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Corporate International Diversification and Stock Liquidity: The Effect of the Informational Efficiency of Stock Price

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Abstract

This study examines the effect of corporate international diversification on stock liquidity. Previous literature suggests that an improvement in the informational efficiency of stock price increases liquidity of the stock, as it reduces risk of trading the stock. We conjecture that the relationship between corporate international diversification and stock liquidity depends on whether overseas expansion increases or decreases the informational efficiency of stock price. If corporate international diversification enhances the informational efficiency of stock price, it would improve liquidity of the stock, and vice versa. The results of empirical analysis using a sample of listed Japanese firms show that corporate international diversification is associated with greater stock liquidity. In addition, the effect of corporate international diversification on stock liquidity becomes weaken and statistically insignificant, after controlling for the effect of the informational efficiency of stock price. These results indicate that internationally diversified firms would experience the greater stock liquidity and the greater liquidity is due to the effect of informational efficiency of their stock prices.

1. Introduction

This study investigates the relationship between corporate international diversification and stock liquidity. Stock liquidity has been received considerable attention from the market microstructure and corporate finance literature, as it would be one of matter of concerns of business management. Previous studies on stock liquidity suggest that the level of stock liquidity influence stock return or firm value (e.g., Amihud and Mendelson, 1986; Amihud, 2002, Faucault el al., 2013). Thus, several studies have been identified the factors that influence the liquidity of stocks. However, the effects of corporate international diversification on stock liquidity has been unexplored. In this study, we focus on the differences in stock liquidity due to firm's overseas expansion. We infer that there is a significant relationship between corporate international diversification and stock liquidity, based on the relationship between informational efficiency of stock price and stock liquidity.

Informational efficiency of stock price is positively related to stock liquidity. The informational efficiency of stock price contributes to the better predictability of the stock return, thereby reducing trading risk of the stock. Thus, the greater informational efficiency of stock price improves liquidity of the stock. Previous studies suggest the determinants of stock liquidity on the basis of the relationship between the informational efficiency of stock price and stock liquidity. The determinants suggested by these studies, such as informed investors, investment horizon, corporate governance, and product market power, have some effects on the degree of the informational efficiency of stock price, thereby influencing liquidity of the stock. These studies argue that the determinants that enhance the informational efficiency of stock price have a positive impact on stock liquidity. In contrast, if they lower the informational efficiency of stock price, it would result in less liquidity of the stock.

Based on the positive relation between the informational efficiency of stock price and stock liquidity, we conjecture that corporate international diversification also affect stock liquidity, as it is expected to have some effects on the degree of informational efficiency of stock price. The expected effects of corporate international diversification on the informational efficiency of stock price are conflicting. Firm's overseas expansion may increase the complexity in operations and information asymmetry between insiders and outside investors, thereby decreasing the informational efficiency of stock price. However, if managers of internationally diversified firms have the greater incentive to reduce the

information asymmetry between them and outside investors, they would release better corporate disclosure which contributes to the greater stock liquidity. Therefore, we construct conflicting hypotheses about the relationship between corporate international diversification and stock liquidity. The relationship would be positive or negative depending on how the degree of the informational efficiency of stock price changes by corporate international diversification.

To test our hypotheses, we examine how corporate international diversification is associated with stock liquidity, with the sample of Japanese listed firms from 2004 to 2016. We use the three measures of stock liquidity, Amihud's relative illiquidity, the quoted spread, and the effective spread. The measure of overseas business activities is the ratio of foreign subsidiaries to total subsidiaries. Our regression results show that firms with higher foreign subsidiaries ratio exhibit lower stock liquidity measures, suggesting that corporate international diversification is associated with greater stock liquidity. This finding is robust to different estimation methods including fixed-effects regression and two-step efficient GMM. In addition, we find that the positive relation between corporate international diversification and stock liquidity becomes weaken and statistically insignificant, after controlling the effect of the informational efficiency of stock price. The greater stock liquidity of internationally diversified firms results from the effect of informational efficiency of their stock price rather than the independent effect of corporate international diversification.

This study provides an empirical evidence for the difference in the level of stock liquidity between Japanese multinational firms and domestic firms. This contributes to the on-going debate on the effect of overseas business activities on various corporate outcomes, because the relationship between multinational operations and stock liquidity has received less attention. The finding of the greater stock liquidity of Japanese multinational firms may imply that firms can enhance their stock liquidity by overseas expansion. However, our additional finding suggests that the positive effect of corporate international diversification on stock liquidity is almost derived from the effect of the informational efficiency of stock price. This provides an implication that firms would have to make an effort to improve the informational efficiency of their stock prices to increase liquidity of their stocks, when they expand their business activities overseas.

The remainder of this paper is organized as follows. Chapter 2 reviews the literature on the determinants of stock liquidity that explains based on the relationship between the informational efficiency of stock price and stock liquidity. In Chapter 3, we establish the

hypotheses for the relationship between corporate international diversification and stock liquidity with assumption about the effect of corporate international diversification on the informational efficiency of stock price. Then, Chapter 4 describes the sample, the variables, and the method for analysis and Chapter 5 presents the regression results. Finally, Chapter 6 offers concluding discussions.

2. Literature Review

Informational Efficiency of Stock Price and Stock Liquidity

The informational efficiency of stock price is one of determinants of stock liquidity. Informational efficiency of stock price is defined as the amount of private information revealed in prices. Thus, the greater informational efficiency of stock price indicates that the price reflects more information about the security's true value. As the informational efficiency of stock price becomes greater, it improves the predictability of stock return and reduces uncertainty about future payoffs, thereby decreasing risk of trading the stock. The reduction in trading risk results in an increase in trading liquidity (Mendelson and Tunca, 2004). Therefore, the informational efficiency of stock price enhances liquidity of the stock. Previous studies determine several determinants of stock liquidity on the basis of the positive relationship between informational efficiency of stock price and liquidity of the stock. In this chapter, we introduce the determinants of stock liquidity suggested by previous studies to understand how they are related to the informational efficiency of stock price and to stock liquidity.

The presence of Informed investors is an important determinant of stock liquidity. The effect of informed investor on liquidity depends on whether they enhance the level of informational efficiency of stock price or not. Thus, informed investors influence liquidity of stocks in two ways. The presence of informed investors may cause information asymmetry between informed and uninformed investors and adverse selection risk on uninformed investors. The adverse selection risk reduces the motivation for uninformed investors to trade, because they are afraid of monetary loss due to their uncertainty about the true value of the stock. If the presence of informed investors increases information asymmetry between informed and uninformed investors and adverse selection risk, it would result in lower liquidity of the stock (higher bid-ask spread) (Glosten and Milgrom,

1985; Easley and O'Hara, 1987). On the other hand, competition among informed investors improves the informational efficiency related to stock price, thereby reducing the perceived uncertainty about the true value of the stock. This improvement in the informational efficiency of stock price would lead to an increase in stock liquidity (Holden and Subrahmanyam, 1992; Mendelson and Tunca, 2004).

Investment horizon also has significant effect on stock liquidity. Some previous studies suggest that investment horizon is negatively associated with stock liquidity (Atkins and Dyl, 1997; Vovchak, 2014). This negative relationship between investment horizon and liquidity can be explained by informational advantage of short-term investors. Wermers (2000) shows that high-turnover funds hold stocks with significantly higher average returns than low-turnover funds and argues that the higher return level is due to the better stock-picking skills of managers of high-turnover funds. Consistent with Wermers (2000), Yan and Zhang (2009) demonstrate that short-term institutional ownership has predictive power for future stock returns, contrary to no incremental predictive power of long-term institutional ownership. They explain that short-term investors would be more informed than long-term investors, because investors who possess superior information about stock value are expected to trade more frequently to exploit their informational advantage.

Better corporate governance is considered to have positive impact on stock liquidity, according to agency theory. Corporate governance improves the firm's financial and operational transparency by enhancing the quality and frequency of information released by the firm. An increase in operational transparency provides better understating about its operations to investors and reduces information asymmetries between insiders and outside investors, as well as among outside investors. This decrease in information asymmetry results in lower adverse selection risk which outside investors face and smaller spread posted by liquidity providers (Chung et al. 2010). Thus, better corporate governance enhances the informational efficiency of stock price, thereby increasing liquidity of the stock. In contrast, liquidity providers may post wider spread for stocks of firms with poor governance because they face greater adverse selection problems in these stocks (Glosten and Milgrom, 1985).

Product market power is also one of the determinants of stock liquidity. As a firm with greater market power can change a price of its product when it faces a productivity shock that influences output, it has ability to pass on the productivity shock to its customers. Thus, product market power reduces the volatility of the firm's cash flow and stock returns.

The lower volatility of cash flow and stock returns enhance the precision of investor's information about stock price, resulting in lower price impact and better stock liquidity. Based on this discussion, Peress (2010) suggests that greater product market power improves stock liquidity. Kale and Loon (2011) also test Peress (2010)'s inference empirically and provide an evidence of the positive relationship between product market power and stock liquidity.

3. Hypotheses Development

3.1. Corporate International Diversification and Informational Efficiency of Stock Price

As seen in previous chapter, the determinants of stock liquidity discussed above is explained by the relationship between the informational efficiency of stock price and stock liquidity. We infer that corporate international diversification also would influence stock liquidity, if it gives rise to a change in the degree of informational efficiency of the firm's stock price. However, we expect that the relation between corporate international diversification and stock liquidity is ambiguous because multinational operations have conflicting aspects on the informational efficiency of stock price. To infer the relation between corporate international diversification and stock liquidity, we consider these conflicting effects of multinational operations on the informational efficiency of stock price.

Corporate international diversification may lower the informational efficiency of stock price. Multinational firms are likely to experience a more complexity in their operations compared with domestic firms. The greater complexity of multinational operations makes it difficult to monitor management efficiently and increases information asymmetry between managers and investors (Lee and Kwok, 1988; Riahi-Belkaoui and Picur, 2001). Geographically diverse operations of multinational firms also may give rise to greater information asymmetry between managers and investors, because greater geographic diversity makes active monitoring of managerial decisions more difficult and expensive in comparison to domestic firms (Doukas and Pantzalis, 2003). Besides, analysts' lower familiarity with language, cultural practices and governmental regulations of foreign countries and more discretion for managers of multinational firms can be some of the reasons for greater information asymmetry between managers and analysts (Duru and Reeb, 2002). Moreover, the challenge of communicating across borders and the principal-

agent relationship between the domestic parent and the foreign subsidiary may increase information asymmetry between insiders and outside investors and among shareholders (Runyan and Smith, 2007). This greater information asymmetry between insiders and outside investors and among outside investors would deteriorate the informational efficiency of stock price.

On the other hands, it might be argued that multinational firms can experience ghe greater informational efficiency of their stock price than that of domestic firms. Value-maximizing managers have incentives to reduce information asymmetry between managers and investors, because it increases monitoring costs and the costs of external financing (Myers and Majluf, 1984; Bartov and Bodnar, 1996). The greater complexity in operations and information asymmetry arising from overseas business activities may increase the incentives to reduce information asymmetry between managers and investors, in order to allow investors to understand about their activities (Luo, 2005). Some previous studies provide an evidence for the positive relation between corporate international diversification and the level of corporate disclosure. Lee et al. (2008) find that multinational firms announce their earnings earlier than domestic firms. Cahan et al. (2005) show that global operations are related to the higher level of voluntary disclosure. This improvement in the level of corporate disclosure of internationally diversified firms would enhance the informational efficiency of their stock prices.

3.2. Corporate International Diversification and Stock Liquidity

As discussed above, corporate international diversification has two conflict effects on stock liquidity. The greater complexity and information asymmetry between insiders and outside investors and among investors of multinational firms would decrease the informational efficiency of their stock prices. In contrast, multinational firms may release the better corporate discloser that improves the informational efficiency of stock price, because managers of those firms are motivated to provide more information about their operations to reduce the increased information asymmetry between them and investors. According to previous studies, the informational efficiency of stock price has a positive effect on stock liquidity. Thus, we can conjecture how corporate international diversification affects liquidity of the firm's stock based on the relationship between informational efficiency of stock price and stock liquidity. If corporate international diversification lowers the informational efficiency of their stock prices, it would decrease

stock liquidity. However, if the effect of better corporate disclosure of multinational firms that outweighs the effects of the information asymmetries between managers and investors and among investors increases the informational efficiency of their stock price, it would result in higher stock liquidity.

So, we build conflicting hypotheses as follows:

H1.a. Corporate international diversification is associated with higher stock liquidity.
H1.b. Corporate international diversification is associated with lower stock liquidity.

4. Data and Methodology

4.1. Sample Selection

We use two types of database: Nikkei Financial Quest and Nikkei Value Search. We obtain the firm's financial information from Nikkei Needs Financial Quest database, and information about foreign subsidiaries from Nikkei Value Search database. The sample consists of all firms listed on the Japanese stock markets except for financial industry and utilities. The data set covers the period 2004 – 2016 because company's data incorporated by Nikkei Value Search database has become available since 2004. We exclude observations with missing value of variables used in the analysis. Then, we winsorize all the variables at the 1^{th} and 99^{th} percentiles to minimize the effects of outliers. The final dataset consists of 3,804 firms and 34,291 firm-year observations.

4.2. Stock Liquidity Measures

We use three types of liquidity measures: Amihud(2002)'s illiquidity measure, quoted spread and effective spread.

(1) The Amihud estimate

Amihud (2002) illiquidity measure (*ILLIQ*) is the average ratio of the daily absolute return to the trading volume on that day. It is calculated as follows:

$$\mathrm{ILLIQ_{it}} = \frac{1}{\mathrm{D_{it}}} \sum_{\mathrm{d=1}}^{\mathrm{D_{it}}} \frac{|\mathrm{R_{itd}}|}{\mathrm{VOLD_{it}}d}$$

where $\mathrm{R_{itd}}$ is the return on stock i on day d of year t, $\mathrm{VOLD_{itd}}$ is the respective daily volume in yen, and $\mathrm{D_{it}}$ is the number of days available to obtain data for stock i in year t. *ILLIQ* is a rough estimate of the daily price impact of the order flow and measures how much one yen of trading volume causes absolute price change. Then, we calculate the average relative illiquidity (*RILLIQ*) for each year. *RILLIQ* is the ratio of illiquidity measure to the average market illiquidity across stocks in that year. It is calculated as follows:

$$RILLIQ_{it} = \frac{\mathrm{ILLIQ_{it}}}{\frac{1}{\mathrm{N_t}} \sum_{\mathrm{t=1}}^{\mathrm{N_t}} \mathrm{ILLIQ_{it}}}$$

where $\mathrm{N_t}$ is the number of stocks in year t. Since average illiquidity varies considerably over the years, *ILLIQ* is replaced by *RILLIQ*, mean-adjusted value of *ILLIQ* (Amihud, 2002). We use *RILLIQ* as the measure of illiquidity.

(2) Quoted spread

The quoted percentage spread of stock (*QUOTED SPREAD*) is defined as the difference between ask price and bid price divided by the mid-price of the quotes. We calculate the quoted spread as follows:

$$Quated\_Spread_{it} = \frac{\mathrm{Ask_{it}} - \mathrm{Bid_{it}}}{(\mathrm{Ask_{it}} + \mathrm{Bid_{it}})/2}$$

where $\mathrm{Ask_{it}}$ is the ask price for stock i at time t, $\mathrm{Bid_{it}}$ is the bid price for stock i at time t. We compute the average spreads for each year. The quoted spread is the implicit trading cost of market orders when a trade occurs in the quoted price with no price improvement (Chung et al., 2010).

(3) Effective spread

The effective percentage spread of stock (*EFFECTIVE SPREAD*) is defined as the twice of the absolute value of the difference between the transaction price and the quote mid-price divided by mid-price of the quote. We calculate the effective spread as follows:

$$Effectiv\_Spread_{it} = \frac{|\mathrm{P_{it}} - (\mathrm{Ask_{it}} + \mathrm{Bid_{it}})/2| \times 2}{(\mathrm{Ask_{it}} + \mathrm{Bid_{it}})/2}$$

where $\mathrm{P_{it}}$ is the transaction price for stock i at time t. The effective spread measures the cost of trading when it occurs in prices inside the posted bid and ask quotes (Chung et al., 2010).

4.3. International Diversification Measures

The degree of corporate international diversification is measured by the foreign subsidiaries ratio (*FSR*). We calculate the foreign subsidiaries ratio by dividing the number of foreign subsidiaries of the firm to the total number of subsidiaries. For the number of subsidiaries, we collect the number of consolidated subsidiaries except for associated companies from Nikkei Needs Financial Quest.

$$FSR_{it} = \frac{\text{The number of foreign subsidiaries}_{\mathrm{it}}}{\text{The total number of subsidiaries}_{\mathrm{it}}}$$

4.4. Control Variables

We include a number of control variables in empirical analysis to control the effects of other determinants of liquidity. Following previous studies, we employ growth opportunity (*TOBIN_Q*), profitability (*EBITDA Ratio*), firm size (*SIZE*[1]), leverage (*LEV*), Investment (*INV Ratio, R&D Ratio, Other INV Ratio*[2]), operational efficiency (*NWC Ratio*[3]) and dividend payout dummy (*Payout Dummy*) as control variables. These are considered to have significant effects on stock market liquidity. For example, high-growth firms are likely to have higher stock liquidity, because they can attract more attention from investors. Larger firms may also have greater liquidity due to more available information and smaller adverse selection risk.

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[1] *SIZE* is the natural logarithm of total assets.

[2] *INV Ratio* is the ratio of investment in tangible fixed assets to total assets. *R&D Ratio* is the ratio of total R&D to total assets. *Other INV Ratio* is the ratio increase in total assets excluding tangible fixed assets and liquid assets to total assets.

[3] *NWC Ratio* is the ratio of net working capital to total assets.

4.5. Method

We examine the relationship between corporate international diversification and stock market liquidity to test the hypotheses in previous chapter. We assume the baseline equation as follows:

$$(1) \qquad ILLIQ_{it} = \alpha + \beta \times ID_{it} + \gamma \times X'_{it-1} + Y_t + IND_k + \varepsilon_{it}$$

where $ILLIQ_{it}$ is stock market illiquidity of firm i in fiscal year t, ID_{it} is the degree of corporate international diversification, X'_{it-1} is a set of control variables, Y_t is a set of year fixed effects, absorbing time-varying shocks all firms face, IND_k is a set of industry fixed effects, absorbing time-invariant unobservable characteristics that differ across industries. Regarding the definition of industry fixed effects, we refer Nikkei Medium Classification Industry Code.

In the baseline equation, the coefficient of interest is β, representing the corporate international diversification sensitivity of stock market liquidity. If β has a negative sign, Hypothesis 1a is supported that corporate international diversification is associated with higher stock liquidity. This implies that overseas operations contribute to increase stock market liquidity by enhancing the informational efficiency of stock price. In contrast, if β is positive, Hypothesis 1b is supported.

4.6. Descriptive Statistics

Panel A of Table 1 presents summary of statistics of all the variables. The average foreign subsidiaries ratio (*FSR*) is 0.28. The mean of the sample firms' relative illiquidity (*RILLIQ*) is 0.965, and their average quoted spread (*QUOTED SPREAD*) and effective spread (*EFFECTIVE SPREAD*) are 0.014 and 0.011, respectively.

In Panel B of Table 1, we divide firms into two groups, multinational firms deploying international operations and domestic firms not deploying international operations, based on whether the firm has foreign subsidiaries in such period. As shown in Panel B, the means of liquidity measures of multinational firms are smaller than that of domestic firms. This indicates that multinational firms in our sample have more liquid stocks relative to domestic firms. Panel B also presents that, on average, multinational firms have larger total assets and higher Tobin's q ratio than domestic firms. Therefore,

multinational firms in our sample have greater firm size and growth opportunity compared to domestic firms.

Table 2 shows the correlation coefficients between all variables. The stock liquidity measures show strong positive pairwise correlations ranging from 0.612 to 0.987. The international diversification measure (*FSR*) is negatively correlated with the stock liquidity measures, suggesting that firms deploying more overseas activities are associated with greater stock liquidity.

5. Results

5.1. The Relation Between Corporate International Diversification and Stock Liquidity

To investigate the relationship between corporate international diversification and stock liquidity, we estimate the regression model in equation (1) using the pooled cross-sectional time-series data. Table 3 presents the ordinary least squares (OLS) regression results of the models regressing the three different measures of stock liquidity (*RILLIQ*, *QUOTED SPREAD*, and *EFFECTIVE SPREAD*) on the international diversification measure (*FSR*). The table reports the results of basic model in which the international diversification variable is only a regressor, as well as comprehensive versions with the complete set of control variables. Year dummy variables and industry dummy variables are included in all regressions.

In Table 3, the regression results of basic models (model 1, 3, and 5) show that corporate international diversification has a significantly negative relation with stock illiquidity. In model 1, which uses *RILLIQ* as the dependent variable for example, the estimated coefficient on *FSR* is -0.493 and statistically significant at the 1% level. It implies that the higher degree of foreign subsidiaries ratio is associated with greater stock liquidity. The consistent conclusion can be drawn from model 3 and 5 using *QUOTED SPREAD* and *EFFECTIVE SPREAD* as the dependent variables, respectively. The coefficients on *FSR* in model 3 and 5 are negative and statistically significant at the 5% level.

Model 2, 4, and 6 provide the results of regressions including a set of control variables. We confirm that the estimated coefficients on *FSR* do not change qualitatively, although the coefficient on *FSR* in model 2 is attenuated because of the correlation between *FSR*

and control variables. In model 2, which uses *RILLIQ* as the dependent variable, the estimated coefficient on *FSR* is -0.433 and statistically significant at the 1% level. The results of the regression using *QUOTED SPREAD* (model 4) or *EFFECTIVE SPREAD* (model 6) are corresponding with the results of basic models indicating a negative relationship between the stock liquidity measures and the international diversification measure.

Table 3 shows that control variables have significant relations with stock liquidity as well. Stock liquidity is higher for firms with larger Tobin Q, greater EBTIDA ratio, larger firm size, and higher investment in fixed assets and NWC ratio. In contrast, we find that more levered and paying dividend firms exhibit a lower liquidity of stocks. Larger firms are related to greater stock liquidity, since the information about them is more available due to greater media and analyst coverage (Stoll and Whaley, 1983). The positive effects of Tobin Q and investment in fixed assets may be the reason of more attention of investors about firms with greater growth opportunity. These results of control variables are consistent with that of previous studies (e.g., Chung et al., 2010; Kale and Loon, 2011; Prommin et al., 2014).

After controlling the other possible determinants of stock liquidity, the negative relation between *FSR* and stock illiquidity remains unchanged. Thus, we conclude that the ratio of foreign subsidiaries is a positive effect on stock market liquidity, providing support for the Hypothesis 1a that corporate international diversification is associated with higher stock liquidity.

5.2. Robustness

In this section, we check the robustness of results in previous section with respect to different estimation methods. We first use the fixed effects regression method to control for unobserved firm-specific variables that differ across firms but are constant over time. The method focuses on changes in the variables over time to estimate the effects of the independent variables on the dependent variable. The estimated regression model of fixed effects method is as follows:

$$(2) \qquad ILLIQ_{it} = \alpha + \beta \times ID_{it} + \gamma \times X'_{it-1} + Y_t + F_i + \varepsilon_{it}$$

where F_i is firm-specific fixed effects. The definitions of other variables are consistent

with the equation (1).

Panel A of Table 4 presents the fixed effects regression model results. Consistent with Table 3, we report the results of basic model in which an international diversification variable is only a regressor, as well as comprehensive versions with the complete set of control variables. We find again that all stock liquidity measures are negatively and significantly related to the international diversification measure in both basic version models and comprehensive versions, except for the model 4 which uses *QUOTED SPREAD* as the dependent variable and includes other control variables. These results reinforce our earlier observation that corporate international diversification is positively associated with stock liquidity. The estimated coefficients on other control variables are qualitatively similar to those in Table 3 with few exceptions.

Next, we rely on the two-step efficient generalized method of moments (GMM) for robustness check. The model employs the instrumental variable to take into account the endogeneity concerns of regressor. To alleviate the endogeneity of *FRS*, we use some instrumental variables[4]: *FRS*, the ratio of foreign sales, the number of subsidiaries, firm age and the number of board members. The estimated regression model is as follows:

$$ID_{it} = \delta \times IV_{it-1} + \mu_{it} \quad (3)$$

$$ILLIQ_{it} = \alpha + \beta \times (\delta \times ID_{it-1} + \mu_{it}) + \gamma \times X'_{it-1} + Y_t + F_i + \varepsilon_{it} \quad (4)$$

Where IV_{it-1} is the group of instrumental variables, and μ_{it} is the error term. The definitions of other variables are consistent with the equation (1) and (2).

Panel B of Table 4 shows the results of the two-step efficient GMM regression. The results indicate that the stock liquidity measures are significantly and negatively related to international diversification measure. The estimated coefficients on *FRS* are negative and statistically significant in all regression models. These results provide additional evidence to support Hypothesis 1a that corporate international diversification is associated with higher stock liquidity. Note again that the coefficients on the control variables are qualitatively similar to those in Table 3 and Panel A of Table 4.

[4] All the instrumental variables are 1 year lagged (t-1) variables.

5.3. Additional Analysis

In this paper, we infer that corporate international diversification may influence stock liquidity on the basis of the effect of the informational efficiency of stock price on liquidity of the stock. If corporate international diversification enhances the level of informational efficiency of the firm's stock price, it would increase liquidity of the stock, and vice versa. Our empirical results from various estimation methods show that firms with multinational operations exhibit the greater stock liquidity. We can conjecture that the positive relation between corporate international diversification and stock liquidity is due to an improvement in the informational efficiency of the stock price. In this section, we examine whether greater stock liquidity of internationally diversified firms is associated with the effect of the informational efficiency of stock price for additional analysis.

We first regress our stock liquidity measures on the measure of the informational efficiency of stock price to control for its effect on stock liquidity, using the R-square regarded as the measure of stock price informational efficiency.

$$(5) \qquad ILLIQ_{it} = \lambda + \varphi \times R_{it} + \omega_{it}$$

where R_{it} is the R-square of CAPM for stock of firm i in year t, ω_{it} is the error term. In the equation (5), the error term (ω_{it}), which is called the residual, can be interpreted as the degree of stock liquidity excluding the effect of the informational efficiency of stock price. We again estimate the two-step efficient GMM in the equation (4), replacing the stock liquidity measures with the residuals of each liquidity measures.

Table 5 presents the results of our additional analysis using the residuals of stock liquidity measures as the dependent variables. We report the results of regression models using our original stock liquidity measures in Panel B of Table 4, as well as the results of adjusted regression models in which the residuals of each liquidity measures are alternative variables of the original stock liquidity measures, to compare the results. The results indicate that the negative relation between stock liquidity measures and international diversification measure becomes weaken and statistically insignificant when the stock liquidity measures are substituted by the residuals of them. The estimated coefficient on *FSR* in model 2 using the residual of *RILLQ* is -0.181 and statistically significant at the 10% level, which is much smaller and less significant compared to the coefficient in model 1 using the original *RILLQ* as the dependent variable. Furthermore,

in model 4 and 6 where the residuals of *QUOTED SPREAD* and *EFFECTIVE SPREAD* are the dependent variables, the estimated coefficients on *FSR* become smaller and even statistically insignificant. These results suggest that the positive impact of corporate international diversification on stock liquidity is almost due to the effect of the informational efficiency of stock price.

6. Conclusion

The relationship between corporate international diversification and stock liquidity depends on how corporate international diversification influences the level of the informational efficiency of stock price. Corporate international diversification has two conflicting effects on the informational efficiency of stock price. The greater complexity in operations and information asymmetry between insiders and outside investors and among investors of multinational firms may lower the informational efficiency of their stock prices. However, they may experience the higher informational efficiency of stock prices in virtue of better corporate discloser by managers who have an incentive to reduce information asymmetry between them and investors. If corporate international diversification improves the information efficiency of their stock price, it would also increase stock liquidity, and vice versa.

Our empirical results suggest that firms with internationally diversified operations are associated with greater stock liquidity, after controlling for other determinants of liquidity. All measures of stock illiquidity are negatively and significantly related to foreign subsidiaries ratio in various estimation model. These results confirm that firms with multinational operations obtain an advantage of an improvement in their stock liquidity. Next, for additional analysis, we estimate again with the adjusted liquidity variables to clarify whether the relationship between corporate international diversification and stock liquidity is due to the effect of the informational efficiency of stock price. We find that the positive relation between corporate international diversification and stock liquidity becomes weaken and statistically insignificant, after controlling for the effect of the informational efficiency of stock price.

Likewise, internationally diversified firms exhibit greater stock liquidity than that of domestic firms. This implies that internationally diversified firms may enhance firm value exploiting the effect of overseas activities on stock liquidity. Considering the results

of additional analysis, however, the positive relation between corporate international diversification and stock liquidity seems to be derived from the effect of the informational efficiency of stock price, not the independent effect of corporate international diversification. Therefore, firms expanding their business overseas would better to accompany an effort for an improvement in the informational efficiency of their stock price, to increase their stock liquidity. What factors contribute to the difference in informational efficiency of stock price for Japanese multinational firms and domestic firms remains a question. For example, if Japanese multinational firms are required to release better disclosure or have more informed investors such as institutional investors compared to domestic firms, these might improve the information efficiency of their stock price, thereby increasing stock liquidity. Further research is needed to clarify the details for the greater informational efficiency of stock price for Japanese multinational firms, that result in their greater stock liquidity.

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Table 1 Descriptive Statistics

Panel A: Summary Statistics

	All firm - years				
Variable	N	Mean	Median	SD	Min	Max
RILLIQ	34,042	0.965	0.125	2.130	0.00008	16.699
QUOTED SPREAD	34,291	0.014	0.007	0.018	0.000	0.174
EFFECTIVE SPREAD	34,291	0.011	0.006	0.014	0.001	0.159
FSR	34,291	0.279	0.152	0.320	0.000	1.000
Tobin Q	34,291	1.121	0.970	0.626	0.052	7.128
EBITDA Ratio	34,291	0.081	0.076	0.061	-0.333	0.298
SIZE	34,291	10.677	10.524	1.590	6.706	15.325
LEV	34,291	0.368	0.346	0.194	0.000	0.990
INV Ratio	34,158	0.033	0.024	0.035	-0.085	0.201
R&D Ratio	34,291	0.013	0.004	0.021	0.000	0.127
Other INV Ratio	34,158	0.006	0.003	0.052	-0.300	0.308
NWC Ratio	34,291	0.187	0.182	0.127	-0.112	0.668
Payout Dummy	34,291	0.916	1.000	0.277	0.000	1.000

RILLIQ=relative illiquidity measure, Quoted Spread=quoted spread, Effective Spread=effective spread, FSR=foreign subsidiaries ratio, TOBIN Q=Tobin'q ratio, SIZE=a natural logarithm of total assets, LEV=leverage, INV Ratio= tangible fixed assets ratio, R&D Ratio=the R&D expenditure ratio, Other INV Ratio= assets except for tangible fixed assets ratio, NWC Ratio=net working capital ratio, Payout Dummy=dividend payout dummy

Table 1 (Continued)

Panel B: Sample without Foreign Subsidiaries V.S. Sample with Foreign Subsidiaries

	Firm - years without foreign subsidiaries (FSR = 0)						Firm - years with foreign subsidiaries (FSR > 0)					
Variable	N	Mean	Median	SD	Min	Max	N	Mean	Median	SD	Min	Max
RILLIQ	13,639	1.468	0.371	2.606	0.000	16.699	20,403	0.629	0.058	1.658	0.000	16.699
QUOTED SPREAD	13,848	0.018	0.011	0.021	0.000	0.174	20,443	0.011	0.006	0.014	0.000	0.162
EFFECTIVE SPREAD	13,848	0.014	0.009	0.016	0.001	0.159	20,443	0.008	0.004	0.011	0.001	0.128
FSR	13,847	0.017	0.000	0.082	0.000	1.000	20,440	0.230	0.160	0.250	0.000	1.000
Tobin Q	13,848	1.106	0.958	0.632	0.078	7.128	20,443	1.130	0.980	0.621	0.052	7.128
EBITDA Ratio	13,848	0.074	0.068	0.062	-0.333	0.298	20,443	0.086	0.081	0.060	-0.333	0.298
SIZE	13,848	10.166	10.087	1.397	6.706	15.325	20,443	11.023	10.849	1.619	6.706	15.325
LEV	13,848	0.398	0.383	0.205	0.000	0.988	20,443	0.348	0.327	0.183	0.005	0.990
INV Ratio	13,801	0.029	0.020	0.035	-0.085	0.201	20,357	0.036	0.028	0.035	-0.085	0.201
R&D Ratio	13,848	0.006	0.000	0.014	0.000	0.127	20,443	0.018	0.010	0.024	0.000	0.127
Other INV Ratio	13,801	0.005	0.002	0.057	-0.300	0.308	20,357	0.007	0.003	0.048	-0.300	0.308
NWC Ratio	13,848	0.162	0.148	0.140	-0.112	0.668	20,443	0.205	0.200	0.115	-0.112	0.668
Payout Dummy	13,848	0.893	1.000	0.309	0.000	1.000	20,443	0.932	1.000	0.253	0.000	1.000

Table 2 Correlation Matrix

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
[1]	RILLIQ	1.000												
[2]	QUOTED SPREAD	0.612	1.000											
[3]	EFFECTIVE SPREAD	0.624	0.987	1.000										
[4]	FSR	-0.053	-0.049	-0.054	1.000									
[5]	Tobin Q	-0.130	-0.165	-0.156	0.006	1.000								
[6]	EBITDA Ratio	-0.211	-0.196	-0.202	0.085	0.322	1.000							
[7]	SIZE	-0.391	-0.438	-0.451	-0.048	-0.094	0.096	1.000						
[8]	LEV	0.067	0.043	0.050	-0.225	0.015	-0.125	0.141	1.000					
[9]	INV Ratio	-0.072	-0.099	-0.102	0.087	0.082	0.307	0.110	0.10	1.000				
[10]	R&D Ratio	-0.077	-0.069	-0.072	0.302	0.085	0.038	0.096	-0.16	0.089	1.000			
[11]	Other INV Ratio	-0.060	-0.091	-0.093	-0.016	0.140	0.138	0.050	-0.02	0.065	-0.030	1.000		
[12]	NWC Ratio	0.032	0.064	0.060	0.200	-0.081	-0.057	-0.096	-0.02	-0.150	0.198	-0.055	1.000	
[13]	Payout Dummy	-0.124	-0.103	-0.118	0.02	-0.144	0.209	0.259	-0.14	0.071	-0.026	0.059	0.012	1.000

Table 3 OLS Regression Results

Variable	RILLIQ		QUOTED SPREAD		EFFECTIVE SPREAD	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
FSR	-0.493 ***	-0.433 ***	-0.004 **	-0.004 ***	-0.003 **	-0.003 ***
	(0.169)	(0.114)	(0.002)	(0.001)	(0.001)	(0.001)
Tobin Q		-0.498 ***		-0.004 ***		-0.003 ***
		(0.037)		(0.000)		(0.000)
EBITDA Ratio		-3.117 ***		-0.018 ***		-0.016 ***
		(0.395)		(0.003)		(0.002)
SIZE		-0.601 ***		-0.006 ***		-0.004 ***
		(0.042)		(0.000)		(0.000)
LEV		1.472 ***		0.010 ***		0.008 ***
		(0.253)		(0.002)		(0.001)
INV Ratio		-0.168		-0.009 **		-0.007 **
		(0.731)		(0.004)		(0.003)
R&D Ratio		1.135		-0.006		-0.006
		(1.505)		(0.008)		(0.006)
Other INV Ratio		-0.250		0.001		0.001
		(0.232)		(0.001)		(0.001)
NWC Ratio		-0.632 *		-0.006 *		-0.005 *
		(0.314)		(0.004)		(0.003)
Payout Dummy		0.085		0.002 ***		0.001 **
		(0.062)		(0.001)		(0.000)
Industry_Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year_Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.023	0.233	0.091	0.321	0.096	0.328
N	34,042	33,911	34,291	34,158	34,291	34,158

*** p < 0.01; ** p < 0.05; * p< 0.10

Table 4 Regression Results from Alternative Estimation Methods

Panel A Results from Fixed Effects Method

Variable	RILLIQ		QUOTED SPREAD		EFFECTIVE SPREAD	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
FSR	-0.288 **	-0.274 **	-0.001 *	-0.001	-0.001 **	-0.001 **
	(0.118)	(0.115)	(0.001)	(0.001)	(0.000)	(0.000)
Tobin Q		-0.264 ***		0.000		0.000
		(0.023)		(0.000)		(0.000)
EBITDA Ratio		-4.096 ***		-0.024 ***		-0.019 ***
		(0.253)		(0.003)		(0.002)
SIZE		-0.326 ***		-0.002 ***		-0.002 ***
		(0.047)		(0.000)		(0.000)
LEV		0.433 ***		0.003 **		0.003 ***
		(0.151)		(0.001)		(0.001)
INV Ratio		0.106		-0.004 *		-0.004 **
		(0.229)		(0.002)		(0.002)
R&D Ratio		-2.345 **		-0.024 *		-0.022 **
		(1.031)		(0.013)		(0.009)
Other INV Ratio		-0.409 ***		-0.001		-0.001
		(0.106)		(0.001)		(0.001)
NWC Ratio		-0.007		0.000		0.000
		(0.319)		(0.002)		(0.002)
Payout Dummy		-0.001		0.000		0.000
		(0.042)		(0.000)		(0.000)
Industry_Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year_Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.003	0.037	0.175	0.186	0.188	0.2
N	34,042	33,911	34,291	34,158	34,291	34,158

*** p < 0.01; ** p < 0.05; * p< 0.10

Table 4 (Continued)

Panel B Results from Two-step Efficient GMM Method

Variable	RILLIQ		QUOTED SPREAD		EFFECTIVE SPREAD	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
FSR	-0.464 ***	-0.42 ***	-0.015 ***	-0.012 ***	-0.012 ***	-0.009 ***
	(0.141)	(0.132)	(0.005)	(0.004)	(0.004)	(0.003)
Tobin Q		-0.273 ***		0.000		0.000
		(0.021)		(0.000)		(0.000)
EBITDA Ratio		-4.065 ***		-0.027 ***		-0.022 ***
		(0.201)		(0.002)		(0.002)
SIZE		-0.323 ***		-0.002 ***		-0.001 ***
		(0.042)		(0.000)		(0.000)
LEV		0.369 ***		0.002 **		0.002 ***
		(0.140)		(0.001)		(0.001)
INV Ratio		0.064		-0.004 *		-0.004 *
		(0.172)		(0.002)		(0.002)
R&D Ratio		-2.388 **		-0.022 *		-0.021 **
		(0.948)		(0.012)		(0.009)
Other INV Ratio		-0.450 ***		-0.002 *		-0.001
		(0.091)		(0.001)		(0.001)
NWC Ratio		0.130		0.000		-0.001
		(0.266)		(0.002)		(0.002)
Payout Dummy		0.052 *		0.000		0.000
		(0.028)		(0.000)		(0.000)
Industry_Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year_Dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	33,812	33,683	34,039	33,908	34,039	33,908
j	6.05	6.07	6.10	5.54	5.36	5.04
idstat	11.98 **	11.88 **	11.81 **	11.82 **	11.81 **	11.82 **
widstat	524.1	763.6	26.14	25.71	26.14	25.71

*** p < 0.01; ** p < 0.05; * p< 0.10

Table 5 Regression Results with Revision of Stock Liquidity Measure

Variable	RILLIQ		R_RILLIQ		QUOTED SPREAD		R_QUOTED SPREAD		EFFECTIVE SPREAD		R_EFFECTIVE SPREAD	
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
FSR	-0.420	***	-0.181	*	-0.012	***	-0.003		-0.009	***	-0.002	
	(0.132)		(0.095)		(0.004)		(0.004)		(0.003)		(0.003)	
Tobin Q	-0.273	***	-0.228	***	0.000		-0.001	***	0.000		-0.001	***
	(0.021)		(0.019)		(0.000)		(0.000)		(0.000)		(0.000)	
EBITDA Ratio	-4.065	***	-2.872	***	-0.027	***	-0.017	***	-0.022	***	-0.014	***
	(0.201)		(0.214)		(0.002)		(0.001)		(0.002)		(0.001)	
SIZE	-0.323	***	-0.168	***	-0.002	***	0.000	**	-0.001	***	-0.001	***
	(0.042)		(0.027)		(0.000)		(0.000)		(0.000)		(0.000)	
LEV	0.369	***	-0.141		0.002	**	0.000		0.002	***	0.000	
	(0.140)		(0.123)		(0.001)		(0.001)		(0.001)		(0.000)	
INV Ratio	0.064		-0.151		-0.004	*	-0.003		-0.004	*	-0.003	*
	(0.172)		(0.149)		(0.002)		(0.002)		(0.002)		(0.002)	
R&D Ratio	-2.388	**	-1.974	***	-0.022	*	-0.005		-0.021	**	-0.007	*
	(0.948)		(0.722)		(0.012)		(0.005)		(0.009)		(0.004)	
Other INV Ratio	-0.450	***	-0.385	***	-0.002	*	-0.004	***	-0.001		-0.003	***
	(0.091)		(0.056)		(0.001)		(0.001)		(0.001)		(0.001)	
NWC Ratio	0.130		0.277	**	0.000		0.001		-0.001		0.001	
	(0.266)		(0.117)		(0.002)		(0.001)		(0.002)		(0.001)	
Payout Dummy	0.052	*	0.070	**	0.000		0.000		0.000		0.000	
	(0.028)		(0.033)		(0.000)		(0.000)		(0.000)		(0.000)	
Industry_ Dummies	Yes		Yes		Yes		Yes		Yes		Yes	
Year_Dummies	Yes		Yes		Yes		Yes		Yes		Yes	
N	33,683		30,165		33,908		30,388		33,908		30,388	
j	6.07		5.59		5.54		4.58		5.04		5.40	
idstat	11.88	**	11.83	**	11.82	**	11.73	**	11.82	**	11.73	**
widstat	763.6		810.3		25.71		24.37		25.71		24.37	

*** p < 0.01; ** p < 0.05; * p< 0.10