Investigating the role of creative accounting on the ecological effects of renewable energy consumption and business policy: A mathematical approach

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Abstract

Today, the use of renewable energy is the most important option in the field of environmental protection, and activists in the field of environmental ethics emphasize it. In this study, the evaluation of the role of renewable energy consumption and business policy in environmental protection with emphasis on creative accounting in companies admitted to the Tehran Stock Exchange has been investigated. The research conducted, in terms of the type of quantitative data, in terms of the objective of the type of applied research, and in terms of the way of implementation regarding the hypotheses, is placed in the descriptive-correlation research group. The target society is the companies admitted to the Tehran Stock Exchange, 166 companies have been selected as a sample using the screening method. Data was collected using Tadbir Pardaz and Rahevard Novin software, Kodal system and annual financial statements of companies and analyzed using Eviews software. To test the research data using methods such as Lemer's F test and Haussman test to determine the pooling or pooling as well as the fixed or random effects of the data, White's test to check the homogeneity of the model, Durbin Watson's test to analyze the correlation of variables with In the previous courses, the VIF (Variance Inflation Factor) test was used to check the reliability of the coefficient of determination, the Dickey-Fuller and unit root tests were used to analyze the mean values of the variables, as well as the Jarek-Bera test to check the normality of the data. Based on the obtained results, the effect of creative accounting as a mediating variable in an interactive relationship with independent variables (renewable energy consumption, commercial policy, commercial competition and environmental uncertainty) on the dependent variable (environmental destruction) is positive and significant. The research findings show that the studied companies use the variable of creative accounting as a factor for not disclosing ecological effects (environmental destruction).

Keywords: environmental ethics, creative accounting, renewable energy consumption
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1 Introduction

From the perspective of sustainable development, the environment is an important natural capital that is necessary both for direct consumption (for example, breathing clean air) and for maintaining the flow of production. Therefore,

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damage to the environment means a continuous reduction of a country's capital and causes a decrease in the quality of services obtained from it. In this way, it harms human well-being. Economists, while maximizing the added value of economic activities, seek to determine the amount of use of the environment in such a way that it does not harm the survival of this natural capital and the natural system does not lose its equilibrium dynamics. The damages caused by the rapid development of the energy sectors in the environment in recent decades have caused the environmental effects to be placed as a limitation against the development programs of the energy sector [18].

Many business units are forced to bear environmental costs to reduce environmental damage, achieve more income, or gain popularity and commercial success. Accounting reporting, as one of the important components of the management information system, can play a role by taking a lot of responsibility in helping to protect the environment from polluting production companies. This is important through the disclosure of information related to the expenses made by companies to protect the environment, they play a decisive role in enlightening the public mind. Reporting information related to the environment can provide managers with a broad and accurate view of product costing and pricing, and it also helps companies design the process of producing goods and provide their services with as much emphasis on environmental issues as possible. On the other hand, from the competitive aspect, goods and services that are environmentally friendly can be preferred by customers [2].

Due to the increasing progress in all sciences, many advances have been made in management accounting, including the appearance of innovative tools. Among the innovative tools that have emerged in the framework of accounting systems, is creative accounting, which is defined as a conscious behavior to reduce periodic income fluctuations. According to the management accounting conceptual statement of the International Federation of Accountants, environmental management accounting is the management of economic and environmental performance by creating and applying appropriate accounting procedures and systems related to the environment [1].

Creative accounting is the science and art of creating attractive accounts within existing performance parameters. Manipulation of accounting data in favour of providing and presenting a favorable operating picture, something that managers will be interested in, does not necessarily refer to ignoring the rules and regulations of the accounting method. On the contrary, this goal is often achieved without violating accepted standards, using so-called creative accounting.

The term creative accounting has an Anglo-Saxon origin and implies the use of legal accounting methods that allow the company to present a favourable public image. Therefore, by definition, creative accounting can be distinguished from any accounting fraud that violates accounting rules by manipulating data. However, creative accounting is unacceptable, even though it respects accounting rules and regulations because its ultimate goal is to distort the perceived financial position and the company's performance numbers to mislead investors and other classes of end users of accounting information.

The evolution of creative accounting makes it impossible to measure the real situation of the business and strongly affects the accounting reality through the manipulation of numbers. Such methods are facilitated not only by the existence of loopholes and loopholes in the rules but also by the flexibility of the rules themselves, which allow a certain degree of methodological choice(methodology) used to transform financial statements in a favorable way for management. The most creative accounting practices target profit numbers to present a lofty or arrogant impression of the company's performance. Such practices are called outcome management.

The desire to have a healthy environment increases by increasing the ability to pay its costs and benefit from more prosperity, and with the provision of the necessary capital, the environment also improves. According to this argument, many of the environmental problems of developing countries can be attributed to the low level of income and issues caused by poverty. Under such conditions, applying trade restrictions makes it more difficult to impose financial resources to improve the environmental situation [14].

Another challenge facing Iran's environment is the issue of air pollution caused by industrial development and increasing economic activities. In Iran, the transportation sector is the largest producer of polluting gases. Power plants and industries also have a significant contribution to the emission of air pollutants [15].

Since the most important harmful factor in environmental pollution is air pollution (emission of CO_2 gas), air pollution is the basis of action in this research. This type of pollution is more prevalent than other types and affects people's lives more widely.

This research investigated the following hypotheses:

The main hypothesis

The consumption of renewable energy and the commercial destruction of the environment with an emphasis on creative accounting have a significant impact.

2 Sub-hypotheses

1. Renewable energy consumption (capacity) has a significant effect on ecological effects with emphasis on creative accounting.
2. Commercial policy criteria have a significant effect on ecological effects with emphasis on creative accounting.
3. Competition (business environment) has a significant effect on ecological effects with emphasis on creative accounting.
4. Environmental uncertainty has a significant effect on ecological effects with an emphasis on creative accounting.

Also, the conceptual model of the research is defined as follows:

First hypothesis model:

$$Co2_{i,t} = \beta_0 + \beta_1 REC_{i,t} + \beta_2 CA_{it} + \beta_3 REC_{i,t} * CA_{i,t} + \beta_4 LEV_{it} + \beta_5 SIZE_{i,t} + \varepsilon_{i,t}$$

The second hypothesis model:

$$Co2_{i,t} = \beta_0 + \beta_1 PPES_{i,t} + \beta_2 ETO_{i,t} + \beta_3 ES_{i,t} + \beta_4 IA_{i,t} + \beta_5 GWTS_{i,t} + \beta_6 CA_{it} + \beta_7 PPES_{i,t} * CA_{it}$$
$$+ \beta_8 ETO_{i,t} * CA_{it} + \beta_9 ES_{i,t} * CA_{it} + \beta_{10} IA_{i,t} * CA_{it} + \beta_{11} GWTS_{i,t} * CA_{it} + \beta_{12} LEV_{it} + \beta_{13} SIZE_{i,t} + \varepsilon_{i,t}$$

The third hypothesis model:

$$1 - Co2_{i,t} = \beta_0 + \beta_1 BC_{i,t} + \beta_2 CA_{it} + \beta_3 BC_{i,t} * CA_{it} + \beta_4 LEV_{it} + \beta_5 SIZE_{i,t} + \varepsilon_{i,t}$$

The fourth hypothesis model:

$$1 - Co2_{i,t} = \beta_0 + \beta_1 EnvUnc_{i,t} + \beta_2 CA_{it} + \beta_3 EnvUnc_{i,t} * CA_{it} + \beta_4 LEV_{it} + \beta_5 SIZE_{i,t} + \varepsilon_{i,t}$$

where in:

Degradation of the company's environment	Co2
Creative accountant	CA
Consumption of renewable energy	REC
Asset efficiency	PPES
The stability of the company's organization	ETO
The company's ability to produce and distribute products and services efficiently	ES
To innovate the company's ability	IA
Company's growth	GWTS
Business competition	B.C
Environmental uncertainties	EnvUnc
Size of the company	Size
The lever belongs to	LEV

3 Analysis method

In terms of the type of quantitative data, in terms of the objective, in terms of the type of applied research, and in terms of the way of implementation regarding the research hypotheses, this research is placed in the descriptive-correlation research group. The statistical community studied in the current research the companies admitted to the Tehran Stock Exchange are in the period of 1390 to 1399. Also, to determine the sample size, the screening method was used, according to the defaults, 166 companies were selected as the sample size. Data collection was done using Tadbir Pardaz software, Rahvard Navin, Kodal system and annual financial statements of companies and analyzed using E-Views version 9 software.

4 Research variables and how to calculate them

A) How to calculate the company's environmental degradation (dependent variable) In this research, in order to measure the variable of environmental degradation using the model of Khodadad Lashkari and Fard Moradi Nia [11], from the method (a questionnaire through email and correspondence with the company), the average amount of fuel consumed (natural gas and liquefied natural gas...) per each square meter obtained in

horizon and based on that, the amount of carbon dioxide is roughly expressed. In this method, only the amount of natural gas consumed is the criterion of action, and other fuels such as liquefied petroleum gas... due to the existing conditions, which have a very small consumption, will not have much effect on the result obtained.

Approximate estimation of carbon dioxide using average natural gas consumption to get an approximate amount of carbon dioxide from natural gas fuel, the emission or conversion coefficient of CO_2 from natural gas fuel is 120,000 in terms of (scf/106lb), which we multiply by 16 and divide into one million to convert to m3/kg. The obtained number is equal to 1.92 as the CO_2 emission coefficient resulting from the burning of natural gas, which is multiplied by the average amount of gas consumed in units of cubic meters per second per square meter. The number obtained after multiplying by 10,000 square meters is expressed as the amount of CO_2 gas produced per hectare.

B) Creative accounting (intermediary variable) In this research, Jamshidpour et al.'s model was used to measure creative accounting, which consists of accounting changes obtained from profits and losses (accounting errors). To measure this variable, an artificial variable has been used in such a way that if a company has accounting errors for each year in the research period, code 1 and if it does not have accounting errors, code0 is defined.

C) Independent variables   1. Renewable energy consumption (capacitive)
In this research, to measure the variable of renewable energy, Pesaran et al.'s model has been used, which consists of the consumption of non-fossil fuels by the company (solar, wind, bio...).

2. Business strategy
The planned efforts of the organization's high-level management to influence organizational achievements are considered through the management of the organization's relationships with the environment [19]. In this research, the five strategy indicators proposed by Miles and Snow are used, the relevant data available to calculate them. These indicators are as follows:
(a) Asset efficiency: It is obtained by dividing fixed assets by total sales (PPES).
(b) the organizational stability of the company: It is measured by the employee turnover ratio (ETO).
(c) the company's ability to produce and distribute products and services efficiently: this ratio is measured by the ratio of employees to sales (ES).
(d) the company's ability to innovate: It is measured by the ratio of intangible assets to total assets (IA).
(e) Company growth: It is measured by sales growth (GWTS).

3. Competition (business environment)
In this research, the concept of the business environment used is related to the level of competition in the business environment or industry in which the company operates. High competition in the business environment indicates a dynamic environment. Because competition makes markets more dynamic, while a stable environment reflects less competition. In this research, only one concept of business competition is considered, which is considered under the title of competitiveness of the business environment [4, 6], and the Herfindahl Index is used to measure the variable of business competition [3, 5, 7, 8, 9, 12].
Herfindahl index (HI) is calculated with the following formula:

$$HI = \sum_{i=1}^{n} S_i^2$$

$$HI = \sum_{i=1}^{n} \left(\frac{X_i}{X} \right)^2$$

in this formula, n is the number of companies in the market and S is the share of companies in the total size of the market. In the mentioned index, the number of companies (x) and the size of their relative shares (x_i) are included in the calculation. If there are many companies with the same relative sizes in the market, the Herfindahl index will be very small and close to zero, and if there are few companies with unequal relative sizes in the market, the index will be close to one [16].
The HI index is calculated for each year; the market share is calculated using the ratio of the net sales of the company to the net sales of the entire industry. Industry classification is done according to the classification of different industries in Tehran Stock Exchange. Industries with less than five companies are excluded.

4. Environmental uncertainty
The sales variation coefficient is used to measure environmental uncertainty. For this purpose, the standard deviation ratio of the company's sales over a ten-year period is calculated over the company's average sales over a ten-year period [17].

The said method is as described in the following relationship:

$$EU_{i,t} = \frac{\sigma\ Sales}{\mu\ Sales}$$

EU: represents the coefficient of change in sales and variable index of environmental uncertainty.
$\sigma\ Sales$: the standard deviation of the company's sales over a ten-year period (from year t-9 to t)
$\mu\ Sales$: the company's average sales over a ten-year period (from year t-9 to t)

4.1 Control variables

Financial leverage (LEV): It is measured by dividing total liabilities by total assets. Size of the company (SIZE): It is the size of the company that is used in the research [10] from the logarithm of total assets. Considering the existing inflation in Iran during the past years, the logarithm of assets, which is not inflation-adjusted and is based on book values, cannot reflect the real size of companies in an inflationary environment. Therefore, in this research, an attempt is made to test the size of the company using the logarithm of the company's sales.

5 The results obtained from the data test

According to the results obtained from the Flimer test and the Haussman test, the Flimer probability of all research models is less than 5%, therefore, to estimate all models from the panel method, and considering that the Hausman test probability of all research models is less than 5%, to estimate the models The fixed effects model has been used. The results of White's test show that the probability of significance is less than 5%, so the homogeneity of variance is not established, and instead of using the ordinary least square method, the generalized least square method (GLS) has been used. Based on the results obtained from Durbin-Watson's test, the probability of F statistic in all hypotheses was more than 5%, so the absence of correlation between variables was confirmed. In the VIF test, which was used to test the existence or non-existence of a co-linear relationship between independent variables, the variance inflation factor for all variables was less than 10, so there was no co-linearity problem.

According to the results obtained from the Dickey-Fuller and unit root tests to check the significance of the research variables, the statistical probability for all variables was less than 5%, so the significance of the research variables and the hypothesis H0 based on having a unit root of the variables were not accepted and finally, the Jarek-Bera test was performed to check the normality of the data and the results showed that the probability of the statistic is less than 5%, and as a result, the normality of the data distribution was confirmed. The results of the analysis of research hypotheses.

6 Results

The first hypothesis: as it has emerged from the results, all the coefficients are statistically significant at the 5% level, and the results of the influence of the independent variables of renewable energy consumption (biological capacity) are dependent on the variable. Considering that the significance level of the interactive variable of renewable energy consumption ∗ creative accounting is 0.0197 and its coefficient is -0.230, therefore, it can be said that creative accounting is a mediating variable in the relationship between renewable energy consumption and ecological effects. There is. Based on the findings of the research, it can be said that the increase in energy consumption in the country causes an increase in environmental pollution (emission of CO_2 gas).

The second hypothesis: the effect of commercial policy on the environment is clear. Institutions play a central role in commercial policy. The degree of business competition affects the results of environmental policies. The business policy index shows the effect of the company's political factors on the environmental performance. The results of this research show that the environmental performance improves with the increase of business strategies. The presence of stronger and more democratic business institutions causes seriousness in the establishment and implementation of environmental laws and reduces environmental pollution. In addition, the negative coefficient obtained for the commercial policy index in relation to the emission of pollution indicates the important role of the presence of creative accounting of companies as a tool to reduce the level of public awareness of environmental issues, which can be the basis for improving the quality of the environment.

The third hypothesis: The results show that the independent variable of commercial competition is statistically significant in affecting the dependent variable Lco2 (ecological effects (environmental destruction)) at the 5% level

Table 1: Estimation of the main research model

meaningful	t statistic	standard deviation	Coefficient	Variables
0.0000	12.52503	0.840322	10.52505	Renewable energy consumption
0.0000	12.62256	0.013857	0.174916	Creative accounting
0.0197	$363066-2$	0.097571	$230567-0$	Renewable energy consumption * creative accounting
0.0000	-42.55055	0.397722	-16.92328	asset efficiency
0.1435	$472513-1$	0.002050	$003019-0$	Organizational stability
0.0000	-39.73115	0.029126	1.157200	The company's ability to produce and distribute products
0.0134	1824.6	0.329446	-14.09643	The ability of the company to create innovation
0.0000	-40.95077	0.249605	-10.22150	company's growth
0.0000	7.156259	0.01514	0.010834	Creative accounting
0.0000	-13.72987	0.004868	$066830-0$	asset efficiency * creative accounting
0.0953	35843.36	0.022378	$813630-0$	Organizational stability * creative accounting
0.0264	-3.85514	0.013319	0.956573	The company's ability to produce and distribute products * Creative accounting
0.0746	$798044-1$	0.000381	$000684-0$	The ability of the company to create innovation * creative accounting
0.0171	$54330-5$	$-10E2.45$	00000.18	Company growth * Creative accounting
0.0000	203990.5	0.753630	$921881-3$	competition (business environment)
0.0000	4.437450	2.839807	12.60150	Creative accounting
0.0006	$545338-3$	10.4485	-37.03053	Competition * creative accounting
0.0000	$+08E6.63$	$-10E4.79$	0.317856	Uncertainty Environmental
0.0000	7.058075	$-10E4.84$	4.203836	Creative accounting
0.0000	$+11E-1.28$	$-12E1.68$	$215117-0$	Environmental uncertainty * creative accounting
0.0000	$+11E14.1$	$-11E2.02$	1.49766	size of the company
0.0000	$+10E8.21$	$-11E3.22$	2.62275	Financial Leverage
F statistic	135.9192	Adjusted coefficient of determination	0.68413	
F statistic probability	0.000000	Watson camera statistics	1.9214	

($Prob. < 0.05$). As can be seen, the significance level of the interactive variable of business competition*creative accounting is 0.00 and its coefficient is -37.03. Therefore, considering that with the inclusion of the creative accounting variable in this relationship, the coefficient of the competition variable has decreased from -3.92 to -37.03, so it can be said that creative accounting plays a role as a mediator in reducing ecological effects in this relationship.

Considering the high priority of production and employment over a clean environment in the country, low environmental standards, low technology and lack of technical efficiency in production, lack of technical efficiency in the transportation sector, etc., it is not far from expected that In Iran, economic development leads to an increase in environmental destruction. Due to the fact that the reduction of production and economic growth is against the development goals of the country, it is necessary to try to reduce the negative effects of economic development on the environment by adopting strategies such as increasing energy efficiency in the production sector, encouraging technological innovations, etc.

The fourth hypothesis: The results indicate that the independent variable of environmental uncertainty is statistically significant in influencing the dependent variable Lco2 (ecological effects (environmental destruction)) at the 5% level ($Prob. < 0.05$). As can be seen, considering that the significance level of the interactive variable of environmental uncertainty * creative accounting is 0.000 and its coefficient is -0.215, therefore, it can be said that creative accounting is a mediating variable in the relationship between environmental uncertainty and There are ecological effects.

7 Discuss

Although the development of economic activities in the long term seeks economic prosperity, but in some situations, industrial development programs may not lead to prosperity, and this is when environmental pollution issues are raised in countries. Environmentalists protested against the deplorable state of the environment caused by the ever-increasing development of trade, and organized widespread protests and meetings in different parts of the world. According to them, as a result of trade liberalization, the volume of economic activities (including polluting activities) expands and the use of resources and energy increases inappropriately [15].

The role of governments in environmental management is more than anything related to the way of providing

public goods, including environmental protection and their quality. In recent years, due to the spread of commercial activities and their destructive effects on the environment, monitoring the activities of manufacturing companies in order to improve the quality of the environment seems to be mandatory. Currently, Iran is one of the countries that is facing environmental problems. By proposing creative accounting as one of the effective factors in the management of the environment and existing natural resources, the research has focused on explaining the role of creative sensitivity on the ecological effects of renewable energy consumption and commercial policy. The sample size is the number of 166 companies admitted to the Tehran Stock Exchange in the period of 2010-2019.

The variables used to test research hypotheses are: carbon dioxide emissions per capita to calculate environmental degradation, non-fossil fuel consumption to measure renewable energy, five indicators (asset efficiency, company's organizational stability, company's ability to produce and distribute efficient products and services , the company's ability to create innovation and company growth) to calculate the business policy variable, the Herfindahl index to measure the competition(business environment), the coefficient of sales changes to measure environmental uncertainty, and the accounting errors listed in the company's income statement to measure creative accounting.

The results of the first hypothesis of the research state that 78% reduction of the effects of renewable energy consumption on the effects of environmental degradation was due to the use of creative accounting variable. By examining the results of the second hypothesis, it can be said that the mediating variable of creative accounting has an interactive relationship with asset efficiency indicators, the company's ability to produce and distribute efficient products and services, and the company's growth has a reducing effect on ecological effects, and in an interactive relationship with organizational stability indicators and the company's ability to innovate does not play an effective role. Also, the results of the third and fourth hypothesis show that the variable of creative accounting has a reducing effect on the effects of environmental degradation in an interactive relationship with the variables of commercial competition and environmental uncertainty.

8 Conclusion

Following the economic structural changes of the countries, as well as the growth and development of industries, as well as the growth of urbanization, the consumption of different types of energy has increased. Although the increase in the volume of economic activities ultimately leads to economic growth, the environmental aspect of the change and increase of this factor should not be hidden from the views. If the technology, technology and investment in the environment remain constant, the uncertainty of economic activities will cause the degradation of the environment [13].

Among the approaches that can be used to reduce environmental costs and develop products is environmental management accounting. In this regard, Bennett and his colleagues stated that environmental management accounting, like management accounting itself, is a forward-looking approach in the long-term planning of the activities of commercial units, which is done by collecting all available information (financial and non-financial) and according to the component. Environmental factors play an important role in the development and production of new products.

Evaluating an environmentally conscious investment is one of the important cases in which a decision is made about the process of their activity, considering the company's goals and environmental effects. In this regard, environmental management accounting emphasizes environmental issues by reporting transparent information about the production process, using accounting principles and methods to create, preserve, store and increase value [1].

The results of this research show that the effect of creative accounting on the role of renewable energy consumption and business policy in environmental destruction is positive and significant, and the studied companies use the variable of creative accounting as a factor in not disclosing ecological effects (environmental destruction).

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