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On carbon emission reduction and firm performance: example from 3M Company

Abstract

Recent research indicates apparent business scepticism about the business benefit in carbon reduction. This paper examines the relationship between carbon emission reduction program of 3M Company and its performance (represented by dividend per share). Using the least square multiple regression statistics, findings from the test indicate a significant relationship between carbon emission reduction of 3M Company and its dividend per share within the years studied, indicating that, against apparent business concern, 3M's carbon reduction contributed significantly to improve its dividend per share (within the years studied). The paper thus concludes it is likely that some companies may experience enhanced dividend per share if engaged in a carbon reduction program. The paper suggests that further studies on the effect of emission reduction on firm performance should use single cases as this may possess greater propensity to show clearer result.

Keywords: carbon emission reduction, dividend per share, green business, firm performance, profitability, energy efficiency.

JEL Classification: M11, M41.

Introduction

The global campaign for reduction of greenhouse gasses (GHGs) has been met with resentment and apathy from some corporate empires around the world. This seeming lethargy on the part of corporations in the face of carbon reduction exigency may perhaps be understandable from the point of natural obsession often experienced by humans regarding adaptation to change; thus O'Donovan and Roode (2002) posit that change is imbibed gradually via a learning process. However, often certain learning and adaptation processes take time; but sadly the cost of delay (especially regarding carbon emission) may be huge and irrecoverable. The contemporary global campaign for carbon reduction emanated strongly from the Kyoto Protocol that specified the urgency for the emission reduction of six greenhouse gasses (GHGs) (UNFCCC, 2011), and emphasized that, given the involvement of business, carbon emission reduction is one aspect of desired corporate environmental responsibility. However, it appears that in the absence of regulations, most firms are reluctant to green their business processes by investing in carbon reduction operations. Perhaps the phobia about and apathy toward carbon reduction has contributed to what is regarded as 'climate change denial'— a climate change rebuttal scheme being employed by some business titans to weaken public policies regarding carbon regulation. Such negative business posture toward carbon reduction mimics the capitalist conception of the corporate goal, popularized by Milton Friedman, as being solely one of profit. Hence, some businesses fear that the seeming capital intensive nature of carbon emission reduction may result in depletion of corporate capital and reduce profitability (The Economist, 2011). This attitude seems like a cancer that cor-

rodes corporate motivation regarding carbon reduction. It has therefore become apposite to redress this by finding practical evidence to show that, against popular fear and belief that investment in carbon emission reduction may erode corporate capital and/or profitability, there may be potential gain accruable from corporate carbon reduction efforts. Hence, the major question that motivates this paper is: could corporate carbon emission reduction impair or improve corporate performance?

The objective of this paper is, therefore, to use a single case of 3M Company and provide evidence that corporate carbon emission reduction may contribute to improve firm performance. This paper is significant considering the current reports indicating that global warming is escalating (The Guardian UK, 2011a), possibly because desired action to curb GHG emission has not taken off commensurably on the part of the corporate sector. Hence, in the absence of binding carbon emission regulation, research results of this nature that provide evidence of potential corporate benefit from GHG reduction may galvanize some corporate interest in venturing into GHG reduction efforts. Findings from this paper indicate that firms should not engage resentfully in emission reduction projects to comply merely with regulations; they should also be driven by the incentive that such green efforts hold potential for corporate wellbeing. Whilst there is an abundance of research on the impact of environmental responsibility on firm performance; research focussing specifically on the role of carbon emission reduction on corporate financial performance is limited. This paper is, therefore, an attempt to make a modest contribution that encompasses the carbon reduction debate and corporate performance. Overall it strives to persuade firms not to regard emission reduction distastefully and adopt an obligatory stance, but to view it from the perspective of a profitable invest-

ment that also positions the corporation as a climate friendly firm and thus engenders a positive corporate image.

The rest of the paper proceeds as follows: the next section provides a brief conceptual framework; this is followed by a review of related literature. Following this, the next section presents the case of 3M Company's carbon reduction effort and the impact thereof on its performance. The final section draws conclusions.

1. Conceptual framework

This section presents brief overview of the two major concepts within the context of this case study. It begins with the concept of corporate carbon emission; this is followed by the second concept – dividend per share.

1.1. Corporate carbon emission reduction. Corporate carbon emission reduction is only one aspect of contemporary corporate environmental responsibility. The 3rd Conference of Parties (COP3) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Kyoto Japan resulted in the popular Kyoto Protocol that set binding targets for 37 industrialized nations and the European Community for reduction in greenhouse gasses (GHGs) (UNFCCC, 2011). The Protocol recognized six GHGs as most crucial for targeted reduction; these gasses are: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆) (WRI and WBCSD, 2011). Although the gasses number six, carbon dioxide has occupied the center stage of the GHGs orchestrated by the priority accorded to it by carbon trading schemes such as the European Union (EU) and the United Kingdom (UK) Emission Trading schemes. In this paper, carbon and GHG are used interchangeably given that corporate emission of carbon is often associated with emission of other Kyoto GHGs and non-Kyoto GHGs. For instance, 3M Corporation's report of GHG emission has the inscription "Million metric tons of CO₂ equivalent emissions (including Kyoto and non-Kyoto gases) (3M Company, 2011a, p. 20).

Despite the delay in the official capping of GHGs, some corporations around the world such as 3M Company regard GHG emission reduction as one of corporate moral and environmental responsibility with the view that 'safe climate is sound business' (WRI and WBCSB, 2011). There are different levels or scopes of corporate carbon and/or GHG emission. Consequently, a corporate effort toward GHG reduction starts by knowing and classifying corporate GHG inventory scopes (WRI & WBCSD, 2002). The GHG Protocol recognizes three categories of corporate GHG emission scopes: Scope 1 –

direct GHG emissions: these comprise corporate GHG emissions that emanate directly from corporate facility operations or services. Scope 2 – electricity indirect emissions: these are GHG emissions that result from corporate usage of purchased electricity; and Scope 3 – other indirect GHG emissions: these are corporate GHG emissions arising from corporate usage of outsourced services, materials and goods (WRI & WBCSD, 2002). Consequently the above categorization enables corporations to account for its GHG footprint and to engage in emission reduction efforts along different scopes of chain of operations and/or services. A leading global accounting tool or standard is the World Resources Institute and World Business Council for Sustainable Development GHG Protocol Accounting Standard. This protocol has been adopted by the International Organization for Standards in its 2006 "*ISO 14064-1: Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals*" (WRI and WBCSB, 2011, p. 1; ISO, 2011). In the absence of legally binding capping of CO₂, contemporary corporate carbon reduction efforts such as in 3M Company have been voluntary.

1.2. Firm performance. Strategic management literature affirms that it may be difficult to obtain an objective and reliable single measure of firm performance (Dess and Robinson Jr., 1984) mostly because of complex interactions surrounding corporate governance architecture and financial and marketing processes. However, despite the existence of numerous measures of firm performance, to focus this paper within the context of the aforementioned objective, dividend per share will be used to examine the performance of 3M over the nine years of study. This approach distinguishes this paper from previous studies because, whilst these have used other popular measures of performance such as ROI, ROE, ROA and ROS; none of these studies has used dividend per share; hence this paper attempts to adopt a different stance from previous research by looking at the possible relationship between GHG emission reduction and dividend per share. The choice of dividend per share is motivated by the apparent capitalist ideology that the objective of the corporation is to maximize profit in order to convince the shareholders that the firm is still worth investing in; and such profit culminates to enhance the shareholders' wealth which may be visible via dividend payments which enhance the market price of corporate stock. Correia et al. (2011) give practical illustrations of companies whose failure to pay dividend led to the plummeting of their corporate stock price which thus scared investors. It therefore means that, whether the concept of dividend is approached from the perspective of dividend relevant

or irrelevant theories, the summary of the theoretical arguments is that dividend payment policy affects both the investment and finance decisions of the firm and thus affects the firm's value and shareholders' wealth. Dividends paid to shareholders increase their wealth and thus create opportunities for investors to reinvest more into the profitable firm or to diversify their investment outside the firm. Overall the good news of firms' ability to pay dividend dovetails to enhance the stock value of such firms in the market. The importance of dividends in a firm's value informs the corporate dividend regulations of many countries regarding what is considered the 'solvency and liquidity test'. The implication is that a firm can only pay dividend on condition that it passes both the solvency and liquidity test; for some countries, including the USA, the firm must pass the liquidity test before payment of dividend. For some others including *inter alia* Australia, South Africa, New Zealand and Canada, the firm must pass both the solvency and liquidity tests before payment of dividend (see e.g. Allens, 2010; PWC, 2009).

Thus, if dividend payment can be restricted to corporate solvency and/or liquidity competence, it can therefore be assumed that corporations that are consistent in paying dividend may be regarded as performing well and are thus financially healthy. Whilst the solvency test measures a firm's ability to meet long-term obligations, the liquidity test is a measure of a firm's ability to meet short-term obligations; consequently, whether a country adopts the solvency test, or liquidity test, or both as prerequisite condition for payment of dividend, it is a fair measure of corporate financial health.

Hence, since dividend is relevant to both firm value and shareholders' value, this paper uses dividend payment to examine the performance of 3M Company for nine years of its involvement in GHG emission reduction and energy efficiency. This paper differs from others in that none of the previous studies regarding GHG emission and firm performance has used dividend per share and none has examined GHG emission and firm performance using a single case study.

2. Related literature

Related empirical research that seeks to establish a possible relationship between emission reduction and firm performance includes Nishitani et al. (2011) who examine the impact of pollution emission reduction on increase in sales. Their findings reveal that firms that reduce their pollution emissions may boost their economic performance through increased demand for their products that also results in enhanced productivity (Nishitani et al., 2011). Similarly, Pogutz and Russo (2009) drew a sample from the Global Fortune 500

index and, using the least square regression for the periods 2002 to 2005 found a significant short-term relationship between environmental performance and financial performance as measured by return on asset (ROA), return on sales (ROS) and return on equity (ROE). In a related study Smale et al. (2006) examine the impact of European Union CO₂ emissions trading on the sales volume and profits of the UK firms for a period of three years (2004–2006); their findings indicate profit potential for some of the firms that engage in carbon trading scheme. Similarly, Hart and Ahuja (1996) examine the relationship between emission reduction and firm performance using ROS, ROA and ROE; their findings show that emission reduction reflects positively on the bottom line within one to two years of engagement in emission reduction. They conclude that positive impact on operating performance (ROS and ROA) may occur within the next one year, whilst positive impact on financial performance may take up to two years. Ziegler et al. (2009) examine the effect of corporate climate change activities on stock performance. By applying the flexible Carhart four factor model based on the capital asset pricing model, their finding on portfolio analysis shows a negative relationship over the periods 2001 to 2006. In a similar study, using carbon management as measurement Busch and Hoffmann (2011) find a negative relationship between carbon management and financial performance. In their research on the effect of voluntary corporate environmental initiatives on shareholder wealth, Thorburn and Fisher-Vanden (2011) find that corporate engagement in voluntary greenhouse gas emission reduction weakens corporate value. Such findings should not dissuade willing corporations from pursuing carbon and energy reduction manufacturing and service operations for the reason that even if reduction in firm value may occur due to greening business processes, it may occur within the short-term period, possibly due to invested capital that may not be recoupable within the first or second year of investment in carbon reduction or energy efficient programs (see e.g. Hart and Ahuja, 1996). However, this experience may not be the same for all firms as corporate structures and governance systems differ. Contrary to this finding, Paton and Elsayed (2005) reached a surprising conclusion that environmental performance has a neutral effect on corporate performance.

In an attempt to resolve these conflicting findings, Schaltegger and Synnestvedt (2002) present a model between green and economic performance; in conclusion, they argue that it is not necessarily the level of environmental performance that may realize economic success, but that it is the type of environmental engagement that may yield economic success. The implication of this may be that certain environmental management engagements may yield more economic results than others; thus the cheapest form of green

environmental adherence may not produce desired firm success. Instead environmental challenges that are in vogue and most pressing, such as carbon emission reduction and energy efficiency may yield better and faster economic success. Consequently this paper attempts a modest adherence to the Schaltegger and Synnøestvedt (2002) recommendation by focussing attention on the relationship between corporate carbon reduction and dividend per share using a single case of 3M Company. The concluding remarks by Hart and Ahuja (1996, p. 35) that “results may be more significant for particular industries” would seem to support this focus on the case of one industry; hence it becomes pertinent to examine a particular case to verify this statement.

3. GHG emission reduction and energy efficiency in 3M Company

3M is a multinational company with its global headquarters located in Minnesota where it was originally founded in 1902 by “five industrious and tenacious northern Minnesota businessmen with diverse occupations” (3M Company, 2011b). It manufactures over 55,000 diversified technology products (US Department of Energy, 2011). 3M’s environmental penchant became apparent in the 1970s when environmental consciousness was not a matter of concern for many firms around the world. Spurred on by an operating environment that was limited by the energy shortage in the 70s, 3M has since 1973 proactively developed a state of the art energy efficient program that has led to over 80 per cent improvement in energy use (US Department of Energy, 2011).

Despite seeming climate change denial and apathy by some corporations and the existing lack of global agreement on capping of corporate GHG, 3M Company has distinguished itself by assuming a committed climate response action through voluntary GHG emission reduction in all its global branches (3M, 2011a). According to 3M’s 2011 sustainability report, it has reduced its worldwide absolute GHG emissions by 72 per cent (3M, 2011a, p. 19). The company has been able to achieve this climate friendly feat by investing in assorted renewable energy options and through energy conservation. For instance, 3M’s Perth, Canada plant began installing a 2000 square feet solar wall in 2006 which is expected to replace 329 million British Thermal Unit (Btu) of electricity each year; similarly in the United States, at the Texas branch, 3M has engaged in a wind energy option since March 2001 by purchasing the equivalent of 1,250, 000KWh wind electricity which, according to 3M, is equal to 13 per cent of the branch’s annual energy use (3M, 2011a). In addition, 3M is also engaging in on-going product carbon foot-printing which includes innovations in assisting consumers to reduce personal environmental foot-printing (3M, 2011a). Furthermore according to

3M “energy efficiency is an important part of reaching our GHG reduction goals” (3M, 2011a, p. 22). 3M’s energy efficiency program includes, amongst others, employee programs on efficient use of existing facilities, life cycle management, new product development, use of Six Sigma methodology and constant innovation on alternative sources of energy (3M, 2011a).

4. Methodology

This section attempts to establish a possible relationship between GHG emission reduction and 3M’s performance. Performance is measured by dividend per share for a period of nine years that corresponds with the sustained program of worldwide emission reduction in 3M Company. Data for this study was captured from the 3M’s 2011 Sustainability Report. The least square regression model is used to measure the strength of prediction of the dependent variable (dividend per share: Y) by the independent variable (GHG emission reduction: X_1).

4.1. Control variables. Since the emergence of Miller and Modigliani (M&M) (1961) theory of irrelevance of dividend under perfect capital market; the issue of corporate dividend policy has been controversial. Hence there seems to be no generally agreed single determinant of dividend (Amidu and Abor, 2006; Anil and Kapoor, 2008). However previous researchers have looked at the impact of the following variables on dividend payment: profit (earnings), tax, cash flow, firm’s beta, sales growth, market to book ratio (Rozeff, 1982; Anil and Kapoor, 2008; Correia et al., 2011; Mehta, 2012).

In this analysis the following control variables are included:

- ◆ Cash flow ($Cflo$).
- ◆ Earnings before interest and tax/total assets ($EBIT/TA$).
- ◆ % of earnings paid out as tax ($Tax/PBIT$).
- ◆ Sales growth.

The Regression equation:

- ◆ Dependent variable (Y) = Dividend per share.
- ◆ Independent variables (X) = (X_1, X_2, X_3, X_4, X_5).
- ◆ X_1 (GHG), X_2 ($Cflo$), X_3 ($EBIT/TA$), X_4 (Tax/PBT), X_5 ($Sales\ growth$).

Thus the least square model is represented by:

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5,$$

where Y is the dividend per share; a is the regression estimate of the intercept; b is the regression estimate of the slope for X_1 to X_5 gradient; x_1 is the GHG emission; x_2 is the cash flow ($Cflo$); X_3 is the earnings before interest and tax/total assets ($EBIT/TA$); X_4 is the % of earnings paid out as tax ($Tax/PBIT$); X_5 is the Sales growth.

The research question is thus restated as: does GHG emission reduction influence 3M's dividend per share? The hypotheses below is tested at 5% significant level.

Hypothesis:

H0: GHG emission reduction does not have signifi-

cant influence on 3M's dividend per share.

H1: GHG emission reduction has a significant influence on 3M's dividend per share.

The data and regression output appear in Table 1 and Table 2.

Table 1. 3M Company: GHG emission reduction, dividend per share

	$Y(D/Share)$	$X_1(GHG)$	$X_2(CFIO)$	$X_3(EBIT/TA)$	$X_4(Tax/PBT)$	$X_5(Sales\ growth)$
2002	1.24	17.8	0.61	18.36	31.65	1.7
2003	1.32	17.9	1.8	19.9	32.16	11.6
2004	1.44	13.5	2.7	20.88	32.53	9.7
2005	1.68	11.6	1.07	23.63	33.69	5.7
2006	1.84	10.3	1.4	26.75	30.63	8.3
2007	1.92	8.5	1.8	25.07	32.12	6.7
2008	2	6.8	1.8	20.23	31.09	3.3
2009	2.04	5	3.04	17.67	29.97	-8.4
2010	2.1	6.2	3.5	19.62	27.66	15

Source: Data compiled from different pages of 3M Company 2011 Sustainability Report. Available online at: <http://multimedia.3m.com/mws/media/webserver?mwsId=NNNNNPPuFZAnGSo53sVUKshq9qpl9ZpuCqON9qON9NNNNNN>.

Table 2. Regression result

Summary output								
Regression statistics								
Multiple R	0.994245171							
R square	0.988523459							
Adjusted R sq.	0.969395891							
Standard error	0.056986279							
Observations	0							
ANOVA								
	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	5	0.839146581	0.167829	51.68056	0.004131384			
Residual	3	0.009742308	0.003247					
Total	8	0.084888889						
	<i>Coefficients</i>	<i>Standard error</i>	<i>T stat.</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	3.201944781	0.528680224	6.056487	0.009031	1.519448356	4.884441206	1.519448356	4.884412
$X_1(GHG)$	-0.0693233	0.008762676	-7.9112	0.00421	-0.09721005	-0.04143655	-0.097210046	-0.0414366
$X_2(CFIO)$	-0.049598734	0.039697264	-1.24942	0.300112	-0.17593314	0.046735676	-0.175933144	0.0767357
$X_3(EBIT/TA)$	0.004440994	0.011093714	0.400316	0.715726	-0.03086416	0.039746143	-0.030864155	0.0397461
$X_4(Tax/PBT)$	-0.23910212	0.018146463	-1.31762	0.279218	-0.08166036	0.033839932	-0.081660355	0.0338399
$X_5(Sales\ growth)$	0.005315407	0.004809336	1.105227	0.349737	-0.00999004	0.02062086	-0.009990045	0.0206206

5. Discussion of findings

From the regression output in Table 2, the F -statistic is 51.68 at a significance level of $P < 0.01$ (less than 5%), which indicates that the regression model is statistically significant. However, a close look at the p -value coefficients of each independent variable suggests that GHG emission, with a separate p -value of less than 0.01 accounts for a stronger relationship in the regression equation. The negative sign on the GHG regression coefficient indicates a negative relationship – meaning that gradual reduction in GHG emission contributed significantly to the increase in dividend per share in 3M Company within the years

of study. However the other independent (control) variables show weak relationship with dividend per share – cash flow (X_2) = 30% (greater than 5% significant level); earnings (X_3) = 71% (greater than 5% significant level); Tax(X_4) = 27% (greater than 5% significant level); and sales growth (X_5) = 34% (greater than 5% significant level). Thus the above result elevates the influence of GHG emission reduction on dividend per share in 3M Company as hypothesized (during the years of study). This contributes to the high correlation of 99%; r^2 of 98% and adjusted r^2 of 96%.

The implication of this finding is that, contrary to the apparent fear by some business that a carbon

reduction program may weaken corporate performance; this may not apply to all companies. A close look at the operating performance of 3M Company for the nine years of study (2002–2010) shows a steady improvement in yearly net sales thus resulting in improved net income which places the company in a better position to service its financial and investment obligations and still have enough balance to distribute as dividends. It can be recalled that the years 2007 to 2010 were marked by a global economic recession that affected the ability of many companies to service their debts and these companies were left with nothing for shareholders' dividends. Notwithstanding such difficult periods, 3M persisted with its carbon reduction and energy efficiency effort and was sufficiently solvent to pay dividends which probably contributed to strengthening its stock price in the market.

Whilst no attempt is made to generalize from this case, it holds important implications for further studies. Thus, instead of lumping many companies together, an examination of this phenomenon on an individual company basis would more likely provide a better understanding of the seemingly obscured relationship between climate responsibility and firm performance. Research in the area of carbon reduction and firm performance should be considered sensitive given that the signal to business would have a strong impact on the way that business thinks about carbon reduction. Lumping many heterogeneous companies together when considering this new phenomenon may produce hazy findings which do not appear to help business executives' understanding and may create confusion about how to proceed in this regard and may even produce apathy regarding carbon reduction. In the absence of a global agreement to contain carbon emissions and, given that business is involved significantly in carbon emission, it seems that research results may provide some antidote to corporate apathy with respect to carbon emissions. To this end therefore, this paper suggests that researchers should play an advocacy role in corporate carbon management by providing examples of corporate success in carbon reduction such as this single case.

5.1. Managerial relevance. Managers are in an agency relationship with the business owners – the investors; corporate executives would be motivated by positive research examples to consider carbon reduction as a business strategy that may have potential positive return to investors. This paper demonstrates to managers that investors may benefit from corporate green strategy – carbon reduction. This becomes very imperative given a recent alarming headline report by The Guardian UK “worst ever

carbon emissions leaves climate on the brinks” – signalling that the year 2010 recorded the highest carbon emission in history (The Guardian, 2011a). The Guardian quotes the executive secretary of the UN Framework Convention on Climate Change (UNFCCC) as saying “this is the inconvenient truth of where human-generated greenhouse gas emissions are projected to go without much stronger international action now and into the future” and stresses further that, “governments must make it possible for society, business and science to get this done” (The Guardian, 2011b). Hence this paper offers a motivational drive to managers who may still be wallowing in a state of indecision about carbon management. Most importantly managers may draw a lesson from this case study that even in the absence of government regulation; a firm may initiate a proactive voluntary carbon management to obviate potential future regulations that may warrant reactive and crisis management. In addition, managers would attract the support of investors toward carbon reduction if there is pragmatic evidence that their value in business would not diminish.

Conclusion

Given the growing concern about motivating corporate carbon reduction efforts and apparent climate change apathy and denial by some corporations, this paper set out to use a single case of 3M Company to examine a possible relationship between 3M GHG emission reduction and its performance, measured in this study by dividend payment (dividend per share). This became necessary as a practical means to contribute toward allaying the apparent concern of business that carbon reduction may impair corporate profit. Using the least square statistics; the regression test of five independent variables showed a significant relationship between GHG emission reduction (X_1) and dividend per share (Y). This result adds credence to the concluding remarks by Hart and Ahuja (1996, p. 35) that “results may be more significant for particular industries”. Although based on a single case, this result has modest implications for business which indicates that not all companies that engage in GHG emission reduction may experience low performance as feared by some business. This result indicates that there may be hidden growth potential accruable from GHG reduction, and companies may reap such benefits by summoning the courage to engage in GHG reduction and energy efficiency programs. Doing so has the dual advantage of reducing global carbon emissions, as well as, improving corporate performance. It is imperative that further research look at other exemplary individual company cases that may provide further

motivation to climate apathetic firms that it really pays the corporation to be green. The result of this paper contributes to corporate carbon emission implications for firm performance and business

research literature by demonstrating that examination of corporate performance implication of GHG emission reduction may become clearer if companies are examined individually.

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