Self-Reporting Firms: Are Emissions *Truly* Declining for Improved Financial Performance?

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Abstract

Organizations are reporting their environmental performance for many reasons; most of these are reports by the organizations themselves – a *self-reporting*. Self-reporting is not a panacea for good firm environmental stewardship. Our observations show financial performance of firms is improved despite increases in their emissions reporting. Policymakers can gain insights from our findings; but so can organizations. Concerted efforts must be made to institute mandates that truly influence market performance as a function of environmental stewardship; organizations who are serious about true environmental stewardship should be supporting such initiatives. In the absence of stringent measures to rein in firm level emissions, the evident compensation for dirty behavior by firms will continue unabated. Policymakers should initiate a widespread effort to provide an equitable platform for all firms to help *decarbonize* the economy. The message for firms is that when true environmental stewardship is required or instituted, the seeming benefits of increasing emissions may result in negative and dire consequences on both their book and market values. Therefore, it is important for firms to make efforts to reduce their emissions in anticipation of mandates that will make their market or book performance to be reflective of their emissions reduction initiatives.

Keywords: emissions, greenhouse gas, financial performance, Tobin's Q, Return on Assets

I INTRODUCTION

With the inception of the environmental *Kuznets curve* – where environmental quality deteriorates at early stages of economic growth and subsequently improves at a later stage – examining how this phenomenon plays out at the firm level is important. This examination sheds light on the relationship between the levels of polluting emissions and firm performance.

This paper evaluates how firms have fared in their environmental and sustainability stewardship by determining how annual changes in emissions relate their financial performance using (i) an accounting book metric, return on assets (ROA), and (ii) a market metric, Tobin's Q.

We use the greenhouse gas (GHG) emissions as the environmental performance. GHG protocol corporate standards classify a company's GHG emissions into three "scopes". The emphasis of this evaluation is on Scope 1 that refers to direct emissions from owned and directly controlled sources by the companies.

Scope 2 and 3 emissions refer to indirect emissions – emissions from the generation of purchased electricity (Scope 2) and emissions along the firm value chain (Scope 3). Collating the inventory of company's GHG emissions over time highlights how well the companies that self-report perform not only on their emissions reduction, but also on their financial metrics. The basic question is – how are self-reporting firms performing?

This study makes use of voluntary corporate climate change data provided by firms participating in the CDP, formerly the *Carbon Disclosure Project*. The CDP represents one of the largest databases for corporate climate change related activities available to investors and public users. Currently, participating firms represent over 50% of the total market capitalization [1].

Negative environmental events could have a weakening effect on corporate share value as seen in the 1989 Exxon Valdez tanker accident and BP's oilrig accident in the Coast of Louisiana in 2010. These types of events and commensurate pressures by stakeholders, has resulted in corporate environmental voluntary disclosures over the years including emissions

disclosure [2]. The value of voluntary disclosure is in the rewards the firms enjoy from the uptick of their market performance indices [3], [4]. This value is the reason why self-reporting is germane to the examination of policies that can influence decarbonization efforts.

For self-reporting firms, there is an observed reduction in the average annual Scope 1 emissions between 2011 and 2017, with a marginal downward trend as shown in Figure 1.

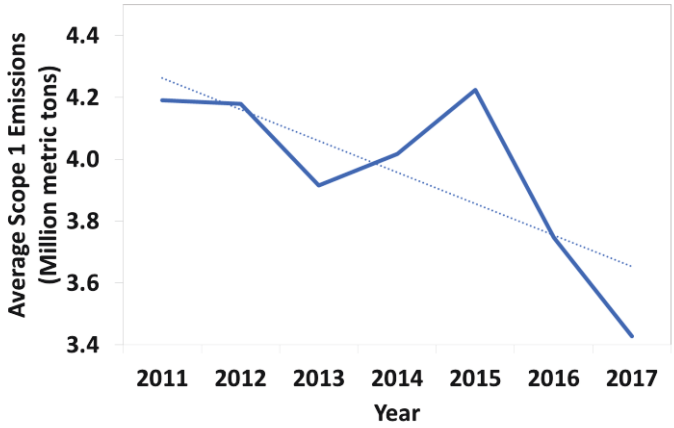

Figure 1: U.S. annual average Scope 1 emissions

The cursory observer would interpret this trend to imply enhanced financial performance; based on previous investigations on 'doing well by doing good' that show good financial performance with improved environmental performance. However, we highlight the differences between the market and book values of the firms and offers a comparison between firms with decreasing emissions and those with increasing emissions.

II BACKGROUND

Stakeholders have continued to exert social, financial, market, economic and policy related pressures on firms to reduce their environmental footprint [5]–[7] leading to proactive initiatives by the firms, such as investments in microgrid systems with emission-free technologies [8], or capacity expansion plans with renewable technologies [9]. Proactive initiatives include energy efficiency, low carbon energy technology investments and the incorporation of carbon

management activities into their corporate business strategies. In addition, corporate firms are also taking more centered roles in meeting global climate change targets in relation to their GHG emissions [10]. However, it has been a long-standing debate as to whether or not corporate firms have been rewarded for their corporate social responsiveness and environmental stewardship. For many years, scholars have investigated this relationship with mixed outcomes.

One stream of studies use portfolio analyses to investigate the impacts of socially responsible investments (SRI) on the performance of corporate firms. While some of these studies show that SRI improves portfolio performance with no penalties for green investments [11], [12], others show negative or no relationship [13]–[15] based on the assumption that investors would pay a premium price for pursuing social objectives at the expense of shareholder value maximization.

Another stream of research also analyzed the relationships between actual firm financial performance and their environmental performance using regression analysis. In a similar vein, some studies showed a negative relationship [16], [17] based on the proposition that firms are primarily concerned with profit maximizing and a shift away from this central objective leads to undesirable consequences on firm bottom line [18].

Other studies [19], [20] also argued for a positive relation based on the *win-win* hypothesis [21] and the natural-resource-based view of a firm [22]. However, fewer studies have combined these effects and argued for a non-linear relationship [23], [24] with a more recent study providing evidence that the non-linear relationship depends on the firm's level of environmental performance and also that the nature of this non-linearity is determined by the firm's industry sector classification [25].

We use a different approach by investigating the average impact of firms' direct GHG emissions measured by their Scope 1 emissions on firm financial performance over the years. This is

achieved by developing a metric which measures the average effect of the change in metric tons of CO_2 on firm financial performance for both categories of firms that had their emissions increased and those that had it decreased in each reporting year. This effect was investigated for financial performance measured using an accounting or book value metric, return on assets (ROA), and a stock market metric, Tobin's Q.

III METHODOLOGY

Our methodology focused on the annual change of Scope 1 emissions of each firm (ΔE). Based on these values, we separated firms that experienced an increase in their annual Scope 1 emissions, and those that experienced a reduction. Within each group, two financial performance metrics were evaluated: return on asset (ROA) averaged as Book Value (BV) and Tobin's Q averaged as Market Value (MV). Lastly, we introduced a new metric to capture the average relative impact of change in emissions on ROA for both firm groups (BVE).

Because it is possible that a firm can increase emissions in one year, and decrease in another, all metric analyses were conducted on a yearly level. Thus, a firm that experienced an increase in emissions in 2012, but a decrease in 2013, would be included accordingly into each group for the respective years. To account for this situation, our metrics take the form of annual averages, calculated in the following fashion, where $\boldsymbol{t} \in (\mathbf{2012}, \mathbf{2013}, \ldots, \mathbf{2017})$ is the year, $\boldsymbol{j} \in (\mathbf{0}, \mathbf{1})$ is the binary indicator for emissions change category, *i.e.,* increase (0) or decrease (1), in annual emissions, $\boldsymbol{k} \in (\mathbf{1}, \mathbf{2}, \ldots, \boldsymbol{n_{t,j}})$ is the firm index and bounded by the count, $\boldsymbol{n_{t,j}}$, indexed by year and by emissions change category.

$$\Delta \boldsymbol{E_{t,k,j}} = \boldsymbol{Emissions_{t,k}} - \boldsymbol{Emissions_{t-1,k}} \qquad \textbf{(1)}$$

$$\boldsymbol{BV_{t,j}} = \frac{\mathbf{1}}{\boldsymbol{n_{t,j}}} \sum_{\boldsymbol{k}}^{\boldsymbol{n_{t,j}}} \boldsymbol{ROA_{t,k,j}} \qquad \textbf{(2)}$$

$$\boldsymbol{MV_{t,j} = \frac{1}{n_{t,j}} \sum_{k}^{n_{t,j}} TQ_{t,k,j}} \quad \textbf{(3)}$$

$$\boldsymbol{BVE_{t,j} = \frac{1}{n_{t,j}} \sum_{k}^{n_{t,j}} \frac{ROA_{t,k,j}}{\Delta E_{t,k,j}}} \quad \textbf{(4)}$$

Equation 1 is used to classify the firms into those with increased ($\Delta \boldsymbol{E_{t,k,j}} > \boldsymbol{0}$) versus those with decreased ($\Delta \boldsymbol{E_{t,k,j}} < \boldsymbol{0}$) emissions over the previous year. This value is captured in the difference between the current year's emissions and the immediate past year emissions. Equation 2 is the average ROA by the category of the firms represented by BV indexed by year and emissions category. Equation 3 is the average Tobin's Q also indexed by year and emissions category. Equation 4 is the average relative impact of emissions on ROA, by year and emission category. While our data spans 2011-2017, we initiate our calculations from 2012 to account for the change from 2011.

IV DATA SOURCES

The data for Scope 1 emissions was collected from the CDP (formerly, the Carbon Disclosure Project). CDP runs the global environmental disclosure system focusing on corporate carbon emissions. Theoretically, by reporting to CDP, it is expected that firms will gain competitive advantage by getting ahead of regulatory and policy changes [26], [27], identifying and tackling growing risks, and finding new opportunities for action being demanded by investors and customers across the world [1]. While the CDP data includes countries from around the world, our focus is on U.S.-based firms with a total of 118. Data on ROA and TQ were collected from The Thomson's Reuters' Financial Database.

V RESULTS AND DISCUSSION

We present three striking observations. First, the bars in Figure 2 show that the average ROA, *i.e.*, the Book Value (BV), is higher for companies that had an increase in their Scope 1 emissions.

The exceptions are in 2012 and 2014 when the ROA of the self-reporting firms with reduced emissions within the reporting period were higher than those with increased emissions. We see that for firms with increasing emissions, ROA was 30% greater in 2013, 46% greater in 2015, 37% greater in 2016 and 32% greater in 2017 compared to those firms that had their emissions reduced. Thus – on average – increasing Scope 1 emissions is correlated with higher returns. This result is *somewhat* counterintuitive to the notion that reducing GHG emissions is financially beneficial.

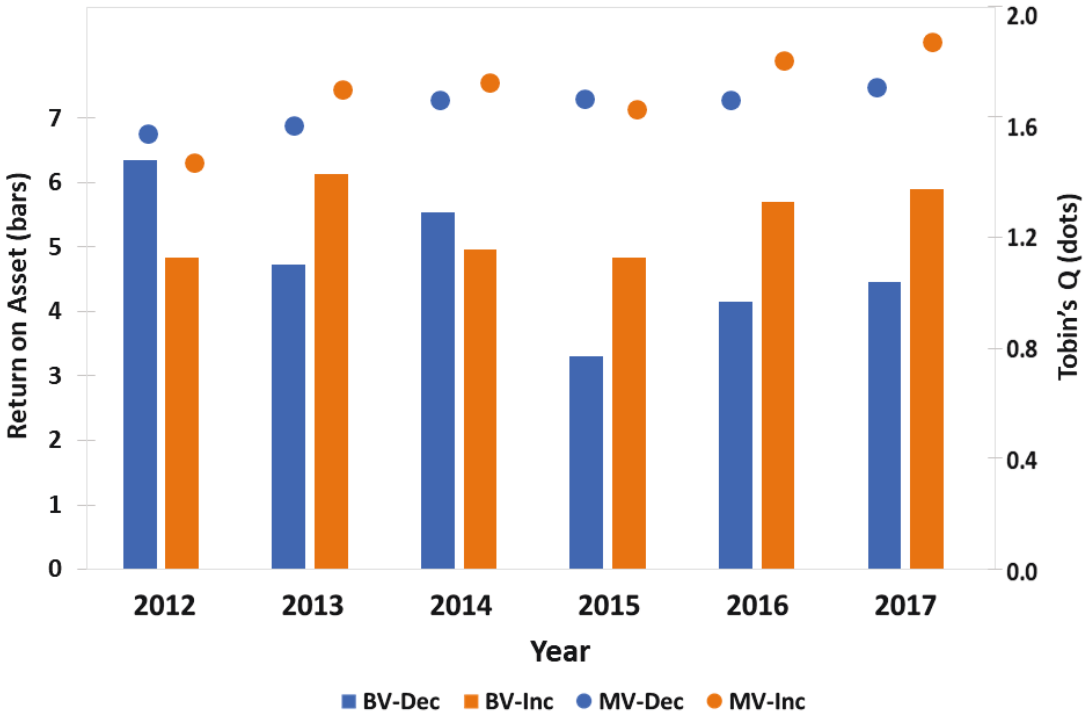

Figure 2: Average firm return on assets (ROA) and market value comparisons of firms with decreased and increased emissions.

Note: BV-Dec – Book Value captured through ROA for firms with decreased emissions
BV-Inc – Book Value captured through ROA for firms with increased emissions
MV-Dec – Market Value captured through Tobin's Q for firms with decreased emissions
MV-Inc – Market Value captured through Tobin's Q for firms with increased emissions

Second, while it can be stated that the outcome is based on the ROA – a book value metric of firm financial performance – we find that the result is further supported by the market value

metric, TQ. Figure 2 also shows dots representing the market value on the secondary vertical axis. These results imply an equivalency between both book and market values patterns. But, we do observe that differences between the firms with increased versus decreased emissions are not as significant in the market value as in the ROA analysis. The differences are marginal, with 8% larger in 2013, 3% in 2014, 8% in 2016, and 9% in 2017. Most years still show a better market performance for firms that had increasing Scope 1 emissions with exceptions in years 2012 and 2015. The average TQ for firms that decreased their Scope 1 emissions is 1.71 while it is 1.75 for firms that increased their emissions.

Third, given the consistency of the results across both market and book value indices, we turn to a metric that evaluates the impact of the emissions change by category on the ROA. Figure 3 captures the annual performance in each of the firm categories – the categories are whether a firm's emissions decreased or increased.

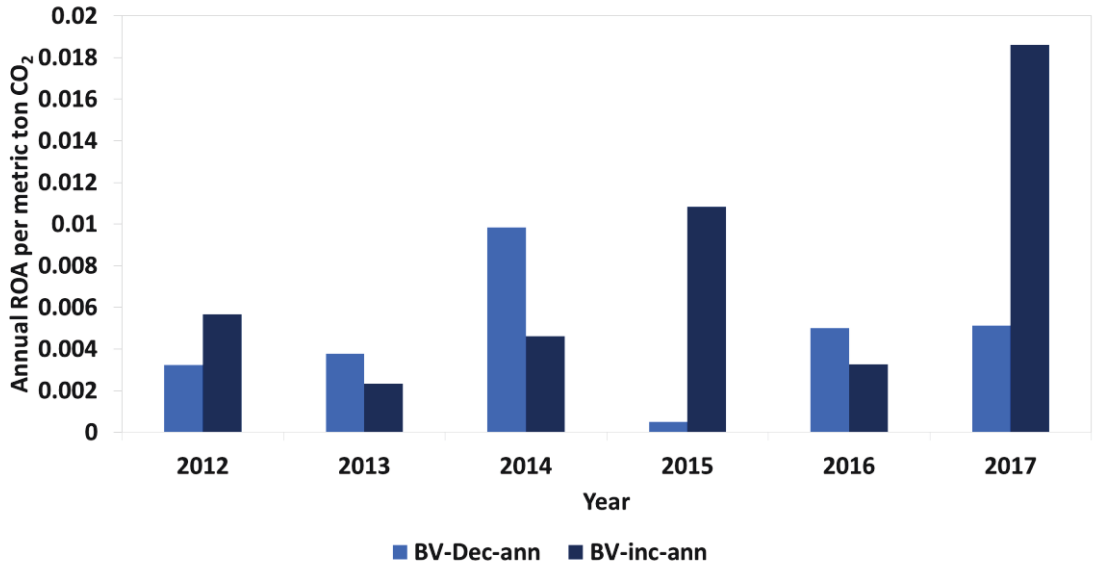

Figure 3: Average ROA per change in emissions

Note: BV-Dec-ann – Annual Average Book Value measured by the ROA for firms with decreased emissions
BV-Inc-ann – Annual Average Book Value measured by the ROA for firms with increased emissions

We observe an equal split between the categories. Consistent with our earlier finding, firms that increased their emissions experienced, on average, a substantially greater ROA per metric ton of increase in CO_2 emissions. Furthermore, Figure 4 shows that the cumulative of the average annual ROA per metric ton of CO_2 from Figure 3 for firms with increased emissions – denoted by the area graph in darker shade – is not only higher, but it is also steeper than for firms with decreased emissions – as seen in the area graph in lighter shade. This result reaffirms the evidence of higher returns for firms with increased emissions. Note that the cumulative is arrived at by adding all previous years' average ROAs up until the respective current year, and it allows a clear presentation of how steep the ROA is relative to the changes in emissions by both categories of firms.

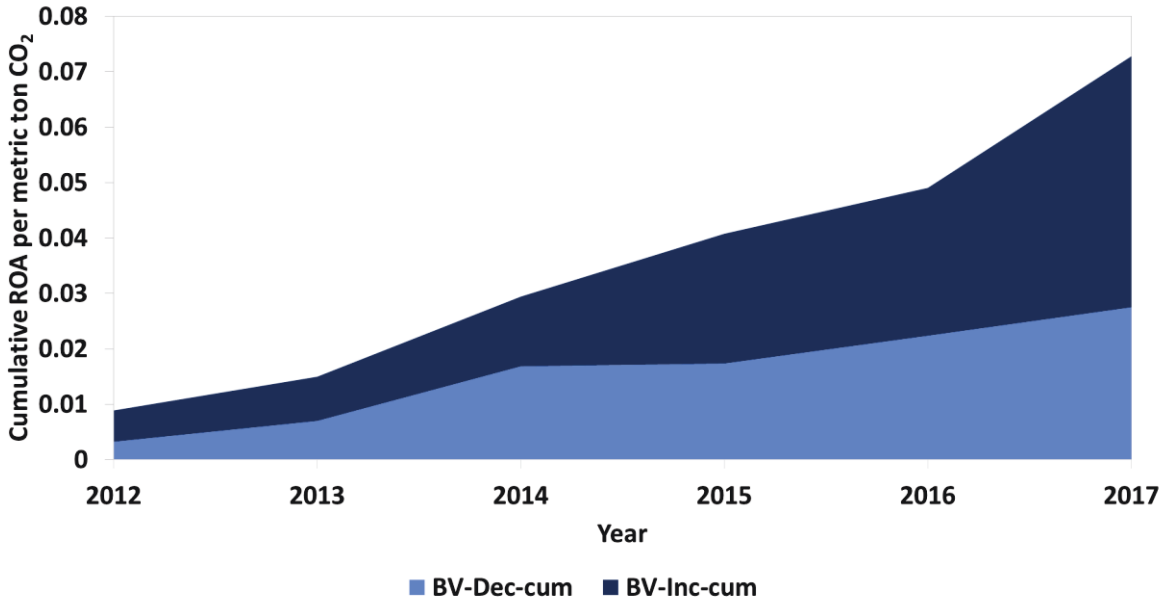

Figure 4: Average ROA increase per change in emissions

Note: BV-Dec-cum – Cumulative of the Average Book Value measured by the ROA for firms with decreased emissions
BV-Inc-cum – Cumulative of the Average Book Value measured by the ROA for firms with increased emissions

VI CONCLUSION

Based on our analysis, we see evidence in self-reporting U.S. firms that calls into question the evaluation of firm performance based on their environmental efforts to reduce GHG. Despite the observed reduction in aggregate average annual emissions, it appears that, on average, the

impact of incentives for GHG reductions are weakly and negatively correlated with financial performance be it book, or historic value based or market value dependent.

For book value measures, the anticipation of higher returns on reducing GHG emissions was not empirically justified. For market value measures, the expected (and often repeated) claims of higher market performance for firms that reduce their emissions was not empirically validated, instead, there are mixed results. We postulate that voluntary self-reporting does not necessarily translate to incentives for enhancing environmental stewardship.

These results underline the calls for more widespread governmental policies or regulations that could influence the market level valuation for firms based on their environmental efforts and branding. Such policies could offer avenues to change the equation on which financial metrics are predicated by incorporating a firm's level of investment in environmental stewardship.

It should be noted here that this outcome of book value and market value benefiting from increased emissions is independent of the other underlying issues that may arise. For example, emissions increases may also result from increased revenue because the ROA is the ratio of net income to assets. Therefore, the result is consistent under total emissions or emissions per unit of revenue or net income. We can interpret emissions per unit of revenue or net income as the inverse of Figures 3 and 4 implying that high values of ROA-to-emissions ratio translate to low values of emissions changes per unit of revenue or net income for firms with increased emissions and vice-versa for firms with reduced emissions[1].

[1] Note that the $ROA = \frac{Net\ Income}{Asset}$, where Net Income is the Revenue less all expenses including interests and taxes. Therefore, the case that an ROA of 1/1 (for a small company) is equivalent to the ROA of 100/100 (for a large company) underscores why measures presented in Figures 3 and 4 are adjusted for the relative sizes of the firms as a fraction of their change in emissions captured by Equation 4.

We find similarities between these results and the observation by an earlier study suggesting that the limited effort at improving corporate environmental performance is partially due to short-term financial performance objectives that inform managerial decision making [28]. The implication of the results from this analysis is that if self-reporting firms exhibit this underwhelming trait, then the picture that includes the rest of the ecosystem would be disconcerting. Additional tools and mechanisms may be needed to enhance GHG emissions mitigation efforts because voluntary reporting is not enough to incentivize GHG emissions reduction efforts. Thus, a true policy issue is that carbon taxes or the internalization of environmental pollution costs need to be integrated to more fully appreciate their true costs. However, right now, there is motivation to keep increasing emissions because of the *somewhat* positive effect it has on the firms' near-term bottom lines. Nonetheless, we posit that it is imperative for firms to make efforts to reduce their emissions in anticipation of mandates that will make their market or book performance to be reflective of their emissions reduction initiatives.

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