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The Relationship between the Environmental and Financial Performance of Australian Electricity Producers

S. Forughi, A. De Zoysa, S. Bhati

Abstract**—**The present study focuses on the environmental performance of the companies in the electricity-producing sector and its relationship with their financial performance.

We will review the major studies that examined the relationship between the environmental and financial performance of firms in various industries. While the classical economic debates consider the environmental friendly activities costly and harmful to a firm's profitability, it is claimed that firms will be rewarded with higher profitability in long run through the investments in environmental friendly activities. In this context, prior studies have examined the relationship between the environmental and financial performance of firms operating in different industry sectors. Our study will employ an environmental indicator to increase the accuracy of the results and be employed as an independent variable in our developed econometric model to evaluate the impact of the financial performance of the firms on their environmental friendly activities in the context of companies operating in the Australian electricity-producing sector.

As a result, we expect our methodology to contribute to the literature and the findings of the study will help us to provide recommendations and policy implications to the electricity producers.

Keywords**—**Australian electricity sector, efficiency measurement, environmental-financial performance interaction, environmental index.

I. Introduction

AUSTRALIA is acknowledged as a foremost energy exporter of the world as it exports more than 70 per cent of its energy production [1] and account for 23.4 per cent of Australia's total exports value [2]. While Australia's contribution to World's energy supply is significant, it has also contributed to the increase in fossil fuel CO_2 emissions in the world. The energy sector in Australia is the largest source of greenhouse gas emissions in the country, comprising 72.3 percent of Australia's net emissions. According to the measurements of total fossil fuel CO_2 emissions conducted in 2008, Australia is ranked among the top CO_2 emitting countries in the world [3]. Australia has the highest per capita emissions of any developed country (double the OECD average and four times the global average), although it is responsible for just 1.4% of the global GHG emissions [4].

Shima Forughi, Anura De Zoysa and Shyam Bhati are with the School of Accounting, Economics and Finance, Faculty of Business, University of Wollongong, Wollongong, NSW 2522 Australia (phone: 0061 434197514, 0061 2 42215382, 0061 2 42215383; e-mail: shima@ uow.edu.au, anura@ uow.edu.au, shyam_bhati@uow.edu.au).

Australia is a country with small population. However, despite its small population, it is identified as the ninth-largest user of primary energy per capita in the world with coal providing the most of the energy used in the country [5]. Australia is not only one of the world's leading producers of coal but also the world`s largest exporter of coal, exporting 31 percent of global exports. With increased coal production, CO_2 emissions from coal consumption presented an increasing trend and found to be about 57% of the total emission in Australia [6]. In addition to coal, Australia is one of the world's major exporters of liquefied natural gas and uranium [5]. Australia is also the main coal and iron ore provider to China—the world`s largest energy consumer—which is "believed to be responsible for approximately half of the man-made contributions to the greenhouse effects" [7].

Given the significant role, Australia is playing in the world's energy production and GHG emissions; it has a responsibility to take effective measures significantly decrease the amount of GHG emissions in response to the global demand for action on climate change [4]. In response, successive governments in Australia have taken numerous measures such as introduction of carbon tax, direct action plan and Renewable Energy Target (RET) to reduce GHG emission significantly.

The electricity sector is the single biggest source of GHG emissions in Australia, accounting for 35 percent of Australia's total GHG emissions [8]. To generate electricity, this sector predominantly uses old and inefficient coal-fired power stations, which require replacement or retirement in the coming decades. As a result, the sector produces more GHG emissions per unit of electricity than any other developed country, China and Middle Eastern nations [9]. However, this sector is also identified as a sector that, can achieve significant emission reductions in electricity generation and usage as this sector is relatively easy and cheaper to restructure in comparison to other sectors with high GHG emissions such as transport and agriculture [4]. Given this situation, the measures taken by this sector to reduce its GHG emissions and their impact can be expected to have wider implications not only for other sectors in the country but also for other countries aiming to reduce GHG emissions [4]. Given this background, the present study aims to develop an advanced econometric model capable of assessing the impact of environmental friendly activities undertaken by Australian electricity producers on the financial performance of those companies.

There are enduring arguments on the impact of environmental activities on financial performance of firms. According to the debates of classic economy, these types of investments are not as beneficial to the firms as to the society and, therefore, firms usually under-invest in the environmental performance [10]. In addition, it is assumed that the enforcement of environmental standards by governments will create a trade-off between the societal benefits and organizational costs. On the contrary, some authors [11]-[15] argue that by following environmental regulations firms will be able to achieve higher profitability in the long-run due to different factors such as customer satisfaction and lowering production costs. These researchers address the environmental investments as a "win-win" approach for societies and firms [10].

The present research aims to shed different lights by proposing an improved methodology and a model to analyze the environmental and financial performance of firms, addressing some shortcoming of previous studies. The model presented in this study employs an Environmental Performance (EP) variable to measure the environmental performance of a firm from different perspective. This variable will serve as an independent variable in the econometric model presented in the study along with other variables commonly used in previous studies to evaluate the relationship between the environmental and financial performance of the electricity producing companies in Australia.

Considering the significance of assessing the measures taken by electricity sector to reduce GHG emissions in the sector, this study expects to contribute to the academic literature by proposing an effective model to establish the relationship between the environmental and financial performance of the Australian electricity producers.

II. Literature Review

The brief literature presented in this section review some major prior studies that have examined the link between the environmental activities and financial performance of organizations.

Konar and Cohen [14] examined the impact of environmental performance on market value of a firm using data collected from 321 largest publicly traded manufacturing firms in the United States. They separated the environmental performance from intangible assets and extended the standard economic technique of decomposition of the market value of a firm into its tangible and intangible assets to evaluate the value of a firm's environmental performance in the market. The tangible asset value, assessed as the replacement cost of the tangible assets, is estimated by means of accounting based values and Tobin's q, a marked based value. For certain variables, lagged values have been used but the focal period is year 1989. The authors controlled for the effect of following variables on the financial performance of firms: value of intangible assets, replacement value of assets, research, and development expenditure, advertising expenses, market share at the four digit Standard Industrial Classification (SIC) level, four-firm concentration ratio, two-year sales growth 1987-89, imports/ value of shipments at the two digits SIC level, ratio of age of the plants assets to the property, plant and equipment, capital expenditures to depreciation ratio, toxic chemical releases in 1988 to the revenue in 1988, and number of environmental lawsuits against the firm in 1989.

The results presented statistically and economically significant negative effect of the poor environmental performance on the intangible asset value of the examined firms. In the majority of industries, the effect of environmental regulation on intangible-asset value is likely to be economically insignificant. However, the effect of toxic-emission levels was found to be both statistically and economically significant. Traditional polluting industries were found to be incurring larger losses throughout all industries.

Looking for clear answers on the relationship between the corporate financial performance (CFP) and its environmental performance (CEP), Salama [16] hypothesized that this inconsistency could be because of the econometric analysis imperfections. He indicated to the inclusive results of outliers that make them a main problem for OLS and related methods [16]. Thus, as an alternative to OLS regression techniques, this study introduced robust regression analysis methods as such methods are less susceptible to outlier-filled data used throughout the study. Based on the prior literature, this study hypothesized that the corporate environmental performance and its successive financial performance are positively related [16]. The study used a sample of companies consisting 201 companies listed in Britain's Most Admired Companies (MAC) and used firm size, systematic risk, R & D intensity and industry effects (industries are categorized as high-profile and low-profile industries) to control the results.

To examine the link between the CEP and CFP, "the main hypothesis and variables were combined into a multiple regression model" [16, pp. 415]. The obtained results presented positive relationship between CEP and CFP that signifies having "a reputation for leadership in environmental affairs" by keeping in mind the important role of the environmental stakeholders [16]. The author suggests that the corporations can start to assign some resources into the environmental schema by regaining trust with stakeholders and investors [16].

To test the relationship between the environmental and financial performance of 227 UK firms, Elsayed and Paton [10] accomplished static and dynamic panel data analysis. Referring to the importance of this relationship, they stated that a positive relationship between the two variables could be a support for the environmental investment in order to achieve the 'win-win'[1] solution for society and firms. However, this theory is indecisive in estimating the impact of environmental performance on the financial performance of a firm. The authors started their analysis by estimating static panel data regression models (both fixed and random models) of firm performance as a function of environmental performance. To

[1] The 'win-win' scholars [11]-[13] believe that the environmental improvement and protection can be beneficial to both the firm and society [10]. This theory is explained in more detail in the theoretical framework.

make an allowance for dynamic effects in panel data models, the authors included a lagged dependent variable. In this study, the Tobin's q, return on assets and return on sales have been used to measure the firm performance.

The static panel data estimates provided by this study did not find a significant impact of lagged environmental performance on two financial performance measures but it found a weak significant negative impact on the return on assets. The dynamic panel data estimates also exhibited a very weak evidence of effect of the environmental performance on the financial performance. However, cross-section and pooled estimates suggested a strong significant effect of the lagged environmental performance on financial performance. The authors believe that these different results could be due to the existence of unobservable firm effects that have important impact on the financial performance. The study found a differential impact of environmental performance on the return on assets but not on the other measures of financial performance.

Considering these findings, the study suggests that the static effects are more important in studies of the environmental and financial relationship than the dynamic effects. This study obtained a neutral impact of environmental performance on financial performance, which is compatible with "the theoretical work in which firms invest in environmental initiatives until the point where the marginal cost of such investments equals the marginal benefit" [10, pp. 410].

Moneva and Cuellar [17] have evaluated the relationship of the voluntary and obligatory disclosure of the firms' environmental performance that affect the quality and homogeneity of the environmental information. Assuming that obligatory reporting may demonstrate uniformity in reporting practices; they analyzed a period, in which the reporting is voluntary, separate from another period, in which it is compulsory. To conduct this research, the data was collected from published annual reports of 44 listed companies on the continuous market of the Madrid Stock Exchange as a sample through the period 1996 to 2004. The information is classified into 5 elements to evaluate the environmental performance of the firm through the environmental disclosures in the annual reports. These 5 categories of information include dummy variables which are POLICY (disclosure of a formal environmental policy) and EMS (environmental management systems) in companies and financial variables which are ASSET (environmental assets or investments), COST (environmental expenditure disclosed in the annual reports) and PROVISION (environmental liabilities and contingencies for the year) which are financial variables [17]. In addition, investment in R&D activities and the age of the firm's assets are two other exogenous financial variables, which are related to environmental performance. The authors have defined a valuation model to evaluate the capacity of financial reporting to capture information that affects share values.

The results presented that "non-financial environmental disclosures are not value relevant, but financial environmental disclosures are" [17, pp. 453]. In addition, the value relevance of the environmental reporting increased after the introduction of the 2002 accounting standard on environmental issues that showed a relationship between environmental reporting and financial performance in the Spanish milieu. This study suggests that the explanatory power of stock prices is not improved by the combination of financial reporting with non-financial environmental measures. Furthermore, "market participants prefer disaggregated financial disclosures to assess future financial performance" [17, pp. 453].

Stating that environmental strengths and weaknesses affect corporate financial performance, Lioui and Sharma [18] conducted a study based on data collected from nearly 17,000 firms for the period from 1991 to 2007. They hypothesized that: (1) "Both environmental and CSR Strengths and Concerns have a (direct) negative impact on corporate financial performance" and (2) "Firms having some Environmental CSR related activities (either strengths or concerns) get an extra reward for their R&D activities" [18, pp. 102-103].

Both environmental strengths (which are beneficial products and services, pollution prevention, recycling, clean energy) and concerns (including hazardous waste, regulatory problems, Ozone depletion, substantial emissions, agricultural chemicals and climate change) are considered as dummy variables. Several controls were also used to explain firms' performance including R&D/sales, R&D missing (a dummy variable), log assets, advantage (total debt/total book assets) and ROA. The results from ROA and Tobin's q presented negative relationship with environmental CSR strengths and concerns, which might be because investors observe environmental schemes as likely costs or penalties and thus, the direct negative effect of ECSR. A positive relationship was found between the interaction of the environmental strengths and concerns and R&D with CFP (corporate financial performance). The study argue that this positive relationship represents the potential advantages to the firm through more efficient R&D activities and concluded that for better understanding of the complicated relationship between ECSR and firm valuation, it is crucial to take into account these indirect impacts.

Horvathova [15] proposes a more precise and comprehensive method to examine the inter-temporal effect of environmental performance on financial performance. Through this improved method, firms` EP is evaluated based on the weight of different pollutants relating to their "dangerousness" to environment [15]. To conduct this research, annual financial and environmental firm-level data for Czech Republic is applied. The data on EP are acquired from the Integrated Register of Pollutant Emissions, a component of European Pollutant Release and Transfer Register (EPRTR), which is a quantitative environmental dataset for the period 2004-2008 [15].

Two types of environmental data are obtained; one on environmental performance and other on environmental managerial systems. Every firm in the sample is evaluated based on the certification of Eco-Management Audit Scheme (EMAS) and ISO 14001 (both of these certificates have common goals and so, the certificate type is ignored in this

study) [15]. The validity of the "Porter Hypothesis" [11] has been examined through this research, which indicates, "better environmental performance may be beneficial for firms since pollution is a sign of economic inefficiency" [15, pp. 91].

The results of the study present that "increased firm's emissions deplete company profitability in the 1 year lag period, but improve in the 2 years lag period" [15, pp. 96]. The results support the Porter's idea [11] about the effect of the environment on financial performance in the end. In particular, the study concludes, "it takes more than one accounting period before firms can benefit from decreasing pollution" [15, pp. 96]. The examined dataset is the large one in the literature containing about 100 different types of emissions.

The effect of environmental performance on financial performance of firms is more accurate in this study compared to the previous literature. In addition, the normalization of the weight of pollutants based on the reporting threshold improves the consistency and comparability of the data. Finally, the author claims that this study is the first one investigating the EP-FP relationship for the Czech firms. The evaluation of the EP-FP correlation has been vastly conducted across developed countries but there is none for the Central and Eastern European countries. Two studies are found to examine this relationship in Czech firms [19], [20] but during the transition years from 1996 to 1998; while this paper studies the post-transition period of 2004-2008 [15]. The EP indicator introduced in this study and the econometric model to measure the impact of environmental performance on the financial performance will be the basis of the methodology of the present study.

To evaluate the impact of financial status of the firms and their ownership structure on their environmental performance, Earnhart & Lizal [21] examined an "unbalanced panel of Czech firms" during the period 1993-1998 [21, pp. 28]. Their results revealed a positive relationship between financial performance and environmental performance in future. They also found the state ownership to be more effective in the improvement of environmental performance compared to other types of ownerships. The authors claim that due to existence of economies of scale, the increased production level by firms will reduce their level of pollution. Therefore, "a firm with high absolute emissions and high production might be more environmental friendly than, a firm with low emissions but very small production" [21, pp. 17]. To conduct this analysis, they measured the effect of profit generated by every firm with lagged periods, level of production, fixed assets size of the company and industrial factors as effective variables in the amount of each firm`s emissions (dependent variables) in their estimated models [21]. The specified variables and modeling of their analysis are applicable (with some modifications) to measure the effect of financial performance on the environmental performance of electricity generation companies in the present study.

III. Theoretical Framework

The literature suggests that there are more costs and fewer benefits associated with the environmental protection activities of the organizations [22]-[24]. Many theories have been applied in prior studies on the corporate social and environmental responsibility [25]-[27], [10], [16]. In 1970, Milton Friedman [28] famously claimed that the sole social responsibility of business is to increase its profits [27]. Largely this view has not changed over the years and modern businesses also consider social and environmental activities as time and resource consuming and business expect positive outcomes if they were to engage in such activities [18].

Some theories support the link between the environmental and financial performance of organizations. The most recent one is the Resource-Based View (RBV) Theory applied in the study of Salem et al. [27] on the relation of the firms` environmental issues and their competitiveness and financial performance. The authors claim that the lack of a specific theoretical framework has led to the inconsistency among the environmental-financial evaluation studies. Thus, the question of how environmental performance affects financial performance is left with no response [27]. The argument of the RBV theory is that "the resources are not evenly distributed and developed across corporations. This theory helps to clarify, to some extent, the ability of corporation to compete effectively [29].

McWilliams and Siegel [23] suggest that the investment in a firm`s corporate social responsibility could be measured like any other investments that might have future financial benefits. The resource costs to reach to corporate social responsibility will be considered on the supply side and the opportunity of product distinction by investment in corporate social elements on the demand side. There would be a neutral relationship between the social and financial performance of the firms. As Elsayed and Paton [10, pp. 397] points out "firms that do not invest in social responsibility will have lower cost and lower price, while those firms that focus on social characteristics to their product will incur higher costs, but their consumers will be willing to pay higher prices."

Salama [16] employed robust regression method to find the relationship between the firm`s environmental and financial performance on the basis of Stakeholder theory. He supports a positive environmental-financial relationship. This theory discusses that firms` efficiency could be increased by satisfying different groups of stakeholders' interests [30]-[32], [16].

Elsayed and Paton [10] conducted a panel data analysis to evaluate the impact of environmental performance on financial performance re-enforcing the requirement for studies to differentiate between the theoretical models. In their study, they refer to part of theoretical background of the environmental-financial performance measurement such as win-win theory started by Porter [11], Porter and Van der Linde [12], [13], followed by Hart [33], Shrivastava [34]-[36] and Karagozoglu and Lindell [37] [10, pp. 396]. The cornerstone of this theory is that imposition of strict environmental regulations will result in tighter competition

and efficiency as well as motivate innovation. Therefore, via improvements in the environmental activities, "firms can win by improving productivity and profitability and, at the same time, environmental resources can be protected" [10, pp. 396]. However, opponents to this approach such as Palmer et al. [22] and Walley and Whitehead [38] argue that there are very rare cases of win-win situations in the real world [10].

Puente and Arozamena [39] applied Industrial Ecology Theory to explain the achievement of more efficient and sustainable development. Their conceptual framework incorporates urban and industrial metabolisms. "The sustainable integration of human activities on their natural environment" is the focus of the industrial ecology theory [39, pp. 183]. This theory aims to improve the "process efficiency, decreasing consumption and waste generation through flows recirculation and exchange networks of material and energy" [39, pp. 183].

Critically analyzing the previous literature with mixed, conflicting and inconsistent results (negative, positive and statistically insignificant relationships), Aggarwal [40] introduced a new theoretical approach in order to explain the coherency and consistency of the results of the future studies in this area. To evaluate the link between the environmental and financial performance of a firm, the author suggests the Legitimacy Theory and Stakeholder Theory are the most appropriate backgrounds of such studies. According to the work of Lindblom [41], the legitimacy theory stressed on "the societal norms and expectations" in the long-term survival of a firm. Based on this theory, corporate social and environmental responsibility would decrease "the risk of regulatory actions and boycotts and strengthens the firm`s license to operate" [40, pp. 14].

Exploring the related literature on the relationship of environmental performance with the financial efficiency of organizations, the present study will follow the legitimacy theory to explain the relationship between company performance and environmental performance. This will also explain how companies legitimize the financial activities in order to improve the environmental responsibilities [42].

Based on this theory, we will include an independent variable expressing the practice of environmental frameworks denoted as $ES_{i.t.}$ in the model presented in this study. In addition, Regional Dummies employed in this model signify different states and territories in which a firm operates and follows up the rules and regulations of that region.

IV. Methodology

To find the link between the environmental and financial performance, we will first evaluate the efficiency of every company in the sample. After finding out the efficiency of firms, the efficiency of firms would be applied as a variable in the proposed econometric model.

A. The FP-EP Relationship

There are very different qualitative and quantitative ways suggested in the literature to build environmental performance indicators compared to the financial ones which is due to "the different levels of data availability and short history of standardized environmental reporting" [15, pp.93].

According to Horvathova [15], there is a significant problem with all applied measures of environmental performance and that is due to the different levels of dangerousness of various types of pollutant which lead to the misleading results; as well, "the emission reduction and ratio of recycled waste is known to be sensitive to the initial amount of pollutant emitted" [15, pp. 94] . Thus, normalizing the amount of emission is recommended to overcome this issue.

In prior studies, different indices have been constructed to measure environmental performance. For example, in the work of Stern et al. [43], an index is constructed dividing the natural log of tons of sulphur dioxide by the the population to solve the Panayotou`s SO_2 regression [43, pp. 1157]. To evaluate the effects of ownership structure on environmental performance, Earnhart and Lizal [21] estimated environmental performance using absolute emissions and emissions divided by the production level referred to as relative emissions. Clarkson et al. [44] constructed an empirical proxy for a firm`s environmental performance named Pollution Propensity (PP) which is equal to the amount of toxics released in pounds scaled by the cost of goods sold. The environmental performance is measured as the inverse of the PP [44, pp. 129]. In order to relate the market value of firms to the measures of their environmental performance, Konar and Cohen [14] investigated, two environmental performance measures which are "the aggregate pounds of toxic chemicals emitted per dollar revenue of the firm and the number of environmental lawsuits pending against the firm in 1989" [14, pp. 286].

The above literature intends to achieve a consensus on the applied variables and thus results and find out how (positive or negative) the environmental activities could affect the financial performance and vice versa. This inconsistency is due to the inaccuracy of the measurements as well as lack of agreement on the most appropriate variables and methods to evaluate this relationship. However, the study conducted by Horvathova [15] using annual financial and environmental firm-level data of companies in Czech Republic proposes a more precise and comprehensive method to examine the inter-temporal effect of environmental performance on financial performance. This improved method evaluates firms' environmental performance based on the weight of different pollutants relating to their "dangerousness" to the environment. The validity of the "Porter Hypothesis" [11], which indicates, "better environmental performance may be beneficial for firms since pollution is a sign of economic inefficiency", is tested in this study [15, pp. 91]. The results of the study show that environmental performance of a firms has negative impact on the firm's financial performance when the environmental performance lagged by 1 year lag. However, the impact becomes positive the environmental performance lagged by 2 years lag [15]. This results support the Porter's idea [11] about the effect of the environment on financial performance in the end. In particular, the study concludes, "it takes more than one accounting period before firms can

benefit from decreasing pollution" [15, pp. 96]. Since the dataset used in the study contained about 100 different types of emissions, the measurement of environmental performance of firms was more accurate in this study compared to the accuracy of measurements used in the previous studies. In addition, the normalization of the weight of pollutants based on the reporting threshold improves the consistency and comparability of the data.

Inspired by the applied econometric model and EP indicator introduces in the study of Horvathova [15], the present study will employ additional variables, which are found to be more effective identifying the relationship between the environmental performance and financial performance. The variables proposed to be used in the study includes the efficiency score calculated separately using Data Envelopment Analysis (DEA), Regional Dummies identifying the state/ territory in which a firm operates, the environmental variable with 5 years lagged period. Considering the fact that the studies which measured the environmental impact with lagged periods (maximum 2 years), found negative results in the first year followed by positive results in the second year, this year utilizes a larger lagged period with the view to accuracy of the findings of the study.

B. Data

The sample of companies selected for this study consists of companies operating in the Australian electricity-generating sector. This study aims to assess the impact of the environmental performance of these companies on their financial performance. The sample period contains the period from 2000 to 2012 with varying number of companies for each year due to availability of data. The required environmental data will be obtained from the National Pollutant Inventory (NPI) data source and the financial data are accessible through the financial statements of the sampled companies.

To construct the EP indicator, we use the risk score of the toxic chemicals with highest threat to human health provided by the Scorecard website. Scorecard is a free-public information service launched by Environmental Defense in 1998 and now owned by Green Media Toolshed (GMT). Purpose of this non-profit organization has been to recognize and highlight the most polluting companies based on their environmental records. Since no one would like to be acknowledged as the "top polluter" in the society, the Scorecard would create strong incentives for less pollution. According to Scorecard, "risk scores are calculated for reporting TRI releases to air or water by multiplying each chemical`s release quantity (in pounds) by the appropriate chemical-specific TEP" [44]. TEPs (Toxic Equivalency Potentials) are defined as the relative risk to the human health allied with a release of one pound of a chemical, which is compared to the risk posed, by release of a reference chemical. The reference chemical is applied in the construction of a common denominator for chemicals that may cause cancerous or noncancerous chronic health effects [44].

In this risk scoring system, all releases of carcinogens are converted to pounds of benzene-equivalents; all releases of chemicals that cause noncancer health effects are converted to pounds of toluene-equivalents [44].

$$EP_{i,t} = \sum P_{ijt} S_j / Q_{it}$$

where, $EP_{i,t}$: Environmental performance of a company, $P_{i,j,t}$: Emission amount for pollutant j, S_j: Risk score, Q_{it}: KWh electricity production.

C. The Econometric Model

To examine the effect of the environmental performance on the financial performance of the firms, we have adjusted the estimated model in the Horvathova`s work [15] and estimated our proposed model as follows:

$$FP_{i,t} = \beta_0 + \beta_1 * EP_{i,t-1} + \beta_2 * EP_{i,t-2} + \beta_3 * EP_{i,t-3} + \beta_4 * EP_{i,t-4} + \beta_5 * EP_{i,t-5} + \beta_6 * Efficiency$$
$$+ \beta_7 * Size + \beta_8 * Risk + \beta_9 * Tech + \beta_{10} ES_{i,t} + \sum_{i=1}^{n} \mu_i * \mathrm{Re}\,gionalDummies_i + e_{i,t}$$

where, $FP_{i,t}$: Measure of financial performance including ROA, ROE, ROI, Tobin`s Q, Gross Profit Margin, Net Profit Margin, $EP_{i,t-1}$, …, $EP_{i,t-5}$: Environmental performance of a company lagged from 1 to 5 years, Efficiency: The efficiency score obtained by the means of DEA analysis, Size: firm size, which is the logarithm of its total assets, Tech: Plant and Equipment divided by Total assets, Risk: Debt to Equity ratio, $ES_{i.t}$: Environmental Standards; score 1 will be given to the firm if it follows an environmental framework and score 0 otherwise, Regional Dummies: scores 1… n to different states/territories.

The size of companies and the leverage, that presents the owner`s risk, are specified as control variables. Bearing in mind the impact of technological progress on the improved methods of electricity production, we will consider Technology defined as the ratio of Plant and Equipment to Total Assets of every single firm as the second proxy. This study also examines the impact that a firm's financial performance may have on its environmental performance.

V. Conclusion

More than two-thirds of energy produced in Australia is being exported, making Australian energy industry a foremost contributor to its economy. Coal is accounted for around 40% of energy production and for more than 80% of electricity generation. However, the highest portion of Australia's carbon emissions resulted by electricity production, accounting for 35 per cent of the whole greenhouse emissions in the country. Although in terms of total emissions, Australian share of global GHG emissions is lower than many developed countries such as Italy, Canada, Germany, the UK, and the USA, its per capita GHG emission is equivalent to 27.5 mT[2] making it the worst pollutant in the developed world [45, pp. 33-34].

[2] mT: 1 mT/1000 kg is the measurement unit for CO_2 [45, pp. 33-34].

As mentioned above, the electricity sector in the country is an important sector for Australia's attempt to meet its GHG emission reduction targets. In this study, we attempt to analyze the relationship between the environmental performance of the Australian electricity produces and their financial performance with the view to examine the research proposition that there is a positive relationship between the two in the long run. The major contribution to this study is the applied methodology, which is more inclusive compared to the prior studies conducted on the issue. The model proposed to be used in this study applies additional variable to measure the environmental performance of a firm's 5 years lagged period, which is the longest lagged period used in any previous studies. Since firms' efficiency is specified as one of the independent variables, the efficiency of each sample company will be first measured using DEA approach. The results of the DEA analysis will then be applied as a variable in the model to measure the impact of environmental performance on the financial performance of each firm. This study intends to assess the performance of the Australian electricity-producing firms from both aspects of financial efficiency and environmental performance through this expansive approach. Finally, we expect to provide recommendations and policy implications to the electricity generators highlighting the link between financial performance and environmental activities that transform the traditional ways of electricity production to more efficient and green ways of electricity production.

REFERENCES

[1] Australian Bureau of Agricultural and Resource Economics 2011, *ABARE*, ABS, Canberra.
[2] J. Falk and D. Settle, "Australia: Approaching an Energy crossroads", *Energy Policy*, vol. 39, pp. 6804-6813, 2011.
[3] L. Zanin and G. Marra, "Assessing the Functional Relationship between CO_2 Emissions and Economic Development Using an Additive Mixed Model Approach", *Economic Modelling*, vol. 29, pp. 1328-1337, 2012.
[4] G. Buckman and M. Diesendorf, "Design Limitations in Australian Renewable Electricity Policies", *Energy Policy*, vol. 38, pp. 3365-3376, 2010.
[5] Australian Bureau of Agricultural and Resource Economics 2008b, *ABARE*, ABS, Canberra.
[6] T.A. Boden, G. Marland, and R.J. Andres, USA. U.S. Department of Energy, Global, Regional, and National Fossil-Fuel CO2 Emissions, *Carbon Dioxide Information Analysis Center*, Oak Ridge, Tenn.: Oak Ridge National Laboratory; 2011.
[7] UK. IPCC, Intergovernment Panel on Climate Change, *Synthesis Report*, Cambridge University Press, Cambridge; 2007.
[8] R. Garnaut, *The Garnaut Climate Change Review*. Melbourne: Cambridge University Press, 2008.
[9] A. Stock, Australia. Climate Council of Australia Limited, *Australia's Electricity Sector: Ageing, Inefficient and Unprepared*. Canberra; 2014.
[10] K. Elsayed and D. Paton, "The Impact of Environmental Performance on Firm Performance: Static and Dynamic Panel Data Evidence", *Structural Change and Economic Dynamics*, vol. 16, pp. 395-412, 2005.
[11] M.E. Porter, "America's green strategy", *Scientific American*, vol. 264, no.4, pp.96, 1991.
[12] M. Porter and C. Van der Linde, "Green and Competitive: Ending the Stalemate", *Harvard Business Review*, vol. 73, pp. 120–134, 1995a.
[13] M. Porter and C. Van der Linde, "Toward a New Conception of the Environment-Competitiveness Relationship", *Journal of Economic Perspectives*, vol. 9, no. 4, pp. 97–118, 1995b.
[14] S. Konar and M.A. Cohen, "Does the Market Value Environmental Performance?", *The Review of Economics and Statistics*, vol. 83, no. 2, pp. 281-289, 2001.
[15] E. Horvathova, "The Impact of Environmental Performance on Firm Performance: Short-Term Costs and Long-Term Benefits?", *Ecological Economics*, vol.84, pp. 91-97, 2012.
[16] A. Salama, "A Note on the Impact of Environmental Performance on Financial Performance", *Structural Change and Economic Dynamics*, vol. 16, pp. 413-421, 2005.
[17] J.M. Moneva and B. Cuellar, "The Value Relevance of Financial and Non-Financial Environmental Reporting", *Environ Resource Econ*, vol. 44, pp. 441-456, 2009.
[18] A. Lioui and Z. Sharma, "Environmental Corporate Social Responsibility and Financial Performance: Disentangling Direct and Indirect Effects", *Ecological Economics*, vol. 78, pp. 100-111, 2012.
[19] D. Earnhart and L. Lízal, "Effect of Pollution Control on Corporate Financial Performance in a Transition Economy", *European Environment*, vol. 17, pp. 247–266, 2007a.
[20] D. Earnhart and L. Lízal, "Does Better Environmental Performance Affect Revenues, Cost, or Both? Evidence from a Transition Economy", William Davidson Institute Working Paper, no. 856, 2007b.
[21] D. Earnhart and L. Lízal, "Effects of Ownership and Financial Status on Corporate Environmental Performance", *William Davidson Working Paper*, no. 492, August 2002.
[22] K. Palmer, W.E. Oates and P.R. Portney, "Tightening Environmental Standards: The Benefit-Cost or the No-Cost Paradigm?", *Journal of Economic Perspectives*, vol. 9, no. 4, pp. 119-132, 1995.
[23] A. Mc Williams and D. Siegel, "Corporate Social Responsibility: A Theory of the Firm Perspective", *The Academy of Management Review*, vol. 26, no. 1, pp. 117-127, 2001.
[24] S. Ambec, and P. Barla, "A Theoretical Foundation of the Porter Hypothesis", *Economic Letters*, vol. 75, pp. 355-360, 2002.
[25] D.C. Hayes, "The Contingency Theory of Managerial Accounting", *The Accounting Review*, vol. 52, no. 1, pp. 22-39, 1977.
[26] S.J. Goerner, B. Lietaer and R.E. Ulanowicz, "Quantifying Economic Sustainability: Implications for Free-Enterprise Theory, Policy and Practice", *Ecological Economics*, vol. 69, pp. 76-81, 2009.
[27] M.A. Salem, N. Hasnan and N.H. Osman, "Environmental Issues and Corporate Performance: A Critical Review", *Journal of Environment and Earth Science*, vol. 2, no. 10, pp. 112-122, 2012.
[28] M. Friedman, "The Social Responsibility of Business is to Increase its Profits", *The New York Times Magazine*, 13 September 1970, viewed 1 October 2013, http://www.colorado.edu/studentgroups/libertarians/issues/friedman-soc-resp-business.html.
[29] W.J. Duncan, P.M. Ginter and L.E. Swayne, "Competitive Advantage and Internal Organizational Assessment", *the Academy of Management Executive 1993-2005*, pp. 6-16, 1998.
[30] R.E. Freeman, *Strategic Management: A Stakeholder Approach*, Boston: Pitman, 1984.
[31] M.B.E. Clarkson, "A Stakeholder Framework for Analysing and Evaluating Corporate Social Performance", *Academy of Management Review*, vol. 20, no. 1, pp. 92-117, 1995.
[32] M. Orlitzky, F.L. Schmidt and S.L. Rynes, "Corporate Social and Financial Performance: A Meta-Analysis", *Organization Studies*, vol. 24, no. 3, pp. 403–441, 2003.
[33] S. Hart, "A Natural-Resource-Based View of the Firm", *Academy of Management Review*, vol. 20, no. 4, pp. 986–1014, 1995.
[34] P. Shrivastava, "The Role of Corporations in Achieving Ecological Ustainability", *Academy of Management Review*, vol. 20, no. 4, pp. 936–960, 1995a.
[35] P. Shrivastava, "Environmental Technologies and Competitive Advantage", *Strategic Management Journal*, vol. 15, pp. 183–200, 1995b.
[36] P. Shrivastava, "Ecocentric Management for a Risk Society", in P McDonagh & A Prothero (eds), *Green Management: A Reader*, London: The Dryden Press, 1997, pp. 22–39.
[37] N. Karagozoglu and M. Lindell, "Environmental Management: Testing the Win-Win Model", *Journal of Environmental Planning and Management*, vol. 43, no. 6, pp. 817–829, 2000.
[38] N. Walley and B. Whitehead, "It's not Easy Being Green", *Harvard Business Review*, vol. 72, pp. 46–52, 1994.
[39] M.C. Puente and E.R. Arozamena, "Urban and Industrial Metabolism: Towards Sustainable Planning", *Journal of Civil Engineering and Architecture*, vol. 6, no. 2, pp. 183-189, 2012.
[40] P. Aggarwal, "Relationship between Environmental Responsibility and Financial Performance of Firm: A Literature Review", *Journal of Business and Management*, vol. 13, no. 1, pp13-22, 2013.

[41] C. K. Lindblom, "The Implication of Organization Legitimacy for Corporate Social Performance and Disclosure", presented at Critical Perspectives in Accounting Conference, New York, USA. 1993.
[42] V. Magness, "Strategic Posture, Financial Performance and Environmental Disclosure: An Empirical Test of Legitimacy Theory", *Accounting, Auditing and Accountability Journal*, vol. 19, no. 4, pp. 540-563, 2006.
[43] D.I. Stern, M.S. Common and E.B. Barbier, "Economic Growth and Environmental Degradation: The Environmental Kuznets Curve and Sustainable Development", *World Development*, vol. 24, no. 7, pp. 1151-1160, 1996.
[44] P.M. Clarkson, Y. Li, G.D. Richardson and F.P. Vasvari, "Does it Really Pay to be Green? Determinants and Consequences of Proactive Environmental Strategies", *Journal of Accounting and Public Policy*, vol. 30, no. 2, pp. 122-144, 2011.
[45] J. Asafu-Adjaye and R. Mahadevan, "Implications of CO_2 Reduction Policies for a High Carbon Emitting Economy", *Energy Economics*, vol. 38, pp. 32-41, 2013.