Graphs Used in ASEAN Trading Link's Annual Reports: Evidence from Thailand, Malaysia, and Singapore

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Abstract

This study reports a preliminary finding of the types and numbers of graphs being presented in the annual reports of about thirty top listed companies trading publicly in the stock markets of three countries-Thailand (SET), Malaysia (BM), and Singapore (SGX)-that were chosen based on their inclusion in the ASEAN Stars Index under the ASEAN Trading Link project. A total of 6,753 graphs from nineteen sectors were extracted and examined. Banking, real estate, and telecommunications are ranked the three most condense sectors, accounting for 50.2% of the total number of graphs observed. The three most used graphs are the Conservative Bar, Donut graph and Stack Bar. Less than one percent of Infographic type graphs were used. The five most depicted graphed variables are Asset, Revenue, Net profit, Liability, and Dividend.

Using rudimentary framework to detect distorted or misleading statistical graphs, the study found 60.6% of the graphs distorted across the three markets, SET, BM, and SGX. BM ranked first in percentages of graphs being distortedly presented (73%). The other two markets, SET and SGX, have about the same proportions, 53.88% and 53.03%, respectively. Likewise, the proportions of Well-designed versus Inappropriate-designed graphs of the latter two markets are a little over one time (SET = 1 : 1.17; SGX = 1 : 1.13), whereas the proportion is almost triple for the BM market (BM = 1 : 2.70). In addition, the trend of distorted graphs found is slightly increasing as the longevity of the ASEAN Stars Index increases. One possible explanation for the relatively equal proportion of inappropriate graphs found is that SET is the smallest market and SGX, though the largest, is the most regulated market. BM, on the other hand, may want to present their financial data in the most attractive manner to prospective investors, thus, regulatory constraints and governance structure are still lenient.

Keywords : Graph Distortion, ASEAN Trading Link, Business Visualization

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1. Introduction

The quality of data shown publicly is likely to be influenced by regulatory demands, especially concerning financial data required in company annual reports. Financial data users can differ greatly. For example, expert users may prefer to have detailed, real numbers to do their own fundamental and technical analyses. Novice users, on the other hand, might just want simple, easy to comprehend graph representations of the actual data. However, the type of graphs being used and how they are portrayed may also affect users'cognition and consequently, the course of action they may take.

Beattie and Jones [2001] reviewed various communication advantages of using pictorial and graphical representations for annual reports. The advantages are 1) attract reader's attention, 2) remember easily and accurately, 3) portray patterns, trends, relationships, and anomalies easily and effectively, and 4) capture the essence of a company's performance by presenting key indicators using graphs. They examined 300 annual reports from six countries and collected the frequency of graph use, the variable selected, and the graphical formats chosen. The authors hypothesized that micro-based and macro-based countries would choose different data to be graphed, e.g., financial versus non-financial, short-term versus financial performances, and so on.

In addition to obeying the law, companies publish financial reports to show their past performance. Many present the information so that it will impress potential investors, which in turn can induce needed capital to follow theirstrategic moves. Others might conceal information so that unwanted bad impressions such as a downward trend or a dip in profit cannot easily be detected. Graphs and infographics can serve both ends of the continuum. When presented in a clear and informative manner, they can help enhance a user's cognition and information processing capability; whereas, employing a distorted manner, the graphs and infographics could mislead a user's judgment.

The objective of this research is to collect and examine graphs and infographics used in presenting financial data in the annual reports of companies indexed in the ASEAN Stars of three countries: Malaysia, Singapore, and Thailand. The graphs and infographics are classified into different graph types and graph objectives in terms of financial variables used as the graph data source. Graph distortions, or inappropriate graphs, are coded following previous research addressing misleading graphs in external annual reports. A comparison of graphs used and the numbers of extorted graphs are analyzed across these three markets.

2. Literature Review

This section gives a brief background for the context of this study, including the data collection platform, ASEAN Trading Link and ASEAN Stars Index, general description of graph characteristics, and previous research on graphs used in annual reports as well as distorted and misleading graphs.

2.1 ASEAN Trading Link and ASEAN Stars Index

The ASEAN Stars Index has been formed by the ASEAN Trading Link to communicate to investors about the "blue chips" securities of the ASEAN exchange. The index is formed with the 30 largest, most liquid companies from each of the six member countries in the Link (total 180). The ASEAN Trading Link is a collaborative trading community of seven member exchanges, including the Indonesia Stock Exchange (IDX), Bursa Malaysia (BMB), the Philippine Stock Exchange (PSE), Singapore Exchange (SGX), Stock Exchange of Thailand (SET), Hochiminh Stock Exchange (HOSE), and Hanoi Stock Exchange (HSE). Note that Vietnam has two stock exchanges included in the Link. The index is aimed to help investors who are unfamiliar with the ASEAN exchange. The first development phase of the link was composed of only three markets, SET, BM and SGX. The link wasinaugurated in the third quarter of 2010. This type of cooperation will allow ASEAN investors to access a broader and more diverse portfolio of stocks with lower cost. The link will also increase visibility and capability of ASEAN markets for global investors [Asia Etrader, Q3 2012, www.asiaetrading.com].

The list of companies in each individual exchange varies on a bi-annual basis (every June and December), depending on their performance of the top 30 stocks of each market (FTSE ASEAN Index, www.set.or.th), except for Hochimin and Hanoi, which select 15 stocks based on market capitalization, while being free-float adjusted and liquidity-screened using internationally recognized methodology from FTSE [FTSE Factsheet, 28 November, 2014]. Companies might be included in the list in one year and excluded the next if their performance drops. Thus, a company that presents its best possible performance can increase their odds of being included in the ASEAN Stars Index.

Since regulations from each member country differ, it is expected that the selectivity and quality of data and graphs presented in respective annual reports may differ. A prior study found graphic usage and distortion vary according to the country [Penrose, 2008]. In addition, inter-country distortion differs significantly in terms of graph topics. In an international context, language-boundary has to be a concern so that graphs can become much more important, asthey constitute a readily understood, largely language-independent, communication medium [Beatties and Jones, 2001].

In an annual report, a user typically examines corporate performance and financial standing from graphic representations in the business section. These representations may not echo actual financial performance of the firm [Penrose, 2008]. However, users tend to understand the complication of financial data better with visual images [Bauer and John-Laird, 1993; Glenberg and Langston, 1992; Larkin and Simon, 1987; Novick, 2001]. Thus, graphic representations of financial data are usually included because they can sum up a large amount of data and explanation with one or two images. Even though an-

nual reports with graph presentations are used extensively by investors since they supposedly reflect the identity of an individual company [Hines, 1988; Woodward, 1998], little research has been done to study the quality of graphs used [Huang et al., 2011], and very few discussions have been made regarding the graphs used across different countries [Beatties and Jones, 2002b].

2.2 Graph Characteristics

Graphs are charts that use lines, points, or an image to show the change in value of one variable to another. Different characteristics are used to describe or specify a graph, including type of chart, chart orientation, chart dimension, temporal dimension, and type of data in the chart.

2.2.1 Type of Chart

Line graph, pie graph, bar or column graph, candle graph, etc. Each chart type has its particular objective for example, a column graph or line graph is suitable for presenting time-series data. Despite the fact that each type of graph is good for a certain purpose, some graph designers ignore that and use an inappropriate graph type that may mislead readers.

2.2.2 Chart Orientation

Vertical and horizontal. Past research found that readers' perception was affected by graph orientation. Vertically oriented bar graphs appear to enhance readers' visualization better than a horizontally oriented one [Tangmanee and Jittarat, 2013].

2.2.3 Chart Dimension

2D (two dimension), 2/3D (three dimension on two dimension plane), 3D (real three dimension). A few studies have examined the dimension aspect of a graph. Comparing two- and three-dimensional graphs, past research showed that two-dimensional graphs were more reliable. However, using favorable impression framework, research also found that people preferred to create three-dimensional graphs [Penrose, 2008].

2.2.4 Temporal Dimension

Single period chart and multiple-period chart. A single - period chart is suitable for representing discrepancy between categories, whereas a multiple-period chart is used to show the trend of data. For multiple-period charts, 5-year chart is most often chosen, followed by 10-year and 3-year charts [Beatties and Jones, 2001].

2.2.5 Type of Data

Financial and non-financial data. Annual reports contain financial and non-financial information. Financial graph information mainly focuses on performance variables, e.g., sales, net income and revenue [Huang et al., 2011].

3. Graphs Used in Annual Reports

Currently, the popularity of using graphs has vastly accelerated because technology used to create graphs has been developed continuously [Kostelnick, 2008]. The trend of using graphs in reports will continue to grow as it is easier for

graph designers to make complex graphs. The use of graphs to present a company's financial situation in financial reports is a significant dimension of financial disclosure management [Beatties and Jones, 2002a]. Most annual reports currently include graphs that intend to serve as effective communication tools from the company to its stakeholders [Beatties and Jones, 2001; Penrose, 2008]. The graphs in annual reportsare mostly used to communicate a company's financial situation and are usually presented as bar and line graphs. The other graph type often found in annual reports is the pie chart as it is suited for single categorical data [Beatties and Jones, 2000]. Critical financial information is disclosed to support an investor's decision making. Graphical representations of financial data have additional advantages because they can attract attention and stimulate the interest of annual report users [Beatties et al., 2008].

To show financial performance and position, the four most popular financial variables depicted in an annual report are sales, earning per share, earnings and dividend per share [Beatties and Jones, 2009]. These variables, called the KFVs, are recommended by the National Association of Investors Corporation (NAIC) because they can give investors initial screening information of potential investments. However, not all companies may want to bring attention to these figures. Companies with large performance growth may want to avoid making their growth appear remarkable and so are less likely to disclose KFVs in their annual reports [William and Diane, 2010] for political or management reasons. Column graphs have been the most popular type graphs used by company to portray their KFVs [Beatties and Jones, 2000; 2001]. Past research in this area also compared profit and non-profit companies and found that multi-period trends are more popular in profit companies, whereas non-profit companies focus more on showing their financial operation of the most recent years [Beatties and Jones, 1994]. Nevertheless, almost all studies about the use of graphs in annual reports are from the US, Europe and Australia very few have been conducted for Asia-Pacific countries. Despite the increasing use of graphs in annual reports, these graphs can be misleading. In a comparative study of Hong Kong and China [Huang et al., 2011], it was found that companies often used misleading graphs with a "year reversals" feature when their financial performances were low.

4. Distorted or Misleading Graphs

Distortion graphs are mostly used for financial information by companies particularly in strong capital markets since all graphs represent financial status and convey image [Beatties and Jones, 2000]. An annual report is one of the channels that every company uses basically to represent its operationsto its stakeholders. Penrose [2008] did an extensive review of literature on annual report use of graphs [Penrose, 2008]. He grouped the 1980's studies into three clusters: 1) studies on how to prepare graphics that avoid distortion, 2) studies on how to identify and measure distortion, and 3) studies of graphic-distortion in annual reports. The author pointed

out different venues of research: *Well-designed graph creation,* which includes suggestions on the preparation and guidelines to graph accounting and financial data; *Graphic distortion,* which is to identify and measure distorted levels of graphs, especially for financial graphs and *Graphs used in annual reports,* which is to find evidence\about the abuse of graphs used in annual reports.

Public trading companies should communicate quality data, especially in their annual reports. Once the data are out, different stakeholders will try to understand, analyze, and make decisions based on the data. Thus, regulators and standard setters tend to review the governing body's measures to ensure information quality of reports. However, hardly any measures address graph quality directly. Nevertheless, in the book, "How to Lie with Statistics", Darrel Huff [1954] provided a rudimentary framework to detect distorted or misleading graphs [Huff, 1954]. He suggested possible determinants of graph distortion as follows: 1) 3D effect graph, 2) Improper scaling, 3) Truncated graph, 4) Missing scale on Y-axis, 5) Omitting data, 6) Complexity, 7) Poor construction, 8) Axis changed, 9) Improper extraction, 10) Excessive usage, and 11) Biased labeling.

Not all bad designed graphs are necessarily distorted, though graphs which violate the criteria of good-designed can mislead decision makers [Christensen and Larkin, 1992]. Past researchers suggested guidelines to identify bad designed graphs. For example, Cleveland and McGill [1984, 1985, 1986, 1987] developed a hierarchy of graphic specifiers that help to rate graph accuracy from criteria such as position along common aligned or non-aligned scale, length, angle/slope, area, volume/density/color saturation, and color hue [Cleveland and McGill, 1984, 1985, 1986, 1987]. Tufte [1983] used data-ink ratio to examine characteristics of good versus bad charts [Tufte, 1983]. The effect of data-ink ratio on task performance speed and the level of situation awareness were empirically tested by Blasio and Bisantz [2002]. Using experimental design, they found the effect of data-ink ratio on faster participants' reaction time. In terms of distortion, Tufte also pointed out that perspective or three dimensions often distort the graph of one-dimensional data. Arunachlam et al. [2002] classified types of bad design graphs as non-continuous measurements, masking or using one scale for two variables of different magnitudes, reverse annual sequences, and omitting negative value [Arunachalam et al., 2002]. They asserted that bad designed graphs can affect a user's judgement. Huang et al. [2011] used Steinbart's GDI (Graphic Discrepancy Index) and Mather et al's RGD (Relative Graph Discrepancy Index to study whether companies are more likely to prepare improper designed graphs when their performance is low. They found partial support to their hypothesis that improperly designed graphs and low performance were related.

Graph Distortion Measurements: GDI versus RGD. Both GDI and RGD have been established to assess how accurate a graph will represent its underlying data. This is because an improper scaling design may not be apparently perceived by a graph user. The first graph's

distortion measurement is "Lie Factor", which was created by Tufte in [1983]. Later, the measurement was fine-tuned and further developed by Taylor and Anderson in 1986 with the name "Graph Discrepancy Index", currently known as GDI. The formula for GDI is shown below.

$$\text{Graph Discrepancy Index (GDI)} = \left(\frac{a}{b} - 1\right) \times 100$$

where

a is the percentage change in graph;

$$a = \frac{\text{heights of last column} - \text{heights of first column}}{\text{heights of first column}} \times 100$$

b is the percentage change in data;

$$b = \frac{\text{value of last data point} - \text{value of first data point}}{\text{value of first data point}} \times 100$$

To calculate the GDI, the graph should have both X and Y axes so that the height of the graph can be measured objectively. In their study, Beatties and Jones [2002] asserted that when the GDI of a particular graph is greater than 10%, the graph is able to mislead a reader's perception, especially for the user with a low level of financial understanding [Beatties and Jones, 2002b]. However, GDI measurement can be inconsistent. Mather et al. [2005] suggested four cases of GDI inconsistencies, for examples, no change in the percentage change in the graph, no difference between the percentage change in data, the percentage change in the graph is equal to the percentage change in data and finally, the distortion might not be apparent if there are very small changes in both the graph and data [Mather et al., 2005]. They then proposed an improve measurement, called the Relative Graph Discrepancy Index (RGD) in 2005. The formula for RGD is below.

$$\text{Relative Graph Discrepancy Index (RGD)} = \frac{g_2 - g_3}{g_3}$$

where

d_1 = value of first data point

d_2 = value of last data point

g_1 = height of first column

g_2 = height of last column

g_3 = the correct height of last column if it is plotted accurately; $g_3 = \frac{g_1}{d_1} \times d_2$

RGD also has some limitation of discontinuity in the function when the last data point (d_2) is zero. Although with this calculation limitation, the authors were convinced that it is by far the best measurement of graph distortion. Huang et al. [2011] used RGD in their research and declared 5% RGD to be the mark for a misleading graph [Huang et al., 2011]. Both GDI and RGD have been used extensively in graph distortion research.

Misleading Graphs in Annual Reports Misleading graphs have been widely discovered in financial reports [Penrose, 2008] because companies seek capital through public financing nowadays [Kuasirikun, 2011]. Thus, information presented to outsiders is vital to a firm's future prospects. A clear understanding of a company's

financial situation can definitely influence the investor's decisions. At present, most annual reports include graphs to show monetary and non-monetary information of a company. Some of these graphs are misleading. Often, they have a non-zero axis, inappropriate graphical identifier and missing scale [Beatties and Jones, 2009]. Many studies have used GDI to measure graph distortion level to identify improper scaling graphs and found companies exaggerate their scales upward more than downward. Despite there being much research that focuses on misleading graphs, studies within the context of Asia are rare, especially for South-East Asia. Most misleading graph studies in Asia always concentrate on the Hong Kong market [Courtis, 1997; Huang et al., 2011].

5. Research Method

5.1 Data Collection

A total of 6,753 graphs were collected from three markets: SET from Thailand, BM from Malaysia, and SGX from Singapore. Only companies listed in the ASEAN Stars Index during the fiscal years of 2012 and 2014 were included. Listing of companies in the Index of these two years were combined, making a total of 102 companies, 33 from SET, 36 from BM, and 33 from SGX. In order to be included in the Index, the company's performance would have to be evaluated a year earlier. Therefore, graphs reported in the financial statements of a year prior to being included in the Index were collected in this study, spanning from fiscal year 2010~2013. Each graph was treated independently regardless of how many times a particular company was listed at the time of data collection. Although companies may have different fiscal years, some are from March to February, some January to December, and others October to September, the counting of companies and their respective graphs were based on their own fiscal year declaration.

A data collection sheet with checklists was designed based on previous literature in business visualization and the manipulation of statistical and financial accounting graphs and infographics. Traditional EXCEL classifications were used. Graphed variables/topics were collected as exhaustively as possible, and only the top five graphed variables were reported. Two key financial variables, ROA and ROE, were used as proxies for a firm's performance at each period of a company's inclusion in the ASEAN Stars Index. Inappropriate or distortion criteria were identified and coded for each graph.

<Table 1> shows that on the average, one-fourth of the graphs are from companies in the Bank/Investment SVC industry (25.2%). Lesser developed markets, SET and BM, comprise about one-third of the graphs collected, 31.7% and 36.7%, respectively. The Real Estate sector was represented more than any other sector in the SGX market (824 graphs, 29.9%). Although the largest number of graphs was collected from the SGX market, only 11 out of 19 sectors were represented. About thirty plus companies in each market were chosen to list in the ASEAN Stars Link in 2010 and 2012.

〈Table 1〉 Numbers of Graphs Collected by Industry

Sector/Industry	Market			
	SET 33 Companies*	BM 36 Companies*	SGX 33 Companies*	Total 102 Companies*
Automobiles and parts		16(0.6%)	4(0.1%)	20(0.3%)
Bank and investment	465(31.7%)	927(36.7%)	307(11.1%)	1,699(25.2%)
Chemical	90(6.1%)	66(2.6%)		156(2.3%)
Cyclical consumer product	104(7.1%)	394(15.6%)		498(7.4%)
Cyclical consumer services		36(1.4%)		36(0.5%)
Energy	10(0.7%)		85(3.1%)	95(1.4%)
Food and beverages	272(18.5%)	167(6.6%)	143(5.2%)	582(8.6%)
Health care	117(8.0%)	217(8.6%)	316(11.5%)	650(9.6%)
Household products and services	8(0.5%)			8(0.1%)
Industrial Conglomerate	10(0.7%)	10(0.4%)		20(0.3%)
Industrial goods	16(1.1%)			16(0.2%)
Industrial services	111(7.6%)	94(3.7%)	144(5.2%)	349(5.2%)
Mineral resources			130(4.7%)	130(1.9%)
Real estate		75(3.0%)	367(13.3%)	442(6.5%)
Retailers	1(0.1%)			1(0.1%)
Telecommunication	82(5.6%)	28(3.5%)	824(29.9%)	994(14.7%)
Transportation	17(1.2%)			17(0.3%)
Utilities	61(4.2%)	396(15.7%)	236(8.6%)	693(10.3%)
Food and drug retailers	104(7.1%)	40(1.6%)	203(7.4%)	347(5.1%)
Total	**1,468(100%)**	**2,526(100%)**	**2,759(100%)**	**6,753(100%)**

Note: *The graphs decoded in this study are confined to corporate annual reports and accounting documents published online in the ASEAN Stars' links. The numbers of companies listed during 2010 and 2012 for SET, DM, and SGX are 33, 36 and 33, respectively. Some of these companies, 6, 12, and 6 of them, respectively had only one year of data during the data collection period.

6. Results

6.1 Graph Types Used

As shown in <Table 2>, almost 90% of all graphs presented in financial reports are simple, EXCEL traditional graph types. The lesser developed markets appear to utilize more composite and non-traditional graph types: 17.98% for SET, 12.55% for BM, and 10.91% for SGX. Conservative Bar dominates the type of graph used by many folds across all graph types and across all markets (41%). The second most popular graph is the Donut graph, accounting for 14.66%. Infographic type is not as prominent as expected because less than one percent (0.93%) was found. Conservative Bar and Line graph are most popular among all the composite and non-traditional graph types (7.9%).

〈Table 2〉 Graph Types Used

Graph Type	SET	BM	SGX	Total
Conservative Bar	472(32.15%)	1,062(42.04%)	1,235(44.76%)	2,769(41%)
Modified Bar	96(6.54%)	321(12.71%)	90(3.26%)	507(7.51%)
Stack Bar	232(15.80%)	106(4.20%)	347(12.58%)	685(10.14%)
Line	149(10.15%)	241(9.54%)	165(5.98%)	555(8.22%)
Pie	79(5.38%)	174(6.89%)	81(2.94%)	334(4.95%)
Doughnut	160(10.90%)	303(12%)	527(19.10%)	900(14.66%)
Area	11(0.75%)	0(0%)	10(0.36%)	21(0.31%)
Stack Area	5(0.34%)	2(0.08%)	3(0.11%)	10(0.15%)
Simple, Traditional types	*1,204(82.02%)*	*2,209(87.45%)*	*2,458(89.09%)*	*5,871(86.94%)*
Infographic	35(2.38%)	18(0.71%)	10(0.36%)	63(0.93%)
Conservative Bar+Line	152(10.4%)	179(7.1%)	203(7.4%)	534(7.9%)
Conservative Stack Bar+Line	27(1.84%)	26(1.03%)	11(0.4%)	64(0.95%)
Modified Bar+Line	15(1.02%)	22(0.87%)	1(0.04%)	38(0.56%)
Conservative Bar+Stack Bar	6(0.41%)	1(0.04%)	1(0.04%)	8(0.12%)
Line+Area	10(0.68%)	12(0.48%)	3(0.11%)	25(0.37%)
Conservative Bar+Area	6(0.41%)	0(0%)	1(0.04%)	7(0.10%)
Modified Stack Bar	0(0%)	9(0.36%)	9(0.33%)	18(0.27%)
Modified Stack Bar+Line	0(0%)	4(0.16%)	0(0%)	4(0.06%)
Miscellaneous	13(0.89%)	46(1.82%)	62(2.25%)	121(1.79%)
Composite, Other types	*264(17.98%)*	*317(12.55%)*	*301(10.91%)*	*882(13.06%)*
Total	**1,468(100%)**	**2,526(100%)**	**2,759(100%)**	**6,753(100%)**

Note: This table shows cumulative numbers (%) of graphs found during the years 2010~2013.

6.2 Distorted or Inappropriate Graphs

As shown in <Table 3>, more than half of the collected graphs (60.6%) are distorted one way or another, with 46% having a single distorted feature in a given graph and 14.6% multiple distorted features. During the first two years (2010 and 2011) of listing on the ASEAN Stars Index, the distortions were about the same. However, the trend of distorted graphs found is seen to slightly increase as the Index grows older. Single feature distortion graphs peak in 2013 (49.9%). The distorted feature with highest numbers is Missing Scale, with a cumulative number of 1997 (29.5%) for all four years. Combining Missing Scale with Reverse Year and with 3D Effect are also high, 7.09% and 4.75%, respectively.

In terms of inappropriate or distorted graphs by individual market <Table 4>, BM has the highest percentage of distorted graphs, including both single and multiple features (73%). The other two markets, SET and SGX, have about the same proportions, 53.88% and 53.03%, respectively. Likewise, the proportions of Well-designed versus Inappropriate-designed graphs of the latter two markets are a little over one time (SET = 1 : 1.17; SGX = 1 : 1.13), whereas the proportion is almost triple in the BM market (BM = 1 : 2.70).

〈Table 3〉 Types of Distortion in Graphs and Infographic-resemble Graphs Found in the ASEAN Stars Index by Year

Distorted Feature in One Graph	2010	2011	2012	2013	Total
Well-designed	*557(37.4%)*	*723(43.4%)*	*718(40.3%)*	*657(35.9%)*	*2,655(39.3%)*
Inappropriate Scale	103(6.93%)	102(6.13%)	99(5.56%)	99(5.42%)	403(5.96%)
Reverse Year	53(3.56%)	77(4.63%)	66(3.71%)	110(6.02%)	306(4.53%)
3D Effect	158(10.6%)	40(2.40%)	83(4.66%)	76(4.16%)	357(5.28%)
Omitting Negative Value	1(0.06%)	1(0.06%)	1(0.05%)	2(0.10%)	5(0.07%)
Missing Scale	390(26.2%)	474(28.5%)	534(30.0%)	599(32.8%)	1,997(29.5%)
Unable to Visually Prove the Scale	0(0%)	7(0.42%)	8(0.44%)	26(1.42%)	41(0.60%)
Single Distortion Feature	*705(47.4%)*	*701(42.1%)*	*791(44.4%)*	*912(49.9%)*	*3109(46.0%)*
Inappropriate Scale and Reverse Year	3(0.20%)	11(0.66%)	8(0.44%)	3(0.16%)	25(0.37%)
Inappropriate Scale and 3D effect	11(0.74%)	2(0.12%)	7(0.39%)	4(0.21%)	24(0.35%)
Inappropriate Scale and Omitting Nagative Value	1(0.06%)	0(0%)	0(0%)	0(0%)	1(0.01%)
Reverse Year and 3D effect	29(1.95%)	23(1.38%)	30(1.68%)	13(0.71%)	95(1.40%)
Reverse Year and Missing Scale	107(7.20%)	124(7.45%)	140(7.87%)	108(5.91%)	479(7.09%)
3D Effect and Missing Scale	63(4.23%)	73(4.38%)	84(4.72%)	101(5.53%)	321(4.75%)
Reverse Year and Unable to Visually Prove the Scale	1(0.06%)	0(0%)	0(0%)	4(0.21%)	5(0.07%)
Reverse Year, 3D effect and Missing Scale	9(0.60%)	0(0%)	0(0%)	0(0%)	9(0.13%)
Reverse Year and Omitting Nagative Value	0(0%)	1(0.06%)	0(0%)	1(0.05%)	2(0.02%)
3D effect and Unable to Visually Prove the Scale	0(0%)	1(0.06%)	0(0%)	8(0.43%)	9(0.13%)
Reverse Year, 3D Effect and Unable to Visually Prove the Scale	0(0%)	0(0%)	0(0%)	7(0.38%)	7(0.10%)
Reverse Year, 3D Effect and Missing Scale	0(0%)	4(0.24%)	0(0%)	8(0.43%)	12(0.17%)
Multiple Distortion Features	*224(15.0%)*	*239(14.3%)*	*269(15.1%)*	*257(14.0%)*	*989(14.6%)*
Total	**1,486(100%)**	**1,663(100%)**	**1,778(100%)**	**1,826(100%)**	**6,753(100%)**

〈Table 4〉 Types of Distortion in Graphs and Infographic-Resemble Graphs Found in the ASEAN Stars Index by Market

Distorted Feature in One Graph	SET	BM	SGX	Total
Well-designed	*677(46.1%)*	*682(26.9%)*	*1,296(46.9%)*	*2,655(39.3%)*
Inappropriate Scale	89(6.06%)	214(8.47%)	100(3.62%)	403(5.96%)
Reverse Year	90(6.13%)	119(4.71%)	97(3.51%)	306(4.53%)
3D Effect	73(4.97%)	166(6.57%)	118(4.27%)	357(5.28%)
Omitting Negative Value	4(0.27%)	1(0.03%)	0(0%)	5(0.07%)
Missing Scale	335(22.8%)	866(34.2%)	796(28.8%)	1,997(29.5%)
Unable to Visually Prove the Scale	33(2.24%)	2(0.07%)	6(0.21%)	41(0.60%)
Single Distortion Feature	*624(42.5%)*	*1,368(54.1%)*	*1,117(40.4%)*	*3,109(46.0%)*
Inappropriate Scale and Reverse Year	19(1.29%)	6(0.23%)	0(0%)	25(0.37%)
Inappropriate Scale and 3D effect	10(0.68%)	10(0.39%)	4(0.14%)	24(0.35%)
Inappropriate Scale and Omitting Nagative Value	1(0.06%)	0(0%)	0(0%)	1(0.01%)
Reverse Year and 3D effect	33(2.24%)	59(2.33%)	3(0.10%)	95(1.40%)
Reverse Year and Missing Scale	52(3.54%)	166(6.57%)	261(9.45%)	479(7.09%)
3D Effect and Missing Scale	50(3.40%)	214(8.47%)	57(2.06%)	321(4.75%)
Reverse Year and Unable to Visually Prove the Scale	0(0%)	1(0.03%)	4(0.14%)	5(0.07%)
Reverse Year, 3D effect and Missing Scale	0(0%)	1(0.03%)	8(0.28%)	9(0.13%)
Reverse Year and Omitting Nagative Value	1(0.06%)	0(0%)	1(0.03%)	2(0.02%)
3D effect and Unable to Visually Prove the Scale	1(0.06%)	8(0.31%)	0(0%)	9(0.13%)
Reverse Year, 3D Effect and Unable to Visually Prove the Scale	0(0%)	7(0.27%)	0(0%)	7(0.10%)
Reverse Year, 3D Effect and Missing Scale	0(0%)	4(0.15%)	8(0.28%)	12(0.17%)
Multiple Distortion Features	*167(11.3%)*	*476(18.8%)*	*346(12.5%)*	*989(14.6%)*
Total	**1,486(100%)**	**2,526(100%)**	**2,759(100%)**	**6,753(100%)**

Across three markets, the five most popular graphed variables are Asset, Revenue, Net profit, Liability, and Dividend. These are slightly different among the three markets in terms of the frequencies of the graphed topics presented <Table 5>. For less developed markets, like Thailand and Malaysia, EPS (Earning per Share) and Market Price per Share were depicted in graphs more than Dividend in Singapore.

To test the difference in the extent of graphs being presented by company by market, distorted graphs on each financial variable were collected on a firm-year basis. Levene Statistics in <Table 6> show that the variances differed in different markets for every financial variable. The F statistics show that all three markets differ in the average number of distorted graphs for majority of their financial variables. Liabilities, Market Price per Share, and EBITDA are the exception.

〈Table 5〉 Top Five Graphed Variable/Topic

Financial Variable	Market			Total (Sorted High-Low)
	SET	BM	SGX	
Asset	250(17.0%)	330(13.1%)	163(5.9%)	743(11.0%)
Revenue	187(12.7%)	228(9.0%)	356(12.9%)	771(11.4%)
Net Profit	89(6.1%)	105(4.2%)	157(5.7%)	351(5.2%)
Liabilities	38(2.6%)	138(5.5%)	142(5.1%)	318(4.7%)
Dividend	25(1.7%)	92(3.6%)	133(4.8%)	250(3.7%)
Market Price per Share	8(0.5%)	120(4.8%)	101(3.7%)	229(3.4%)
EPS	28(1.9%)	79(3.1%)	70(2.5%)	177(2.6%)
EBITDA	31(2.1%)	62(2.5%)	48(1.7%)	141(2.1%)
	2	2	2	2
	2	2	2	2
	1,468(100.0%)	2,526(100.0%)	2,759(100.0%)	6,753(100.0%)

Note: The frequencies shown in this table are the number of times a variable is graphed, not the number of companies graphing the topic. If a company presented two topics on the same graph (for example, Sales and Earnings), this would counted as 0.5 of a graph for both Sales and Earnings.

〈Table 6〉 Test of Differences in the Average Number of Distorted Graphs by Market

Financial Variable	Numbers of Distorted Graphs Mean (SD), Firm-years			Levene Statitstics, Sig	$F(df_1, df_2)$, Sig
Variable	SET	BM	SGX		
Asset	3.28(3.58), 50	2.77(2.95), 90	1.83(1.06), 54	11.05, 0.000	3.718(2, 191), 0.026*
Revenue	1.32(.685), 73	1.86(1.66), 95	2.68(2.70), 73	18.14, 0.000	10.112(2, 238), 0.000**
Net Profit	1.11(0.40), 65	1.73(2.20), 52	1.82(1.43), 45	10.86, 0.000	3.972(2, 159), 0.021*
Liabilities	1.05(0.22), 20	2.39(2.08), 41	2.37(3.32), 35	5.24, 0.007	2.370(2, 93), 0.099
Dividend	1,08(0.02), 13	1.45(.879), 51	2.16(1.31), 50	6.02, 0.003	8.373(2, 111), 0.000**
Price per Share	N/A	1.34(.691), 65	1.13(.343), 38	10.69, 0.001	1.584(2, 101), 0.210
EPS	1.00(0.00), 20	1.03(.171), 67	1.24(0.48), 41	37.40, 0.000	7.465(2, 125), 0.001**
EBITDA	1.00(0.00), 18	1.91(2.92), 23	2.56(3.60), 9	4.36, 0.018	1.324(2, 47), 0.276

*$p < .05$, **$p < .01$.

7. Discussion and Conclusion

The present study examines the graphs used in annual financial reports of securities traded publicly in the stock markets of three country members of ASEAN, Thailand, Malaysia, and Singapore. A little over a hundred securities from these markets were included if they were listed in the ASEAN Stars Index. Similar to the findings of Tanlamai and Tangsiri [2010], the graphs being used for publicly available data, especially annual reports, are column/bar charts and pie charts. These traditional graphs are readily constructed by any spreadsheet and infographic software. The familiarity of column and bar charts makes them easy to understand and, thus, easily to be manipulated and created in appropriately.

Using rudimentary framework to detect distorted or misleading graphs [Huff, 1954], it was surprising to find almost two thirds of graph occurrences were distorted one way or another across all three markets. Similar to previous studies [Beatties and Jones, 2000, 2001, 2009], missing scale graphs were most apparent in the present setting. Intentionally done or not, when the scales are not shown, annual report readers will cognitively process the relative differences of data by guessing the changes in the height/width of the depicted columns and bars in that chart. In real numbers or graphs with proper scaling, the difference between the scale units of thousands (1,000s) and of millions (1,000,000s) is quite vast. However, in graphs with no scale, the difference is relatively the same. In the case of graphs used to represent financial variables, proper scale of the data needs to be presented otherwise, novice investors might form wrong perceptions on a company's performance leading to making wrong investment decisions [Beatties et al., 2008; Hines, 1988]. Note that distorted graphs were found increasing as the ASEAN Trading Link community becomes more mature.

When comparing across the three markets, the number of distorted graphs in BM (Malaysia) was the highest, almost three times more than the other two markets, SET (Thailand) and SGX (Singapore). One possible explanation is that BM is a growing market with political stability, a favorable condition for investment decisions. SET, on the other hand, has gone through almost a decade of political ups and down since the 2006 coup. With political crises, anti-government protests, and constant changes of government, investment prospects of the country are uncertain. Listed companies in the Thai market have tried their best to show their transparency and good governance in the hope of attracting foreign investment as well as to boost the whole capital market. With the smallest number of graphs collected in SET, the proportion of misleading and inappropriate graphs is inevitably smaller than those from BM. The SGX market is the most mature and well known worldwide. The regulatory environment governing this capital market is quite stringent, and transparency and good governance are de facto standards of financial reporting since its Code of Corporate Governance was initiated in 2001 http://www.mas.gov.sg/regulations-and-financial-stability/regulatory-and-supervisory-framework/corporate-governance/corporate-governance-of-listed-

companies/code-of-corporate-governance.aspx. Thus, the proportion of inappropriate design to well-designed is the smallest across the three markets despite the largest number of graphs being collected in this study.

Revenue and Assets are the two most frequently variables depicted as graphs across all markets, which is similar to findings in western countries [Beatties and Jones, 2001]. The average firm-year misled graph depiction of the five out of eight financial variables differed between markets. No apparent pattern was detected thus, further investigation is needed to understand why certain data are more prone to distortion than others. All in all, there remains a limited number of empirical studies in the emergent economies. It is hoped that this research can contribute to reducing this trend while contributing to international annual reporting literature. As Penrose [2008] put it, more information about other countries' distortion practices beside Europe and Central America, in this case Southeast Asian countries, is needed. Thus, future research using graph distortion measurements like GDI and RGD should be conducted on the annual report graphs in ASEAN markets.

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