CARBON EMISSION DISCLOSURE AND THE COST OF CAPITAL: AN ANALYSIS OF MALAYSIAN CAPITAL MARKET

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ABSTRACT

The main purpose of this study is to examine the relationship between voluntary disclosure and cost of capital by exploring the impact of voluntary carbon emission disclosure (VCED) on the firm's weighted-average cost of capital. A carbon disclosure index is used to evaluate the quality of carbon emission disclosure in 2013 and 2014 annual reports of 247 Malaysian public listed companies. By using content analysis, the result highlights a significant increase in the level and quality of carbon emission disclosure practice from 2013 to 2014. In addition, the finding from regression analysis indicates insignificant relationship between VCED quality and weighted-average cost of capital. Overall, our findings suggest that the carbon emission disclosure is still low, as such, the quality of VCED do not have an impact on firm's cost of capital. The results of the study allow the government to measure progress toward achieving its target to reduce carbon emission and will add weight to the call by accounting regulation body such as Malaysian Accounting Standard Board for a specific standard on carbon reporting.

Keywords: Climate Change, Carbon emission disclosure, Cost of Capital, CAPM, WACC

INTRODUCTION

Climate change is becoming one of the most important issues of the twenty-first century (Peng, Sun and Luo, 2015) and it is widely recognised as the most significant environmental issue facing the global economy (Freedman, Park and Stagliano, 2015; Renukappa, Akintoye, Egbu and Goulding, 2013). Majority of the scientist agreed that carbon emissions (CO_2) is the most prominent factor responsible for climate change (Solomon et al., 2009). A serious threat of climate change and CO_2 emission on the environment (Freedman et al., 2015), people (Al-Amin, Jaafar and Siwar, 2010) and business (Besio and Pronzini, 2014) are already observable. Evidence does suggest that the failure of the business to manage these impacts can expose them to considerable risk (Linnenluecke, Birt and Griffiths, 2015). Nowadays, many businesses aware and accept that they need to address the issue of climate change in order to survive (Renukappa et al., 2015).

Concerns about emissions have prompted the participants in capital markets, both shareholders and creditors to incorporate carbon-related considerations in their risk analysis to assess investment options and lending decision. Taking into this consideration, there is a growing

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demand for business to publicly report information about their climate change-related business practices (Global Reporting Initiative and KPMG 2007) and it is expected that firms will report this issue in a comprehensive, transparent, and accountable manner (Belal et al., 2010).

Although, there is a demand from investors for the disclosure, a relatively little evidence exists as to the impact voluntary disclosures have on financial markets (Bachoo, Tan and Wilson, 2013). In fact, the benefit from increased disclosure via a lower cost of capital remains a controversial issue among managers, policy makers as well as researcher (Souissi and Khlif, 2012). Much of the previous and current research closely examined the relationship between financial disclosure and cost of capital. In recent years, academic researchers have increasingly investigated the impact of voluntary disclosure on cost of capital. Nevertheless, most of the previous studies in this area have concentrated on environmental disclosures. There is still a lack of substantial empirical evidence on the association between carbon disclosure and cost of capital. One of the reasons is that, carbon emission disclosure is largely voluntary in certain country and unregulated nature of carbon emission disclosure has led to substantial managerial discretion in terms of disclosure choice and content (Merkl-Davies and Brennan, 2007). This motivates us to fill the void by examining the impact of carbon disclosure on firm value from the perspective of cost of capital, particularly in Malaysia. Malaysia provides a good setting to investigate the relationship between VCED quality and cost of capital. Malaysia is among the countries vulnerable to the adverse impacts of CO_2 emissions and has well developed capital market (Embong, Mohd-Saleh and Sabri Hassan, 2012). The raising population reaching approximately 27 million has ranked Malaysia the 26th largest greenhouse gas (GHG) emitter in the world (Murad, Molla, Mokhtar and Raquib, 2010). This posed a great challenge to Malaysia since the growth rate of GHG emissions seems likely to increase rapidly and become a threat to the environment and Malaysian economy.

The aim of this study is to assess the quality and the trend of carbon disclosure of 247 Malaysian public listed companies. Additionally, by using regression analysis, this study aims to examine the potential impact of carbon disclosure on the cost of capital of these companies. This study contributes to the extent literature by provide empirical evidence between the voluntary disclosure and cost of capital literature by focusing narrowly on carbon disclosure and the weighted-average cost of capital.

The findings of this study have several important policy implications. First, through carbon reporting practices of Malaysian companies, it allows the government to measure progress toward achieving its target to reduce carbon emission. Second, the result of the study also will add weight to the call by accounting regulation body such as Malaysian Accounting Standard Board for a specific standard on carbon reporting. Without the use of a defined reporting standard, the credibility of a company's reporting will probably be at stake.

The remainder of this paper is organised as follows: The following section synthesises relevant literature and develops the research hypotheses. Section 3 elaborates on the research design and Section 4 reports the empirical result. The final section summarises the study.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

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Corporate disclosure is potentially a vital tool of communication between a firm's management and outside investors. Signaling theory is suitable in explaining the behavior of individuals or organization when have access to different information (Connelly, Certo, Ireland and Reutzel, 2011). The sender of the information typically determine whether and how to communicate (or signal) the information, whereas the receiver need to determine how to interpret such signal (Connelly et al., 2011). Signaling theory posits that, if the party with superior information signals to others, information asymmetries can be reduced (Bazine and Vural, 2011). This theory assume that managers have superior information as compared to outside investors on companies' expected future performance, even with the assumption of an efficient capital market, and managers may enhance the quality of their financial reporting by voluntarily providing additional disclosures (Healy and Palepu, 2001).

The impact of disclosure on cost of capital has been investigated in recent years by several theoretical and empirical studies. The effects of voluntary disclosure on the firm's cost of capital are mixed. One stream of analytical research suggests that information might have a negative value as the investors may perceive themselves to be worse off if they consider that the firm is disclosing information which might be exploited to their detriment (Hassan, Romilly, Giorgioni and Power, 2009). Additionally, as the firms are required to release their emission information, this will produce more uncertainty about the value of the equity. In such circumstances, equity owners have to require higher rates of return on these firms. Thus the cost of equity of these companies will be increased.

The other stream of research provides empirical results on the disclosure which are generally consistent with finance-theory predictions in which more public information enhances firm value by reducing the firm's cost of capital. It is found that the voluntary disclosure can improve investor base, which in turn improved risk sharing and decrease the firm's cost of capital. As consequences, the disclosure provides investors with better opportunities to assess the prospects of the company.

Richardson and Welker (2001) examined the influence of social disclosure on cost of capital of Canadian firm and reported a positive and significant relationship. Lambert, Leuz and Verrecchia (2007) investigated the direct and indirect effects of disclosure quality on the cost of capital and conclude that the direct effect occurs because higher-quality disclosures affect the firm's assessed covariance with other firms' cash flows which attributed to a reduction in the estimation of information risk. Further, Li and Yang (2011) also suggested that greater voluntary disclosure is associated with lower market cost of capital. In Malaysia, Embong et al. (2012) examined the relationship between disclosure and cost of equity of firm listed on Bursa Malaysia for the year 2004-2006. Based on 675 observations, the author found that significant negative relationship between disclosure and cost of equity, indicated that higher disclosure is good for the market and the economy in general.

With regard to environmental and carbon emission disclosure, Plumlee, Brown, Hayes and Marshall (2015) investigated how quality of voluntary environmental disclosure is related to the firm value. The author used cost of capital and future expected cash flows as the proxy of firm values and found a positive association between both variables. Dhaliwal, Li, Tsang and Yang, (2011) found that environmental disclosure reduced asymmetry and uncertainty, thus decrease cost of capital. Most recently, Bonetti, Chi, Michelon and Tanaka (2013) found that firm that providing more precise, verifiable and hard environmental information on CO_2

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emissions levels experience a less severe shock to the cost of capital than the firms that not providing such information. Consistent with signaling theory and these studies, the following hypothesis is developed lower market cost of capital.

He, Tang and Wang (2013) also found evidence on the inverse association between cost of capital and carbon disclosure, which is consistent with voluntary disclosure theory. By analyzing firms that participated in the Carbon Disclosure Project (CDP) in 2010, the author concluded that firms make a rational choice in exhorting the voluntary carbon disclosure in reducing the pressure exerted by legitimacy threats and to lower the cost of capital.

H1: There is a negative association between the quality of voluntary carbon emissions disclosure and the cost of capital.

SAMPLE SELECTION AND DATA COLLECTION

Sample Selection

All companies listed on main market of Bursa Malaysia as at 31 December 2014 is select as a population of the study. The final sample comprises 247 observations of annual report disclosure for the year 2013 and 2014 after remove those firms belonging to the finance and insurance sectors and companies with unavailable annual reports and data. Data on carbon emission disclosure is extract using the content analysis method from the annual reports of these companies. Content analysis is utilised since it has been commonly used in the areas of climate change, GHG and carbon emission disclosure. It is defined as "a research technique for making replicable and valid inferences from text (or other meaningful matter) to the contexts of their use" (Krippendorff, 2004). To search for the carbon related information in the annual report of these companies, the keyword outlined by previous researcher is be used. The annual report is choose as the medium of reporting because it is the most likely place that stakeholders and parties interested in environmental disclosure (carbon emission is part of it) would seek and obtain information. For cost of capital data, the information is collected from the Bloomberg and Thompson DataStream.

Dependent Variable

As for this study is concerned, the weighted-average cost of capital (WACC) will be used as the measurement for firm's cost of capital. According to Modigliani and Miller (1958), the firm's overall cost of capital was computed based on weighted average of the cost provided for each capital's components used by the particular company. Acquainted as WACC, it's practically used in assessing the firm's cost of financial structure. Thus, adopted from Modigliani and Miller (1958, 1963), the cost of capital WACC of a firm after corporate taxes (but before personal taxes) is given by the formula as below:

$$WACC \ = \frac{D}{V}\left(1 - T_C\right)r_d + \frac{E}{V}.r_e \tag{1}$$

The equations denotes Vas representation for the market value of the firm; D as the market value of debt while E is the market value of equity. In addition, Tc represents the corporate tax imposed to that company; r_d is the cost of issuing the debt; while r_e is the cost of equity.

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To quantify the market value of the debt (D), its equal to the number of bonds outstanding multiplied by the current market price of the bond. While, the total market value of the common stock (E) is equal to the current market price of one share of stock multiplied by the number of shares outstanding. Both total market value of bonds and the total market value of common equity will be add in calculating the total market value of the firm (V). The cost of debt is the yield to maturity of the current price of the bonds relative to the expected future coupon payments and the face value of the bond at maturity. Followed Modigliani and Miller (1958), we will used the cost of debt by estimate the yield to maturity by using firms current bond rating provided by Rating Agency of Malaysia (RAM).The cost of equity r_e can be estimated using expected required return based on Capital Asset Pricing Model (CAPM) framework developed by Sharpe (1964). The equation can be displayed as follows:

$$R_e = R_F + \beta_a \ (R_M - R_F) \tag{2}$$

Where, β_a is the company's beta; R_F is the risk free rate and R_M is the market risk. Beta was used to measure the systematic component of risk for the common stock. It was calculated as the slope coefficient of the characteristic line, and also can be expressed as:

$$\beta_a = \frac{\mathrm{Cov}(r_a, r_p)}{\mathrm{Var}(r_p)} \tag{3}$$

Where r_a measures the rate of return of the asset, r_p measures the rate of return of the portfolio, and Cov (r_a,rp) is the covariance between the rates of return.

Independent Variable

The quality of voluntary carbon emission disclosure (VCEDQ) is computed based on hand-collected data for the fiscal year 2014 annual report. Although the firms have an alternative way to present corporate information, annual report is one of the main resources of corporate information and the most likely place that stakeholders and parties interested in environmental disclosure (carbon information is part of it) would seek and obtain information.

This study employs content analysis as it is widely used in the studies in the areas of climate change, GHG and carbon emission disclosure. The content analysis index developed by Choi, Lee and Psaros (2013) is employed in this study to measure the quality of voluntary carbon emission disclosure. The author has constructed the checklist based on the factors identified in information request sheets by the Carbon Disclosure Project (CDP). The index consists of 18 disclosure items related to 5 areas of information. All items are treated as equally important and assigned the weights of 0 to 1 to the items disclosed. A dichotomous variable has been used to identify items that can appear in the firm's annual report. As such, 1 is awarded if the firms disclosed information related to the items and 0 is otherwise. The score was then divided by the total number of items included in the information checklist (18) to achieve the overall reporting quality score.

Control Variables

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To control for the effect of other determinants of the cost of capital, we employed firm characteristics variables such as company size, leverage, profitability, market to book to book value and capital intensity. These variables are used as they are consistently found to be related to cost of capital and significant determinants of cost of capital (Jung, Herbohn and Clarkson, 2014).

$SIZE_t$ = Firm size, measured as the natural log of total assets in year t

LEV_t = leverage, measured as total debt divided by total assets in year t

ROA_t = profitability, measured as earnings before interest and taxes divided by of total assets in year t value of debt, divided by total assets in year t

MB_t = market-to-book ratio, measured as the market value of equity plus the book

CAP_INT_t = capital intensity, measured as capital expenditures divided by sales revenues in year t

Empirical Model

The study predicted that cost of capital is influenced by quality of VCR. Thus, the models for this study are presented as follows:

$$WACC = \beta_0 + \beta_1 VCEDQ + \beta_2 LnSIZE + \beta_3 LEV + \beta_4 ROA + \beta_5 MBV + \beta_6 CAP\_INT_t \; \varepsilon$$

WACC is firm's cost of capital; VCEDQ is the quality of voluntary carbon emissions reporting; FSIZE is the natural log of total assets; LEV is the ratio of total debt to total assets ROA is the ratio of return to total asset; CAP_INT is the ratio of capital expenditure to sales revenue and ε is the estimate error.

RESULT AND INTERPRETATION

Descriptive Analysis

Table 1epresents the findings on the number of reporting companies from year 2013 to 2014. Overall, it is found that there is an increase of number of reporting companies in 2014 as compared to 2013. The result indicates that 53% of the total companies in 2014 have disclosed their information on carbon emission while only 35% of the total companies disclosed such information in 2013.

Table 1: Number of reporting company

	2013	2014
Number of disclosing companies	86	131
Number of non-disclosing companies	161	116
Total	247	247

Table 2 reports descriptive analysis for variables used in this study. The mean WACC estimate is 7.6079 in 2013 and 7.2869 in 2014. The finding in Table 2 reveals that the quality of

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reporting is relatively low with an average score of 3.7120% in year 2013 and to 5.8287% in year 2014.

Table 2: Descriptive Statistics of Variables

	2013				2014			
	MEAN	STD DEV	MIN	MAX	MEAN	STD DEV	MIN	MAX
WACC	7.6079	2.4229	1.7013	16.8164	7.2869	2.45351	1.6903	19.7688
VCEDQ	3.7120	7.1088	0.00	50.00	5.8287	8.50581	0.00	57.14
SIZE	2271855	8431486	9980	99999300	2328364	8738939	28322	1110000000
LEV	0.37887	0.1941	0.0062	0.9835	0.3777	0.1977	0.0059	1.4604
ROA	3.9345	8.94078	-38.85	58.32	3.6953	11.2965	-59.59	67.70
MB	1.9328	5.31699	.08	58.34	1.7530	5.2637	-0.3522	69.9157
CAP_INT	-0.1002	0.2270	-1.9427	-0.0001	-0.1036	0.3319	-0.5213	-0.0009

Nevertheless based on paired samples test shown in Table 3, there is a significant increase in the quality of voluntary carbon emission disclosure from 2013 to 2014. Consistently, the maximum disclosure as in Table 2 is slightly increased to 57.14% as compared to only 50% in 2013. The increase is might be due to increase in the companies' awareness on the environmental issue particularly on carbon emission.

Table 3: Two paired sample t-test

	COEFFICIENT	T-STAT	P-VALUE
VCEDQ		-3.249	0.001

Correlation Analysis

Since the data in not normally distributed, the Pearson product-moment correlation is used to quantify the severity of multicollinearity in model selected. The correlations between the variables were reported in Table 4 and Table 5 for year 2013 and 2014 respectively. The correlation results indicate there is no problems of multicollinearity within the selected variable since the correlations were relatively low for both years. Gujarati (2004) illuminate that multicollinearity problems exist when the correlations value exceeded 0.80. The correlations results for WACC signify negative coefficient with LEV (-0.337); positive significant coefficient with ROA (+0.253); and MBV (+0.357) all at 5 % significant level for the year 2013. The correlations results for the year 2014 also exhibit the same relations as the previous year. The correlations results for WACC signify negative coefficient with LEV (-0.281); positive significant coefficient with ROA (+0.267); and MBV (+0.331) all at 5 % significant level.

Table 4: Pearson's Correlation of Variables for the year 2013

	WACC	VCEDQ	SIZE	LEV	ROA	MBV	CAP_INT
WACC	1.000						
VCEDQ	.044	1.000					
SIZE	.102	.043	1.000				
LEV	-.337**	.059	.219**	1.000			
ROA	.253**	.020	.309**	-.168**	1.000		
MBV	.357**	.007	.194**	.119	.462**	1.000	
CAP_INT	-.045	-.041	-.221**	-.038	-.065	-.211**	1.000

Table 5: Spearman Correlation of Variables for the year 2014

	WACC	VCEDQ	SIZE	LEV	ROA	MBV	CAP_INT
WACC	1.000						

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VCEDQ	.051	1.000				
SIZE	-.026	.139**	1.000			
LEV	-.281**	.048	.312**	1.000		
ROA	.267**	.160**	.254**	-.200**	1.000	
MBV	.331**	.195**	.148**	.066**	.426**	1.000
CAP_INT	-.116	-.039	-.281**	-.069	-.139**	-.204**	1.000

Particularly, there is no rule in determining the strength of association to particular values towards the magnitude of the Pearson's correlation coefficient. Hitherto, there are some general guidelines provided by Cohen, Cohen, West and Aiken (2003) indicating a coefficient with $r < 0.3$ does indicates a small coefficient; while coefficient's in range of $.3 < |r| < .5$ indicates medium or moderate correlation as exhibit by the of correlations' result in Table 4 and 5. Though the estimated correlation coefficient does indicates positive and negative correlated within the variable selected however it still considers low; therefore, it is not large enough to cause any concern in the regression model.

Multiple Regressions Analysis

To test the hypothesis that firm's level of WACC is a function of six tested variables which are VCEDQ, SIZE, LEV, ROA, MBV and CAP_INT, the multiple regression analysis was performed using 247 observations for the year 2013 and 2014. The results of the regression analysis provided in Table 6 do conveyed the confirmation for the research hypothesis for both years. For year 2013, the WACC signify positive significant relations with SIZE (+2.480) and MBV (+3.078) at 5% and 1 % significant level respectively. While for leverage ratio (LEV) the coefficient value indicating negative significant relations with cost of capital (-6.845) and (-4,454) at 1 % significant level respectively for year 2013 and 2014. This in line with the study done by Li et al. (2014) which reports leverage is negatively and significantly associated with the cost of debt.

Yet the quality of VCED towards cost of capital cannot be confirms in this study since the results for VCEDQ for both years are insignificant. This results are contradict towards a few study done on these issue (i.e; Bonetti et al. 2013; He et al., 2013, Lambert et al., 2007; Li et al., 2014 and Plumlee et al. 2015) which reported a significant relations with cost of capital. Nonetheless, most of the study used separate indictor for each cost of obtaining the capital which are cost of debt and cost of equity instead of the weighted cost of both debt and equity's capitals as per current study. From the Malaysian experience, the finding of the current study fails to confirm significant relations between the VCED quality with cost of capital.

Table.6. Multiple Regressions

	2013			2014		
	COEFFICIENT	**T-STAT**	**P-VALUE**	**COEFFICIENT**	**T-STAT**	**P-VALUE**
Constant		5.051	.000		6.167	.000
VCEDQ	.022	.378	.706	.025	.405	.686
SIZE	.154	2.480	.014*	.023	.350	.726
LEV	-.433	-6.845	.000**	-.315	-4.454	.000**
ROA	-.011	-.153	.878	.084	1.130	.259
MBV	.213	3.078	.002**	.065	.894	.372
CAP_INT	-.005	-.080	.937	-.086	-1.314	.190
R Square			0.185			0.105

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Adjusted R Square	0.165	0.082
F statistic	9.109	4.669
Anova	0.000	0.000

Even so, the ANOVA results thus support hypotheses 1 as depicted in Table 6, the F statistics is substantiated at the 1% significant level for year 2013 (9.109) and 2014 (4.669). Thus entail the null hypotheses that the regressions coefficients are all zeros can be rejected at 1% level of significant. Consequently denoting that the estimated regressions for hypotheses 1 is efficient for predictions, and the hypotheses can be accepted. Indicating that there are associations between selected variable with cost of capital for listed companies in Bursa Malaysia is concern.

CONCLUSIONS

This study focuses on the relationship between the quality of voluntary carbon emission disclosure and weighted cost of capital. Overall this study concludes that the voluntary carbon emission disclosure in Malaysia is still low, as such, the quality of carbon emission disclosure do not have an impact on firm's cost of capital. However, the result of the study shows a significant increase in the level and quality of carbon emission disclosure practice from 2013 to 2014. This indicates that level of awareness on carbon emission reporting among companies in Malaysia has increased between those years. The results of the study allow the government to measure progress toward achieving its target to reduce carbon emission and will add weight to the call by accounting regulation body such as Malaysian Accounting Standard Board for a specific standard on carbon reporting.

The findings of the study should be interpreted in light of several limitations. Firstly, only two year of observations are considered in the current study. Thus, it would be interesting to conduct a longitudinal study which involves more than two year of observation as it may help to trace the trend of carbon emission disclosure and the impact towards firms' cost of capital. Secondly, the study focuses merely on the quality of carbon emission reporting. In addition, the aspects focus in this study is quite limited and the area focus should be extended to cover wider aspects in the annual report. Lastly, it would be interesting for future research to consider the development of a comprehensive framework, as to assess the quality of corporate governance and examine its influence on voluntary disclosure of carbon emission.

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