Foreign Exchange Exposures, Financial and Operational Hedge Strategies of Taiwan Firms

Yi-Chein Chiang *
Associate Professor

and

Hui-Ju Lin
Graduate Student

Department of International Trade
Feng Chia University, Taiwan

* Corresponding author. Tel: 886-4-24517250 ext.4261; fax: 886-4-24510409.
Address: Department of International Trade, Feng Chia University, Taichung, Taiwan
E-mail address: ycchiang@fcu.edu.tw
Tel: 886-4-24517250 ext.4261.
Fax:886-4-24510409.

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Abstract

Using multiple-horizon data of Taiwan non-financial firms during the period of 1998 - 2002, this study examines financial and operational hedge strategies of foreign exchange exposures simultaneously. Our empirical findings show that the use of operational hedge strategies does not help reduce foreign exchange exposures for Taiwan firms. Also, the use of foreign currency derivatives (FCD) is an effective hedging strategy in a one-month horizon, but it is less effective when the horizon lengthens. In addition, the use of foreign currency-denominated debts (FDD) always increases foreign exchange exposures.

JEL classifications: F31, G32

Keywords: foreign exchange exposures, operational hedge, foreign currency derivatives, foreign currency-denominated debt

1. Introduction

Taiwan is a small open economy. Firms in Taiwan always have been forced to direct most of their operations toward foreign countries due to the scarcity of natural resources and the small home markets. Unexpected fluctuations in foreign exchange rates have been an important concern to firms with international business operations since future cash flows, and therefore the value of firms will be affected. According to Marshall (2000), a total of 87 percent of Asia Pacific respondent companies surveyed in his research rank foreign exchange risk management as equally or significantly important as business risk management.

To mitigate the impact of foreign exchange rate fluctuations, it has been claimed that firms can employ financial hedge strategies through foreign currency derivatives (FCD) and foreign currency-denominated debts (FDD).[1] Many empirical studies have proven that firms use FCD or FDD for the purpose of hedging. Geczy (1997) suggests that firms may use derivatives to reduce cash flow variation. Allayannis and Ofek (2001) find a strong negative association between FCD use and a firm's foreign exchange exposures. Nguyen and Faff (2003) find that the use of FCD reduces

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[1] Since foreign currency-denominated debts (FDD) represent cash outflows in foreign currencies, they can be used as hedges when firms have foreign cash inflows, either from operations abroad or from exports.

short-term foreign exchange exposures. As the return horizon lengthens, FCD appear to be less effective in hedging foreign exchange exposures. Burgman (1996) interprets the positive relation between leverage and foreign currency risk as multinational corporation's (MNC's) use of FDD to hedge currency risk. Chen, Cheng, He, and Kim (1997) find that the debt ratio is positively associated with the level of foreign operations, which provides the evidence of FDD hedging foreign currency risk. The results of Allayannis and Ofek (2001) are that exposures through foreign sales are positively and significantly related to a firm's decision to issue foreign debts and the level of foreign debts. Elliott, Huffman, and Makar (2003) find a positive relationship between foreign currency exposures and the level of FDD, indicating that FDD may be used as a hedge. Kedia and Mozumdar (2003) find strong evidence that firms issue FDD to hedge their exposures both at the aggregate and the individual currency levels.

Theoretical papers argue that operational hedge strategies are more effective in managing long-run exposures, whereas financial hedge strategies are more effective in managing short-run exposures (Logue, 1995; Chowdhry and Howe, 1999). MNCs have the operating flexibility to shift their sales and production operations among locations to hedge foreign exchange risk (Miller and Reuer, 1998; Debruin and Huffman, 1999; Pantzalis, Simkins and Laux, 2001). Large firms are more likely to have multiple operations and thus benefit from the national hedges associated with geographic diversification (Makar, DeBruin and Huffman, 1999). MNCs with greater network breadth are less exposed to currency risks, whereas firms with more highly concentrated networks (greater depth) are more exposed (Pantzalis, Simkins, and Laux, 2001).

Allayannis, Ihrig, and Weston (2001) examine financial and operational hedge strategies simultaneously. They find that firms' financial hedge strategies are related to lower exposures, but operational hedge strategies do not reduce exposures. In their studies, the use of FCD and FDD are combined as an indicator variable of financial hedge strategies. In our opinion, however, FCD also can be used for speculative purposes. Likewise, FDD also can be used for other purposes, such as raising funds or improving a firm's capital structure. Since firms may use FCD or FDD for different incentives, we try to separate these two financial hedge strategies in our study.

Using multiple-horizon data of Taiwan non-financial firms during the period of 1998 - 2002, this study examines financial and operational hedge strategies of foreign exchange exposures simultaneously. We create a measure of foreign exchange exposures for each firm using a two-factor model as in Jorion (1990). The absolute value of the estimated exposure is then regressed on the use of financial and operational hedges, with such additional control variables as the percentage of overall revenues from abroad and the firm size. We use three proxies for operational hedge strategies: breadth, depth, and dispersion. FCD and FDD are separated into two proxies of financial hedge strategies. Our empirical findings show that the use of operational hedge strategies does not help reduce foreign exchange exposures for Taiwan firms. Also, the use of FCD is an effective hedging strategy in one-month horizon, but it is less effective when the horizon lengthens. In addition, the use of FDD always increases foreign exchange exposures.

The remainder of this study is structured as follows. Section 2 describes the data. Section 3 presents the empirical framework and results. The results are then discussed in section 4. Finally, section 5 concludes this study.

2. Data

We select non-financial firms listed on the Taiwan Stock Exchange Corporation (TSEC). Financial firms are excluded, as the focus of our study is on end-users rather than producers of financial services. To be included in the sample, firms must have monthly stock returns covering the period January 1998 through December 2002. This selection criterion results in 326 firms.

It is widely believed that higher foreign involvement accompanies the higher foreign exchange exposures. Thus, the degree of “high” foreign involvement in our studies is defined as: (1) the firm's ratio of foreign sales to total sales (FS/TS) is more than 10 percent, and (2) the firm's holding shares of any foreign subsidiaries is more than 20 percent[2] during the sample period. There are 99 firms in our final data, according to these two standards.

Table 1 summarizes the descriptive statistics of the variables used in this study. The data shows that firms in our sample have sizable foreign sales. Table 2 presents the correlation matrix of the independent variables used in the second stage of the regression.

(Table 1 and Table 2 are about here)

3. Empirical Framework

3.1. Estimation of foreign exchange exposures

Like Jorion (1990) and many subsequent studies, the foreign exchange exposure (β_{2i}) is estimated using the following equation:[3]

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[2] Under the generally accepted accounting principles of Taiwan, if a company holds a moderate shares (20 - 50 percent) or more of the voting stocks in a foreign corporation, the investment is considered as a significant influence on the foreign corporation.

[3] One-month horizon data is used here.

$$R_{it} = \beta_{0i} + \beta_{1i} R_{mt} + \beta_{2i} R_{xt} + u_{it} \quad (1)$$

where R_{it} is the return on stock i in period t, and R_{xt} is the percentage change in the exchange rate in period t.[4] We control for market movements by including the return on the market portfolio in period t, R_{mt}.[5] u_{it} is the error term.[6]

The results of equation (1) show that there are 48 firms positively exposed (β_{2i}>0) and 51 firms negatively exposed (β_{2i}<0). The positive exposures mean that stock returns increased as NTD depreciated against USD. The negative exposures mean that stock returns increased as NTD appreciated against USD.

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4 The exchange rate used here is the U.S. Dollar (USD) in terms of the New Taiwan Dollar (NTD). There are at least three reasons to use this exchange rate. First, Taiwan is a small and export-oriented economy, and the United States is one of the largest trade partners of Taiwan all the time. Second, since the U.S. dollar is a leading vehicle currency, prices of tradable goods are often denominated in the U.S. dollar, no matter which countries Taiwan firms trade with (Chiao, Hung and Nwanna, 2001). Third, the currency values of major trade partners of Taiwan (i.e., China and Hong Kong) are pegged to the U.S. dollar.

5 The market portfolio, TAIEX, is a market capitalization-weighted index of Taiwan that involves all currently listed common stocks, except newly-issued stocks and the stocks of financially distressed firms in Taiwan.

6 The correlation between R_{xt} and R_{mt} is -0.356.

Table 3 reports the results of the mean differences tests between firms with positive and negative exposures. As the tests provide no significant difference between them, we will use full samples instead of distinguishing them in the following empirical tests.

(Table 3 is about here)

3.2. Cross-sectional regression with financial hedge strategies

Once the foreign exchange exposure is estimated, the basic relationship between the absolute value of the exposure versus foreign involvement, proxied by foreign sales to total sales (FS/TS), and financial hedge strategies controlled with the size effect is then tested using the cross-sectional regression framework.[7]

Financial hedge strategies include foreign currency derivatives (FCD) and foreign currency-denominated debt (FDD).[8] Like Allayannis, Ihrig, and Weston (2001), we construct an indicator variable "Hedge" that sets equal to 1 if firms use

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[7] The independent variables are not highly correlated according the correlation coefficients shown in table 2. In addition, multicollinearity is not a severe problem here since the variance inflation factors (VIF) are less than ten (Kennedy, 1998).

[8] Compared to the relatively large percentage of firms that use FCD (79 percent), only 31 percent of the firms in our sample use FDD.

FCD or FDD and 0 for non-users. Since firms may use FCD or FDD for different incentives, we use another equations to separate these two financial hedge strategies. In equation (2b), "FCD" is an indicator variable that sets equal 1 if firms use FCD and 0 for non-users. In equation (2c), "FDD" is an indicator variable that sets equal 1 if firms use FDD and 0 for non-users. In addition, we use equation (2d) to consider FCD and FDD simultaneously.[9] A negative value on the estimated coefficient for the dummy suggests that financial hedges reduce exposures.

$$\left|\beta_{2i}\right| = \alpha_0 + \alpha_1 (FS/TS)_i + \alpha_2 (Hedge)_i + \alpha_3 (Size)_i + \varepsilon_i \tag{2a}$$

$$\left|\beta_{2i}\right| = \alpha_0 + \alpha_1 (FS/TS)_i + \alpha_2 (FCD)_i + \alpha_3 (Size)_i + \varepsilon_i \tag{2b}$$

$$\left|\beta_{2i}\right| = \alpha_0 + \alpha_1 (FS/TS)_i + \alpha_2 (FDD)_i + \alpha_3 (Size)_i + \varepsilon_i \tag{2c}$$

$$\left|\beta_{2i}\right| = \alpha_0 + \alpha_1 (FS/TS)_i + \alpha_2 (FCD)_i + \alpha_3 (FDD)_i + \alpha_4 (Size) + \varepsilon_i \tag{2d}$$

Table 4 shows the results of the four equations.[10] Consistent with the evidence of

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[9] We use indicator variables to measure FCD and FDD usages because the reported notional principal amounts are missing or are just the aggregate data. Detail data is difficult to get.

[10] According to the Ramsey Reset test, there is no functional form misspecified. According to the White test and the Generalized Durbin-Watson test, there is no heteroskedasticity and autocorrelation in the residuals of the OLS regression. After the Komogorov-Smirnov test, the residuals are not rejection of normality.

Allayannis and Ofek (2001), we find a negative relationship between foreign exchange exposures and "Hedge," indicating that firms use financial strategies as hedges. The negative and significant coefficient on "FCD" in equation (2b) also indicates that firms use FCD as hedges. But the positive and significant coefficient on "FDD" in equation (2c) indicates that foreign exchange exposures increase when firms use FDD. When "FCD" and "FDD" are separated in equation (2d), the results remain the same. Therefore, FDD is not an effective instrument for currency risk management.

The positive and significant coefficients on FS/TS indicate that for a given exposure, an increase in revenue from foreign operations increases foreign exchange exposures. The negative and significant coefficients on the firm size indicate that greater firm size is significantly associated with lower foreign exchange exposures.

(Table 4 is about here)

3.3. Cross-sectional regression with financial and operational hedge strategies

We use three proxies for a firm's operational hedging: (1) the number of countries in which it operates (breadth), (2) country concentration (depth), and (3) the geographic dispersion of its subsidiaries across countries (dispersion).

"Breadth" is the logarithm of the number of foreign countries in which the firm has subsidiaries. "Depth" is calculated as the (number of foreign subsidiaries in the top two foreign countries) / (number of foreign subsidiaries).[11] "Dispersion" is constructed with the Hirschman-Herfindahl concentration index over all the countries in which a firm operates. The geographic dispersion for firm i is calculated as:

$$(Dispersion)_i = 1 - \sum_{j=1}^{K} [(No.subsidiaries)_j / (TotalNo.subsidiaries)_i]^2 \qquad (3)$$

where K is the total number of countries in which firm i operates. This measure has a value close to 1 if the firm has subsidiaries in many countries and a value of 0 if the firm has subsidiaries in only one country.[12]

We now add the operational hedges to equations (2a) and (2d) and test financial and operational hedge strategies simultaneously. Equations (4a) to (4f) are used to test as following:

$$\left|\beta_{2i}\right| = \alpha_0 + \alpha_1 (FS/TS)_i + \alpha_2 (Hedge)_i + \alpha_3 (Size)_i + \alpha_4 (Breadth)_i + \varepsilon_i \qquad (4a)$$

$$\left|\beta_{2i}\right| = \alpha_0 + \alpha_1 (FS/TS)_i + \alpha_2 (FCD)_i + \alpha_3 (FDD)_i + \alpha_4 (Size)_i + \alpha_5 (Breadth)_i + \varepsilon_i \qquad (4b)$$

$$\left|\beta_{2i}\right| = \alpha_0 + \alpha_1 (FS/TS)_i + \alpha_2 (Hedge)_i + \alpha_3 (Size)_i + \alpha_4 (Depth)_i + \varepsilon_i \qquad (4c)$$

$$\left|\beta_{2i}\right| = \alpha_0 + \alpha_1 (FS/TS)_i + \alpha_2 (FCD)_i + \alpha_3 (FDD)_i + \alpha_4 (Size)_i + \alpha_5 (Depth)_i + \varepsilon_i \qquad (4d)$$

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[11] See Pantzalis, Simkins and Laux (2001).

[12] See Allayannis, Ihrig and Weston (2001).

$$\left|\beta_{2i}\right| = \alpha_0 + \alpha_1 (FS/TS)_i + \alpha_2 (Hedge)_i + \alpha_3 (Size)_i + \alpha_4 (Dispersion)_i + \varepsilon_i \quad (4e)$$

$$\left|\beta_{2i}\right| = \alpha_0 + \alpha_1 (FS/TS)_i + \alpha_2 (FCD)_i + \alpha_3 (FDD)_i + \alpha_4 (Size)_i + \alpha_5 (Dispersion)_i + \varepsilon_i \quad (4f)$$

The OLS regression results of equations (4a) to (4f) are shown in table 5.[13] The coefficients on financial strategies, FS/TS and firm size remain the same sign as in table 4. In addition, the positive coefficients on both "Breadth" and "Dispersion" indicate that firms that are geographically dispersed have high exposures. The negative coefficient on "Depth," however, indicates that firms concentrating in few countries have low exposures. Overall, our results suggest that operational hedging is not an effective tool for currency risk management.

(Table 5 is about here)

3.4. Robust test

Instead of the absolute value of estimated exposures in previous sections, we

[13] The independent variables are not highly correlated according to the correlation coefficients shown in table 2. In addition, multicollinearity is not a severe problem here since the variance inflation factors (VIF) are less than ten. After the Ramsey Reset test, there is no functional form misspecified. After the White test and the Generalized Durbin-Watson test, there is no heteroskedasticity or autocorrelation in the residuals of the OLS regression. After the Komogorov-Smirnov test, the residuals are not rejection of normality.

now use the raw value of estimated exposures from equation (1) as the independent variables, and run equations (4a) to (4f) again. The results are shown in table 6.

The coefficients on “Hedge” are positive now. But if financial hedge strategies are separated into “FCD” and “FDD,” we find the same results as shown in Table 5. The coefficients on “FCD” are still negative but insignificant. The coefficients on “FDD” are still positive and significant. This means that foreign exchange exposures decrease when firms use FCD, but increase significantly when firms use FDD. The positive and significant coefficients on both “Breadth” and “Dispersion” emphasize that firms that are geographically dispersed have high exposures. The negative and significant coefficients on “Depth,” however, emphasize that firms concentrating in few countries have low exposures. The coefficients on FS/TS and firm sizes remain the same sign as in table 5.

(Table 6 is about here)

3.5. Estimation of foreign exchange exposure over different horizons

Bodnar and Wong (2003) mention that exposures may be more accurately estimated over longer horizons, due to the complexity of factors influencing exposures and the noise in high-frequency observations of exchange rates relative to the persistence of low-frequency movements. Thus, we examine foreign exchange exposures with longer horizon (three-month, six-month and twelve-month) returns of stocks and market portfolios as in equation (1).[14]

Using the MLE estimated exposures over different return horizons as dependent variables, we regress equations (4a), (4b), (4c), (4d), (4e) and (4f) again. When the three-month horizon estimated exposure is used as the dependent variable, we get results (6a), (6b), (6c), (6d), (6e) and (6f), as shown in table 7. When the six-month horizon estimated exposure is used as the dependent variable, we get results (7a), (7b), (7c), (7d), (7e) and (7f), as shown in table 8. When the twelve-month horizon estimated exposure is used as the dependent variable, we get results (8a), (8b), (8c), (8d), (8e) and (8f), as shown in table 9.[15]

According to tables 7, 8, and 9, the signs of coefficients on FCD are different from those of the one-month horizon. They are positive but not significant now, indicating that foreign exchange exposures do not decrease when firms use FCD in a longer horizon.

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[14] The residuals of equation (1) for multiple return horizons are homoscedasticity, but with high-order autocorrelation. After using the “stepwise autoregression instruction” in the SAS program to remove insignificant autoregressive parameters, the maximum likelihood estimators (MLE) are produced.

[15] After White test and Generalized Durbin-Watson test, there is no heteroskedasticity and autocorrelation in the residuals.

The coefficients on other independent variables almost remain the same sign as those of the one-month horizon. The positive coefficient on FS/TS exhibits that for a given exposure, a raise in revenue from foreign operations increases foreign exchange exposures. The negative coefficient on the firm size indicates that greater firm size is significantly associated with lower foreign exchange exposures. The positive coefficients on both “Breadth” and “Dispersion” indicate that firms that are geographically dispersed have high exposures. The negative coefficient on “Depth,” however, indicates that firms concentrating in few countries have low exposures.

To sum up, most of the results from multiple return horizons are the same as those of the one-month horizon, except that FCD is not an effective hedge strategy as the horizon lengthens.

(Tables 7, 8, 9 are about here)

4. Discussion

In our empirical study, two financial hedge strategies have very different effects. The use of FCD is an effective hedging strategy in a one-month horizon, but it is less effective when the horizon lengthens. Our results are consistent with those of Nguyen and Faff (2003).

The use of FDD, however, always increases foreign exchange exposures. It seems that Taiwan firms issue FDD for other incentives instead of foreign exchange exposure hedges. Our results contradict to those of the previous studies. Many Taiwan firms issue offshore convertible bonds (also known as Euro-convertible bonds, ECB) denominated in U.S. dollars. The ECB holders have an option to convert into stocks or not. If they convert, there are no U.S. dollar debts anymore, and firms do not bear any foreign exchange exposures from issuing ECB. If they do not convert, however, firms will have a short position in U.S. dollars and bear foreign exchange exposures from issuing ECB. Since it is a contingent exposure and not easy to control, firms issuing ECB always increase foreign exchange exposures.[16]

Meanwhile, the use of operational hedge strategies cannot reduce foreign exchange exposures, the same result as Allayannis, Ihrig, and Weston (2001). The foreign involvements of Taiwan firms often concentrate in Asia.[17] As we know, Asian currencies have a high correlation with each other. They often move in the same direction. Hence, Taiwan firms cannot get the advantage of currency diversification

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[16] Currency options are effective hedge tools of contingent exposures (Click and Coval, 2002). However, there are still no exchange-traded currency options in Taiwan financial markets.

[17] Data Source: Industrial Development & Investment Center Ministry of Economic Affairs in Taiwan.

even operating in several countries, and operational hedge strategies do not function well.

5. Conclusions and Research Restrictions

Foreign currency risk management is of considerable interest to theoreticians and practitioners in corporate finance. Our study contributes to the literature by using multiple-horizon data of Taiwan non-financial firms during the period of 1998 - 2002 to examine financial and operational hedge strategies of foreign exchange exposures simultaneously. Our empirical findings show that the use of operational hedge strategies does not help reducing foreign exchange exposure for Taiwan firms. Also, the use of FCD is an effective hedging strategy in a one-month horizon, but it is less effective when the horizon lengthens. In addition, the use of FDD always increases foreign exchange exposure.

Empirical examination of hedging theories has been difficult due to the general unavailability of data on hedging activities. Until the Financial Accounting Standards Board (FASB) issued SFAS 119 (1994), the corporations were required to disclose the notional amount of derivatives and other financial instruments in footnotes of their annual reports. Securities and Futures Commission (SFC) in Taiwan published similar rules in 1996. However, there is still no standard form for footnotes of the annual financial reports used in Taiwan. They are often disclosed as aggregate data. Hence, we can only use dummy variables instead of true values for financial hedges. This is the research restriction of this study.

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Table 1 Descriptive Statistics of the Key Variables

	N	Minimum	Maximum	Mean	Std. Deviation
Rus	60	-0.06	0.06	0.0015	0.0181
Rm	60	-0.19	0.25	-0.00562	0.0947
FS/TS	99	0.08	0.99	0.6260	0.2671
SIZE	99	9.39	11.43	10.1378	0.4737
BREADTH	99	0	1.02	0.3197	0.2544
DEPTH	99	0.34	1.1	0.7930	0.2097
DISPERSION	99	0	0.88	0.4721	0.2807

Note: **Rus** is the return on the exchange rate of NTD/USD1

Rm is the return on the market capitalization-weighted index of Taiwan, TAIEX

FSALES is foreign sales ratio (foreign sales/total sales, FS/TS)

SIZE is log (firm's total assets)

Breadth is log (number of foreign countries in which the firm has subsidiaries)

Depth is (number of foreign subsidiaries in the top two foreign countries) / (number of foreign subsidiaries)

Dispersion is geographic dispersion index:

$$(Dispersion)_i = 1 - \sum_{j=1}^{K}[(No.subsidiaries)_j / (TotalNo.subsidiaries)_i]^2$$

Table 2 The Correlation Matrix between Variables

	FSALES	SIZE	HEDGE	FCD	FDD	BREADTH	DEPTH	DISPERSION
FSALES	1.000							
SIZE	-.073	1.000						
HEDGE	.141	.318	1.000					
FCD	.145	.248	.970	1.000				
FDD	.136	.605	.335	.292	1.000			
BREADTH	-.080	.092	.099	.097	-.002	1.000		
DEPTH	-.320	.056	-.129	-.131	-.055	-.207	1.000	
DISPERSION	.186	.097	.131	.132	.148	.319	-.819	1.000

Table 3　Comparison of Mean Values for Descriptive Statistics between Firms with Positive and Negative Exposures

	Full Sample (n=99)	Firms Positively Exposed (n=48)	Firms Negatively Exposed (n=51)	Difference in Means t-test
Exposure coefficient ($\|\beta_{2i}\|$)	0.7194	0.7324	0.6932	0.32
FS/TS	0.626	0.6679	0.5659	1.823
Size	10.1378	10.0907	10.2081	-1.317
Breadth	0.462	0.4106	0.5114	-0.615
Depth	0.793	0.7746	0.8156	-0.917
Dispersion	0.4721	0.4892	0.449	0.716

This table reports the t-statistic for the mean differences test between the samples consisting of firms with positive and negative exposures. Significance levels are indicated as follows: ***1%, **5%, *10%.

Table 4 Cross-Sectional Regression with Financial Hedge Strategies

Dependent Variable：$|\beta_2|$ OLS (Ordinary Least Square)

	(2a)	(2b)	(2c)	(2d)
Intercept	3.25197**	3.20061**	4.90287***	4.85425***
FS/TS	0.44738*	0.45486*	0.35866	0.37235
Hedge	-0.00137			
FCD		-0.03245**		-0.07358*
FDD			0.27378***	0.28621***
Size	-0.27733**	-0.27032	-0.44327*	-0.43398
Adj R-Square	0.8810	0.08860	0.11390	0.11610
F-Value	3.06**	3.08**	4.07***	3.09**

This table reports the cross-sectional regression results of equations (2a) to (2d) using one-month horizon data. The absolute value of β_2 is used as the dependent variable.

* p<0.10, ** p<0.05, *** p<0.01

Table 5 Cross-Sectional Regression with Financial and Operational Hedge Strategies

Dependent Variable：$|\beta_2|$ OLS (Ordinary Least Square)

	(4a)	(4b)	(4c)	(4d)	(4e)	(4f)
Intercept	3.26870**	4.93211***	3.42466**	5.01380***	3.27684**	4.84662***
FS/TS	0.45796*	0.38328	0.38509	0.31220	0.41652*	0.34655
Hedge	-0.00929		-0.01651		-0.01043	
FCD		-0.08474*		-0.08679*		-0.08106*
FDD		0.29498***		0.28286**		0.28033***
Size	-0.28103**	-0.44431	-0.26888*	-0.42488	-0.28437**	-0.43731
Breadth	0.04428	0.05639				
Depth			-0.26143	-0.25561		
Dispersion					0.15472	0.13827
Adj R-Square	0.091	0.12070	0.09510	0.09510	0.0928	0.1198
F-Value	2.35*	2.55**	2.47**	2.60**	2.40*	2.53**

This table reports the cross-sectional regression results of equations (4a) to (4f) using one-month horizon data. The absolute value of β_2 is used as the dependent variable.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 6 Cross-Sectional Regression with Financial and Operational Hedge Strategies

Dependent Variable : β_2 OLS (Ordinary Least Square)

	(5a)	(5b)	(5c)	(5d)	(5e)	(5f)
Intercept	2.30543	5.42196**	2.87656	5.86919**	2.40621	5.29114**
FS/TS	0.46455	0.30801	0.24016	0.09178	0.30485	0.164
Hedge	0.04359		0.00067		0.0089	
FCD		-0.00879		-0.04025		-0.03361
FDD		0.53414**		0.51244*		0.49390*
Size	-0.26266	-0.57360**	-0.22970	-0.53062**	-0.29233	-0.57831**
Breadth	0.04898	0.06666				
Depth			-0.89263*	-0.86395*		
Dispersion					0.74197**	0.70250**
Adj R-Square	0.03570	0.07640	0.06860	0.10580	0.0796	0.1142
F-Value	0.87	1.54	1.73	2.20*	2.03*	2.40**

This table reports the cross-sectional regression results of equations (4a) to (4f) using one-month horizon data. The raw value of β_2 is used as the dependent variable.

* p<0.10, ** p<0.05, *** p<0.01,

Table 7 Cross-Sectional Regression with Financial and Operational Hedge Strategies over 3-month horizon MLE (Maximum Likelihood Estimates)

	(6a)	(6b)	(6c)	(6d)	(6e)	(6f)
Intercept	2.99907	4.94035**	3.14020	4.93030**	3.00334	4.76598*
FS/TS	0.94863***	0.83784**	0.86464**	0.76010**	0.87692**	0.77566**
Hedge	0.41580*		0.40724*		0.41161*	
FCD		0.30821		0.31248		0.31693
FDD		0.38755		0.36170		0.35628
Size	-0.26598	-0.45478*	-0.24849	-0.42258*	-0.27131	-0.44128*
Breadth	0.06194	0.08343				
Depth			-0.29054	-0.28308		
Dispersion					0.26882	0.25038

This table reports the cross-sectional regression results of equations (4a) to (4f) using three-month horizon data. The absolute value of β_2 is used as the dependent variable.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 8 Cross-Sectional Regression with Financial and Operational Hedge Strategies over 6-month horizon MLE (Maximum Likelihood Estimates)

	(7a)	(7b)	(7c)	(7d)	(7e)	(7f)
Intercept	2.55004	4.95824	2.70865	5.07737	2.61023	4.94828
FS/TS	1.12540*	1.02394**	1.074988**	0.96868*	1.07868**	0.98020**
Hedge	0.27100		0.28735		0.28891	
FCD		0.25375		0.28060		0.28189
FDD		0.49891		0.48508		0.48070
Size	-0.21931	-0.46421	-0.21937	-0.45900	-0.22568	-0.46300
Breadth	0.10134	0.10625				
Depth			-0.11651	-0.13248		
Dispersion					0.14218	0.12292

This table reports the cross-sectional regression results of equations (4a) to (4f) using six-month horizon data. The absolute value of β_2 is used as the dependent variable.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 9 Cross-Sectional Regression with Financial and Operational Hedge Strategies over 12-month horizon MLE (Maximum Likelihood Estimates)

	(8a)	(8b)	(8c)	(8d)	(8e)	(8f)
Intercept	-0.93503	2.17118	-0.64545	2.51636	-0.87117	1.36547
FS/TS	0.63688	0.54691	0.51107	0.42766	0.48148	0.37575
Hedge	0.83452		0.81038		0.77812*	
FCD		0.82566		0.78231		0.67114*
FDD		0.62447		0.62800		0.48031
Size	0.13142	-0.18272	0.15422	-0.16724	0.10179	-0.11577
Breadth	0.02196	-0.03543				
Depth			-0.51912	-0.51831		
Dispersion					0.82588	0.78255

This table reports the cross-sectional regression results of equations (4a) to (4f) using twelve-month horizon data. The absolute value of β_2 is used as the dependent variable.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$