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Abstract

The purpose of this paper is to analyse the use of derivative financial contracts in a sample of Japanese firms. Approximately 60% of responding firms use derivatives. Hedging foreign exchange rate risk and interest rate risk are the most common purposes for the use of derivatives with foreign exchange rate forward contracts and interest rate swaps the most common derivatives used. Evidence of a firm size effect with derivatives use is also found. We postulate that the size effect is driven by a greater perceived range of risk exposures faced by larger firms. Also, we do not find sufficient statistical evidence to conclude that information asymmetry is a determining factor in the use of derivatives for hedging in Japan.

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1. Introduction

The Modigliani and Miller (1958) irrelevance proposition provides insight into a wide range of finance problems including the hedging decision. In effect there is little benefit derived from corporate activities if investors can carry out the same activity for themselves at no additional cost. Finance theory suggests that a value maximising firm should choose to hedge where hedging will increase firm value, yet empirical tests have provided little evidence in support of hedging increasing firm value. A positive relationship between firm size and use of derivatives appears to be the most consistent explanation for derivative use (in relation to hedging) and it is generally argued that this relation is cost driven with larger firms facing lower costs.[2] This paper suggests the alternative explanation that larger firms use derivatives for hedging more than smaller firms because larger firms face a wider perceived range of risk exposures.

Recent literature also addresses the importance of the relationship between hedging and disclosure practices where it is argued that information asymmetry between shareholders and managers provides a further explanation for the use of derivatives in corporate hedging (DeMarzo and Duffie, 1995). This question is also analysed with respect to the variation in choice of accounting policies across firms.

The paper is organised as follows: Section 2 reviews the literature dealing with the incentives for corporate hedging while the data, based on a questionnaire administered to

[2] Although derivatives are used for hedging, speculation and arbitrage, our interest is with the use of derivatives for hedging.

Japanese firms, is described in Section 3. Analysis is reported in Section 4 and conclusions are reported in Section 5.

2. Literature Review

The Modigliani and Miller (1958) irrelevance result applies to corporate hedging under conditions of perfect competition. Why should the market value corporate hedging if investors can hedge at a similar cost? It has often been argued that explanations for corporate hedging can be found in situations where Modigliani and Miller irrelevance does not hold, that is, where the market is imperfect. For example, analytical models suggest that the existence of agency costs, costly financial distress, convex tax schedules and information asymmetry may explain corporate hedging behaviour.

Hedging can reduce the level of agency costs by reducing the possibility of under-investment and over-investment problems (Titman, 1985; Bessembinder, 1991 and Smith, Smithson and Wilford, 1990). Where a firm holds debt it is possible that a positive net present value project will be ignored by management acting in the interests of shareholders, as the benefits of the project may accrue entirely to the debtholders. Further, with a levered firm it is also possible that a negative net present value project will be preferred by shareholders where there is a small probability of extreme positive payoffs, most of which would accrue to the shareholders. An appropriately designed hedging policy can remove the incentive for these forms of wealth transfer.

Hedging can also reduce the costs of financial distress (Titman, 1985). If hedging is applied to reduce the volatility of earnings, the probability of default is reduced and so the expected cost of financial distress is reduced and firm value is increased.

The existence of a convex tax schedule suggests that after-tax firm value is concave in pre-tax value (Smith and Stulz, 1985). For example, a firm will maximise value if losses can be minimised or investment tax credits can be maximised. With tax losses the ultimate tax benefit arising from tax losses is not immediately available whereas the costs from tax on profits is payable now. Thus, if tax losses can be avoided or reduced or the benefits of investment tax credits maximised by careful hedging then the present value of corporate cash flows is increased resulting in increased firm value (Smith and Stulz, 1985).

Strangely, little evidence has been documented to support the tax effect (except in the case of tax credits), agency cost or financial distress cost explanations for derivatives use (Mian, 1996 and Nance, Smith and Smithson,1993). The only consistent explanatory variable in empirical tests is firm size.[3] The observed positive relation between firm size and use of derivatives suggests scale economies may be an important factor in determining hedging behaviour but the lack of empirical evidence for the standard

[3] The size effect in relation to derivative use has been found in empirical studies, for example Bodnar, Marston and Hayt (1998); Mian (1996) and Nance, Smith and Smithson (1993).

theoretical explanations is puzzling.[4] This gives rise to the need to focus more clearly on the question of the importance of size in determining derivative use.

The hedging literature often avoids specifying the choice of optimal derivative instrument. Either the firm is assumed to use some optimal, though not stated, combination of derivatives or forward contracts are assumed for simplicity. Froot, Scharfstein and Stein (1993) argue that although optimal hedging does not generally mean complete hedging, the use of options (non-linear) will be preferred over forwards or futures (linear). Non-linear derivatives will typically allow firms to co-ordinate investment and financing plans more precisely than linear instruments (Froot, et.al 1993, p. 1655). They also argue that hedging allows a firm to better co-ordinate investment and financing decisions. Given external sources of finance are more costly than internal sources, hedging increases value by helping to ensure that a firm has sufficient internal funds to undertake attractive (positive net present value) investments.[5]

Much of the literature argues that hedging increases the value of a firm where it is assumed that management act to maximise firm value. DeMarzo and Duffie (1995) focus on the question of whether management will always choose to maximise firm value. It is possible that the fairly weak empirical results observed in the literature on hedging and increases in firm value stem from the impact of factors not directly tied to maximisation

[4] Size economies may also mean that shareholders cannot hedge in the same cost effective manner as firms.

[5] On the costs of external finance, see Myers (1977) and Myers and Majluf (1984).

of firm value. Information asymmetry may exist between managers and shareholders, with managers being better informed about the firm than shareholders. DeMarzo and Duffie (1995) show that there may be an interaction between accounting disclosures, hedging and value maximisation and this interaction is a function of the level of information asymmetry. They argue that hedging reduces the amount of noise and increases the information content of a firm's profits. In a full disclosure environment managers may choose not to hedge at all. The reason for this result is the assumed link between the salaries (and how the salary is packaged) of risk adverse management and profitability of the firm. As hedging reduces the variability of the profits of the company, profits become a better indicator of management performance resulting in greater variability in management compensation and decreasing management well-being. Although shareholders favour full disclosure they may agree to less disclosure if this ensures that management use "maximal" hedging resulting in increased firm value. Accounting disclosure could play a key role in this problem with the choice between deferral accounting (low level of disclosure) and mark-to-market accounting (high level of disclosure) providing examples of firm disclosure choice. Thus it is expected that firms with greater scope of risk, or riskiness, will favour lower accounting disclosure practices.[6,7]

[6] Under mark-to-market accounting, changes in market value of the hedging instrument generally show up as they occur in earnings. Deferral accounting refers to a general method of accounting, under which the gains and losses on the hedging instrument are not brought into the income statement and balance sheet until the time at which the gains or losses associated with the hedged exposure are also recorded (DeMarzo and Duffie, 1995).

3. Data

All members of the Japanese Institute of Internal Auditors were sampled giving rise to a population of 913 firms. A survey was distributed to these firms in June and July 1997. The response rate was 33% representing 302 responses. The respondents span a wide range of Japanese industries. Table 1 shows a breakdown of the sample between users and non-users of derivatives. Approximately 60% (177) of respondents indicate that they are currently using derivatives. Yanagida and Inui (1996) find 41% of non-financial Japanese firms use derivatives and a recent U.S. survey by Bodnar, Marston and Hayt (1998) find 50% of non-financial U.S. firms use derivatives.[8] The sample of 302 includes 291 non-financial firms and 11 financial firms.[9] All results were generated excluding the financial institutions and the results did not change sufficiently to warrant separate analysis.

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[7] Risk or scope of risk is defined as exposure to interest rate, foreign exchange rate, commodity price, marketable security price and credit risks.

[8] Yanagida and Inui (1996) is in Japanese.

[9] Of the 11 financial firms, 9 indicate that they use derivatives, 1 previously used derivatives and 1 did not use derivatives. Due to the unique nature of the business of financial firms analysis was conducted excluding them, the results are similar to those of the total sample and are not reported separately. Also, there are 14 firms which use derivatives for hedging and speculation. Due to potential conflict with these firms, analysis was conducted excluding them, the results are similar to those of the total sample and are not reported separately.

Respondents use derivatives mainly for hedging across 14 different types of derivative contracts. This is shown in Table 2. Of the 617 identified cases of derivative use across 14 different contracts, hedging is identified as the purpose in 478 cases. Table 2 shows the most common derivatives are forward foreign currency exchange rate contracts and interest rate swaps.[10] Stock price index futures are the main speculative contract but well down on the list of common hedging instruments. Interest rate swaps are the most common contracts used for reducing the cost of capital.

Table 3 provides a breakdown of the risks and instruments used to hedge those risks. Foreign currency exchange risk is the most common type of risk hedged. This is hedged in 248 cases. The next most common type of risk to be hedged is interest rate risk with 184 cases. Marketable security price risk, commodity price risk and credit risk are relatively uncommon risks which are hedged. This result is consistent with other studies (see Bodnar, Marston and Hayt, 1998 and Yanagida and Inui,1996). However, Japanese firms appear more concerned with foreign currency exchange risk and interest rate risk than with other risks relative to U.S firms.[11]

[10] This is consistent with other studies such as Bodnar, Marston and Hayt (1998) and Yanagida and Inui (1996).

[11] For example, Bodnar, Marston and Hayt, (1998) report that commodity price risk is managed with derivatives by 56% of derivative users and equity risk is managed by 34% of users (p.4). In our study, the use of derivatives to manage risks other than foreign exchange and interest rate is reported for only 56 of the 488 cases.

Tables 4 through 10 concentrate on the accounting policies used or recommended for use by Japanese firms. Table 4 identifies the common base from which current accounting practices are adopted; Japanese generally accepted accounting principles (GAAP), guidelines issued by the Japanese Institute of CPAs and corporate tax law and regulations are the most important bases when accounting for derivatives by Japanese firms. While most respondents generally agree with mark-to-market accounting (MMA) as a concept, as shown in Table 5, the responses in Tables 6, 7, 8, 9 and 10 suggest that there is considerable variation in the application of MMA. For example, Table 6 shows that only 25% of respondents (21) consider that MMA should apply to all financial instruments, while 35% (29) consider that MMA should apply to some derivatives with the choice determined by management intent. Respondents that generally agreed with the adoption of MMA had a range of views on the level to which MMA should be adopted. Respondents that generally disagreed with MMA also had various views for not adopting it. While all four reasons (as shown in Table 7) are generally important to very important as reasons for not adopting MMA, difficulty in obtaining reliable market value data is regarded as very important by more respondents than other reasons for not adopting MMA. This possibly reflects the high use of over-the-counter contracts (swaps and foreign currency forwards) as shown in Table 3. These contracts may be more difficult to obtain a fair market price for than exchange-traded contracts. Quoted market price is regarded as the most common method of determining fair value, as shown in Table 8.

The evidence in Table 9 also raises interesting variation in responses with many respondents not identifying the use of any method to account for hedges with the smallest proportion of respondents using MMA. Only 16% (25) of respondents state that they apply deferral accounting. The exposures and hedges where deferral and mark-to-market accounting are applied are shown in Table 10. Again, there is considerable variation in the application of accounting methods, with many providing no response.

Tables 11 through 14 concentrate on the management of derivative exposures. Table 11 shows that 36% of respondents have formal written treasury policies and operational guidelines on derivative use. This compares to 79% in the U.S. (Bodnar, Marston and Hayt, 1998). Few firms have risk limits. Best practice in risk management would suggest a well documented policy on the use of derivatives and well specified risk limits.[12] These results suggest a divergence between U.S. practice and Japanese practice.

The level of approval required for derivative transactions is shown in Table 12. Irrespective of the size of transactions or frequency of occurrence, the level of approval required is generally department manager or above. Larger less frequent transactions require more senior personnel approval. However, a large proportion of Japanese firms allow a single department within each firm to use and manage their own derivatives (Table 13). It is interesting to note that DeMarzo and Duffie, (1995) argue that decentralised hedging may provide the advantage of increasing the information content of

[12] See Risk Management Guidelines for Derivatives (1994).

divisional performance reports, thereby enhancing the firms ability to allocate resources internally. Although this provides some support for the informational effects of hedging it highlights a further difference between U.S practice and Japanese practice. Table 14 adds further evidence of a difference in risk management between Japanese and U.S. firms. In particular only 3% (9) of responses to this question indicate that the use of value-at-risk (VAR) as an internal risk measure. Yanagida and Inui (1996) also observe low use of VAR by Japanese firms whereas in the U.S., Bodnar, Marston and Hayt (1998) find 44% of derivative users indicate that they use VAR. It is unclear why such a large difference exists in the use of VAR between Japanese and U.S. firms. One reason may be that Japanese managers take a different view on risk assessment to U.S. managers. The lower level of VAR use may also be due to less technical derivative use in Japan relative to the U.S. For example, foreign currency derivatives are the main derivatives used in Japan (as per Table 3) and these may not require the use of VAR or other more complex risk management techniques. This is also evident from the greater use of less complex risk measurement methods used such as regular checks on nominal amounts and assessment of mark-to-market values (as per Table 14). Further research in this area is required.

4. Analysis

This section focuses on the relationship between firm size, exposure of the firm to financial risks and the impact of accounting choice on hedging. This study does not attempt to assess the impact of taxes, bankruptcy costs and agency costs given the generally poor explanatory power of these variables in prior tests. As the data set is questionnaire based with the variables following either a classificatory scale or a ranking

scale in all cases except revenue, the Spearman rank correlation coefficient and the Kruskal Wallis test are used for statistical analysis.

A positive correlation is generally observed in empirical tests of the relation between various measures of size and derivative use (Bodnar, Marston and Hayt, 1998; Mian, 1996 and Nance, Smith and Smithson, 1993).[13] As respondents provided information on the use of derivatives and annual firm revenue, it is possible to test the ability of firm size (proxied by annual revenue) to explain Japanese firm derivative use. To gain some indication of the propensity of larger firms to use derivatives, the test for equality of revenue for the derivative and non-derivative user groups is shown in Table 15. The mean annual revenue for Japanese firms which use derivatives is approximately 6 times greater than the mean annual revenue for non-users.[14] The size effect is confirmed with a statistically significant Kruskal Wallis test statistic (χ^2=43.028).

Although the Kruskal Wallis test is consistent with the contention that derivative users are larger in terms of revenue than non-derivative users, the larger firms may be using only a small range of derivatives. Alternatively, these larger firms may have a greater scope of risk exposures and use derivatives across a greater range of exposures. The

[13] Firm sales is used as a proxy for firm size in Bodnar, Marston and Hayt (1998). Whereas Mian (1996) use book value of total assets minus book value of common equity plus market value of equity and Nance, Smith and Smithson (1993) use the sum of the book value of debt plus the market value of equity.

[14] The median annual revenue for derivative users is approximately 4 times that of non-users.

correlation between revenue and perceived scope of risk exposure is estimated to provide a test of the relationship between firm size (in terms of revenue) and perceived scope of risk exposure.

As shown in Table 3, respondents identify the types of exposure for which derivatives are used. There are five broad categories; interest rate risk, foreign currency exchange rate risk, commodity price risk, marketable security price risk and credit risk. A simple "perceived scope of risk exposure" index is constructed according to the number of exposures identified by respondents. This index ignores the actual magnitude of the exposure, focusing instead upon the variety of exposures identified as requiring the use of derivatives. This gives an indication of the scope of hedging conducted by firms. Index values range from one to five with a value of five indicating that derivatives are used to hedge all of the five listed exposures and a value of one indicating that only one of the exposures is hedged. The Spearman rank correlation coefficient between the perceived scope of risk exposure and revenue is 0.3778, which is statistically significant at the 5% level, suggesting that larger firms do perceive a wider scope of risk than smaller firms.

To explore further the use of derivatives in Japanese firms, indicator variables are created to identify those firms that use option contracts and those firms that use forward type contracts, such as forwards, futures and swaps. Table 2 and Table 3 provide the basic indicator variable information. The option index is set to one where the firm uses currency options, currency futures options, interest rate options, interest rate futures options, treasury bond options, treasury bond futures options, caps and floors and zero

otherwise. Caps and floors are included in this group as these derivatives are generally bundles of individual options, one for each coupon date of the underlying bond. The forward index is set to one if the firm uses forward contracts, futures contracts and/or swaps with a value of zero in all other situations. Swaps are included in this group as they may be approximated by a bundle of forward contracts with identical forward prices, one forward contract for each reset date. Although swap contracts may include option like-characteristics, the assumption that swaps may be treated as a combination of forwards should describe the majority of swap contracts written.

Tables 16 and 17 show that approximately two thirds of the respondents use forward type contracts alone with a combination of forward type contracts and options used by approximately one third of the respondent firms. Only one firm indicates that it uses options alone. It is also apparent from Tables 16 and 17 that only firms with higher revenue levels use both options and forward type contracts with the smaller revenue firms tending to use only forward type contracts (Table 16). Firms with a greater perceived scope of risk also tend to use both forwards and options (Table 17). Given Table 16 forward type contracts are clearly favoured amongst the respondents in this sample with options tending to be used by the larger firms in combination with forward type contracts.

DeMarzo and Duffie (1995) suggest that, given information asymmetry, managers might prefer accounting methods that tend to shield derivative use. It is argued that those firms with greater hedging levels will favour low disclosure (reject mark-to-market accounting in favour of other methods). Given 123 valid responses from Table 5, the correlation

between the preference for mark-to-market accounting and perceived scope of risk exposure is -0.0734 (prob. = 0.4195).[15,16]

5. Conclusion

This paper provides insight into Japanese firms' attitude to the use of derivatives. It also identifies a statistically significant size effect in the use of derivatives for a sample of financial and non-financial Japanese firms. The larger the firm, in terms of revenue the greater the use of derivatives. The greater use of derivatives is also aligned with greater perceived scope of risk exposure. Finally, the suggestion of Demarzo and Duffie (1995) that mark-to-market accounting and risk exposure are negatively correlated is found in this paper though not at statistically significant levels. Information asymmetry and accounting choice may be a factor in the explaining of the use of derivatives by Japanese firms but this question is left to future research and more comprehensive data sets. Another area for further research is the use of multivariate analysis, especially focussing on the relationship between firm size, scope of risk exposure and the use of forwards or options.

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[15] A statistically insignificant positive Spearman rank correlation of 0.0112 between the actual accounting methods used, deferral accounting and mark-to-market accounting (Table 9) and the scope of exposure is also observed. This result is inconsistent with DeMarzo and Duffie (1995) though this result is not unexpected given current GAAP requirements and the limitations on the use of mark-to-market at the time of the study.

[16] A second index for risk was developed which includes all cells in Table 3. The correlations between revenue and accounting measures with this composite index are statistically similar to those using the scope of risk index and are not reported.

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Table 1
The extent of derivative use by Japanese firms: A questionnaire on the use of derivatives was distributed to 913 Japanese firms. The response rate was 33% (302 firms). There are 11 financial firms and 291 non-financial firms.

Use of Derivatives	*Number of Respondents*	*% of Total*
Firms which currently use derivatives	177	59%
Firms which previously used derivatives but not currently	11	3%
Firms which do not use derivatives	114	38%
TOTAL	**302**	**100%**

Table 2
The extent of derivative use amongst Japanese firms include hedging, speculation and cost reduction: There are four categories of use, 14 different types of contracts and 617 responses (respondents could indicate more than one use).

	Hedging	*Speculation*	*Reducing Cost of Capital*	*Other*	***TOTAL***
Forward foreign exchange contracts	148	7	6	0	**161**
Forward interest rate contracts	7	4	3	0	**14**
Foreign exchange futures contracts	4	1	0	0	**5**
Interest rate futures contracts	12	7	2	0	**21**
Treasury bond futures contracts	19	9	0	0	**28**
Stock price index futures contracts	12	11	0	0	**23**
Foreign exchange options and foreign exchange futures options contracts	39	6	0	0	**45**
Interest rate options and interest rate futures options contracts	8	4	3	0	**15**
Treasury bond options and treasury bond futures options contracts	15	8	0	0	**23**
Stock index futures contracts	10	8	0	0	**18**
Foreign exchange swaps	55	3	7	0	**65**
Interest rate swaps	103	6	27	5	**141**
Caps and floors	33	1	6	0	**40**
Other synthetic instruments	13	1	4	0	**18**
TOTAL	**478**	**76**	**58**	**5**	**617**

Table 3
The types of risks that Japanese firms hedge: There are five types of risk across 6 broad types of contracts and 488 responses. The difference in totals between hedging in Table 2 and the total in Table 3 is due to ten respondents not providing both information on the types of risks (Table 3) and the detail of the contracts they use (Table 2).

Risk / *Instrument*	*Interest rate risk*	*Foreign exchange risk*	*Commodity price risk*	*Marketable security price risk*	*Credit risk*	***TOTAL***
Foreign exchange forward contract	2	152	4	1	1	**160**
Forward rate agreement (FRA)	7	1	0	1	0	**9**
Swaps	109	50	1	5	2	**167**
Options	16	40	2	16	0	**74**
Futures	16	4	6	16	0	**42**
Caps & floors	34	1	0	1	0	**36**
TOTAL	**184**	**248**	**13**	**40**	**3**	**488**

Table 4
The basis of accounting practice adopted by Japanese firms when accounting for derivatives: There are 349 responses across (at least) six different bases of accounting practice. Respondents could answer more than one basis of accounting.

Basis of accounting	*Respondents*
Japanese – GAAP	141
Guidelines issued by Japanese Institute of CPAs	101
Corporate tax law and regulations	80
Guidelines issued by the Federation of Japanese Bank Institutions	3
Guidelines issued by the Ministry of Finance	12
Others	12

Table 5
The degree of attitude of respondents to their firm adopting mark-to-market accounting (MMA): MMA results in changes in market value generally showing up as they occur in earnings. There are 123 responses.

Degree of attitude towards adopting MMA	*Respondents*
Strongly agree	17
Fairly agree	66
Fairly disagree	36
Strongly disagree	4
TOTAL	**123**

Table 6
The range of approaches considered by respondents as appropriate for the application of mark-to-market accounting (MMA): MMA results in changes in market value generally showing up, as they occur in earnings. There are 84 responses. These respondents generally agree with the adoption of MMA (from Table 5).

The range of approaches considered appropriate for MMA	*Respondents*
Apply MMA to some derivatives: measure some at current value and others at cost (e.g. distinction based on management intent)	29
Apply MMA to all derivatives	14
Apply MMA to some financial instruments: measure some at current value and others at cost (e.g. distinction based on management intent)	18
Apply MMA to all financial instruments	21
Other	2
TOTAL	**84**

Table 7
The levels of importance and reasons given by respondents for not adopting mark-to-market accounting: There are four reasons and three levels of importance. These respondents generally disagree with the adoption of MMA (from Table 5).

Reasons for not adopting MMA	*Very Important*	*Important*	*Not Important*
Increased profit volatility	9	11	8
Difficulty in obtaining reliable market value data	11	18	6
Conflict with the corporate law provisions which prohibit recording unrealised gains	8	19	3
Increased costs (e.g. cost of changing accounting systems, costs of development of new accounting systems)	3	12	12

Table 8
The range of methods used by Japanese firms for determining the fair value of derivatives: There are at least five different methods across 148 responses.

Range of methods for determining fair value	*Respondents*
Quoted market price	104
Standard pricing model (e.g. Black Scholes)	4
Discounted cash flow analysis	5
Computer simulation	9
Other methods	26
TOTAL	**148**

Table 9
The types of accounting methods Japanese firms use for hedging: There are three choices of accounting method across 155 responses.

Accounting method[*]	*Respondents*
Deferral method of accounting	25
Mark-to-market accounting	17
No special accounting method used	112
TOTAL	**154**

* Under mark-to-market accounting, changes in market value generally show up, as they occur in earnings. Deferral accounting refers to a general method of accounting, usually for both income statement and balance sheet. Under certain hedge accounting criteria, the gains and losses on the hedging instrument are not brought into the income statement and balance sheet until the time at which the gains or losses associated with the hedged exposure are also recorded (see DeMarzo and Duffie, 1995).

Table 10
The kinds of transactions or exposures that hedge accounting is applied to in Japanese firms: There are five kinds of transactions or exposures.

Source of Exposure or Hedge	*Accounting method used*	*No accounting method used*	*Not Applicable*	*No response*
	Deferral Accounting (N=25)			
Cash flow volatility	6	5	3	11
Market value volatility	3	4	3	15
Future commitments	5	3	6	11
Other prospective contracts	2	2	8	13
Cross hedges/dynamic hedges	0	1	10	14
	Mark-to-market accounting (N=17)			
Cash flow volatility	2	4	3	8
Market value volatility	1	4	4	8
Future commitments	3	1	5	8
Other prospective contracts	2	2	4	9
Cross hedges/dynamic hedges	0	0	6	11

Table 11
The form of treasury policy adopted by Japanese firms in the management of derivatives: There are seven forms of treasury policy across 325 responses. Respondents could provide more than one form of policy.

Form of Policy	*Respondents*
Formal written treasury policies and operational guidelines	117
Authorised list of instruments that may be used	47
Deal limits for single transactions	63
Overall market risk exposure limits	24
Overall credit risk exposure limits	15
Counter-party dealing limits	35
Stop loss limits	24

Table 12
The level of approval required in Japanese firms for different sized derivative transactions: There are five different levels of approval across small or regular transactions and large or irregular transactions.

Level of Approval Required	*Small transaction or occurs regularly*	*Large transaction or irregular in nature*
Personnel or staff	3	1
Section manager	8	0
Department manager	59	11
In-Charge member of the board of directors	58	63
President or chief executive	37	83
Unknown	2	1

Table 13
The organisational structure for the use and management of derivatives
in Japanese firms: There are five different structures with 169 responses.

Description of structure	*Respondents*
Single department uses derivative managed by the same department	103
Single department uses derivative managed by another department	33
Derivative used in more than one department, managed by individual departments	18
Derivative used in more than one department, managed by another department	10
Other	5

Table 14
Methods adopted by Japanese firms for the measurement of risk for management purposes: There are more than six methods of risk measurement used by Japanese firms across 269 responses.

Description of risk measurement used	*Respondents*
Regular check of the nominal amount of the contract	139
Assess the mark-to-market values of derivatives	97
Use the "basis point value (BPV)" to assess the unrealised gains / losses	15
Use the "sensitivity analysis" of volatility to assess the unrealised gains / losses	9
Use the concept of "value at risk" as an internal risk measure	9
Other	11
TOTAL	**269**

Table 15
Revenue statistics for Japanese firms which use and do not use derivatives: The revenue statistics include mean annual revenue per firm (in Yen), the standard deviation of the annual revenue and the minimum and maximum annual revenue across 267 responses. Also, the Kruskal-Wallis test for equality of mean revenues per user and non-user group is shown.

Statistics / *Users/Non-users*	*No. of Firms*	*Mean Revenue per Firm (¥m p.a.)*	*Std. Dev. Of Revenue (¥m)*	*Minimum Revenue (¥m p.a.)*	*Maximum Revenue (¥m p.a.)*
Firms which use derivatives	162	6,766	18,687	42	141,764
Firms which do not use derivatives	105	1,156	1,986	10	13,000

Kruskal-Wallis Test for Equality of populations

	No. of Observations	*Rank Sum*
Derivative Use	162	25,751.00
No Use of Derivatives	105	10,027.00
Chi-square test*	43.028 (0.0001)	

* Chi-squared test with 1 degree of freedom, Probability is reported in brackets

Table 16
Revenue statistics for Japanese firms which hedge using a combination of forward type derivatives and/or options: There are 155 responses. Hedge indicators are set to one if the derivative type (option or forward) is used and to zero if the derivative type is not used. Forward type contracts include forwards, futures and swaps. Options include currency options, currency futures options, interest rate options, interest rate futures options, treasury bond options, treasury bond futures options, caps and floors.

Hedge using forwards	*Hedge using options*	*No. of responses*	*Mean revenue per firm (¥m p.a.)*	*Std. dev. of revenue (¥m)*	*Min. revenue (¥m p.a.)*	*Max. revenue (¥m p.a.)*
0	1	1	570.00	0.00	570	570
1	0	99	3,318.01	6,456.80	42	38,217
1	1	55	13,883.31	29,771.31	205	141,764

Table 17
Scope of risk exposure statistics and the choice of hedging with options and/or futures for Japanese firms: Exposure index statistics include the mean and standard deviation of index value across 170 responses. Perceived scope of risk index ranges from one to five according to five broad exposure categories; interest rate risk, foreign currency exchange rate risk, commodity price risk, marketable security price risk and credit risk. Hedge indicators are set to one if the derivative type (option or forward) is used and to zero if the derivative type is not used. Forward type contracts include forwards, futures and swaps. Options include currency options, currency futures options, interest rate options, interest rate futures options, treasury bond options, treasury bond futures options, caps and floors.

Hedge using forwards	*Hedge using options*	*No. of responses (N=170)*	*Mean exposure index value*	*Std. dev. of exposure index value*
0	1	1	1.0000	0.0000
1	0	107	1.5140	0.6496
1	1	62	2.2581	0.8859