THE COMMUNICATION OF QUANTITATIVE INFORMATION ON MARKET RISK USING GRAPHICS IN THE ANNUAL REPORTS OF BANKS AND SECURITIES FIRMS

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INTRODUCTION

The explosive growth of the derivatives markets[i] and the highly publicised recent losses[ii] have created concerns among various parties about the possibility of increasing systemic risk. Systemic risk is the risk that a disruption (in a firm, in a market segment, to a settlement system, etc.) causes widespread difficulties in other firms, in other market segments or to the financial system as a whole (see Shah 1977 for details).

The Basle Committee (1994) holds the views that improving public disclosure on qualitative[iii] and/or quantitative[iv] market risk information may reduce systemic risk and help to stabilise the financial system. This can be accomplished in three ways. Firstly, financial markets function most efficiently when market participants have sufficient information about risks and returns to enable them to make informed investment and trading decisions. Secondly, during episodes of market stress, the lack of transparency can contribute to an environment in which rumour alone can cause a firm's market access and funding to be impaired. Finally, market participants, if provided with meaningful information, can impose market discipline on firms to compel them to manage their affairs in a prudent fashion.

Disclosure of both qualitative and quantitative information on market risk, the risk of a fall in the value of a derivatives portfolio due to adverse changes in interest rates, exchange rates and prices is seen as especially important. It has been suggested that the most effective method of disclosing quantitative information on market risk is through graphic presentation.

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Evidence shows that graphs can be effectively used to disclose quantitative information hence improved transparency of market risk profiles (Basle Committee 1994; Beckstrom and McDonald 1993; Goodman, Poplawski and Rosen 1996).

An experimental study (Casson and Yahya, 1999) on the impact of the use of graphic displays on decision making, has shown that users perform better when graphics are added to the market risk narratives. Specifically, their study demonstrates that graphic presentation provides better predictive accuracy, higher confidence in decision making and better understanding.

However, to date there has been no systematic study which examines the nature and extent of graph use by banks and securities firms in disclosing quantitative information on market risk, and which relates the use of graph with the characteristics of the firms. Therefore, this study attempts to fill this gap and contribute to the current discussion regarding the communicative effectiveness of market risk information in the annual reports of banks and securities firms.

The remaining part of this paper is divided into four sections. The second section reviews the literature on the use of graphs in presenting accounting information. The third section explains the research objectives and methodology. The fourth section analyses the results and the paper ends with conclusions in the fifth section.

LITERATURE REVIEW

Use of Graphs

There are a number of studies that survey the extent to which graphs have been used in communicating quantitative accounting information. Johnson, Rice and Roemmich (1980) survey 50 annual reports produced by U.S. companies for the years 1977 and 1978 and find that there are 423 graphs used in all. Steinbart (1989) examines the annual reports of 319 U.S. companies. He discovers that 250 companies (79 per cent) include graphs in their annual reports.

Beattie and Jones (1992a) survey reports produced by 240 listed U.K. companies as at 31 March 1989. The results of the survey show that 189 companies (79 per cent) use graphs with 156 companies (65 per cent) using graphs for at least one key financial variable, which are turnover, profit before tax, earnings per share (EPS) and dividends per share. Beattie and Jones (1992c) survey 25 leading building societies in the UK and find that 20 (80 per cent) of them used graphs.

Green, Kirk and Rankin (1992) conduct a survey of some 117 Irish semi-state sector and public limited companies and find that approximately 54 per cent of the sample used graphs.

The Canadian Institute of Chartered Accountants (CICA,1993) surveys the 1991 annual reports of 200 companies in 12 industry sectors in Canada. The survey

reveals that 166 companies (83 per cent of the 200 surveyed) employed graphics in their 1991 annual report. They use 1,683 graphs or an average of 10 per report (the range is from 1 to 38 graphs in a single report).

Beattie and Jones (1994) analyse 76 annual reporting documents from 47 large U.K. fund-raising charities. They find that there are 44 documents containing graphs (58 per cent) covering 35 charities (75 per cent) and including a total of 119 graphs. This represents an average of 2.5 graphs per charity (n=35).

Beattie and Jones (1997) compare the use of graphs for reporting in the 1990 annual reports of 176 leading U.S. and U.K. industrial companies. They find that 92 per cent of U.S. companies use graphs compared with 80 per cent of U.K. companies.

In a recent study, Beattie and Jones (1998) study about 300 companies from six countries. They discover that 263 (88 per cent) of the companies studies included graphs in their annual reports.

Based on these studies, there is evidence which shows that the majority of companies use graphs for disclosing accounting information. In the area of market risk disclosures, surveys involving multinational financial firms conducted by Priest (1997) and the Basle Committee and IOSCO (1997) provide only an overview of the use of graphs in market risk disclosures. Priest reports that 6 financial firms produce histograms of actual daily trading revenue against the confidence level used in their Value-at-Risk (VaR) methodology. The Joint Report by Basle Committee and IOSCO, indicates that only 15 banks use graphical means to compare daily (VaR) estimates with actual portfolio outcomes.

Type of Charts Used

The main types of graph used in the communication of quantitative information are bar chart/histogram, line, pie and pictorial graphs (Beattie and Jones, 1992b). Prior studies (Beattie and Jones 1992a, 1992c, 1997; CICA 1993; Steinbart 1989) discover that column graphs (bar chart and histogram) are the most frequently used among the companies for disclosing accounting information.

The CICA (1993) finds that the column charts accounted for 61 per cent of all charts. Beattie and Jones (1992a) report that 64 per cent of the companies use a column type of graph. In a study involving building societies, Beattie and Jones (1992c) discover that the most popular graph type used is the column chart (vertical bar chart). Forty-four of the 52 key variables are graphed using column charts. Steinbart (1989) reveals that the bar chart is by far the most common type of graph, representing almost 78 per cent of all graphs. Other types for example, line graph and pie charts are given approximately equal attention in these studies. In a recent study, Beattie and Jones (1997) find that in the U.S. and U.K., bar/column charts are the most popular types of graph used, showing 79 per cent and 62.4 per cent of use respectively.

Surprisingly, Beattie and Jones (1994) discover that the most common graph type employed is the pie chart (54 per cent). In their study they investigate the presentation format used the annual reports of charities. Other types of graphs used are bar/column charts (45 per cent) and line graph (1 per cent).

Location of the Graphs

Identifying the location of the graph is important because auditing practice standards in most countries only require auditors to audit financial statements that include footnotes to the account, and do not require other sections, for example, the management discussion and analysis (MD&A) section to be considered in their auditing process (Choi and Mueller 1992). By noting the location of the graphs, we may deduce whether or not the graph has been audited.

The CICA (1993) identifies the location of the graphs within the annual reports, and discovers that most companies include graphs in various parts of the annual reports. However, among the sections, about two thirds (67 per cent) of the companies have graphs in the financial review or MD&A section. Almost half of the graphs are presented in that section (753 graphs out of 1,683 or 45 per cent of the total). Surprisingly, only three companies (2 per cent) place graphs with the audited financial statements.

Beattie and Jones (1992a) investigate which section of the annual report included graphs, and find that 66 per cent of the companies included their graphs in the financial highlights section, followed by 32 per cent of the companies locating their graphs in MD&A section.

Graph Construction

A number of researchers have investigated graph construction, and shown that there are graphs which are not properly prepared. Beattie and Jones (1992a) find a total of 142 graphs (30 per cent of the 465 key financial variable graphs) show material discrepancies. Steinbart (1989) who focuses on the quantification of graph discrepancy in graphs and based his study on 698 graphs, discovers an average measurement discrepancy of +11 per cent. Sugden (1989) also finds a number of misleading graphic practices. Johnson, Rice and Reommich (1980) discover that there are 125 out of 423 (29 per cent) graphs improperly constructed. Beattie and Jones (1994) find that 78 per cent of the 40 pie graphs are in the specific form of ellipses, which means that the area of segments is no longer proportional to the segment angle. Beattie and Jones (1997) find that 24 per cent of graphs are materially distorted in both the U.S. (43 out of 182) and the U.K. (40 out of 166).

The Characteristics of Companies and the Use of Graphs

There is limited published evidence from prior studies which showing relationships between the use of graphs and certain characteristics of the companies. To our knowledge, there are at least three published studies which discuss this issue. For example (Beattie and Jones 1992a; Steinbart 1989) discover that companies with a

good financial performance are more likely to use graphs. Beattie and Jones (1994) discover no evidence that graphs usage by charities is contingent upon either the charity making a surplus/deficit or upon the level of administration expense.

RESEARCH OBJECTIVES AND METHODOLOGY

As an extension of the previous studies, this study has two aims (1) to examine the extent to which graphs are used to communicate quantitative information on market risk and (2) to relate the use of graphs to financial derivatives activities and other attributes of the banks and securities firms. This can be reduced to five research objectives:

I. To determine the frequency of graph use by banks and securities firms.
II. To examine the type of graphs used.
III. To ascertain the location of graphs within the annual report.
IV. To report any improperly constructed graphs.
V. To observe the characteristics or types of banks and securities firms which use graphs.

The study uses the 1996 annual reports of international banks and securities firms (70 and 10 respectively). The bank sample represents the major financial firms in their respective countries: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Japan, Netherlands, Norway, Sweden, Switzerland, the United Kingdom and the United States. The sample of securities firms are from the United States (9 firms) and Japan (1 firm). The criterion for inclusion in the sample is that the financial firms are involved in derivatives activity. This can be recognised by looking at the availability of information as required by accounting standards bodies. The Statement of Financial Accounting Standards No. 119 (FASB 1994) and International Accounting Standard No. 32 (IASC 1995) require an entity involved in financial derivatives activities to disclose the face, contract or notional principal amount and the nature and terms of market risk of those instruments.

Drawing on a number of prior studies (Beattie and Jones 1992a, 1994; Cleveland 1994; Jarett 1983; Tufte 1983; Wallgren et al. 1996), a data collection sheet is prepared to record the following categories of data obtained from the annual reports[v]:

Details of the banks and securities firms

- Full name,
- Year end,
- Country in which based,
- Selected financial information: notional amount of derivatives and total assets,
- Other selected information: quantitative (numerical) information on market risk.

General graphical information

- use/non-use of graphs
- location of graphs
- type of graph

Specific graph construction details

- degree of measurement distortion, calculated using a graph discrepancy index (an adaptation of Tufte's lie factor, (Tufte 1983, first suggested by Taylor and Anderson 1986, and applied by Beattie and Jones 1992a, b).
- compliance with other basic elements of graph construction, i.e., chart area, area, plot area, legend (area), legend (curve), grid line, label, title text, axis label, minimum value, maximum value, vertical (y-axis), horizontal (x-axis), scale value, tick, plot area frame, curve and source.

The data are coded, transferred to StatXact 3 and then analysed. This statistical package is used because it is suitable for performing small-sample analysis (Agresti 1996; Mehta and Patel 1995).

ANALYSIS OF RESULTS

Use of Graphs

Tables 1 and provide an overview of survey findings. Only 16 banks (20 per cent of the 80 surveyed) use graphs in their 1996 annual report to disclose market risk profiles. None of the ten securities firms uses graph to disclose market risk profiles. Statistical tests using chi-squared (χ^2) show that there is a significant association between the graphics used and the type of financial firm producing the report. Results from the chi-squared tests show that the association is significant at 1 per cent, based on the observed $\chi^2 = 26.00$. The Phi Coefficient Statistic ϕ that is usually used for measuring the degree of association between the variables is 0.707. This indicates a difference of attitude toward the public disclosure of market risk information banks and securities firms.

Table 1: Number and Percentage of Banks and Securities Firms Use Graphs

Banks and Securities Firms	Number	Percentage
Banks	16	20
Securities Firms	0	0
Total	16	20

Table 2: Distribution of Graphs Used for Disclosing Quantitative Information about Market Risk by Country

Country	Number of banks use graphs		Total
	Yes	No	
Australia	1	4	5
Belgium	0	3	3
Canada	1	5	6
Denmark	0	1	1
Finland	0	2	2
France	1	5	6
Germany	0	7	7
Ireland	0	2	2
Japan	4	4	8
Netherlands	0	3	3
Norway	0	1	1
Sweden	0	3	3
Switzerland	2	0	2
United Kingdom	2	7	9
United States	5	6	11
Total	16	54	70

From the descriptive analysis, we can conclude that only banks use graphs to disclose quantitative information on market risk, the rest of the analysis excludes securities firms.

Table 3: Type and Frequency of Graphs Used by Banks for Disclosing Quantitative Information about Market Risk in the Annual Reports

Type of graph used	Number of bank	
	Frequency	Percentage
Histogram	12	52%
Line	9	36%
Scatterplot	3	12%

Notes: The total number of banks is not the same as the number of banks use graphs (16) because there are some which use more than one types of chart. For example, six banks use histogram and line, two use the line and scatterplot, and a bank uses all the three types.

Type of Charts Used

Table 3 shows a frequency distribution for the type of graphs used by banks. This table shows that the two most popular types of charts are histogram (52 per cent), followed by line graph (36 per cent) and scatterplot graph (12 per cent). Nonetheless, there are several banks in the survey that use more than one type of

chart to disclose market risk. The results are consistent with the prior studies as mentioned in the previous section.

In disclosing quantitative information about market risk, histograms or bar charts are usually used for showing the frequency distribution of daily changes in portfolio value over the reporting period. The line type of graph is normally used for displaying the daily movements of market risk. The scatterplot type is used routinely for comparing daily profits and losses with model-generating risk amounts to gauge the quality and accuracy of its risk measurement model, for example Value-at-risk (see Jorion 1996 for discussion).

Location of the Graphs

The survey finds that 15 out of 16 banks which use graphs locate them in the MD&A section. Moreover, only one bank (Abbey National) locates the graph in the notes to the accounts. These results are consistent with the findings of the study by CICA (1993).

Graph Construction

This study also attempts to examine whether any improperly constructed graphs are used when banks disclose information on market risk. A graph is considered properly constructed when the preparer follows the basic rules for graph construction.

Based on the results of the investigation using a graph discrepancy index, the graphs were found not to violate principles which could also mislead users. This is probably because most financial firms use a comprehensive software application for managing market risk (Davidson 1997; Groenfeldt 1997). The software should be able to produce graphic displays of market risk profiles accurately and professionally. However, applying the basic rules of graph construction, we identified several minor mistakes which if avoided may render graphs concerned more reader-friendly, for example, titles and other text in charts.

Wallgren et al. (1996) recommend placing the title above the chart, using left-justification to make it look neat and easier to read. With regard to the writing style, for the title Wallgren et al. suggest using an austere font, such as Helvetica or Arial (Microsoft Word). Finally, they also suggest writing all text in charts horizontally.

In our investigation, we discover that in 6 (25 per cent) of the graphs, the titles are not left-justified. Eight (33 per cent) of the graphs do not use the recommended austere font and finally we observe that in 6 (25 per cent) of the graphs, the texts are not written horizontally.

The Characteristics of Companies and the Use of Graphs

There are several distinctive characteristics (variables) of banks which have been identified. For the purpose of deepening our knowledge about the type of bank

which uses graphs, we test the relationship between the graph used and the variables.

The first analysis is to examine the relationship between the use of graph and the numerical (quantitative) information on market risk, for example a high/low or average amount of value-at-risk or values derived from other market risk measurement techniques. There are 40 banks (57 per cent) which disclose numerical information. On the other hand, none of the bank disclose any numerical information about market risk. To observe the relationship between the use of graph and the disclosure of numerical information on market risk, we use the chi-squared (χ^2).

Results from this test show that the p-value (less than 0.001) for chi-square is at a significant level of 1 per cent. It can be concluded that there is a significant association between the use of graphics for disclosing quantitative information on market risk and numerical information. Phi Coefficient Statistic ϕ = -0.418, is usually used for measuring the degree of association between the variables. Based on these results, we may infer that graphs are more likely to be included in the annual reports of banks which disclose the numerical information. Therefore, there is a possibility that a bank which neither uses graphics nor discloses numerical information is reluctant to disclose market risk information using whatever means.

In addition, we test whether there is any relationship between the banks which use graphs and the geographic region in which they are based. For this purpose, we divide the question into two parts. The geographic aspect is considered firstly in relation to country and secondly to region (i.e., North America, Continental Europe, Scandinavian and Asian). These are initially tested by chi-squared statistics. But since the frequencies of many of the cells are below five, Fisher's Exact Test is used as suggested by Agresti (1996). The tests for the two questions show that they are not statistically significant. All the exact p-values are greater than 0.10. In other words, the proportion of "yes" to "no" (in terms of whether a graph is used) is the same for all categories and there is no relationship between the use of graphs and the categories tested.

These results agree with those of Priest (1997), who remarks that information on derivatives use is becoming standardised. He finds that banks in Europe and Asian especially Japan, driven by a greater grasp of the underlying principles of risk management, catch up with their U.S. rivals.

The study is also interested in testing whether there is any relationship between the use of graphs and banks from countries represented in the Basle Committee[vi]. It is possible to hypothesise that graphs are more likely to be included in the annual reports of such banks in order to improve the disclosure of market risk information as recommended by the Basle Committee in the Fisher Report.

Chi-squared tests of the independence of the use of graphs from the classification of countries represented in the Basle Committee are used. The results show that there is no significant relationship at $p>0.10$.

We also examine whether there is any relationship between the use of graphs and the notional amount of derivatives of banks. Although, the total amounts do not signify the level of market risk the banks are exposed to, they do signify how active they are in trading derivatives (Reed, 1995; Sangha, 1996; USGAO, 1994). Logically an active financial firm should make itself more transparent, by using graphs for disclosing market risk profiles.

Therefore, it is possible to hypothesise that an active bank should make itself more transparent by using graphs for disclosing market risk profiles. To test this hypothesis, banks are divided into two categories, high (more active) and low (less active) based on the reported notional amount of derivatives. It is considered more appropriate to use the median, rather than the mean as a cut-off point because the latter can be significantly influenced by outliers (Agresti and Finlay 1997). Chi-squared then computed on the relationship between the use of graphs and the category of bank.

The results show that the use of graphs to disclose market risk profiles is associated with the positions of the banks. Of 35 banks in the sample which are considered active, 13 (37 per cent) include graphs of at least one type, whereas only 3 banks (9 per cent) of the less active banks use graphs ($\chi^2 = 8.10$; $\phi = 0.34$). This association is significant at 1 per cent. To confirm that the results are not influenced by the size of the bank[vii], chi-squared tests are also run using the high/low of total assets and the use/non-use of graphs. The results show that the relationship is only significant at one-tailed probability of $p = 0.0877$ ($\chi^2 = 2.917$; $\phi = 0.204$).

CONCLUSIONS AND DISCUSSION

The study investigates the extent of the use of graphs by banks and securities firms in external financial reporting. From an analysis of the annual reports of 80 internationally banks and securities firms dealing with financial derivative instruments for the year ended 1996 the study finds that there is 20 per cent, which is 16 banks, use graphs and narrative and the rest only disclose the market risk information using qualitative or numerical data. The study also discovers that none of the securities firms use graphs.

Based on the sample, the main findings of the study may be summarised as follow:
(a) the majority of banks do not use graphs for disclosing market risk,
(b) none of the securities firm uses graphs for disclosing market risk and
(c) banks which are involved actively in derivatives transactions are most likely to use graphs.

This study provides useful information for the accountants who prepare the annual reports of banks and securities firms. They should be aware of the importance of using graphs for displaying quantitative market risk information. As shown by Casson and Yahya (1999), graphics have significant effects in informing decision makers especially in forecasting and understanding the market risk profiles.

However, based on the findings about the use of graphs to disclose market risk profiles, we may conclude that in general, no major effort is being made by the majority of banks and securities firms to improve the transparency of their information by using graphic presentation in their annual report. As a result, this lack of transparency put outsiders or participants in the financial markets at a major disadvantage when analysing the financial performance of those firms.

Microcomputer graphics software and the necessary hardware to run these packages have increased in both sophistication and ease of use. Desktop presentation software packages for the personal computer can produce bar, column, line and pie graphs from manually-entered data or from previously prepared spreadsheet data files. Financial firms should take advantage of these facilities.

FUTURE RESEARCH

The results of the study on the location of the graphs is also consistent with the CICA study of CICA (1993). Knowing the location of the graphs help us to ascertain the influence of external auditors on the graphs clarity. Therefore, in future research someone may look at the role of auditors in improving the communication of financial information, in this case by means of the graphic presentation. This may include a study of the effects of different auditing standards in different countries on auditing graphic presentations.

The results show that banks and securities firms which use graphs for presenting information about market risk disclosure are among those active in financial derivative transactions. This is something we may explore in future research. For example, it may help in understanding the reasons behind the unwillingness of banks and securities firms to use graphs.

Another area of research which may be explored in the future concerns the issues of voluntary disclosure versus regulated disclosure. Researchers may examine whether or not it is advisable to let economic pressure from the marketplace force banks and securities firms to comply or let the regulators establish the necessary standards to improve the disclosure of quantitative information about market risk.

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ENDNOTES

[i]Derivatives instruments include forwards, futures, options and swaps.

[ii]Baring PLC, a venerable 233-year-old bank went bankrupt on February 26, 1995, when it lost $1.3 billion from derivatives trading. This loss wiped out the firm's entire equity capital. In late 1993 and early 1994, MG Refining and Marketing, Inc., the American affiliate of Germany's 14th largest industrial firm Metallgesellschaft, reported staggering losses on its positions in energy futures and swaps. Metallgesellschaft's losses, which may ultimately exceed the figure of $1.3 billion reported, represented about half of its total capital of DM3.672 as of September 30, 1994. Only a massive $1.9 billion rescue operation by 150 German and international banks kept Metallgesellschaft from going into bankruptcy.[1] In another case, on September 26, 1995, Daiwa Bank announced that a 44-year-trader in New York, Toshihide Igushi, had allegedly accumulated losses estimated at $1.1 billion. The loss absorbed one-seventh of the bank, the 12th -largest bank in Japan. According to Jorion (1996), in most cases, the primary reason behind these financial disasters was that senior management poorly managed or monitored the exposure to market risk.

[iii]The examples of qualitative information are; overview of key aspects of organisational structure relevant to risk management and control and methods used to measure and manage market risk and how the firm assesses performance in managing market risk, information (Casson, 1996).

[iv]The examples of quantitative information are; performance of portfolio during the reporting period, daily changes in the portfolio's value over the reporting period, Value-at-risk during, and at the end of, the reporting period and comparison of Value-at-risk estimates against actual performance during the reporting period (Casson, 1996).

[v]The data are piloted and revised.

[vi]The Basle Committee on Banking Supervision is a committee of banking supervisory authorities which was established by the central bank Governors of the Group of Ten countries in 1975. It consists of senior representatives of banks supervisory authorities and central banks from Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States.

[vii]Since there is significant positive relationship between the notional amounts of

derivatives and total asset.

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