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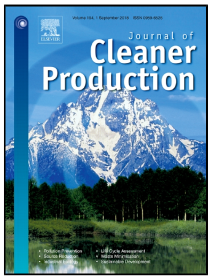

Environmental and Financial Performance. Is there a win-win or a win-loss situation? Evidence from the Greek manufacturing

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Environmental and Financial Performance. Is there a win-win or a win-loss situation? Evidence from the Greek manufacturing

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Abstract

There is a long standing debate regarding the link between environmental and financial performance. To date, this debate results controversial findings, triggering for further research in different industries and countries. The specific study examines the relationship between environmental and financial performance in Greek manufacturing. Environmental performance is measured according to accounting data following the Eco Management and Auditing Scheme guidelines and ISO certification. Return on assets and return on sales ratios are used as indicators of financial performance. Empirical findings suggest that there seems to be a link between these dimensions irrespectively of the particular sector of activity. Contrary to similar studies a "virtuous circle" does not exist, as the avoidance of environmental improving investments is related to a better financial performance. On the other hand, firms with superior financial performance seem to achieve a better environmental performance. At the same time, firm specific and market characteristics significantly affect this relationship. These findings provide evidence that governmental and corporate actions are necessary in order to lead to a more sustainable corporate performance in the long run.

Key words: environmental performance; financial performance; Manufacturing; GMM; Greece.

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1. Introduction

Environmental degradation has increased urgency for a transition to a low-carbon, climate resilient and resource-efficient global economy. This new corporate environment leads to more capital-absorbing investments for "greener" products (Barbera and McConnell, 1990; Trumpp and Guenther, 2015). In these circumstances, different stakeholders have proposed and implemented environmental policies such as (a) direct regulations, b) indirect regulations through environmental taxes, subsidies, tariffs and quotas and c) promotion of voluntary agreements)in order to reduce the burden on the environment.

The effectiveness of these policies on firms' behavior towards the environment depends on the response to two questions concerning the bidirectional relationship between corporate environmental (CEP) and corporate financial performance (CFP). Are resourceful firms more capable of responding to pressures from various stakeholders and overcome both the neoclassical trade-off between CEP-CFP and the concentration of managers to their personal goals (managerial opportunism[1]), engaging in long-term and costly environmental performance improving investments? At the same time, will the benefits from these investments lead to higher market share reducing costly conflicts with various stakeholders, environmental risk, and increasing production efficiency leading to better financial performance (Elsayed and Paton, 2005; Nelling and Webb, 2009)? In this context, environmental issues are confronted in management decision moving beyond the ethical perspective to the promotion of a sustainable economic success (Ambec and Lanoie 2008; Lacy, et al. 2010; Porter and van der Linde, 1995).

[1] Managerial opportunism is defined as the insider use of corporate information for achieving private aims and goals.

For more than fifty years, the emerging public awareness and the consequent public pressure did not lead to generally accepted results on the relationship between CEP and CFP due to problems of measurement, small samples, the lack of addressing the causality problem, the issues of endogeneity (Albetrini, 2013; Blanco et al. 2009; Dixon-Fowler et al. 2013) and the fact that didn't account for important factors as size and location (Wagner, 2001). Different theoretical drivers explain the controversial results (Preston and O'Bannon, 1997). On the one side, stakeholder theory supports that the creation of an ethical corporate image through green investments will lead to higher sales volume while slack resource theory highlights the difficulties that non-financially sound firms face when engaging resources on environmental improvement projects. On the other side, the neoclassical agency theory Friedman (1970), capital and resource consuming investments for production transformation, the innovative production opportunism, the time lag between investment and pay-off that make future results ambiguous create trade off trends (Preston and O'Bannon, 1997; Waddock and Graves, 1997).

The motivation of this research is to investigate the relationship between CEP and CFP in the Greek manufacturing context from 2001 to 2007. It is pertinent to quote that the literature is dominated by European and American studies (Muhammad et al. 2015) and thus using a unique dataset concerning Greek[2] manufacturing can provide important findings with regard to the economy with a plethora of idiosyncratic characteristics. Unlike other countries, mainly European ones, Greece is characterized by an underdevelopment of corporate social responsibility (Skouloudis et al. 2014), a low level environmental regulation (Halkos and Sepetis, 2007), a

[2] Despite the empirical studies in developed countries, little research has been conducted in smaller markets, where large companies are in the spot of public attention for creating positive and sustainable values for the society and the environment (Xiong et al., 2016).

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relatively lax regulation and high level of pollution intensity (Mulatu et al. 2010; Tsani, 2010).

It is a fact that a considerable number of environmental-energy investment plans have been developed during the review period taking into advantage the Support Frameworks for Regional and Industrial Development, the Energy Operational Program (OPE) and the Operational Program "Competitiveness", which was part of the third European Union Support Framework (Kounetas and Tsekouras, 2008). The specific idiosyncratic characteristics, among others, seem to operate in a negative way preventing firms to undertake the necessary capital and resource consuming environmental investments for CEP improvement. Moreover, despite the efforts towards innovative production techniques (Halkos and Evangelinos, 2002; Skouloudis et al. 2014) substantial capital expenditures and large-scale operating costs that are required appear to have a negligible effect on firm's productivity and therefore, on economic growth (Fujii et al. 2011). Furthermore, the inefficiency of European environmental regulations reduces flexibility and prevents firms from innovative solutions (Albertini, 2013; Jaffe and Palmer, 1997).

In this study the possible relationship is investigated by limiting industries of interest in eight manufacturing sectors from Greece. The examined industries appears to have a significant impact on the adoption of energy-environmental investment projects (Kounetas and Tsekouras, 2008; Kounetas et al. 2011) consisting a significant percent of total Greek manufacturing (Fotopoulos and Giotopoulos, 2010) .Thus, following previous empirical findings (Fujii et al. 2013; Grolleau et al. 2012) a process based index for production scale adjustment for environmental pollution was introduced using the cost of energy consumed and the value of the produced output data. The choice of monetary terms instead of the quantity of waste produced or

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processed was a result of sample selection limitations and the intention to avoid "green washing". The use of plant-level data from private mainly firms, made the collection of reliable and easily verifiable corporate environmental management information or physical pollution data impossible.

Finally, the research not only presents evidence on whether Greek firms that perform well on environmental criteria do also well in financial terms, but also how this relationship is also affected by the overall economic environment which they operates. More specifically it is tested and compared how their environmental-financial performance is affected by their size and market power, their financial characteristics, their energy situation and finally their innovation efforts.

The following findings emerge. Firstly, it is shown that there is a significant impact of financial on environmental performance. In addition, the inverse relationship has not been confirmed. Secondly, exploiting the presence of additional variables it is found that R&D efforts and firms' size benefit financial performance while in addition with the two above-mentioned variables capital intensity and market power, also, alters environmental performance.

The rest of the paper is divided into six sections. In section 2, we present the theoretical framework. Section 3, refers to the review of the literature and hypothesis setting while Section 3 presents the dataset and econometric methodology. Section 5 summarizes the empirical results while conclusions are provided in Section 6.

2. Theoretical framework

Scholars have considered different theoretical views to provide an explanation for the relationship between corporate environmental and firm performance. Up to present, theories have been inconclusive and empirical evidence has been mixed. In this section, we consider the most prominent views referring to neoclassical agency and stakeholder theory[3].

Starting with the neoclassical agency theory, Friedman (1970) considers that the expected costs of a firm's environmental responsibility are likely to outweigh the resulting profits and hence a firm's environmental performance is expected to have a negative impact on its profitability. According to this theory, firm's managers, as agents, work to ensure shareholders' benefits while shareholders main objective is to maximize their profit. Therefore, resources devoted to improve environmental footprint and performance would be spent wore wisely to increase firm's efficiency. Hence, the specific theoretical approach can be viewed as a conflict between the interests of managers and shareholders or as a symptom of principal agent problem. From the agency theory perspective, investments in pollution control, voluntary environmental disclosure and environmental regulation efforts should only exacerbate the negative link between financial and environmental performance. In short, this agency problem causes a negative relationship between firms' environmental and financial performance.

The neoclassical agency perspective have been challenged by Freeman (1984) who, in the context of stakeholder theory, pointed out that every firm has relationships with many stakeholders. These stakeholders or groups of stakeholders affect and are affected by firm's actions and decisions while include internal, external and environmental constitutes (Clarkson, 1995). The specific theoretical approach considers the fact that stakeholders may place demands concerning the environmental behavior of firms. Therefore, firms must address these demands in order to avoid the

[3] We would like to thank an anonymous referee for highlighting this issue.

costs of doing business. In particular, stakeholder theory suggests that firm's environmental performance can be reflected on firm's financial. The arguments of stakeholder theoretical point of view can be embedded into the resource-based view of the firm (Wernerfelt, 1984) considering meeting stakeholders' demands as a strategic investment.

3. Review of the literature and hypotheses tested.

Despite the extant literature on the possible virtuous circle between CEP and CFP the results are inconclusive. Moreover, a significant number of studies have proposed explanations for the existence of a virtuous circle between CEP and CFP. The majority of the studies suggest that there is a positive relationship following Porter's "win-win" argument and the integration of slack resource and social impact hypothesis to a positive synergy hypothesis, between them (Albertini, 2013; Endriakt et al. 2014). According to this hypothesis superior CEP will lead to an improved CFP that enables reinvestments in CEP improving actions (Makni et al. 2009).

This bidirectional relationship between CEP and CFP support the possible existence of a "virtuous circle" for two reasons. Firstly, since pollution is regarded as the sign of an incomplete, inefficient or ineffective use of resources, the additional investment in environmental protection facilities and cleaner raw material supply they make manufacturing methods greener, introducing innovation and operational efficiency improving competitive advantage (Porter and van der Linde, 1995; Russo and Fouts, 1997). Secondly, according to product stewardship, the integration of the voice of the environment into product design and manufacturing processes, will increase company's environmental reputation and employee/customer commitment (Dogl and Holtbrugee, 2013; Waddock and Graves, 1997), enhance firm legitimacy

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(Hart and Ahuja, 1996) and reflect strong organizational and management capabilities (Aschehoug et al. 2012).

However, other researchers highlight the conflict between company's business competitiveness and the transition to greener manufacturing (Song et al. 2017) while some studies unravel the role of institutional, societal and cultural settings that influence corporate financial performance (Ortas et al. 2015a, Ortas et al. 2015b). There are serious objections to greener production methods and management when a company's environmental cost to total manufacturing costs ratio is much higher than that of competition as the corporate environmental impact and the product value added are disproportionate (Walley and Whitehead, 1994). This was initially highlighted by Friedman (1970) who stated that corporate social responsibility causes unnecessary costs that reduce financial performance (Hatakeda et al. 2012; Waddock and Graves, 1997). The cost of the significant investments and modifications of production processes may increase efficiency but will reduce profitability both over a short and long period of time (Jaggi and Freedman, 1992; Blacconiere and Patten, 1994; Wu et al. 2009). Additionally, the time lags in the fruition of CEP improving investments, increases uncertainty and risk about current and future profitability (Aragon-Correa and Sharma, 2003). Also, the uncertainty of the outcome allows management opportunism to reduce the priority of important organizational changes (Makni et al. 2009; Waddock and Graves, 1997).

In the environmental performance literature two different strands can be found according to: (a) the environmental performance measures used and (b) the type of the used econometric methodology. Delmas and Blass (2010) distinguished 3 main categories of environmental performance measures. The first one concerns the use of environmental impact measures (emissions, energy use etc.), the second one the regulatory compliance (lawsuits, regulatory compliance) and the final one are the organizational process (expenditures on environmental performance improving technology, environmental management systems).

Similarly, research approaches vary among: (1) portfolio analysis, (2) event studies and (3) regression studies (Ambec and Lanoie, 2008). In the first case equity portfolio's financial performance is analyzed in case of environmental friendly firms and polluting ones (Cohen et al, 1997). Event studies focus on the reaction of market during periods where important environmental issues take place (environmental awards or lawsuits news). Finally, regression analysis explores the relationship of CEP with firm characteristics.

Regression analysis studies can be further divided according to the used database. Most researches rely on time series databases using the Granger causality approach supporting either a two-way relationship or just one direction linkage. Depending on the market and the time period examined some of the research findings verified that the expected benefits of environmentally-friendly investments accrue to the firm sometime after the initial investment and vice-versa (Nakao et al. 2007). Other findings support only one direction of the connection, as either the financial performance has an effect on environmental one (Neiling and Webb, 2009) or environmental performance has an influence on the financial one (Clarkson et al. 2011). Using switch regression Hatakeda et al. (2012) showed that higher financial flexibility (low debt) tends to provide more financial resources that can be used for emissions reduction.

Other researchers used panel databases to control for firm specific characteristics that are invariant over time and directly influence corporate decisions (entrepreneurial capacity, favorable managerial attitude toward corporate transparency

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etc.). In this context King and Lenox (2002) used a 2-stage least squares model and Elsayed and Paton (2005) followed the Generalized methods of moments estimation (hereafter GMM) approach examining the market of USA and UK respectively. Their results are mixed, as the former found a significant positive impact of waste reduction on financial performance whereas the latter support a neutral impact of lagged environmental performance on financial indicators. However, lagged environmental performance has a strongly significant impact on firm performance. More recently Martínez-Ferrero and Frías-Aceituno (2013) examined an international database via GMM and came to the conclusion of the existence of a synergistic "virtuous circle" between them.

Considering the theoretical framework presented in section 2 and the previous empirical findings reviewing the literature the following hypotheses can be tested:

H_1: Higher (lower) environmental performance causes higher (lower) financial performance.

H_2: Higher (lower) financial performance causes higher (lower) environmental performance.

4. Data, variables and methodology

4.1 Data and variables used.

Data were collected from the Annual Survey of Industry in Greece reported by the Hellenic Statistical Authority and contains all manufacturing plants (subdivisions 15-37 of the Community classification NACE Rev. 1.1) around Greece that employ more than 10 people irrespective of size or geographic settlement. The initial panel consists of 4.852 plant level observations for the period between 1993 and 2007. In order to create a reliable database, data were filtered for excluding plants for which

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crucial information were missing for all periods reducing our initial sample to 1.567 plants per year. Subsequently, firms with non-consistent series of variables were excluded from our analysis reducing further our sample by 23 %. The resulting dataset is a balanced panel consisting of 931 per year plant level observations for the period between 2001 and 2007. This time framework examined allows the testing of the recorded by Heras-Saizarbitotia et al. (2011) fade out of fists mover advantage after 2000 . In order to limit the different sectoral categories wider classes that include plants from relative industries were created eight main clusters (please see Table 1).

The absence of firm level reliable toxic release database leads to the use of a process based indicator. The proxy used (CEP) calculates the cost of energy consumption per value of output[4] (deducted by the energy cost included in manufacturing cost), representing the production scale adjusted environmental pollution and following the logic of environemtal performance indicators (Jasch, 2000; Olshhoom et al., 2001). The use of the CEP index allows us to evaluate if cutting edge technology is used as it will increase efficiency, reducing costs and increasing profitability. Any energy efficiency investment must show a clear short-term benefit, or the investment may not be made. This is especially the case where a large investment in the upgrading of major components within the plant is required[5]. To avoid inflation phenomena a proxy of relative energy consumption costs defined as the ratio of energy costs to general price level was used.[6]If the scale of production increases more than energy use environmental performance improves. This

[4] The value of production is calculated as the total manufacturing cost, consisting of conversion cost and the cost of produced volume. In more detail, the conversion cost consists of direct and indirect costs of the production and differ according to the technology employed in production. In our case, if energy cost increases substantially this will increase the index but the effect will be adjusted by the production scale. As a result if there is an increase in the value of the energy used there will be an adjustment in the conversion cost and the value of the production output.

[5] We would like to thank an anonymous referee for highlighting this issue.

[6] We owe this to an anonymous referee.

calculation reveals differences in the development of organizational resources and capabilities through operational changes and innovation that are expected to be linked to the ability of the firm to generate profits. Empirical findings show that EP (an inverted score of environmental pollution per production unit) increases ROA through both return on sales and improved capital turnover (Fujii et al. 2013).

Financial performance is measured using two complementary variables. Using Return on Assets (hereafter ROA), the ability of the company to use its assets effectively is established (Nelling and Webb, 2009) and is affected by both cost reduction and productivity improvement. Return on sales (hereafter ROS) reveals the ability of the company to increase sales keeping costs low (Nakao et al. 2007).

Three groups of firm characteristics influencing financial and environmental performance are incorporated into the models (Waddock and Graves, 1997). The first one encompasses characteristics of firm's capital strength. Such characteristics are the capital intensity $\left(CAPINT\right)$, as captures by the capital-to-labor ratio and the solvency ratio $\left(SOLV\right)$, defined as the interest coverage ratio. High dependence on capital assets is expected to make firms reluctant to transform their production and process technologies to more environmentally sound ones (Elsayed and Paton, 2005; Fujii et al. 2013). In addition, solvency is a key figure for both corporate financial performance and the involvement in environmental projects. At one point "green labeling" influences corporate reputation and investors' perception of firms' future performance providing a type of insurance value decreasing financial cost (Peloza, 2006). At the same time the ability of a firm to meet its obligations will affect its decision to make long-term investments on environmental performance improvement (Hart and Ahuja, 1996).

The second category consists of variables that are related to the firm's underlying knowledge conditions introducing size $\left(SIZE\right)$ and R&D intensity $\left(R\&D_{\text{int}}\right)$ moderators. Size is one of the most relevant factors used for explaining willingness for organizational change. It is found that larger firms are more willing to invest in environmental performance improvements as they attract more public attention (Stanwick et al. 1998), possess more slack resources that are available for environmental investments (Clarkson, Li et al. 2011), have better access to resources, hold greater control over stakeholders and can take advantage of economies of scale (Elsayed and Paton, 2005; Orlitzky, 2001). Furthermore, the investment in "technical" capital results in knowledge enhancement leading to product and process innovation which in turn is expected to increase long term financial performance. Hence, R&D intensity may be a precursor for innovative approaches to environmental issues having a profound effect in the relationship between CEP and FP (Orlitzky, 2008; Przychodzen and Przychodzen, 2015; Rousso and Fouts, 1997).

Finally, following Bain (1956) and Feeny et al. (2005) the Structure-Conduct-Performance (SCP) paradigm is followed, including in our analysis industry-level determinants of competition such as market share $\left(MS\right)$and Herfindhal-Hircham Index $\left(HHI\right)$.

Due to the great diversity of the firms examined in terms of environmental and financial performance possible heterogeneity is tested using eight dummies, one for each sector. Their inclusion seems to have statistically not significant effect leading to the creation of two new dummies controlling whether the firm examined comes from an energy intensive sector or not. Table 2 provides basic descriptive statistics for each of the variables according the sector that belongs.

4.2 Econometric model

In this paper the possible relationship between CEP and CFP based on positive synergy hypothesis is explored. As argued by Makin et al. (2009) and Allouche and Laroche, (2005), higher levels of CEP lead to an improvement of FP, offering the necessary resources for reinvestment in environmental performance improving actions. In more details, the selection-effect shows that more resourceful firms will invest in CEP improvement leading to the slack resource hypothesis (Heras-Saizarbitotia et al. 2011). In addition, according to social impact hypothesis, the "green" image of the firm is expected to further improve financial performance that can be reallocated, improving CEP in the future (Preston and O'Bannon, 1997; Waddock and Graves, 1997). If both forward and backward CEP-CFP relationship exists then, the simultaneous and interactive positive connection forms a virtuous circle (Waddock and Graves, 1997). On the other hand, if achieving a higher level of CEP decreases FP, then environmental responsible investments will be limited. According to the negative hypothesis, a simultaneous and interactive negative relation between CEP and FP forms a vicious circle.

The two basic theoretical arguments introduced above, that is effect of firm's financial performance on environmental performance and vice versa, may be modeled in the context of the following two equations (Eqs 1 and 2) . More precisely,:

$$CEP_{i,t} = \alpha_0 + \boldsymbol{\beta} EP_{i,t-1} + \delta CEP_{i,t-1} + \xi CEP_{i,t-1}^2 + \mathbf{\Gamma X}_{i,t} + \mathbf{\Delta Z}_{i,t} + \boldsymbol{u}_{i,t} \quad (1)$$

$$EP_{i,t} = \zeta_0 + \boldsymbol{\theta} CEP_{i,t-1} + \delta^* EP_{i,t-1} + \xi^* EP_{i,t-1}^2 + \mathbf{\Gamma}^* \mathbf{X}_{i,t}^* + \mathbf{\Delta}^* \mathbf{Z}_{i,t}^* + \varepsilon_{i,t} \quad (2)$$

In Equation X, the $CEP_{i,t}$ is the energy efficiency of the $i-th$ plant under the in time t . In Equation X, $EP_{i,t}$ is the environmental performance of the $i-th$ plant with respect to the sector that it belongs. $\mathbf{X}_{i,t}$ is a matrix of exogenously determined plant level variables, $\mathbf{Z}_{i,t}$ is a matrix of instruments correlated to the level of financial performance. The terms $\mathbf{u}_{i,t}$ and $\varepsilon_{i,t}$ capture additional unobserved factors for each specification. $\boldsymbol{\beta}, \boldsymbol{\theta}, \boldsymbol{\Gamma}, \boldsymbol{\Gamma}^{*}, \boldsymbol{\Delta}, \Delta^{*}, \boldsymbol{\delta}, \boldsymbol{\mu}$ are vectors of parameters to be estimated. Finally, path dependence phenomena can be examined since the lagged values $CEP_{i,t-1}, EP_{i,t-1}$ of the basic variables have been included. Due to the fact that the presence of the lagged regressors in both equations raise autocorrelation concerns in conjunction to possible endogeneity issues between the former and the disturbance terms along with the fact that the form of heteroscedasticity is not known *a priori*, point towards the direction of the GMM estimator or difference estimator of Arellano-Bond (1991) first proposed λ by Holtz-Eakin et al. (1988).

5. Results and discussion

5.1 Results of the static analysis

Starting with the simple correlation between CEP and FP the results suggest that there is a positive and strong link between them (Table 2). The hypothesis stated in section 2 was tested for two econometric specifications. The first one is static, comparing random versus fixed effects specification with the second being a dynamic one, using the GMM approach. Table 3 shows the results of static analysis. The comparison between the two models aims to explore if there are unobservable firm characteristics that may differ between firms but are constant over time and are expected to affect the linkage between financial and environmental performance. The findings suggest that such characteristics exist as environmental performance improvement has a negative effect on FP$\left(ROA\right)$. It is therefore implied that there is

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no economic benefit for firms from the reduced energy consumption making Greek firms conservative in engaging in energy reduction activities. This is in line with Fujii et al. (2010) findings as it seems that the acquisition of energy-saving equipment will negatively affect return on the short term. In the case of Greece it seems that there is no cancelation of the negative financial footprint of the "green" investments as limited importance is attributed by customers to the lifecycle assessment and green supply chain management as it happens in other markets such as Japan (Fujii et al, 2013).

5.2 Results of the dynamic analysis

Despite the usefulness of the above results these models do not take into account the fact that there are time lags between an investment and the flourishing of its results (Elsayed and Paton, 2005). Taking this into consideration, Table 4 presents in parallel the results of the GMM estimator for dynamic panel estimation using the Arellano and Bond (1991) approach for both models. For statistical consistency reasons, first order serial correlation is required (in the differenced estimates) but not second order correlation. Rows AR (1) and AR (2) present the m_1 and m_2 statistics used to test the zero hypotheses that there is no first and second order linear correlation between the residual of the first differences. According to the results presented there is only first order correlation. Moreover, in each case the Sargan test of over-identifying restrictions provides support for the choice of instrument set.

Overall, the results presented in table 4 suggest that there is a statistically significant impact of financial performance on future environmental performance in both cases. On the other hand, environmental performance does not have a significant effect on future financial performance in both model. Only in the case of the first model where ROA is used as a proxy of financial performance the deterioration of energy consumption ratio seems to be linked with better financial performance.

Thoroughly, the results of the 1st model (columns 2 and 3) are in line with Friedman's (1970) aversion to "unnecessary" costs for greening production methods as they seem to exceed the benefits in terms of lower production costs and efficiency-productivity improvements (Hatakeda et al. 2012). At the same time, in accordance to slack resource theory, the existence of a surplus of difficult to imitate resources such as profits make it more likely for firms to invest in the improvement of the level of their environmental performance (Clarkson et al. 2011; Russo and Fouts, 1997). Obviously, firms that are not doing very well financially lack the necessary resources for long term environmental performance improving investments. The results for Model 2 verify the slack resource theory but there is no statistical significant effect of environmental performance on financial one.

The plants examined show an adverse to environmental performance improving investments despite the market growth rate and the join of Euro area that rapidly reduced the country risk premium. The characteristics of the Greek economy seem to out-scale the positive prospects offered by the macroeconomic environment providing a useful analytical framework from a transitioning economy. The low competitiveness as well as the complex environmental regulations, and the less productive methods used (negative link between higher capital intensity and environmental performance) prevent firms from costly environmental performance investments. There is also a test conducted for a non-linear relationship between CEP and FP with statistical no significant results.

Attempting to explore the effect of the firm's specific characteristics in the aforementioned relationship, moderators were used in both models. As previously discussed, the competitiveness within the market is expected to significantly affect environmental performance indirectly through the higher profit margins experienced in the more concentrated markets. If corporate environmental actions are considered as a regular good, the increase of the available resources will lead to an increased demand for additional units. In such a case, higher competition reduces marginal return for all firms, reducing the available resources devoted in investments that improve environmental performance (Li, 2014). This expectation was confirmed in the first model.

Further, the results seem to be in line with empirical findings of Waddock and Graves, (1997) and Alexopoulos et. al (2011) as both the proportion of sales devoted in R&D investments as well as the size of each manufacturing plant have a positive and significant effect on environmental and financial performance. In the case of Greece and despite the more traditional production methods it seems that larger firms are more willing to undertake corporate social responsibility actions reducing corporate environmental impact. Finally, the higher dependency on fixed assets ($CAPINT$) has a negative effect on environmental performance as it makes replacement and maintenance cost very high, thus creating barriers for environmental improving investments (del Rio Gonzalez, 2005).

6. Conclusions

The relationship between corporate environmental and financial performance has received a high degree of attention in research literature and the results are still contradictory. In this study the relationship between corporate environmental and financial performance was examined. Based on the empirical analysis of Greek

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manufacturing plants, the findings support Friedman's aversion to the deviation from the main corporate goal as the changes in production methods that are necessary for improving corporate environmental performance does not lead in improvements in the future financial condition. In advance, slack resource theory was confirmed as difficult to imitate resources, such as financial ones, are necessary for a firm to engage in environmental performance improving projects. These results imply that firms improve their financial performance by avoiding "green" investments due to their high costs, the long and uncertain payback period and the limited advantages gained from the creation of an ethical corporate image.

This study seeks to advance the literature by exploring the possible trade-off effects of the idiosyncratic market characteristics on the relationship between CEP and CFP. In this attempt, in order to avoid the limited available data of plant level environmental index was calculated using the cost of energy consumption per value of output. This index represents the production scale adjusted environmental pollution, revealing differences in the development of organizational resources and capabilities through operational changes and innovation that are expected to be linked to the ability of the firm to generate profits.

Overall, it was verified that differences in institutional, societal and cultural settings influence corporate financial performance. These idiosyncratic characteristics seem to reduce the financial benefits from CEP improving projects and only the resourceful firms are willing to take the necessary steps towards "greener" production methods. Interestingly, the empirical results suggest that slack resource theory explains the decision of managers toward costly and long term environmental performance improving investments. At the same time, firm size, R&D intensity and market power are important prerequisites.

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If a virtuous circle existed result would be beneficial for interested policy makers, corporate managers and the public to create shared value on corporate environmental responsibility and therefore contribute to CER improvements (Xiong et al. 2016). European and national policy makers should analyze the characteristics that prevent the creation a virtuous circle as innovative "green" production methods, which are difficult to imitate, create a competitive advantage. Europe has set targets for sustainable development until 2020 that aim to lead to a resource efficient, greener and more competitive economy. To achieve this goal, considering the markets' characteristics, the following recommendations are made.

Firstly, the government needs to support the development of corporate social responsibility, motivating managers to overcame opportunism and focus on non-financial targets. From a different perspective, eco-innovation may well forward a shift in government policy as relative activities may well be promoted through subvention and the introduction of an appropriate legal and fiscal framework that protects them. Secondly, national and European regulation should evolve in order to meet market's needs, avoiding "window dressing" phenomena and the suppressive and inefficient legislation system.

Thirdly, financial support of firms that invest in environmental friendly production is important for markets with high level of pollution intensity. The slack national environmental legislation, the high cost of capital and operating costs, offset the impact from innovative production methods as consumers preferences are still not significantly related to environmental burden caused. Finally, organizational changes may be urged due to the need to scale up corporate size, as lucrative use of cleaner technologies requires a minimum efficient scale of installations. This need is related to availability of financial, human and technical resources as economies of scale and increased market share make environmental performance improving investments more effective.

The main limitation of the research paper is the narrow scope of its sample exclusively from a European country and the way environmental reporting is measured and its reliance on a specific conceptual framework. Therefore, the findings are context specific and may not be applicable in a wider context. The generalization of the findings to other countries could be subject of future research studies. In addition, the use of alternative measures of corporate environmental performance in the analysis of the relationship between CEP and CFP can be examined. Consequently, future analysis may: (a) use of input or output oriented indexes, (b) control for industry effects and (c) introduce an insight to the effect of total emissions, pollution reduction means or methods in the above relationship (d) use of alternative models to reveal the possible relationship.

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Appendix

Table 1: Plants per Manufacturing sector

Year	Food products, beverages and tobacco	Textiles and textile products	Wood and wood products Pulp, paper and paper products; publishing and printing	Coke, refined petroleum products and nuclear fuel Chemicals, chemical products and man-made fibres Rubber and plastic products	Other non-metallic mineral products	Basic metals and fabricated metal products	Machinery and equipment n.e.c.	Electrical and optical equipment
2001	168	150	115	151	97	104	63	83
2002	168	150	115	151	97	104	63	83
2003	168	150	115	151	97	104	63	83
2004	168	150	115	151	97	104	63	83
2005	168	150	115	151	97	104	63	83
2006	168	150	115	151	97	104	63	83
2007	168	150	115	151	97	104	63	83
Total	1176	1050	805	1057	679	728	441	581

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Table 2: Basic statistics and correlation matrix

	Mean	Standard Deviation	Energy Cost Ratio	ROA	ROS	Herfindahl Index	Market Share	RandD intensity	Size	Capital Intensity
Energy Cost Ratio*	0.029	0.069	1							
ROA	0.056	0.255	-0.408	1						
ROS	0.115	3.963	-0.302	0.387	1					
Herfindahl Index	0.099	0.115	-0.059	0.003	-0.02	1				
Market Share	0.009	0.027	-0.019	0.087	0.012	0.006	1			
R&D intensity	0.002	0.015	-0.018	0.011	0.043	0.104	0.022	1		
Size (Total Assets)**	18.39	51.474	0.028	-0.05	0.023	-0.002	0.437	0.098	1	
Capital Intensity	0.46	0.358	0.009	-0.04	-0.03	0.044	-0.269	-0.076	-0.69	1
Solvency	9.018	213.551	-0.013	0.014	0.004	0.014	-0.006	-0.004	-0.02	0.024

*All the monetary values are in constant 2005 prices using industry deflators.

**In millions euros.

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Table 3: The impact of financial performance on environmental and vice versa using static panel data anlysis

	ROA		ROS		ECR			
	Fixed Model	Random Model	Fixed Model	Random Model	Fixed Model	Random Model	Fixed Model	Random Model
ROA	-	-	-	-	-0.013 (0.002)	-0.012 (0.002)	-	-
ROS	-	-	-	-	-	-	0.001 (0.002)	0.001 (0.001)
ECR	0.427* (0.188)	-0.046 (0.024)	-0.073 (0.143)	-0.160 (0.100)	-	-	-	-
Market Share	0.623* (0.238)	0.588* (0.997)	-	- -	-0.185 (0.122)	-0.013 (0.066)	-	-
Herfindahl Index	-	-	-0.575 (0.199)	-0.115 (0.073)	-	-	0.027 (0.020)	-0.017 (0.014)
R&D intensity	0.492 (0.143)	0.055 (0.127)	0.421 (0.710)	0.785 (0.544)	0.113 (0.073)	0.067 (0.068)	0.112 (0.073)	0.071 (0.068)
Firm Size	-0.315*** (0.004)	-0.015 (0.002)	-0.010 (0.019)	0.003 (0.007)	-0.004** (0.002)	0.001 (0.001)	-0.004*** (0.002)	0.001 (0.001)
Solvency	-0.541 (1.023)	0.090 (0.804)	-0.722 (5.085)	0.616 (3.134)	-0.099 (0.520)	-0.179 (0.454)	-0.099 (0.521)	-0.174 (0.454)
Capital Intensity	0.302*** (0.012)	-0.015 (0.008)	0.118*** (0.058)	-0.005 (0.029)	0.007 (0.006)	0.006 (0.005)	0.008 (0.006)	0.007 (0.005)
Energy Intensity Sector Dummy	0.006 (0.069)	0.010 (0.005)	0.066 (0.345)	0.001 (0.019)	-0.001 (0.035)	0.026 (0.004)	-0.003 (0.035)	0.032 (0.004)
Constant	0.521 (0.060)	0.282 (0.035)	0.215 (0.297)	0.039 (0.123)	0.093 (0.032)	0.020 (0.022)	0.083 (0.030)	0.016 (0.021)
chi^2	49.81		14.34		17.78		39.36	
Hausman test (Prob > chi^2) 0.000	0.000		0.045		0.013		0.005	
Number of observations	931		931		931		931	

Notes: (i) Figures in parentheses are standard errors robust to heteroscedasticity. (ii) Hausman is the Hausman test for fixed effects over random effects. (iii) Serial correlation is the test for first order serial correlation in fixed effects models presented by Baltagi (1995)

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Table 4: Dynamic Effects – (Arellano and Bond)

	ROA	Energy Consumption Ratio	ROS	Energy Consumption Ratio
Dependent Variable $_{t-1}$	0.205* (0.023)	-0.135** (0.052)	-0.288 (0.019)	-1.138* (0.051)
Dependent Variable $_{t-2}$	0.004 (0.004)	0.004 (0.005)	0.007 (0.001)	0.004 (0.005)
ECR $_{t-1}$	0.183** (0.089)	-	-0.455 (0.310)	-
ROA$_{t-1}$	-	-0.012*** (0.004)	-	-
ROS $_{t-1}$	-	-	-	-0.002** (0.001)
Herfindahl Index	-	-	0.098 (0.254)	-0.004 (0.009)
Market Share	0.633** (0.307)	-0.246* (0.069)	-	-
R&D Intensity $_{t-1}$	0.167* (0.085)	-0.049** (0.037)	0.710 (1.121)	-0.050* (0.018)
Size (log Assets) $_{t-1}$	0.026** (0.006)	-0.006* (0.001)	0.013 (0.033)	-0.006*** (0.001)
Capital Intensity $_{t-1}$	0.021 (0.016)	0.009*** (0.004)	0.062 (0.093)	0.010* (0.004)
Solvency Ratio $_{t-1}$	-0.815 (0.995)	-0.043 (0.188)	0.000 (0.000)	-0.048 (0.188)
Energy Intensity Sector Dummy	0.015 (0.096)	0.030 (0.270)	-0.106 (0.536)	0.231 (0.975)
Time Trend	Yes	Yes	Yes	Yes
No. of groups	931	931	931	931
No. of instruments	22	17	22	17
AR (1)	-2850	-8007	-3356	-8.128
AR (2)	-0.960	-1341	-6392	-1199
Sargan test	41688	195115	47418	19736

Notes: (i) Figures in parentheses are standard errors robust to heteroscedasticity.*P<0.10. **P<0.05. ***P < 0.01

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- We examine the relationship between environmental and financialperformance
- We examine a dataset in an idiosyncratic country.
- We test the role of other market characteristics
- We denote the role of governmental actions

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