

Can Carbon Footprint Disclosures Influence the Stock Price of Enterprises in China?

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Abstract

Data of three Chinese areas from 2006 to 2011 were taken to investigate the influence of Company's carbon footprint disclosures on the capital market and the production market. Abnormal returns (AR) of the capital market changed from negative to less positive after year 2010. However, carbon footprint disclosure had less significant but still positive influence on the sales growth rate in the production market. Accordingly, the carbon footprint disclosure is necessary for enterprises.

Keywords: carbon footprint disclosure, abnormal return, sale growth rate

1. Introduction

Many governments have developed clear carbon reduction targets (Grossman and Krueger, 1995; Ganapati and Liu, 2008; Partridge and Gamkhar, 2010), along with relevant legislation and carbon reduction policies. However, it is costly for enterprises to invest in environmental protection programs (Ingram and Frazier, 1980; Freedman and Jaggi, 1982; Walley and Whitehead, 1994). Carbon emission reduction through strategies such as increased waste recycling and the use of renewable materials must generate enough value to motivate enterprises to invest in them. The existing literature has highlighted the importance of carbon emission reduction (Wise et al., 2009). Studies have indicated that the increased recycling of waste and used materials can benefit enterprises both internally and externally. Internally, enterprises can benefit from the reduced materials and production costs. Externally, enterprises that undertake carbon emission reduction projects could lessen the concerns of the authorities and investors regarding environmental protection. Furthermore, the stakeholders' carbon emission reductions also benefit enterprises in terms of the production market (Brown and Dacin, 1997; Sen and Bhattacharya, 2001). For example, carbon-reducing firms may benefit from government regulations regarding the environment, increased competitive advantage, and better access to capital (Côté, Booth, and Louis, 2006). Are these benefits certain enough to cover the large related costs that enterprises must pay? Extant studies do not provide a clear answer (Corbett and Klassen, 2006).

Carbon footprint disclosure is one of the main carbon emission reduction strategies. The carbon footprint is the total amount of CO₂ and other greenhouse gases (GHG) emitted over the full lifecycle of a process or product (U. K. Parliamentary Office of Science and Technology, 2006). Firms' carbon footprint disclosure announcements contain information that is directly related to the product or service provided by the company, and this information regarding the product's carbon footprint becomes available to the consumer. This may change consumers' consciousness of the environmental impacts of products that could be misperceived as being relatively harmful or benign in terms of the environment. While firms are willing to announce their products' footprints, this meaning that they must attempt to perform better than other firms in this regard. If consumers could learn how much carbon emission is associated with their consumption and carbon emissions could become a part of their consumption decisions, both GHG emissions and carbon-reducing firms could benefit. Carbon-reducing firms might enhance their reputations (Orlitzky, Schmidt, and Rynes, 2003) and accumulate moral capital (Godfrey, 2005; Peloza, 2006; Godfrey, Merrill, and Hansen, 2009).

Furthermore, consumers would be likely to pay higher returns (Brown and Dacin, 1997; Creyer and Ross, 1997; Sen and Bhattacharya, 2001), develop difference awareness (McWilliams and Siegel, 2001) regarding the carbon-reducing efforts of specific corporations, and thus prefer to continue to consume their products (Smith and Alcorn, 1991). Finally, these corporations have better financial and operational performance (Horváthová, 2010; Chen and Delmas, 2011). This study applied an event study methodology to changes in the AR of corporate share prices after carbon-reducing action announcements to explore the views of the parties of interest on various carbon-reducing actions, in addition to the impact of investor valuation of corporate announcements of carbon-reducing actions on corporate market value. Compared to other carbon emission reduction strategies, carbon footprint disclosure is less costly than improving the production process or revamping equipment. Thus, carbon footprint disclosure has an external benefit. This paper aims to determine how investors and consumers react to carbon footprint disclosure by observing abnormal returns and the subsequent sales growth.

2. Methods

The event study methodology was first proposed by Ball and Brown (1968) and Fama et al. (1969), and it was mainly designed to investigate whether certain events (corporate dividend declarations or earnings statements) would trigger abnormal changes in stock prices, thus leading to abnormal returns (ARs). ARs are also called excess returns, prediction errors, or residuals. This information can be used to understand whether the market price of a security is associated with a particular event. It mainly uses statistical methods to test the status of an AR, that is, to determine whether the expected AR is zero. The null hypothesis is $H_0 : E(R_i | event) - E(R_i) = 0$, where $E(R_i | event)$ and $E(R_i)$ represent the expected rate of return with and without the occurrence of event, respectively, in order to understand whether such an event could have an impact on the corporate share price. In addition to ARs, this study also considered the cumulative abnormal return (CAR) variable to determine the cumulative effects of an event over a certain period. In general, the event study methodology used to estimate the expected return on a stock is mainly divided into mean adjusted return, market-adjusted return, and market model return. According to the market model return method, the expected rate of return of corporate shares is expressed as shown in Eq. (1):

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

Where R_{it} represents the rates of return on the stock of company i during period t , R_{mt} represents the daily return of the market portfolio during period t , and α_i is the intercept. R_{mt} is the market risk-free rate of return during period t , β_i measures the systematic risk of the corporate stock during period t , and ε_{it} is the error term. In terms of AR calculation, after using Eq. (1) to determine the expected daily return rate of company i 's stock during period t , which is then compared to the actual daily return rate of company i 's stock on the day of the carbon-reducing action announcement, the difference obtained is the AR resulting from company i 's carbon reduction announcement, as in Eq. (2):

$$AR_{it} = R_{it} - \hat{R}_{it} = R_{it} (\hat{\alpha} + \hat{\beta} R_{mt}) \quad (2)$$

Also, CAR is simply the accrued daily AR of a specified period, as in Eq. (3):

$$CAR_{iE} = \sum_{j=1}^E AR_{ij} \quad (3)$$

Where E is the selected period for calculating CAR. The definitions of all related variables and the corresponding data resources are presented in Table 1. In addition to observing corporate share prices after carbon footprint disclosure announcements, this study also used the change in sales growth to measure the production market reaction. To avoid the impact of outliers on stock returns, we used a 90 percent winsorisation to replace the observations from the 5th percentile and below, as well as from the 95th percentile and above. This study uses the data of non-financial listed companies from Taiwan, Hong Kong, and China, shown in Table 1. The number of sample companies is 1571, and the number of carbon footprint disclosure announcements is 89.

3. Results and Discussion

All samples of the distribution status and descriptive statistics for each country regarding carbon footprint disclosure announcements are listed in Table 2. The total numbers of carbon footprint disclosure announcements for the countries are as follows: Hong Kong had 26, Taiwan had 21, and China had 42. Table 3 shows AR, CAR, and sales growth rate after the firms' carbon footprint disclosure during 2008-2013, Table 4 shows the significant changes linked to the firms' carbon footprint disclosure. In Table 3, we set the event window to be three days or five days from the announcement date to calculate the abnormal return resulting from the carbon footprint disclosure. Table 3 shows that neither the abnormal return nor the cumulative abnormal returns for carbon footprint disclosure announcements are significant before 2012(2008, 2009, 2010, and 2011) .on the other hand, the abnormal return in emerging countries was only significantly positive in 2011. There was no significant change in the sales growth rate after carbon footprint disclosure. In Table 4, we compared the abnormal return and the change in the sales growth rate for each year. Table 4 also shows that the abnormal stock return and the change in sales growth improved over time. The difference between the abnormal return and the change in sales growth in 2008 and those in 2013 is significant. However, the extent of the increase is limited.

4. Conclusion

This study tested the reaction of the capital market and the production market to firms' carbon footprint disclosures. Based on our empirical results, the market reaction to carbon footprint disclosures is not significant. After 2012, the stock market reaction to carbon footprint disclosure and the increase in abnormal returns were significantly positive, but the magnitude of the abnormal returns was small. There was no significant increase in sales. Market investors are especially interested in whether corporate decision brings direct and significant profits. Investors obviously have their doubts regarding the profit generated by carbon footprint disclosure because there is no significant improvement in the sales growth rate after carbon footprint disclosure. When we observe the evidence over the long run, there is no significant sales growth from 2008 to 2013 for firms that announced carbon footprint disclosure. However, the abnormal stock return increased significantly for carbon footprint disclosure announcements. The results show that investors still expect potential profits from carbon footprint disclosure; even there is no significant increase in sales growth. A further point of interest is how firms treat the market reaction. According to voluntary disclosure theory (Milgrom, 1981; Verrecchia, 1994), firms with superior performance have more motivation to disclose information. Our results imply that the market reaction is minor, even for firms with a lower carbon footprint. The Carbon Emissions Reduction Act is voluntary. Because the market reaction is minor now, it may be necessary to adopt a more aggressive policy to provide firms with motivation to disclose their carbon footprints. In other words, the government could attempt to increase the profit of firms that disclose their carbon footprints. PAS 2050, created by the British Standards Institution, and ISO 14067, created by the International Organization for Standardization, are influential production regulations in every country. Furthermore, the government could provide preferential tax treatment for firms that disclose their carbon footprints or set restrictions on the sale of products without carbon footprint disclosure. These are the feasible strategies that governments can use to promote carbon emission reduction.

According to the results, the magnitude of the abnormal returns was small, and there was no significant increase in sales growth. However, according to the discussion with Brown and Dacin (1997), Sen and Bhattacharya (2001), and Côté, Booth and Louis (2006), the certainty and size of the benefits to carbon-reducing firms are not great enough to cover the related costs. However, through carbon footprint disclosure, consumers can learn how much carbon emissions are associated with their consumption, and carbon emissions can become a part of their consumption decisions (Limnios et al., 2009). We think that carbon-reducing firms should have optimistic expectations for the future.

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Table 1: Variables, Definitions, and Data Sources

Variable	Notation	Definition
Stock return of company i	R_{it}	The rates of return on the stock of company i in period t
Stock return of market	R_{mt}	The daily return of a market portfolio in period t ; it is also the market risk-free rate of return in period t
Intercept	α_i	Intercept
Systematic risk	β_i	The systematic risk of corporate stock in period t
Error term	ε_{it}	Error term
Abnormal return	AR	The market price of a security is associated with a particular event; it is the difference between the actual return of a security and the expected return on the event day
Cumulative abnormal return	CAR	The market price of a security is associated with a particular event; it is the sum of all the differences between the actual return of a security and the expected return up to a given point in time

Table 2: Carbon Footprint Disclosure Announcement Distribution Situation and Descriptive Statistics of AR

Descriptive statistics of AR and CAR	China	Hong Kong	Taiwan
Average AR of the firms' carbon footprint disclosure	0.0332	0.0625	0.0380
Max AR of the firms' carbon footprint disclosure	0.0859	0.0718	0.0606
Min AR of the firms' carbon footprint disclosure	-0.0226	-0.0267	-0.0116
Average CAR (3,3) of the firms' carbon footprint disclosure	0.0560	0.0742	0.0667
Max CAR (3,3) of the firms' carbon footprint disclosure	0.1453	0.1141	0.2056
Min CAR (3,3) of the firms' carbon footprint disclosure	0.0105	0.0118	0.0387
Average CAR (5,5) of the firms' carbon footprint disclosure	0.0573	0.0706	0.0637
Max CAR (5,5) of the firms' carbon footprint disclosure	0.1509	0.1284	0.1888
Min CAR (5,5) of the firms' carbon footprint disclosure	0.0174	0.0069	0.0309
Number of listed sample companies	837	426	308
Number of announced companies	42	26	21
Percentage %	5	6.1	6.82

Table 3: AR, CAR, and Sales Growth Rate after the Firms' Carbon Footprint Disclosure: 2008 to 2013

Type of sample	2008	2009	2010	2011	2012	2013
AR (%)	0.0372	0.0146	0.0542	0.0712	0.0822*	0.0840*
CAR (3, 3) (%)	0.0754	0.0694	0.1023	0.1222	0.1530*	0.1617*
CAR (5, 5) (%)	0.0931	0.0951	0.1203	0.1377	0.1566*	0.1611*
Difference in sales growth rate	-	0.1489	0.0292	-	0.0346	0.0838
	0.0124			0.1040		

Table 4: Significant Changes Linked to the Firms' Carbon Footprint Disclosure

Type of sample	2008~ 2009	2009~ 2010	2010~ 2011	2011~ 2012	2012~ 2013	2013~ 2014
Δ AR (%)	-0.0226	0.0396*	0.0171	0.0110	0.0018	0.0469*
Δ CAR (3, 3) (%)	-0.0059	0.0330*	0.0199	0.0309*	0.0087	0.0866*
Δ CAR (5, 5) (%)	0.0019	0.0254	0.0174	0.0189	0.0047	0.0682*
Δ difference in sales growth rate	0.1618	-0.1200	-0.1336	0.1388	0.0494	0.0965