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Testing the Moderating Role of Environmental Audits in the Relationship Between the Carbon Tax and Renewable Energy Consumption: Evidence from Japanese Manufacturing Firms

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Abstract

Global warming and climate change are the outcomes of excessive carbon emissions (CO_2) from the consumption of fossil fuels. To reduce the volume of CO_2 and to overcome this challenging environmental problem, it is imperative to encourage renewable energy consumption (REC). Furthermore, environmental regulations can also play a crucial role in promoting sustainable business practices. Thus, the primary aim of this research is to examine the impact of the carbon tax on REC. The random-effects regression model is applied through STATA 16 by using a panel of 1080 manufacturing firm-year observations from Japan for the period 2004-2019. We find a significant positive relationship between the carbon tax and REC. Due to the carbon taxation, businesses shift to renewable energy as it reduces CO_2 and improves corporate environmental performance (CEP). Further, the secondary objective of this research is to examine the moderating role of environmental audits between the carbon tax and REC relationship. The empirical results confirm that environmental audits positively moderate the relationship between the carbon tax and REC. The findings of this study are in line with the stakeholder theory because mainly the environmental protection is an outcome of stakeholders' pressure. Furthermore, the results

and implications of this study are helpful for regulators, environment policymakers, environment managers, investors, and environmentalists. This research study is unique because it is among the very few studies that have explored the impact of the carbon tax on REC in the corporate sector.

Keywords: renewable energy, carbon tax, environmental audits, environmental management systems, Tokyo Stock Exchange.

1. Introduction

With the rapid increase in global population, urbanization, industrialization, and change in consumption patterns have led to serious environmental problems, such as climate change, global warming, air pollution, water pollution, increase in industrial waste, and the overexploitation of natural resources (Tarazkar et al., 2021). Similarly, Su and Fan (2021) argued that environmental degradation is the outcome of continued industrialization and economic growth; that's why environmental protection is becoming the main focus of various stakeholders. Undoubtedly, in the twenty-first century, climate change remains the top priority agenda for the entire world, and it is categorized as a top risk. Various stakeholders such as society, investors, and regulators pressure firms to reduce their environmental footprints. Specifically, the reduction in CO2 is becoming a critical issue for manufacturing units (Aureli et al., 2020). Consequently, businesses are trying to use their capabilities to face these challenges. Due to the seriousness of environmental problems, environmental protection behavior has become the key component of corporate social responsibility (CSR) and getting importance in corporate decision-making (Liu et al., 2020).

Industrialization has been seen as a primary source of climate change and CO2 concentration has risen about 43% since the start of industrialization (Majeed and Tauqir, 2020). The main reason for climate change is the rapid increase in CO2 generated from the consumption of fossil fuels (Atif et al., 2020). It is calculated that in 2020 the global CO2 was 37 billion tons, and it is estimated that if this trend continues, the volume of CO2 will reach 58 billion tons by 2030 (Li, 2021). Furthermore, the CO2 emissions from fossil fuel consumption have also increased rapidly since the industrial revaluation. According to Atif et al. (2020), the consumption of fossil fuels accounts for 99.3% of global CO2 in the year 2017, which increase almost from zero to 33 gigatons. Climate change is directly linked with the production of goods because major production is being done by using traditional energy sources. To overcome these environmental problems, there is a need to reduce CO2 with the help of diversified carbon mitigation strategies at the firm level (Ben-Amar et al., 2017; Kulin & Johansson Sevä, 2019). Replacing the traditional energy sources with renewable energy sources is one of those strategies because the consumption of conventional energy sources epitomizes a threatening environmental issue (Alam et al., 2019). Renewable energy sources include wind energy, water-falling energy, solar energy, geothermal energy, biomass energy, and the energy of tides. No doubt, a few renewables are still costly and need continuous mechanical support to be operative and competitive.

In today's competitive world, business firms are becoming more sensitive towards environmental issues for the sake of a better corporate image (Tang et al., 2018). Several

other motivators may be a reason for adopting environmentally-friendly policies, specifically, the pressure from stakeholders and regulatory bodies, i.e., the government. Therefore, businesses are using environmental protection techniques. To cope with the environmental problems, specifically the CO2, governments worldwide have stepped forward towards many remedial measures. Among these measures, the carbon tax is considered an effective and operative measure to reduce the CO2 adapted and used by many countries to reduce the volume of CO2 (Bhat & Mishra, 2020; Li et al., 2017; Nie et al., 2021). Several developed economies, including Japan, Sweden, and Finland, have levied carbon tax for several years. According to World Bank, more than 32 regions and 46 countries have implemented about 61 environmental policies; 30 are related to a carbon tax (Haites, 2018).

Usually, the environmental audits are executed to monitor compliance with environmental laws and regulations related to environmental accounting rules and make recommendations for improving environmental accounting procedures. (Lee et al., 2017). Furthermore, environmental audits are also used to assure that the firm complies with all the rules and regulations related to environmental protection conveyed by the government or any other regulatory body. A firm can upgrade its image, reputation, and goodwill by having environmental audits because it portrays a positive gesture to the stakeholders regarding the commitment to protect the natural environment. We assume that environmental audits would reduce the environmental footprints and make some policy recommendations to mitigate carbon emissions. This research study has been conducted in the Japanese context. At present, in the Japanese context, an environmental audit is a voluntary choice for any business firm, and there is no regulatory pressure to execute an environmental audit (Lee et al., 2017). However, this research study assumes that business firms that implement environmental audits are more vulnerable to complying with governmental regulations and reducing environmental footprints.

This research paper has two fundamental objectives. First, it aims to understand how carbon tax affects REC based on the data of Japanese listed firms. This objective aligns with the assumption that the carbon tax would promote REC. Second, it seeks to understand the interactive (moderating) role of environmental audits with the carbon tax and REC relationship. These objectives are addressed through a panel data analysis using the data of 129 Japanese-listed manufacturing firms from 2004 to 2019. This study explicitly examines the nature of the relationship between the carbon tax and REC and the impact of the carbon tax on REC. Environmental audits can play a crucial role in implementing the rules and regulations conveyed by the government; thus, the moderating role of environmental audits is also examined.

This study makes several meaningful contributions to the existing literature. Currently, very little research has been conducted regarding a carbon tax at the macro level. To the best of the authors' knowledge, this is the first study that examines the impact of the carbon tax on REC in the corporate sector and clinches that carbon tax improves the REC. Due to the regulatory pressures such as carbon tax, business units are trying to mitigate CO2 by

switching on renewable energy because traditional energy sources generate a higher level of CO2, which reduces the firm's profitability by increasing carbon pricing. Furthermore, this study confirms the moderating role of environmental audits between the carbon tax and REC relationship, implying that environmental audits push a business unit to comply with governmental regulations. Hence, it is concluded that environmental audits strengthen the relationship between the carbon tax and REC. Finally, this research also confirms the stakeholder theory because businesses opt for environmentally friendly policies due to the pressure from various stakeholders.

2. Literature Review and Hypothesis Development

With the advancement of the economy and industrialization, an increasing number of stakeholders paved special attention to environmental degradation triggered by excessive CO2. Mapping on the stakeholder theory, the pressure received from the stakeholders facilitates the business management to adopt and implement specific environmental policy regulations (Betts et al., 2015). In particular, regulatory pressure increases firms' adoption practices related to environmental protection policies such as carbon tax. According to Pickman (1998), regulatory pressure related to environmental regulations encourages businesses to implement sustainable business practices. Similarly, Habib and Bhuiyan (2017) argued that regulatory pressure on the business units often increases environmental performance by reducing environmental footprints. Thus, drawing on the stakeholder theory, the stakeholders' pressures, specifically, the pressure from the regulatory body, i.e., the government, motivate the business units to engage in sustainable strategic practices. The use of renewable energy is also a sustainable business practice to reduce the environmental footprints, specifically carbon emissions. Furthermore, environmental audits ensure compliance with governmental regulations, which could help a business maintain a healthy relationship with all the stakeholders (Lee et al., 2017).

Internal and external factors play a crucial role in improving CEP. Internal factors include corporate culture (Wang & Juslin, 2009), board composition (García Martín & Herrero, 2020; Naciti, 2019; Nguyen & Thanh, 2021; Orazalin, 2020; Orazalin & Baydauletov, 2020; Shahbaz et al., 2020; Tseng et al., 2020; Zubeltzu-Jaka et al., 2020) and managerial style (Zou et al., 2015) which have a significant effect on CEP. At the same time, the external factors include government regulations and policies (Haites, 2018; Li, 2021). The literature argues that the government often has a key role in protecting the natural environment by developing and implementing environmentally-friendly policies that directly solve the environmental problems (Kulin & Johansson Sevä, 2019; Mansbridge, 2014). However, the success of these policies is only possible with public support.

There is no single unanimous effective government policy protecting the natural environment for future sustainability. Thus, the government of any county employs multiple policies and regulations to reduce the environmental load. Among these policies and regulations, the carbon tax policy is considered an effective remedial measure to control the volume of CO2 (Chen & Ma, 2021; Haites, 2018). The carbon tax concept was first introduced in 1990, and its implementation has increased gradually in recent years. The carbon tax is an essential element of government policies; it is also known as an

environmental tax, green tax, and ecological tax (Hájek et al., 2019). Furthermore, it is assumed that the carbon tax is considered government pressure on the business firms to reduce their environmental footprint, i.e., carbon emission, waste emissions, energy consumption, and water consumption. Furthermore, Carl and Fedor (2016) argued that a higher level of carbon tax reduces a firm's profitability; therefore, the firms are trying to reduce their CO2 by introducing sustainable business practices such as a shift on renewable energy, focusing on the recycling of waste and water. In terms of preventing global warming, the carbon tax is one of the ecotaxes usually imposed on the business firms on the production and distribution of CO2 generated from the consumption of fossil fuels (Lin & Li, 2011).

Prior literature reports mixed results on the carbon tax and REC relationship. On the first hand, economists argue that putting a price on CO2 – carbon pricing is the most cost-effective regulatory strategy to reduce the high level of carbon emissions (Haites, 2018). A carbon pricing approach motivates to development and implements CO2 reduction strategies. A carbon pricing strategy can be implemented in a carbon tax. In this form, the government sets the progressive tax rate and stipulates the sources subject to the carbon tax. Usually, the emission reduction is subject to the response of the affected sources on which the tax is imposed (Haites, 2018). A carbon tax policy directly decreases the consumption of fossil fuels (Hu et al., 2021); this impended that REC would increase. In this scenario, the carbon tax is considered an effective remedial policy to protect the natural environment because it would cause to decrease in energy consumption, CO2 emission, and other environmental footprints. According to Hu et al. (2021), carbon tax policy should be considered first in terms of environmental protection because it has various advantages over other policies, such as the carbon tax increasing the government's revenues.

Similarly, Li (2021) argued that the business units can't achieve the optimal social and environmental objective without government interventions; therefore, the government must introduce and implement intervention policies that can directly impact a firm's decision. The carbon tax is one of the progressive interventions that can reduce the environmental footprints. On the other hand, a few studies argue that carbon taxation is not an effective government measure to improve environmental performance because it contributes to economic loss. For example, Shevchenko (2021) stated that the financial penalty in the form of the carbon tax is not an effective measure in improving CEP. Similarly, Zhang et al. (2019) reported that carbon tax is a financial burden that reduces business competitiveness. Bashir et al. (2021) also documented that environmental tax is not effective for promoting renewable energy consumption. This study follows the former thought and argues that carbon tax would promote the REC. Thus, due to the contradiction in the literature and based on the above discussion, it is hypothesized that:

H_1: The carbon tax has a positive influence on renewable energy consumption.

Environmental auditing is a systematic tool for businesses to ensure environmental regulations (Power, 2000). More formally, an environmental audit is an assessment to ensure that a firm complies with environmental policies and regulations. According to

(Ozbirecikli, 2007), the fundamental objective of an environmental audit is the legal compliance of government regulations. In addition to this, the environmental audit also provides a signal to the stakeholders that the firm is proactive and committed to protecting the natural environment (Lee et al., 2017). Indeed, environmental audits improve environmental performance by reducing environmental footprints. Furthermore, the environmental audits also assure compliance with government regulations regarding the protection of the environment. Undoubtedly, environmental regulations are necessary to protect the natural environment, but the effectiveness of these regulations has been reduced if a business is focusing on avoiding penalties rather than improving in the process (Rika, 2009). Thus, environmental audit is the mechanism that overcomes such risk because environmental audit could ensure the compliance of environmental regulations and identify the potential environmental hazards.

In this study, the authors attempt to examine the role of the carbon tax in improving REC by using the data of Japanese-listed firms. The carbon tax is the government policy intervention used to mitigate carbon emissions (Haites, 2018). However, compliance with governmental environmental policies is not easy in the corporate sector, especially in countries where it has not become a compulsory requirement. Similarly, the Japanese government has also implemented a carbon taxation policy in the business world, but there is no strict mechanism for its compliance. However, according to Rika (2009), environmental audit is an institutional factor used to ensure compliance with environmental regulations. Furthermore, during the environmental audit, the weak areas are identified, and it is assumed that the business can take remedial action to cover the weak areas. Moreover, environmental audits have a positive impact on CEP. The shifting on REC is also a dimension of CEP; thus, it is argued that environmental audits push a business to shift on REC. Therefore, based on the above discussion, it is argued that environmental audit moderates the relationship between the carbon tax and REC, assuming that environmental audit will strengthen the relationship. Accordingly, we hypothesized:

> *H_2: Environmental audits positively moderate the relationship between the carbon tax and renewable energy consumption.*

Figure 1 (below) depicts the hypothetical relationship of this study. This implies that carbon tax would improve energy efficiency by increasing the share of REC. Resultantly, it would reduce the volume of CO2. The carbon tax is a government policy intervention that plays an essential role in reducing the consumption of fossil fuels (Shahzad et al., 2021). Furthermore, Figure 1 also shows the moderating role of environmental audits between the carbon tax and REC relationship. Environmental audits assure the compliance of environmental regulations, and it shows the commitment of a business towards environmental protection.

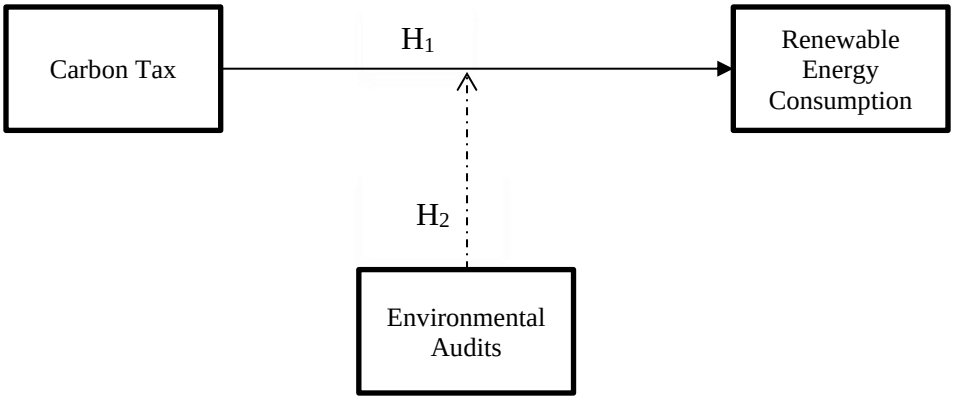

Figure 1: Conceptual Framework

3. Methodology

3.1 Population and Sample

The primary aim of this study is to examine the impact of the carbon tax on REC. In contrast, the secondary aim is to investigate the moderating role of environmental audits between the carbon tax and REC relationship. For this purpose, we used the data of Japanese firms listed on the Tokyo Stock Exchange (TSE). Japan is considered a suitable avenue for the study due to several reasons. Firstly, according to Morishita (2019), Japan plays a leading role in global environmental politics. Secondly, Japan is the third-largest supporter of the United Nations (UN) in promoting sustainable development programs. Thirdly, Japan has made significant infrastructural changes in promoting low carbon society, i.e., introducing a carbon tax system and mechanism of environmental audit. Moreover, according to Endo (2019), the results and implications drawn based on Japanese data can be equally applicable in other Asian countries.

This research study is based on non-probability purposive sampling because, according to Saunders et al. (2019), purposive sampling is appropriate when the researcher focuses on certain population characteristics to answer the underlying research questions. Primarily, it is based Nikkei 225 index. It consists of the top 225 Japanese companies that are listed in TSE. The firms related to the financial sector are removed from the sample due to different reporting patterns, and the financial sector is not the main contributor to environmental damages. Moreover, the firms that are not providing energy disclosure were also removed. The study covered the data from 2004 to 2019 because, in 2004, the Japanese government made various structural changes related to environmental conservation. Finally, we have an unbalanced panel of 1080 firm-year observations of 129 manufacturing firms. Industry-wise details are available in Table 1. In addition to this, the study used the secondary data collected manually from corporate reports and websites.

Table 1: Sample Distribution by Industry

Industry	Frequency	Percentage	Cumulative Percentage
Automobiles & Auto parts	74	6.85	6.85
Chemicals	207	19.17	26.02
Communications	37	3.42	29.44
Electric Machinery	170	15.74	45.19
Electric Power	9	0.83	46.02
Fishery	5	0.46	46.48
Glass & Ceramics	42	3.89	50.37
Land Transport	13	1.2	51.57
Machinery	153	14.17	65.74
Marine Transport	25	2.31	68.06
Nonferrous Metals	69	6.39	74.44
Petroleum	9	0.83	75.28
Pharmaceuticals	124	11.48	86.76
Precision Instruments	37	3.43	90.19
Pulp & Paper	16	1.48	91.67
Steel	53	4.90	96.57
Textiles & Apparel	37	3.43	100
Total	1,080	100	

3.2 *Variables Measurement*

Renewable energy consumption means utilizing alternative energy sources instead of fossil fuels or traditional energy sources. Japanese business firms are disclosing REC information in their corporate reports. To be conservative, we measured REC, our dependent variable through binary coding, coded "one" if a firm using renewable energy and disclosing in corporate reports, otherwise "zero" this measurement is similar to the research studies of Zhang et al. (2021) and Atif et al. (2020). The carbon tax is also measured on a binary scale, equal to "one" if the firm provides the information about the carbon tax, carbon pricing, or environmental violation fines, otherwise "0". This is similar to the studies of Chen and Ma (2021) and Bhat and Mishra (2020) because business firms are not disclosing the quantitative value of carbon tax. The moderating variable environmental audit is also scaled through dummy coding, coded "one" if the firm disclosing the information about the environmental audit, otherwise "zero" this is in accordance with the studies of Aslam et al. (2020) and Lee et al. (2017).

To control the firm-specific heterogeneity, the study employed several firm-specific control variables. Firstly, the environmental management systems (EMS) measured on a binary scale with the help of ISO – 14001 certifications (Arocena et al., 2021; Erauskin-Tolosa et al., 2020; Mungai et al., 2020; Phan & Baird, 2015; Singh et al., 2015) with the assumption that the firms that have a strong EMS are more proactive in promoting REC. Secondly, capital expenditure intensity (CAPEX) is calculated as capital expenditures divided by sales (Francoeur et al., 2021; Kim et al., 2020; Moussa et al., 2020). It is assumed that the firms investing more in capital expenditures are more proactive in promoting green practices. Thirdly, research and development intensity (RDI) is measured as research and development expenditures scaled by net sales (Francoeur et al., 2021; Symeou et al., 2019) because research-oriented businesses are more vulnerable to mitigating environmental risk. Fourthly, return on assets (ROA) is a measure of profitability computed as net income divided by total assets (Campanella et al., 2021; Gerged, 2021; Moussa et al., 2020). Profitable firms have more resources to invest in REC. Fifthly, leverage (LEV) is calculated as total debt divided by total assets (Campanella et al., 2021; Gerged, 2021; Orazalin, 2020). Higher levered firms have higher cash outflows that may have a negative impact on REC. Finally, the firm size (FSIZE) is measured through the natural logarithm of employees (Arocena et al., 2021; Kolsi & Attayah, 2018; Symeou et al., 2019). It is argued that larger firms have more resources for investing in REC. Industry effect is also controlled. The detailed measurements are shown in Table 2.

Table 2: Variables Measurements

No	Name of the Variable	Acronyms	Measurement
1	Renewable Energy Consumption	REC	A binary variable equals '1' if the firm uses the renewable energy consumption and discloses the quantitative amount of renewable energy consumption it is corporate reports, otherwise '0'
2	Carbon Tax	CT	A dummy variable equals '1' if the firm is disclosing carbon tax information in its corporate reports, otherwise '0'
3	Environmental Audit	EA	Measured through binary coding, coded '1' if the firm is executing the environmental audit, otherwise coded '0'
4	Environmental Management Systems	EMS	ISO – 14001 certifications are used as a proxy of the environmental management system. It is measured through binary coding, coded '1' if the firm obtained ISO – 14001 certifications; otherwise, '0'
5	Capital Expenditure Intensity	CAPEX	Capital expenditures / sales
6	R&D Intensity	RDI	Research and Development Expenses divided by sales
7	Profitability	ROA	Net profit of a year scaled by total assets
8	Leverage	LEV	Total debt scaled by total assets
9	Firm Size	FSIZE	Natural logarithm of the employees during a year

3.3 Econometric Model

Due to the nature of the data, a panel data analysis regression technique is used to investigate the proposed hypotheses. Thus, the following econometric model is applied to test the impact of carbon taxation on REC along with moderating role of environmental audits:

$$RCE_{it} = \alpha + \beta 1CT_{it} + \beta 2EMS_{it} + \beta 3CAPEX_{it} + \beta 4RDI_{it} + \beta 5ROA_{it} + \beta 6FSIZE_{it} + \beta 7LEV_{it} + u_{it}$$

$$RCE_{it} = \alpha + \beta 1CT_{it} + EA_{it} + CT*EA\ \beta 2EMS_{it} + \beta 3CAPEX_{it} + \beta 4RDI_{it} + \beta 5ROA_{it} + \beta 6FSIZE_{it} + \beta 7LEV_{it} + u_{it}$$

Where, REC_{it} is the renewable energy consumption of a company i at time t; CT_{it} is the carbon tax; EA_{it} is the environmental audits; EMS_{it} is an adaptation of environmental management systems, i.e., ISO – 14001; $CAPEX_{it}$ is capital expenditure intensity; RDI_{it} is the research and development intensity; ROA_{it} is the return on assets; $FSIZE_{it}$ is the firm size; LEV_{it} is the leverage of the firm and u_{it} is the error term.

4. Analysis and Discussion

4.1 Descriptive Statistics

Table 3 (below) presents the descriptive statistics of all the variables used in the empirical analysis. Data coverage is from 2004 to 2019, and there are 1080 firm-year observations of 129 firms. As discussed earlier, REC is a dummy variable representing whether or a firm is using renewable energy. The 0.913 mean value of REC indicates that 91.3% of firms are using renewable energy. This is undoubtedly a very large value, but this is true in the Japanese context because Japan is very proactive in environmental protection. On the other hand, the mean value of carbon tax is 0.264, meaning that only 26.4% of firms disclose information about government interventions. This value is low because the disclosure about a carbon tax is not yet become the compulsory requirement. Moreover, 69.2% of firms have a mechanism of environmental audit; this is also a good value because the environmental audit is not a mandatory requirement in Japan.

Table 3: Descriptive Statistics

	N	Mean	Std. Dev.	Min	Max
REC	1080	.913	.282	0	1
CT	1080	.264	.441	0	1
EA	1080	.692	.462	0	1
EMS	1080	.871	.335	0	1
CAPEX	1080	.082	.111	0	.961
RDI	1080	.067	.092	0	.824
ROA	1080	.055	.263	-.811	4.049
FSIZE	1080	9.96	1.105	7.307	12.819
LEV	1080	.548	.181	.019	.996

4.2 Correlation Analysis and Multicollinearity

Table 4 presents the pairwise correlations and variance inflation factor (VIF) for dependent, independent, moderating, and control variables used in examining the relationship between the carbon tax and REC. All the variables of interest, i.e., carbon tax and environmental audit, positively and significantly correlate with renewable energy consumption. All control variables have positive and significant correlations with REC, except RDI and LEV. Correlation analysis is also a tool to detect multicollinearity. Gujarati and Porter (2009) suggested that correlation values higher than 0.8 indicate the problem of multicollinearity. Still, as a case of this study, the correlation values are less than 0.8, inferring that multicollinearity is not a problem in this study. Furthermore, we also used the VIF to detect multicollinearity. According to Gujarati and Porter (2009), the value of VIF less than ten does not pose any multicollinearity. In this study, all the VIF values are less than the suggested threshold implying that there is no issue of multicollinearity.

Table 4: Correlations Matrix

Variables	VIF	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) REC	1.30	1.00								
(2) CT	1.18	0.17***	1.00							
(3) EA	1.13	0.15***	0.33***	1.00						
(4) EMS	1.60	0.10***	0.18***	0.37***	1.00					
(5) CAPEX	1.06	0.10***	0.03	0.00	0.02	1.00				
(6) RDI	1.04	0.01	0.13***	0.03	0.10***	0.45***	1.00			
(7) ROA	1.05	0.05**	0.04	0.11***	0.05	0.15***	0.48***	1.00		
(8) FSIZE	1.30	0.06**	0.09***	0.14***	0.02	0.24***	0.08***	0.07**	1.00	
(9) LEV	1.22	-0.0	0.07**	0.01	-0.06**	0.08**	-0.17***	-0.02	0.28***	1.00

**** p<0.01, ** p<0.05, * p<0.1*

4.3 Panel Regression Results

Table 5 represents the regression results for panel data. In panel data analysis, selecting the correct estimator is critically essential. For this purpose, we use several statistical tests for the correct specification of the estimator. Firstly, we apply Breusch–Pagan Lagrange Multiplier (LM) to specify between pooled OLS and random effect model. The statistical value of the LM test (p = 0.000) depicts that the random effect model is more appropriate than simple pooled OLS. Secondly, we apply the Hausman test to identify whether the model follows a random effect or fixed effect. The statistical value of the Hausman test (p = 0.117) confirmed that the random effect model is most appropriate over the fixed effect model. Therefore, the remaining panel regression analysis is based on the random effect model.

4.4 Direct Effect of Carbon Tax on Renewable Energy Consumption

The first hypothesis of this research is about the relationship between the carbon tax and REC. It is hypothesized that carbon tax promotes the REC, meaning that a higher level of carbon tax leads to an increase in renewable energy consumption. The statistical results reported in Table 5 depict that carbon tax positively impacts REC. It is significant at a 1% level of significance ($\beta = 0.092$, $p < 0.01$). Thus, it provides strong support to accept the first hypothesis. These findings are similar to Chen and Ma (2021), Zhang et al. (2021), and Liu et al. (2021), who argued that legal systems have strong correlations with REC. On the other hand, the results contradict the studies of Shevchenko (2021) and Bashir et al. (2021), but this research was conducted in US and OECD countries. The environmental regulations and practices are different in Japan as compared to the US. However, our findings imply that if the government increased the value of carbon tax, it would increase the REC, causing a reduction in CO2. Furthermore, due to strong legal systems, firms are making green investments which helps them in reducing environmental violations and promoting environmental performance in the long run. In addition to this, a financial penalty in a carbon tax or carbon pricing is evidenced as regulatory pressure to reduce emissions by shifting to alternative energy sources. Similarly, Li and Yao (2020) argued that carbon taxes are useful for energy conservation and improve corporate energy efficiency. Therefore, it is concluded that the business units receiving a financial penalty for over carbon emissions would react aggressively to reduce the environmental footprints.

4.5 Moderating Role of Environmental Audits

The second hypothesis predicts that the interaction between the carbon tax and environmental audits will likely promote the culture of REC. Table 5, Model 2 demonstrates that the direct effect of carbon tax on REC remains positive and significant at 1% level of significance ($\beta = 0.165$, $p < 0.01$), whereas, main effect of environmental audit is also positive and significant at 5% level of significance ($\beta = 0.072$, $p < 0.05$). This implies that environmental audit contributes to environmental protection by promoting REC and reducing environmental footprints; these findings are similar to Lee et al. (2017). Furthermore, business firms legitimize their environmental activities through environmental audits (Aslam et al., 2020); therefore, it is useful to reduce environmental footprints. Similarly, the interaction effect between the carbon tax and environmental audit is also positive and significant at a 1% significance level ($\beta = 0.097$, $p < 0.01$); thus, we accept the second hypothesis. It implies that a higher level of the carbon tax and environmental audits promote REC. Resultantly, it would reduce the consumption of fossil fuels, leading to a reduction in CO2 and improvement in environmental performance. In the interactive model, the coefficient of the carbon tax is strengthened from the base model. Carbon tax externality creates a synergy effect with environmental audit and promotes environmental protection activities. This specifies that the environmental audit moderates the relationship between the carbon tax and REC.

The beta coefficients of control variables depict that environmental management systems and firm size are positive and significant at a 10% significance level in the base model.

This indicates that the larger firms and the firms implementing EMS are more committed to consuming REC. Capital expenditure intensity and return on assets (profitability) are positive and significant at a 1% level significance, meaning that a higher level of capital expenditures and profit promotes REC and improves CEP. The coefficient of research and development intensity is positive but not significant at any level; this depicts that RDI is not contributing to RCE. Whereas the leverage coefficient is negative and significant at a 10% level of significance, a higher level of debt discourages renewable energy consumption because firms are paying more interest and principal, reducing investments in green energy sources.

Table 5: Panel Regression Results

Variables	**Model 1**	**Model 2**
	REC	**REC**
CT (Carbon Tax)	0.092***	0.165***
	(0.021)	(0.031)
EA (Environmental Audit)		0.072**
		(0.031)
CT*EA (Interaction Term)		0.097***
		(0.037)
EMS	0.068*	0.070*
	(0.041)	(0.039)
CAPEX	0.330***	0.321***
	(0.120)	(0.117)
RDI	0.131	0.116
	(0.182)	(0.175)
ROA	0.340***	0.470*
	(0.128)	(0.228) **
FSIZE	0.016*	0.017*
	(0.009)	(0.010)
LEV	-0.150*	-0.140**
	(0.087)	(0.072)
Constant	0.883***	0.886***
	(0.109)	(0.113)
Industry Dummies	Yes	Yes
Observations	1,080	1,080
Breusch–Pagan Lagrange Multiplier (LM)	0.000	
Hausman test	0.117	

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

Carbon taxes are becoming popular as a government policy to regulate and control CO2, and it has become equally important for the business units. Therefore, it is necessary to execute the carbon tax policy to decrease carbon emissions because taxes play a crucial

role in reducing carbon emissions. This study also evidenced that carbon tax promotes REC. This research study extends the prevailing carbon tax literature by providing empirical evidence that carbon tax has a significant positive impact on REC. In the absence of government interventions, the business units may trade-off based on cost and benefits. Government interventions could restrict their swap and encourage them to mitigate the environmental burden. The findings are similar to the previous research studies of Chen and Ma (2021) and Liu et al. (2021). Furthermore, the results also depict that environmental audit moderate the relationship between the carbon tax and REC, which implies that an environmental audit is a valuable tool in reducing CO2 by promoting renewable energy consumption. It also confirms that environmental audits strengthen the effect of the carbon tax on REC. Therefore, implementing environmental audits could improve REC and reduce the environmental footprints. Thus, it is suggested that businesses may implement environmental audits to improve their CEP. The findings are consistent with the studies of (Aslam et al., 2020) and (Lee et al., 2017).

5.1 Contribution of the Study

This is a unique study because, as per the known literature, a limited number of research studies have examined the impact of the carbon tax on REC. Still, in the Japanese context, no prior research has examined the effect of the carbon tax on REC by using the data of manufacturing firms. Thus, the study contributes to the existing literature on the carbon tax and REC relationship and fills the gap by examining the moderating role of environmental audits. The findings highlighted that carbon tax is a regulatory pressure that pushes a business to consume renewable energy. The results also confirm the stakeholder theory. Companies develop and implement environmental protection policies to reduce the pressure from various stakeholders. Japan is innovative in protecting the natural environment due to its structural changes, i.e., introducing and implementing environmental reporting guidelines for business units, environmental management systems, and environmental audits. Thus, based on the findings of this research, it is recommended that other countries also develop and implement environmental policies to protect the natural environment.

5.2 Research Implications

We recommend some policy implications for the regulators and policymakers based on the empirical results. First, the governments need to launch a progressive carbon tax system and make it compulsory for the corporate sector to reduce carbon emissions. In addition to this, it is recommended that the regulators not impose heavy carbon at the preliminary phase of the business. Furthermore, along with carbon tax, the government also needs to develop a mechanism to promote sustainable investment, i.e., the investment in renewable energy or clean technologies which would reduce CO2. Furthermore, it's a time to promote green bonds in the corporate sector because their proceeds could only be used for environmental protection activities (Maltais & Nykvist, 2020). The results also revealed that environmental audit and carbon tax promotes REC; ultimately, it would reduce environmental footprints. Since many countries have introduced environmental audit

schemes, but these are not mandatory (Lee et al., 2017) thus, it is suggested for the policymakers and corporate managers to make the environmental audit a compulsory requirement. More broadly, the environmental audit should be an essential part of financial reporting because environmental audits and environmental performance provide helpful information for investors and other stakeholders. In addition to this, environmental audits improve the transparency and promotes sustainable business strategies.

5.3 Limitations and Future Research Directions

The findings of this research must be interpreted in light of the following limitations. Firstly, the carbon tax structure differs from country to county; therefore, the results of this research cannot be generalized globally. It is encouraged for other researchers to investigate the impact of the carbon tax on renewable energy by using multiple countries' data to generalize the results globally. Secondly, the study is limited to renewable energy consumption, and it does not distinguish between several sources of energy consumption as this information is not disclosed in the corporate reports. Thus, it does not classify which source of renewable energy consumption is prominent—basically, this is a methodological weakness of this research. Future research may be carried out with improved disclosure of renewable energy to identify which source of renewable energy consumption is prominent. Thirdly, this study covers only one government intervention: the carbon tax. Undoubtedly, only the carbon tax policy is not an ultimate solution to overcome the environmental problems; various other policies can be used to mitigate the CO2, such as a change in the prices of fossil fuels, training programs, and environmental awareness sessions. Therefore, it may be considered for future research to examine the broader view of government interventions to protect the natural environment and future sustainability. Lastly, this research has not examined the effect of internal governance mechanisms on renewable energy consumption. Thus, it is strongly recommended that future research may be extended by examining the role of internal governance mechanisms in promoting renewable energy consumption.

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