Leverage Deviation in Different Quintiles of SPREAD and PIN

Portfolios: $SPREAD_{it}$	BL_{it+1}	ML_{it+1}	DBL_{it+1}	DML_{it+1}
1–Lowest	0.4996	0.3246	0.0941	0.1181
2	0.5589	0.3979	0.1136	0.1311
3	0.5779	0.4135	0.1178	0.1313
4	0.5725	0.4234	0.1175	0.1334
5–Highest	0.6297	0.4567	0.1424	0.1526
Diff. Highest-Lowest	0.1300***	0.1321***	0.0482***	0.0345**
Portfolios: PIN_{it}	BL_{it+1}	ML_{it+1}	DBL_{it+1}	DML_{it+1}
1–Lowest	0.5063	0.3343	0.0970	0.1238
2	0.5490	0.3869	0.1097	0.1235
3	0.5748	0.4119	0.1221	0.1370
4	0.6059	0.4561	0.1172	0.1362
5–Highest	0.6359	0.4981	0.1396	0.1459
Diff. Highest–Lowest	0.1296***	0.0426***	0.1638***	0.0221*

Note: *, ** and *** represent significance at the 10%, 5% and 1% level, respectively. This table reports the mean of leverage and leverage deviation for five annually rebalanced portfolios based on the levels of SPREAD and PIN. Portfolio 1 (5) consists of firms with the lowest (highest) leverage (leverage deviation) in every year. The table reports t-statistics (in parentheses) to test the significance of differences in means of leverage and leverage deviation measures in portfolios 1 and 5.

the leverage and leverage deviations in the first and last portfolios shows that in response to the increase in information asymmetry, the increase in the leverage and leverage deviation are also significant. These results support H_1.

4.2 Correlations

Table 4 reports Pearson's correlation coefficients for the main research variables. The results show that book leverage is significantly correlated with market leverage (0.7124), book leverage deviation (0.1557), market leverage deviation (0.0584), SPREAD (0.2774) and PIN (0.2550). The results further show that market leverage is positively correlated to book leverage deviation (0.0971), market leverage deviation (0.1635), SPREAD (0.1156) and PIN (0.904). The positive and significant correlation

Table 4: Correlation Coefficients

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ML_{it+1}	1														
DBL_{it+1}	0.097***	1													
DML_{it+1}	0.164***	0.442***	1												
$SPREAD_{it}$	0.306***	0.183***	0.116***	1											
PIN_{it}	0.280***	0.164***	0.090***	0.391***	1										
$EBIT_{it}$	-0.501***	-0.042**	-0.144***	-0.197***	-0.182***	1									
MTB_{it}	-0.332***	0.036*	-0.053***	-0.03	-0.023	0.212***	1								
$TANG_{it}$	0.014	-0.04*	-0.032	0.05**	0.055***	-0.079***	0.026*	1							
DEP_{it}	0.016	-0.003	0.002	0.020	0.024	-0.059***	0.024	0.686***	1						
$TAXR_{it}$	0.040**	-0.188***	-0.081***	0.017	0.022	0.337***	-0.017	0.022	0.036**	1					
$LNTA_{it}$	-0.054***	0.094***	0.031	0.024	0.04*	0.210***	-0.089***	0.077***	0.041***	0.016	1				
LIQ_{it}	-0.412***	0.135***	0.046**	-0.190***	-0.185***	0.187***	-0.123***	-0.232***	-0.162***	-0.059***	0.008	1			
IBL_{it}	0.319***	-0.061***	0.034*	0.126***	0.101***	-0.069***	0.066***	0.002	-0.004	0.053***	-0.252***	-0.200***	1		
IML_{it}	0.540***	-0.076***	0.065***	0.125***	0.106***	-0.239***	-0.336***	-0.027**	-0.014	0.042***	-0.168***	-0.144***	0.501***	1	
$INFL_{it}$	-0.083***	0.045**	0.010	-0.033	-0.024	0.109***	0.029**	-0.013	-0.010	0.120***	0.104***	0.079***	-0.169***	-0.164***	1

Note: *, ** and *** represent significance at the 10%, 5% and 1% level, respectively. This table reports the Pearson correlation coefficients for the main variables. The full sample consists of 4,508 firm–year observations over the period 2004-2017.

between book leverage deviation and SPREAD (0.1833), and between book leverage deviation and PIN (0.1644) as well as the positive and significant correlation among market leverage deviation, and two metrics of information asymmetry, includes SPREAD (0.1156) and PIN (0.904). This outcome provides the preliminary evidence in support of H_1.

4.3 Target Leverage Regressions

Panel A (Panel B) in Table 5 presents the estimation results of model (1) which used book leverage (market leverage) at the end of period $_{t+1}$ as the dependent variable. The first column of each panel shows the expected sign according to literature. In model estimation, we controlled for industry and year effects. The estimation results of model (1) indicate that the sign of the most coefficients is consistent with literature. Results further show that the leverage determinants explain 58% (21%) of the variations in book (market) leverage at the end of period $_{t+1}$. The result of the F-test also shows that the coefficients of the year dummies are jointly, not equal to zero. After estimating model (1), we used book (market) leverage at the end of period $_{t+1}$ as the dependent variable. We then derived the absolute value of the residuals as the book (market) leverage deviation.

4.4 Results of Testing H_1

Table 6 presents the estimation results of model (2) using SPREAD as the independent variable. Panel A (Panel B) reports the estimation results of model (2) using book leverage deviation (market leverage deviation) as the dependent variable.

In each panel, the first, second and third columns provide the estimation results derived from using the OLS, system-GMM and the difference-GMM estimators, respectively. By adding industry and year dummy variables to the regression models, we then controlled for industry and year effects. The robust t-statistics (presented in parentheses) were calculated using standard errors corrected for firm-level clustering. H_1 predicts a positive association between SPREAD and leverage deviations. Consistent with this, the estimation results of model (2) in Panel A indicates that the coefficients on SPREAD by using the OLS (0.0593), system-GMM (0.0462) and difference-GMM (0.0470) were positive and significant. In addition, the coefficients on SPREAD noted in the first column (0.0236), second column (0.0172) and third column

Table 5. Book/Market Target Leverage Regression

	Panel A Book leverage (BL_{it}) regression		Panel B Market leverage (ML_{it}) regression	
Variable	Sign in the literature	Estimated coefficient	Sign in the literature	Estimated coefficient
Intercept		0.3472*** (9.92)		0.2587*** (7.10)
$EBIT_{it}$	–	-0.4737*** (-18.77)	–	-0.5266*** (-21.02)
MTB_{it}	+	0.0011 (1.06)	+	-0.0110*** (-8.85)
$TANG_{it}$	–	-0.1263*** (-8.41)	–	-0.1316*** (-6.94)
DEP_{it}	–	0.0201 (0.52)	–	0.0301 (0.57)
$TAXR_{it}$	+	0.3523*** (10.30)	+	0.1205*** (3.10)
$LNTA_{it}$	+	0.0878*** (4.09)	+	0.1005*** (4.43)
LIQ_{it}	–	-0.0871*** (-22.57)	–	-0.0733*** (-18.83)
IBL_{it}	+	0.4164*** (18.23)	+	
IML_{it}			+	0.4700*** (18.45)
$INFL_{it}$	+	0.2367*** (11.39)	+	0.3129*** (11.20)
$GDPG_{it}$	+	0.4134*** (7.10)	+	0.2991*** (4.47)
Industry effects		Yes		Yes
Years dummy		Yes		Yes
#obs		4186		4186
Adjusted R^2		58.33%		61.00%
F-test (*p*-value)		<0.01		<0.01

Note: *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. This table reports the estimation results of the following regression model:

$$LEV_{it+1} = \omega + \psi \boldsymbol{Z}_{it} + \zeta_{it+1}, \quad LEV_{it+1} = \{BL_{it+1}, ML_{it+1}\}$$

In the table, the first column shows each of the dependent variable determinants used in the model. Panel A (Panel B) reports the regression results for book leverage (market leverage) for the next period as the dependent variable. The first column of each panel reports the predicted sign of independent variables ($\boldsymbol{Z}_{it}$), and the second column reports the estimated coefficients. We include both industry and year effects and report coefficient estimates and associated robust t-statistics (in parentheses) for leverage determinants. The t-statistics are corrected for heteroskedasticity and firm-level clustering. F-test is for the null hypothesis of no significant year fixed effect.

Table 6: Bid-ask SPREAD and Leverage Deviation

Variable	Panel A Book leverage deviation			Panel B Market leverage deviation		
	DBL_{it+1} (OLS)	DBL_{it+1} (BB)	DBL_{it+1} (AB)	DML_{it+1} (OLS)	DML_{it+1} (BB)	DML_{it+1} (AB)
Intercept	0.0191 (1.23)			0.0432** (2.27)		
DBL_{it}		0.1753*** (4.55)	0.1511*** (4.01)			
DML_{it}					0.1996*** (6.34)	0.1982*** (5.92)
$SPREAD_{it}$	0.0593*** (14.40)	0.0462*** (8.19)	0.0470*** (6.81)	0.0236*** (4.92)	0.0172** (2.45)	0.0187** (2.31)
$EBIT_{it}$	-0.0327** (-2.22)	0.0744*** (2.63)	0.1193*** (2.73)	-0.1116*** (-7.34)	-0.0702** (-2.21)	-0.0905* (-1.94)
MTB_{it}	0.0025*** (4.96)	-0.0010 (-0.85)	-0.0023* (-1.71)	0.0006 (1.20)	-0.0035** (-2.47)	-0.0075*** (-4.61)
$TANG_{it}$	-0.0178** (-2.01)	0.0040 (0.21)	-0.0189 (-0.66)	-0.0258** (-2.47)	-0.0233 (-1.07)	-0.0089 (-0.31)
DEP_{it}	0.0496 (1.62)	0.0158 (0.47)	0.0439 (1.14)	0.0905*** (2.91)	0.0529 (1.16)	0.1394** (2.58)
$TAXR_{it}$	-0.1343*** (-6.86)	-0.0402 (-1.06)	-0.0286 (-0.66)	-0.0504** (-2.48)	0.0283 (0.65)	0.0542 (1.01)
$LNTA_{it}$	0.0043*** (4.69)	-0.0002 (-0.03)	-0.0355*** (-2.73)	0.0033*** (4.03)	0.0084 (1.01)	0.0153 (1.02)
LIQ_{it}	0.0104*** (5.29)	-0.0128*** (-3.05)	-0.0172*** (-3.03)	0.0036** (2.14)	-0.0001 (-0.02)	0.0010 (0.18)
IBL_{it}	-0.0313** (-2.03)	0.0898** (2.19)	0.0980** (2.21)			
IML_{it}				0.0277* (1.94)	0.0578 (1.58)	0.0311 (0.60)
$INFL_{it}$	-0.0197 (-1.16)	0.0314 (0.19)	-0.0456 (-0.20)	0.0585*** (2.75)	-0.0011 (-0.01)	0.0176 (0.06)
$GDPG_{it}$	-0.0896** (-2.29)	-0.2236 (-0.54)	-0.6949 (-1.40)	0.1474*** (2.94)	0.0822 (0.16)	0.1066 (0.19)
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 6: Continued

Variable	Panel A Book leverage deviation			Panel B Market leverage deviation		
	DBL_{it+1} (OLS)	DBL_{it+1} (BB)	DBL_{it+1} (AB)	DML_{it+1} (OLS)	DML_{it+1} (BB)	DML_{it+1} (AB)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
#obs	4186	4186	4186	4186	4186	4186
Adjusted R^2	14.61%			17.02%		
Sargan-Hansen (J-statistic)		35.12	30.08		51.68	53.02
Arellano-Bond test for:						
AR(1) in first differences		-7.65***	-7.70***		-7.03***	-8.70***
AR(2) in first differences		0.22	0.77		0.25	-0.04

Notes:*, ** and *** denote significance at the 10%, 5% and 1% level, respectively. This table reports the estimation results of the following regression model:

$DLEV_{it+1} = \alpha + \beta IASY_{it} + \psi \mathbf{Z}_{it} + \vartheta_{it+1}$, $DLEV_{it+1} = \{DBL_{it+1}, DML_{it+1}\}$, $IASY_{it+1} = \{SPREAD_{it+1}\}$.

In this table, the first column shows each of the dependent variable determinants used in the model. Panels A and B report the regression results for the model (2) using book leverage and market leverage for the next period as the dependent variable, respectively. The first, second and third columns of each panel report the results for model (2) using OLS, system-GMM (BB) and difference-GMM (AB), respectively. Industry and year effects are controlled by adding industry and year dummies to the regression models. The robust t-statistics (presented in parentheses) are calculated using standard errors corrected for firm-level clustering. Panels A and B include the Sargan-Hansen over-identification test for the validity of instruments and the Arellano-Bond test for autocorrelation in differenced residuals for GMM estimations. The shaded rows highlight the main findings.

(0.0187) of Panel B in Table 6 was also significantly positive. Our results, thus showed that the increase in SPREAD also increased the book and market leverage deviations. Panels A and B report on the Sargan-Hansen over-identification test (with J-statistics) for testing the validity of the instruments used. In Panel A, the J-statistics in system-GMM (35.12) and difference-GMM (30.08) were not significant. In Panel B, the J-statistics in system-GMM (51.68) and difference-GMM (53.02) were not significant.

These results showed that our instruments were valid. Panels A and B report on the Arellano-Bond test for autocorrelation in differenced residuals. The AR(2) test results showed that there was no second-order autocorrelation in our GMM models.

Table 7 reports on the estimation results of model (2) using PIN as the independent variable. Panel A (Panel B) presents the estimates of model (2) by using book leverage deviation (market leverage deviation) as the dependent variable. In each panel, the first, second and third

Table 7: PIN and Leverage Deviation

Variable	Panel A Book leverage deviation			Panel B Market leverage deviation		
	DBL_{it+1} (OLS)	DBL_{it+1} (BB)	DBL_{it+1} (AB)	DML_{it+1} (OLS)	DML_{it+1} (BB)	DML_{it+1} (AB)
Intercept	0.0307* (1.91)			0.0493*** (2.98)		
DBL_{it}		0.1594*** (4.13)	0.1426*** (3.78)			
DML_{it}					0.1985*** (6.27)	0.1972*** (5.89)
PIN_{it}	0.0245*** (14.70)	0.0174*** (6.71)	0.0195*** (6.43)	0.0743*** (3.59)	0.0605** (1.98)	0.0805** (2.21)
$EBIT_{it}$	-0.0370** (-2.51)	0.0623** (2.20)	0.1167*** (2.71)	-0.1176*** (-8.12)	-0.0722** (-2.29)	-0.0903* (-1.94)
MTB_{it}	0.0022*** (3.96)	-0.0009 (-0.77)	-0.0023* (-1.74)	0.0006 (0.98)	-0.0036** (-2.46)	-0.0075*** (-4.60)
$TANG_{it}$	-0.0245** (-2.57)	0.0070 (0.37)	-0.0118 (-0.41)	-0.0268** (-2.57)	-0.0230 (-1.06)	-0.0069 (-0.24)
DEP_{it}	0.0561* (1.86)	0.0166 (0.49)	0.0489 (1.29)	0.0907*** (3.11)	0.0522 (1.15)	0.1387** (2.56)
$TAXR_{it}$	-0.1380*** (-6.93)	-0.0434 (-1.14)	-0.0305 (-0.72)	-0.0483** (-2.55)	0.0267 (0.62)	0.0542 (1.01)
$LNTA_{it}$	0.0039*** (3.95)	-0.0006 (-0.08)	-0.0362*** (-2.75)	0.0032*** (4.79)	0.0075 (0.91)	0.0138 (0.92)
LIQ_{it}	0.0097*** (4.91)	-0.0119*** (-2.88)	-0.0165*** (-2.98)	0.0033* (1.95)	0.0001 (0.02)	0.0015 (0.26)
IBL_{it}	-0.0371** (-2.18)	0.0851** (2.01)	0.0891** (2.01)			

Table 7: Continued

Variable	Panel A Book leverage deviation			Panel B Market leverage deviation		
	DBL_{it+1} (OLS)	DBL_{it+1} (BB)	DBL_{it+1} (AB)	DML_{it+1} (OLS)	DML_{it+1} (BB)	DML_{it+1} (AB)
IML_{it}				0.0229*	0.0598*	0.0291
				(1.73)	(1.65)	(0.56)
$INFL_{it}$	-0.0265**	0.0142	-0.0639	0.0673***	-0.0014	-0.0013
	(-1.98)	(0.08)	(-0.28)	(3.48)	(-0.02)	(-0.05)
$GDPG_{it}$	-0.1115***	-0.3244	-0.7567	0.1715***	0.0421	0.0367
	(-3.48)	(-0.78)	(-1.53)	(3.75)	(0.08)	(0.07)
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
#obs	4186	4186	4186	4186	4186	4186
Adjusted R^2	18.44%			16.66%		
Sargan-Hansen (J-statistic)		35.52	30.43		52.05	53.36
Arellano-Bond test for:						
AR(1) in first differences		-8.02***	-7.75***		-8.87***	-8.73***
AR(2) in first differences		0.30	0.49		0.51	-0.01

Notes: *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. This table reports the estimation results of the following regression model:

$DLEV_{it+1} = \alpha + \beta IASY_{it} + \psi \mathbf{Z}_{it} + \vartheta_{it+1}$, $DLEV_{it+1} = \{DBL_{it+1}, DML_{it+1}\}$, $IASY_{it+1} = \{PIN_{it+1}\}$.

In this table, the first column shows each of the dependent variable determinants used in the model. Panels A and B report the regression results for the model (2) using book leverage and market leverage for the next period as the dependent variable, respectively. The first, second, and third columns of each panel report the results for model (2) using OLS, system-GMM (BB) and difference-GMM (AB), respectively. Industry and year effects are controlled by adding industry and year dummies to the regression models. The robust t-statistics (presented in parentheses) are calculated using standard errors corrected for firm-level clustering. Panels A and B include the Sargan-Hansen over-identification test for the validity of instruments and the Arellano-Bond test for autocorrelation in differenced residuals for GMM estimations. The shaded rows highlight the main findings.

columns provide the estimation results by using the OLS, difference-GMM and system-GMM estimators, respectively. Industry and year effects were controlled by adding industry and year dummies to the regression model. The robust t-statistics (presented in parentheses) were calculated by using standard errors which were corrected for firm-level clustering. H_1 predicts a positive association between PIN and leverage deviations. Consistent with this, the estimation results of model (2) in Panel A indicated that the coefficient on PIN using the OLS (0.0245), system-GMM (0.0174), and difference-GMM (0.0195) were positive and significant. The coefficients noted in PIN in the first column (0.0743), second column (0.0605) and third column (0.0805) of Panel B in Table 7 were significantly positive. These results showed that the increase in PIN increased the book and market leverage deviations. Panels A and B report the Sargan-Hansen over-identification test (with J-statistics) for the validity of instruments. In Panel A, the J-statistics in system-GMM (35.52) and difference-GMM (30.43) were not significant. In Panel B, the J-statistics in system-GMM (52.05) and difference-GMM (53.36) were also not significant. These results showed that all our instruments were valid. Panels A and B report on the Arellano-Bond test for autocorrelation in differenced residuals. The AR(2) test results indicated that there was no second-order correlation in our GMM models.

4.5 *Results of Testing H_2*

Panels A and B in Table 8, present the estimation results of model (5) which used book leverage and market leverage at the end of period $_{t+1}$ as the dependent variables. The first two columns in each panel report the estimation results of model (5) which used High-SPREAD, while the subsequent two columns show the estimation results when using High-PIN. Industry and year effects were controlled by adding industry and year dummies to the regression model.

The robust t-statistics (presented in parentheses) were calculated by using standard errors corrected for firm-level clustering. H_2 predicts that firms with higher information asymmetry have a slower leverage adjustment speed. Consistent with this, the estimation results of model (5) in the first (0.0384) and the second (0.0332) columns of panel A indicate that firms with higher SPREAD have slower book leverage adjustment speed when compared with other firms. The estimation results of model (5) in the third column (0.0338) and the fourth column (0.0419) of panel A show that firms with higher PIN have slower book

Table 8: Spread/PIN and Leverage Adjustment Speed

Variable	Panel A Book leverage				Panel B Market leverage			
	BL_{it+1} (BB)	BL_{it+1} (AB)	BL_{it+1} (BB)	BL_{it+1} (AB)	ML_{it+1} (BB)	ML_{it+1} (AB)	ML_{it+1} (BB)	ML_{it+1} (AB)
BL_{it}	0.8729*** (10.91)	0.8476*** (8.63)	0.8110*** (10.54)	0.8192*** (8.35)				
ML_{it}					0.7959*** (12.13)	0.8186*** (11.42)	0.7680*** (13.31)	0.7938*** (10.92)
$High\_SPREAD_{it}$	0.2575*** (3.56)	0.2246*** (3.24)			0.1227*** (1.12)	0.0436 (2.73)		
$High\_PIN_{it}$			0.2092*** (3.09)	0.2112*** (2.73)			0.1639*** (4.14)	0.2051*** (4.33)
$High\_SPREAD_{it} * BL_{it}$	0.0384*** (3.40)	0.0332*** (3.09)						
$High\_PIN_{it} * BL_{it}$			0.0338*** (3.09)	0.0419** (1.97)				
$High\_SPREAD_{it} * ML_{it}$					0.0787** (2.07)	0.0414** (2.36)		
$High\_PIN_{it} * ML_{it}$							0.0480*** (2.85)	0.0420** (2.12)
$EBIT_{it}$	0.2037*** (4.25)	0.3348*** (5.75)	0.1685*** (3.74)	0.4048*** (7.12)	0.0213 (0.60)	0.4281*** (9.00)	0.0746* (1.93)	0.4428*** (9.21)
MTB_{it}	-0.0156*** (-8.44)	-0.0199*** (-8.30)	-0.0125*** (-7.61)	-0.0202*** (-8.74)	0.0036*** (3.46)	0.0114*** (5.02)	0.0035*** (2.90)	0.0119*** (5.18)

Table 8: Continued

Variable	Panel A Book leverage				Panel B Market leverage			
	BL_{it+1} (BB)	BL_{it+1} (AB)	BL_{it+1} (BB)	BL_{it+1} (AB)	ML_{it+1} (BB)	ML_{it+1} (AB)	ML_{it+1} (BB)	ML_{it+1} (AB)
$TANG_{it}$	0.0570**	0.1761***	0.0764***	0.1873***	-0.0020	0.1222***	0.0033	0.1206***
	(2.36)	(4.03)	(2.92)	(4.17)	(-0.08)	(2.77)	(0.13)	(2.84)
DEP_{it}	-0.0373	-0.0458	-0.1204***	-0.1243***	-0.0007	-0.0186	-0.0109	-0.0424
	(-0.90)	(-1.10)	(-2.99)	(-2.71)	(-0.02)	(-0.37)	(-0.27)	(-0.85)
$TAXR_{it}$	-0.0659*	-0.1456***	-0.0613*	-0.1656***	-0.0357	-0.0774*	-0.0337	-0.0483
	(-1.96)	(-3.08)	(-1.77)	(-3.52)	(-0.99)	(-1.68)	(-0.88)	(-1.05)
$LNTA_{it}$	-0.0293***	-0.0826***	-0.0106	-0.0794***	0.0242***	-0.0471***	0.0135*	-0.0482***
	(-3.74)	(-5.40)	(-1.39)	(-5.06)	(3.29)	(-3.41)	(1.72)	(-3.44)
LIQ_{it}	0.0283***	0.0385***	0.0223***	0.0394***	-0.0042	0.0169***	-0.0025	0.0144***
	(4.62)	(5.76)	(3.73)	(6.18)	(-1.42)	(3.77)	(-0.73)	(3.47)
IBL_{it}	0.0145	0.0197	-0.0092	-0.0292				
	(0.34)	(0.40)	(-0.22)	(-0.55)				
IML_{it}					0.1103***	-0.2088***	0.1065***	-0.1365***
					(3.39)	(-3.96)	(2.72)	(-2.65)
$INFL_{it}$	0.1958	0.2328	-0.0410	0.1395	0.0205	0.0845	-0.3349**	-0.1527
	(1.37)	(1.19)	(-0.30)	(0.70)	(0.28)	(0.38)	(-2.26)	(-0.73)
$GDPG_{it}$	0.1580	0.0222	0.1645	0.1801	0.4238***	1.1333	-0.4687	0.5359
	(0.49)	(0.06)	(0.58)	(0.51)	(2.60)	(2.48)	(-1.50)	(1.24)
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: Continued

Variable	Panel A Book leverage				Panel B Market leverage			
	BL_{it+1} (BB)	BL_{it+1} (AB)	BL_{it+1} (BB)	BL_{it+1} (AB)	ML_{it+1} (BB)	ML_{it+1} (AB)	ML_{it+1} (BB)	ML_{it+1} (AB)
#obs	4186	4186	4186	4186	4186	4186	4186	4186
Sargan-Hansen (J-statistic)	93.45	76.17	82.37	96.41	93.90	79.84	85.28	85.99
Arellano-Bond test for:								
AR(1) in first differences	-8.02***	-7.63***	-6.66***	-7.92***	-6.54***	-9.54***	-9.15***	-9.44***
AR(2) in first differences	-0.31	-0.72	0.25	0.39	-0.55	-0.92	-0.62	-0.61

Notes: *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. This table reports the estimation results of the following regression model:

$$LEV_{it+1} = \alpha + (1-\lambda)LEV_{it} + \beta High\_IASY_{it} + \theta High\_IASY_{it} * LEV_{it} + (\lambda\psi)\mathbf{Z}_{it} + \vartheta_{it+1},$$

$$LEV_{it+1} = \{BL_{it+1}), ML_{it+1}\}\ IASY_{it+1} = \{SPREAD_{it+1}, PIN_{it+1}\}.$$

In this table, the first column shows each of the dependent variable determinants used in the model. Panels A and B report the regression results for the model (3) using book leverage and market leverage for the next period as the dependent variable, respectively. Industry and year effects are controlled by adding industry and year dummies to the regression models. The robust t-statistics (presented in parentheses) are calculated using standard errors corrected for firm-level clustering. Panels include the Sargan-Hansen over-identification test for the validity of instruments. Furthermore, we include the Arellano-Bond test results. The shaded rows highlight the main findings.

leverage adjustment speed when compared with other firms. Panel B report similar results on market leverage adjustment speed while Panels A and B report the Sargan-Hansen over-identification test (with J-statistics) for the validity of the instruments. The results show that all our instruments are valid. Our results on the Arellano-Bond test also show no second-order correlation in our GMM models.

4.6 Robustness Tests

To confirm our results, we conducted two robustness checks. The first is to consider the effect of the sanctions imposed by the US, EU and the UN against Iran. To fulfill this, we re-estimated our models on severe (when all three types of sanctions exist) and non-severe (when at least one of these three types of sanctions did not exist) economic sanction periods. The second is to take note that the estimation of the target leverage is very important and definitive. We tested the sensitivity of the research results by using a different set of leverage determinants. Specifically, we used leverage determinants from Zhou et al. (2016) to calculate leverage deviations, to re-estimate models (2) and (5), and to test our hypotheses. In our robustness tests, industry and year effects were controlled by adding these as dummies to the regression models. However, to save space, we only reported the coefficient estimates (and t-statistics that were calculated by using standard errors corrected for firm-level clustering) used in testing our hypotheses.

4.6.1 Considering Severe and Non-Severe Economic Sanction Periods

Table 9 reports the hypotheses testing results on severe and non-severe economic sanction periods against Iran. Panels A and B in Table 9 illustrate the results for H_1 and H_2, respectively. In Panel A.1 (Panel A.2), the estimation results of model (2) on severe sanction period by using the OLS, BB and difference-GMM indicate that an increase in information asymmetry (proxied by SPREAD and PIN) increased book (market) leverage deviation. These results are then repeated for the non-severe sanction period. In Panels B.1 and B.2, the estimation results of model (5) on the severe and non-severe sanction periods by using system-GMM and difference-GMM indicate that firms with higher information asymmetry (proxied by SPREAD and PIN) have a slower adjustment speed. Therefore, the reported results in Panels A and B support H_1 and H_2, respectively.

Table 9: Additional Robustness Tests (Severe and Non-Severe Economic Sanction Periods)

Panel A: H_1. Information asymmetry and leverage deviation
Panel A.1: Book leverage deviation

	Non-severe sanctions periods			Severe sanctions periods		
	DBL_{it+1} (OLS)	DBL_{it+1} (BB)	DBL_{it+1} (AB)	DBL_{it+1} (OLS)	DBL_{it+1} (BB)	DBL_{it+1} (AB)
$SPREAD_{it}$	0.0506***	0.0394***	0.0355***	0.0799***	0.0445***	0.0538***
	(11.72)	(5.72)	(4.39)	(17.81)	(4.05)	(4.74)
PIN_{it}	0.0234***	0.0147***	0.0160***	0.0315***	0.0171***	0.0212***
	(11.57)	(3.08)	(4.60)	(15.32)	(5.39)	(3.92)

Panel A.2: Market leverage deviation

	Non-severe sanctions periods			Severe sanctions periods		
	DML_{it+1} (OLS)	DML_{it+1} (BB)	DML_{it+1} (AB)	DML_{it+1} (OLS)	DML_{it+1} (BB)	DML_{it+1} (AB)
$SPREAD_{it}$	0.0291***	0.0150*	0.0176*	0.0331***	0.0164**	0.0185***
	(7.24)	(1.68)	(1.84)	(7.40)	(2.49)	(2.69)
PIN_{it}	0.0833***	0.0480**	0.0496**	0.1057***	0.0467**	0.0945*
	(4.60)	(1.93)	(2.02)	(3.94)	(1.98)	(1.88)

Panel B: H_2. Information asymmetry and leverage adjustment speed
Panel B.1: Book leverage

	Non-severe sanctions periods		Severe sanctions periods	
	BL_{it+1} (BB)	BL_{it+1} (AB)	BL_{it+1} (BB)	BL_{it+1} (AB)
$High\_SPREAD_{it} * BL_{it}$	0.0156***	0.0199***	0.0781***	0.0771***
	(2.76)	(2.95)	(3.75)	(4.19)
$High\_PIN_{it} * BL_{it}$	0.0229***	0.0369***	0.0402***	0.0541**
	(3.16)	(3.25)	(2.71)	(2.09)

Panel B.2: Market leverage

	Non-severe sanctions periods		Severe sanctions periods	
	BL_{it+1} (BB)	BL_{it+1} (AB)	BL_{it+1} (BB)	BL_{it+1} (AB)
$High\_SPREAD_{it} * ML_{it}$	0.0171*	0.0188***	0.0421**	0.0514**
	(1.92)	(2.81)	(2.07)	(2.12)
$High\_PIN_{it} * ML_{it}$	0.0262*	0.0281**	0.0591***	0.0516***
	(1.83)	(2.17)	(3.10)	(3.91)

Notes: *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. Panels A and B report the estimation results of models (2) and (5), respectively in severe and non-severe economic sanctions periods. Industry and year effects are controlled by adding industry and year dummies to the regression models. The robust t-statistics (presented in parentheses) are calculated using standard errors corrected for firm-level clustering.

4.6.2 Using an Alternative Set of Leverage Determinants

Panel A and Panel B in Table 10 highlight the estimation results of models (2) and (5) by using an alternative set of leverage determinants, respectively. In Panel A.1 (Panel A.2), the estimation results of model (2) by using the OLS, system-GMM and difference-GMM indicate that an increase in information asymmetry (proxied by SPREAD and PIN) increases book (market) leverage deviation. Panels B.1 and B.2 highlight the estimation results of model (5) when using system-GMM and difference-GMM. The results show that firms with higher information asymmetry (proxied by SPREAD and PIN) have a slower adjustment speed. Therefore, our results in Panels A and B support H_1 and H_2, respectively.

5. Conclusion and Implications

The outcomes derived from this study contribute to the current literature on leverage policy with two novel findings. First, we provide evidence which shows that information asymmetry is positively associated with leverage deviation. This result is consistent with the notion that information asymmetry increases adverse selection costs and financing frictions. It also forces firms to increase debt financing. While debt financing has tax benefits, it also increases bankruptcy costs, thereby leading to higher costs of capital. As a result, more debt financing in response to an increase in information asymmetry can deviate firm's leverage from its optimal level. Second, our results indicate that firms with a higher (lower) information asymmetry have a slower (faster) adjustment speed. To confirm our analysis, we conducted some robustness checks. Our findings are robust to different proxies for leverage deviation and information asymmetry, different sample periods, an alternative set of leverage determinants and various estimation methods.

These findings have numerous practical implications for board of directors, managers, as well as practitioners and academics involved in the regulatory process. The results inform boards of directors about the importance of information transparency in achieving an optimal capital structure and subsequently in reducing the cost of capital. This is because managers' actions that lead to higher information asymmetry could produce unintended outcomes such as higher costs of capital. Therefore, managers must develop appropriate policies to disclose such information in order to reduce information asymmetry. Moreover, the findings of this study may be of interest to policymakers since

Table 10: Additional Robustness Tests (Different Set of Leverage Determinants)

Panel A: H1. Information asymmetry and leverage deviation
Panel A.1: Book leverage deviation

	DBL_{it+1} (OLS)	DBL_{it+1} (BB)	DBL_{it+1} (AB)
$SPREAD_{it}$	0.0593***	0.0462***	0.0470***
	(14.40)	(8.19)	(6.81)
PIN_{it}	0.0245***	0.0174***	0.0195***
	(14.70)	(6.71)	(6.43)

Panel A.2: Market leverage deviation

	DML_{it+1} (OLS)	DML_{it+1} (BB)	DML_{it+1} (AB)
$SPREAD_{it}$	0.0236***	0.0172**	0.0187**
	(4.92)	(2.45)	(2.31)
PIN_{it}	0.0743***	0.0605*	0.0805**
	(3.59)	(1.85)	(2.21)

Panel B: H_2. Information asymmetry and leverage adjustment speed
Panel B.1: Book leverage

	BL_{it+1} (BB)	BL_{it+1} (AB)
$High\_SPREAD_{it} * BL_{it}$	0.0384***	0.0332***
	(3.40)	(3.09)
$High\_PIN_{it} * BL_{it}$	0.0338***	0.0194**
	(3.09)	(2.56)

Panel B.2: Market leverage

	ML_{it+1} (BB)	ML_{it+1} (AB)
$High\_SPREAD_{it} * ML_{it}$	0.0199***	0.0214**
	(3.25)	(2.36)
$High\_PIN_{it} * ML_{it}$	0.0215**	0.0392***
	(2.08)	(3.94)

Note: *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. This table reports the hypotheses results using a different set of leverage determinants based on Zhou et al. (2016). Panels A and B report the estimation results of models (2) and (5), respectively. Industry and year effects are controlled by adding industry and year dummies to the regression models. The robust t-statistics (presented in parentheses) are calculated using standard errors corrected for firm-level clustering.

policymakers and accounting standard bodies need to set rules and regulations which strive to reduce information asymmetry.

Similar to most studies, the current study has several limitations. One major limitation of the study is that the employed measures of information asymmetry are based on the bid–ask spread (Venkatesh & Chiang, 1986), and the probability of informed trading (PIN) (Easley, Hvidkjaer, & O'Hara, 2002). Although these measures were widely used in past literature, they are approximate measures and may not completely reflect all of the information asymmetry among market participants. Thus, readers need to exercise caution when interpreting the findings. In addition, since the current study only used data from Iranian firms, we were not able to account for any cross-country variations that may affect the relationship between our variables.

Future studies may consider examining other important factors that may affect the relationship between information asymmetry and leverage deviation, in particular, the impact of audit quality on the relationship between the variables. Other studies may consider using proxies for information asymmetry, such as share trading volume and share return volatility.

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