

Having a Better Environmental Performance translates into a Better Financial Performance? A Study in the Food Industry

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Abstract

This study intends to analyse the relationship between Environmental Performance (EP) and Financial Performance (FP) in the food industry. Food industry is key to population survival, but the growing population and consequently the increasing demand in food production affects climate change. The aim is addressing for the first time the relation between EP-FP in the European food industry. This study will help to understand if firms with more efficient consumption of water and with less intensity of CO₂ emissions, might benefit from better financials. By collecting data from external databases and companies reports, a quantile regression and correlation analysis was conducted. Results show that the different sectors of food industry indicate distinct EP-FP nexus. Moreover, findings demonstrate that water use efficiency can significantly affect positive or negatively financials, though CO₂ emissions intensity do not show a clear impact in FP.

Key words: Environmental Performance, Financial Performance, Food Industry, Europe

Resumo

Este estudo pretende analisar a relação entre Performance Ambiental (EP) e Performance Financeira (FP) na indústria alimentar. A indústria de alimentos é fundamental para a sobrevivência da população, mas o crescimento populacional e, consequentemente, a crescente pressão sobre a produção de alimentos afetam as alterações climáticas. O objetivo deste artigo é abordar pela primeira vez a relação entre EP-FP na indústria alimentar europeia. Este estudo ajudará a entender se as empresas com consumo mais eficiente de água e menos intensivas em emissões de CO₂ podem beneficiar de uma melhor performance financeira. Após extrair dados de bases de dados externas e de relatórios das empresas foram realizadas regressões do tipo *Quantile* e foram testadas correlações. Os resultados mostram que os diferentes setores da indústria de alimentos apresentam nexos EP-FP distintos. Além disso, os resultados demonstram que a eficiência do uso da água pode afetar significativamente indicadores financeiros de uma forma positiva ou negativa, contudo a intensidade das emissões de CO₂ não mostra um impacto claro na FP.

Palavras-Chave: Performance Ambiental, Performance Financeira, Indústria Alimentar, Europa

Abbreviations and Acronyms

CEM - *Corporate Environmental Management*

CSR - *Corporate Responsibility Report*

EBIT- *Earnings Before Interest and Taxes*

ED - *Environmental Disclosure*

EM - *Environmental Management*

EP - *Environmental Performance*

EU - *European Union*

FAO - *Food and Agriculture Organization of the United Nations*

FP - *Financial Performance*

ISO - *International Organization for Standardization*

KPIs - *Key Performance Indicators*

ROA - *Return On Assets*

ROCE - *Return On Capital Employed*

ROE - *Return On Equity*

ROI- *Return On Investment*

ROIC - *Return On Invested Capital*

ROS - *Return On Sales*

UK - *United Kingdom*

US - *United States*

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1. Introduction

By 2050 it is expected that the world population reach 10bn (MarketLine, 2019) becoming a real challenge to nurture all the population in a sustainable way. Ritchie (2020)'s study shows that food is responsible for 26% of global greenhouse gas emissions; agriculture occupies half of the global habitable land, consuming 70% of world's water withdrawals and causing 78% of ocean and freshwater eutrophication worldwide. Moreover, 94% of mammal biomass (excluding humans) is livestock, which outweighs wild mammals 15 versus 1, reason why agriculture and aquaculture is listed as a threat for 24.000 out of 28.000 species evaluated to be threatened with extinction.

A leading advisory committee constituted by specialists from EU (European Union) member states, recognized as the EU Standing Committee on Agriculture Research (SCAR) reported that "Globally, and in many regions including Europe, food production is exceeding environmental limits or is close to doing so. (...) Price volatility, access restrictions and the interconnectedness of global commodity markets, as well as the increasing vulnerability of food production systems to climate change and loss of agro-biodiversity, will make food even more inaccessible for the poor in the future." (European Commission website, 2020)

Food industry is a key player to guarantee the world sustainability and crucial in the global economy. In EU, the food industry is the largest industry in the manufacturing sector in terms of turnover, employment and value added (FoodDrinkEurope, 2018). This put this industry in the sight of customers, consumers, governments and regulators pushing these companies to invest in environment management (Jackson and Singh, 2015). Consequently, understanding if there is a positive relation between EP and FP is of great need in order to further investigate and invest in possible ways to explore this relationship.

Additionally, the heterogeneous conclusions about the relations between EP and FP across companies and the lack of insights about the industry and local context put managers in an uncertain situation when investing in environmental management (EM) activities (Liu, 2020; Hang, Geyer-Klingenberg and Rathgeber, 2019). Therefore, it is important to perform industry analysis to give accurate and relevant information to that industry. Until now, any literature has focused on food industry in Europe, concerning the impact environmental practices may have in food companies' financial performance.

In contrast, nowadays, firms face more strict environmental regulations, pushing them to switch from coal technologies to a greener culture (Tzouvanas, Kizys, Chatziantoniou and Sagitova, 2019). Companies start adopting environmental management practices either voluntary or coercively (Liu, 2020). A study developed by KPMG showed that three-quarters of the 4.900 firms analysed in 49 different countries have published corporate responsibility reports (KPMG, 2017).

This concerns lead to the study of the relation between environmental performance and financial performance, which have been a topic of discussion many times addressed by different authors (Tzouvanas et al., 2019; Konar and Cohen, 2001; Russo and Fouts, 1997; Cohen, Fenn and Naimon, 1995; Earnhart and Lízal, 2007; Wagner, 2005).

The main aim of this study is to examine if Environmental Performance (EP) relates to Financial Performance (FP) in the food industry. By analysing EP indicators such as water consumptions intensity and CO₂ emissions intensity in European food companies in 2018, testing if these variables affect FP indicators like Return on Equity (ROE), Return on Assets (ROA) and Profit Margin.

The report starts with the literature review where the main concepts, EP and FP, are explored. Then, it is discussed the relation EP-FP by addressing main theories and inconsistencies in previous studies. Finally, it is presented the methodology used and the results. The report ends with the conclusion and limitations of this study.

2. Literature Review

In this section, the environmental performance concept and financial performance will be explained. Then, a discussion about the main theories and the debates concerning the relation between environmental performance and financial performance is presented. Finally, it is performed a closer look in the food industry, specially, a more precise understanding of what are the conclusions drawn by existing studies in this industry.

2.1. Environmental Performance

Several studies have been analyzing Corporate Environmental Management (CEM), which stands for practices that many companies have been adopting throughout the years to minimize their effects on the environment (Cramer, 1998). Three are the variables that have been used to analyse CEM: Environmental Management Variables (EM), Environmental Performance Variables (EP) and Environmental Disclosure Variables (ED) (Albertini, 2013). Throughout time, these three have been developed in parallel-environmental performance, environmental management, and environmental disclosure (Matisoff, Noonan, and O'Brien, 2013).

EM refers to the activities planned to fulfil a firm's strategy and objectives (Schultze and Trommer, 2012), for example the adoption of an ISO 14001¹ certificate. EP consist in the measurable results of corporate's environmental management (International Organization for Standardization, 2013). Finally, ED are descriptions of the way the company is affecting the environment (Wilmschurst and Frost, 2000); it includes studies addressing the company's Corporate Environmental Management (CEM) or reports about its environmental impacts or, even, an environmental award.

CEM variables are proxies of distinct CEM goals like regulation, performance, or legitimacy (Albertini, 2013). For example, a study about National Stock Exchange of India shows that companies with non-financial parameter disclosure gain more attention from investors (KPMG, 2019).

¹ ISO 14001 standards are developed by a non-profit organization and are attributed only to firms that comply with the established limits (Quazi, Khoo, Tan, and Wong, 2001).

Nonetheless, EP are believed to be the accurate category when analysing the relation between CEM and its financial performance, since translates the effective results of CEM, the remaining only allow the understanding of a firm's efforts and objectives in this area (Albertini, 2013). To illustrate, companies with an ISO 14001 certificate might have heterogeneous environmental performance. Furthermore, using environmental certification or the adoption of an environmental policy does not automatically translate into a better EP (Horváthová, 2010). Moreover, Ellimäki, Gómez-Bolaños, Hurtado-Torres and Aragón-Correa (2019) consider that company's strategy can generate either an effective reduction of environmental impacts by using internal practices like environmental performance, or a symbolic support, such as environmental disclosure.

Environmental performance complexity prevented regulators and researchers from agreeing with a way to measuring it. EP includes a vast range of indicators both quantitative (information that can be measured and lead to a statistical analyses) and qualitative (comprises corporate's environmental strategy or vision, analysis of environmental risks and protection systems, product's environmental labelling and services choices, and the cultural atmosphere) (Dragomir, 2018). Examples of possible definitions of EP are showed below.

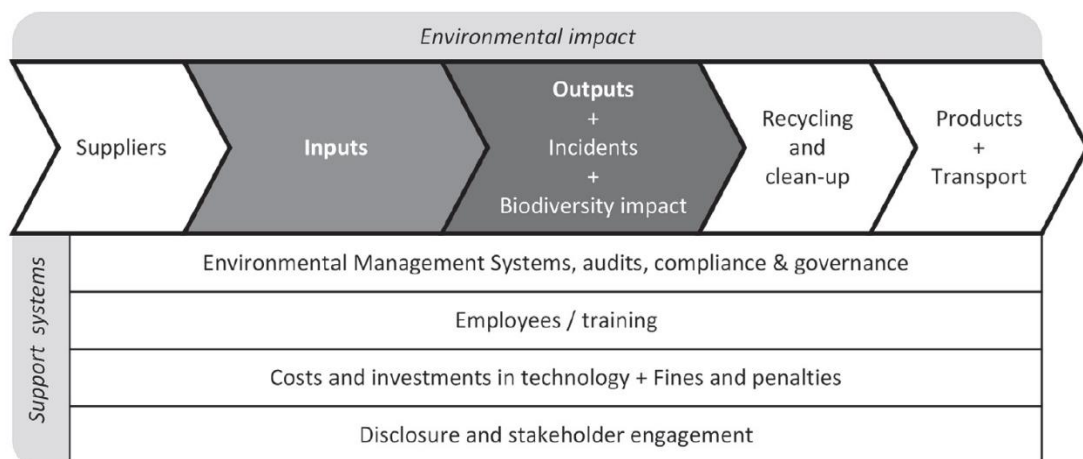
- “Environmental Performance consists in the measurable results of corporate's environmental management” (International Organization for Standardization, 2013,3.9);
- EP variables “evaluate environmental impacts in physical and monetary terms since companies' outputs affect the environment in various ways (...) Measures are mostly quantified in physical units that can be positive (emission reduction) or negative (emission generated). Some are input-oriented or output-oriented.” (Albertini, 2013, p.435);
- “Corporate environmental performance is a measure of environmental impact, resource consumption, and related financial elements, along with the efforts towards the reduction of such impact and the implementation of preventive measures.” (Dragomir, 2018, p.1151)

Dragomir (2018) argues that EP's definitions are mainly focused on environmental operational performance, capturing only one perspective of a corporate environmental status. For example, taking into consideration carbon emissions as a corporate environmental

aspect, its performance can be analysed as the absolute amount of emissions (environmental operational performance), emission reduction in a concrete process (environmental management performance) and cost reduction due to pollution prevention (financial indicator). Consequently, in his definition, Dragomir (2018) intended to capture all the performance analysis possible to be done about any specific environmental indicator in study.

Moreover, Dragomir (2018) proposes an environmental performance model (Figure 1) based on Porter's value chain model (2001). On one hand, the model explores the sources of environmental impact: suppliers' selection, inputs and outputs, incidents, and biodiversity impact (which can be outputs or a result of an output), recycling and clean-up programs, products and transports. On the other hand, the model clarifies about the support systems activities: costs and investments in technology, fines and penalties (monetary impacts), employee training, implementation of Environmental Management System, degree of environmental compliance, the environmental governance system and the quality of corporate disclosures. Each of the section in this model includes many possible indicators that can be used to evaluate the EP of a firm. Dragomir (2018) stated that most authors used inputs and outputs indicators, but others used indicators attributed to the supported system (Dragomir, 2018).

Figure 1. The corporate environmental performance model



Source: Dragomir, 2018.

2.2. Financial Performance

When analysing the relation between environmental performance and financial performance, several financial performance variables can be used. Albertini (2013) grouped these variables in three types: market based, accounting based and organizational measures.

Market based variables translate how is the company position in the market, if it is or not an appealing company to invest on. Ratios like price earning ration, debt ratio (total debt over total assets), profit margin (EBIT over the sales, which means the profitability of the firm), return on total assets (operating profit over the total assets, explaining the ability of the firm to produce profits from its assets), market to book ratio (market price over the frequency a firm sell and buy inventory) are examples of this type of variables (Li, Nginiatedema and Chen, 2017; Albertini, 2013).

According with Albertini (2013), accounting based variables are more interesting than the remaining because they translate the internal economic situation and the managerial performance rather than an outside analysis of the company, although are used as to accesses the interest from stakeholders. Ratios like return on assets (ROA), return on equity (ROE), return on sales (ROS), return on investment (ROI) and return on invested capital (ROIC) are accounting based variables commonly used.

Additionally, organizational measures are specific strategies that are put in practice in order to improve the firm status, therefore are mainly of manager's interest not markets. Examples of this can be cost improvements in consequence of the use of a pollution control equipment or competitive advantage caused by the introduction of a green product (Albertini, 2013). None of these can be analysed through the other variables since they do not go into this kind of detail.

The researches analysing the nexus CEM- FP adopted mostly a market- based or accounting based variables, but some utilized perceptual measures of FP centred on organizational capabilities for example product stewardship and environmental innovation (Hassel, Nilson, and Nyquist, 2005).

Several have been the indicators used by authors to address this topic (Li et al., 2017). Authors such as Maqbool (2019), Iwata and Okada (2011), Cohen and Konar (2001), Russo

and Fouts (1997), and King and Lenox (2001) used different FP measures in their studies, like ROA, ROS, ROE, Tobin's $q-1$, and return on capital employed (ROCE).

2.3. Environmental Performance and Financial Performance

Not long time ago, environmental protection was associated to company's costs, and environmental concerns were considered a distraction from the firm's core goal, profit maximization (Friedman, 1970). Several defied this pattern; e.g., Porter and Van der Linde (1995) presented environmental performance not as a cost but as an opportunity for a better financial performance, as well Hart (1995) foreseen the growing awareness of the natural environment limits as a competitive advantage (both cost and differentiation advantage).

El Saadany, Jaber and Bonney (2011) focused on the cost advantage part, showing that diminishing environmental costs improves EP and profits. King and Lenox (2001) found that less pollution and better FP are related. Tzouvanas et al. (2019), Salama (2005), Konar and Cohen (2001), Russo and Fouts (1997) also concluded that EP leads to an improved FP

Additionally, Ambec and Lanoie (2008) analysed the mechanics behind seven different opportunities for better revenue or for cost reduction that can benefit a company concerned with an enhanced environmental performance. This seven opportunities range from (a) improving access to certain markets, (b) product competitive advantage, (c) healthier revenue from the sale of pollution-control technology, (d) restored relation with external stakeholders and risk management, (e) reduction of costs in resources as materials, energy and services; capital cost efficiency, to (f) reduction on labour costs (Lankoski, 2000; Reinhardt, 2000).

Most studies agree that environmental reputation is a very relevant intangible asset, which affects firm's financials and market value (Li et al., 2019; Dangelico, 2015; Konar and Cohen, 2001). Moreover, companies' decision on engaging in environmental management is based in economic performance, mainly profitability (Montabon, Sroufe and Narasimhan, 2007).

However, not all analyses reached this conclusion like Cordeiro and Sarkis (1997), Jaggi and Freedman (1992), Jacobs, Singhal., Subramanian (2010), Cohen et al. (1995), Earnhart and Lízal (2007), Wagner (2005), which found a negative relation between EP and FP. Others concluded that there was no significant association between EP-FP (Aras, Aybars and Kuthu, 2010; Waddock and Graves, 1997; Moneva and Cuellar, 2009).

When compiling the studies done in this area around 60% supports the positive link between environmental performance and financial performance, whereas 20% supports a negative relation and the remaining 20% an insignificant connection between those variables (Tzouvanas et al., 2019).

Many are the explanations presented for these disparities: type of process analysed (1), methodology (2), analysed period (3), geographical location (4), endogeneity (5) not clear environmental criteria (Konar and Cohen, 2001), no objective financial criteria (Cohen et al, 1995), and firm size (Graham and Potter, 2015; Dixon-Fowler, Slater, Johnson, Ellstrand and Romi, 2013), are some possible reasons for the inconsistencies.

The different company's process (1) analysed (Liu, 2020; Filbeck and Gorman, 2004) can result in contradictory conclusions. Collecting only internal data or go further into the supply chain can lead to different conclusions, this is even more accentuated when different practices, procedures and policies are analysed, for example, recycling, remanufacturing, waste and emission reduction or conscious product design (Graham and Potter, 2015).

Additionally, the different methodologies (2) used may also affect the conclusions (Liu, 2020). When adopting the correlation coefficient and portfolio studies it is probable that EP and FP have a negative nexus, while using a multiple regression and panel data technique does not have any implication. This situation occurs due to lack of control of variables like company's unnoticed heterogeneity (Horváthová, 2010)

Moreover, Cordeiro and Sarkis (1997) find time range (3) as another cause for the conclusion's disparities, showing that short-term analyses cause a negative effect in the relation between EP and FP, while a longer time coverage leads to a positive link between these variables. Also, Tzouvanas et al. (2019) addresses the fact of comparing different periods of time and environmental regulations at the analysed moment.

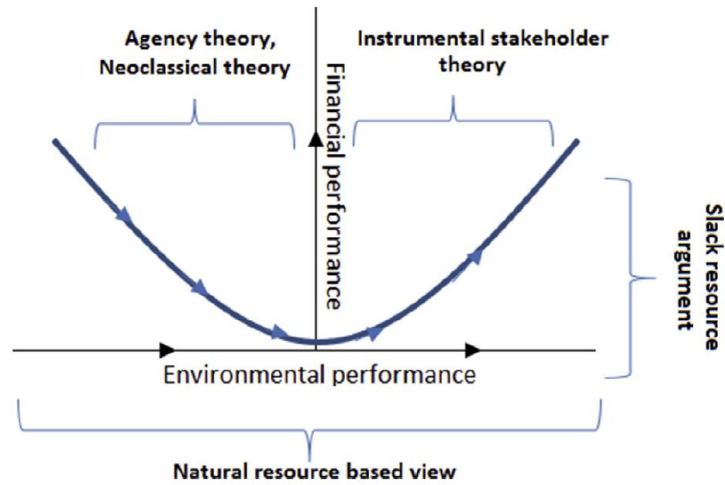
Also, geographical location (4) influence results (Wagner, 2001). Countries with a common law (majority are developing countries) are more likely to provide a positive relation between EP and FP than in civil law countries (most are developed countries) (Horváthová, 2010). Moreover, established companies in weaker institutional countries increase their interest in developing its environmental disclosure and performance in order to gain legitimation (Ellimäki et al, 2019).

Finally, another issue causing these gaps among studies' conclusions is the endogeneity (5) between EP-FP (Liu, 2020 and Tzouvanas et al., 2019). This is specified in the slack resource theory, successful firms dispose of more slack resources which can be invested in EM putting them in a favourable situation when testing EP-FP (McGuire, Schneeweiss and Branch, 1990; Waddock and Graves, 1997; George, 2005).

Although, it is possible to aggregate the different conclusions in two main opinions. On the one hand, the neoclassical theory, which claims that environmental practices will lead to incremental costs, consequently to a worst FP (Friedman, 1970; Walley and Whitehead, 1994). On the other hand, three theories imply that EP affects in a positive manner FP-Resource-based View, Porter's hypothesis and stakeholder theory (Clarkson, 1995; Porter, 1991; Porter and van der Linde, 1995; Hart, 1995; Li et al., 2019; Hang et al, 2019).

The natural resource-based view agree that EP might in the beginning cause high costs, but as any investment, can turn into higher profits (Broadstock, Collins, Hunt, and Vergos, 2018; Lewandowski, 2017; Trumpp and Guenther, 2017). This happens because firms develop valuable knowledge about the resources or capabilities that can become competitive advantages (Wernerfelt, 1984; Hart, 1995). Concerning Porter's hypothesis, it emphasises the necessity of time to the development environmental innovations (about two years) to reach positive financial effects (Porter and van der Linde, 1995; Liu, 2020). The stakeholder theory highlights the relevance of managing stakeholder's satisfaction to improve company's external reputation thus incrementing profits and growth (Hang et al, 2019; Pesqueux and Damak-Ayadi, 2005; Allouche and Laroche, 2005). Figure 2 eases the understanding of these theories and Table 1 summarizes them.

Figure 2. Theory behind EP-FP



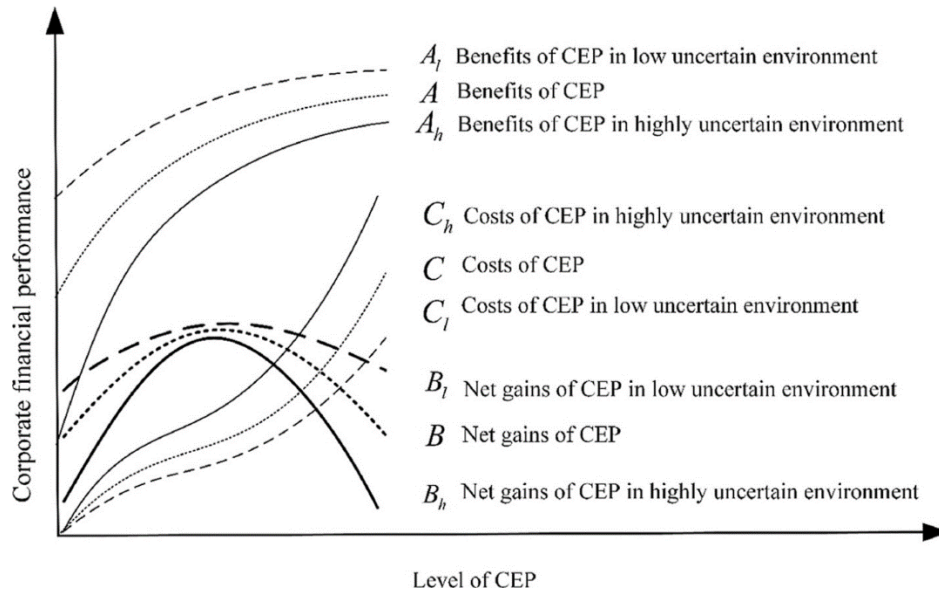
Source: Tzouvanas et al., 2019.

Table 1. Summary of EP and FP relation

EP & FP Relation	Theories/ Approaches	Authors
Positive (+)	Porter's hypothesis	Porter and Van der Linde (1995); Liu (2020)
Positive (+)	Slack Resource Argument	Tzouvanas et al. (2019)
Positive (+)	Stakeholder Theory	Allouche and Laroche (2005); Salama (2005); Pesqueux and Damak-Ayadi (2005); Hang et al. (2019)
Positive (+)	Natural Resource- Based View	Lewandowski (2017); Trumpp and Guenther (2017); Broadstock et al. (2019)
No Significance	-	Waddock and Graves (1997); Moneva and Cuellar (2009); Aras et al. (2010)
Negative (-)	Neoclassical theory	Friedman (1970); Cohen et al. (1995); Cordeiro and Sarkis (1997); Wagner (2005); Earnhart and Lízal (2007); Jacobs et al. (2010)

Still, there are other theories explain the EP-FP nexus. In fact, Zhang, Wei, Zhu, and George-Ufot, (2020) suggest an inverse U-shape to explain CEP-CFP relation (Figure 3), because reflects the impact of environmental uncertainty on this relation. Therefore, the authors encourage managers to develop benefit-cost analysis to meet the optimal engagement on CEP.

Figure 3. CEP-CFP relation



Source: Zhang et al., 2020.

Several recent studies have been analysing the relation between EP and FP in different regions, such as Europe (Fernández-Cuesta, Castro, Tascón and Castaño, 2019), China (Song, Zhao and Zeng, 2017), US (Liu, 2020; Li et al., 2017), Indonesia (Nishitani, Jannah and Kaneko, 2017), Greece (Alexopoulos, Kouneta and Tzelepis, 2018). All found that firms with superior EP generate better FP, especially in medium/long term.

The industry studied in this paper (food industry) was not addressed many times. Moreover, the few addressing it, explore different concepts of environmental and financial performance. Likewise, findings in this sector are mixed.

Li et al. (2017) found out that in consumer staple sector the impact of green initiatives and green performance on financial performance is superior to other sectors. However, Liu (2019) concluded that Food industry environmental initiatives have below-average impact on firm's financials in US, possibly due to lack of public acknowledgement or poor industry structure.

Moreover, Jackson and Singh (2015) classify companies into four types: those that have performed great on both environmental initiatives and financially; those that accomplished poor results on both; and those that performed great in one of this aspects -environmentally or financially- and poorly on the other. The authors also concluded that firms better ranked

on environment are more likely to present higher financial performance when compared with lower ranked firms.

Other study in UK (United Kingdom), found itself conflicting results. It found strong support between waste reduction and cost performance, but no link between energy waste and cost performance (Graham and Potter, 2015). The authors discuss that the reason for this might be the cost of investment in each type of environmental practices, for example, energy reduction could demand more investment than waste reduction.

Overall, most studies find a positive relation between EP-FP, but in food industry there is not a clear understanding on this topic. Moreover, the studies done so far include companies from only one country, making hard to make conclusions for all the food industry.

2.4. Theoretical Framework and Research Hypotheses

The goal of this study is to analyse the relation between environmental performance and financial performance in the food industry (Figure 4), which is a topic of great interest at an humanitarian level, affecting regulators, investors, employees, customers and managers (Tzouvanas et al., 2019; Iwata and Okada, 2011).

In fact, guaranteeing a sustainable growth in this industry is key in Europe since is the biggest industry in the region in terms of turnover and value added (FoodDrinkEurope, 2018), also is an industry forced to grow due to the increasing demand from the growing worldwide population (MarketLine, 2019). Moreover, Jeswani, Burkinshaw and Azapagic (2015) pointed out the need for studying the relationship between environmental performance (EP) and financial performance (FP) in the various industries, since several of the published studies include more than one industry, making hard to understand that relationship in each one.

To study the relation between environmental performance and financial performance in the food industry, we summarized in two main hypotheses.

On one hand, several authors worldwide studied the impact of CO₂ emissions in financial indicators such as ROA, ROE and Profit Margin (Trinks, Mulder and Scholtens, 2020; Qian and Xing, 2018; Gonenc and Scholtens, 2017; Rokhmawati, Sathye and Sathye, 2015; Iwata and Okada, 2011). Therefore, we hypothesize whether companies with less intensity of CO₂

emissions benefit financially from this effort (*H1*), by analysing this hypothesis for each financial variable. In summary, the first hypothesis is:

H1: Companies with less CO₂ intensity have a higher financial performance.

H1 a. Companies with less CO₂ intensity have a better ROA.

H1 b. Companies with less CO₂ intensity have a better ROE.

H1 c. Companies with less CO₂ intensity have a better Profit Margin.

On the other hand, authors such as, Gatimbu, Ogada, Budambula and Kariuki (2018) and Li et al. (2017) instigated how water productivity can affect financials, like Profit Margin and ROA. Hence, we pose the hypothesis that low water intensity firms allow having a better financial performance (*H2*). In short, the second hypothesis is:

H2: Companies with less water consumption intensity have a higher financial performance.

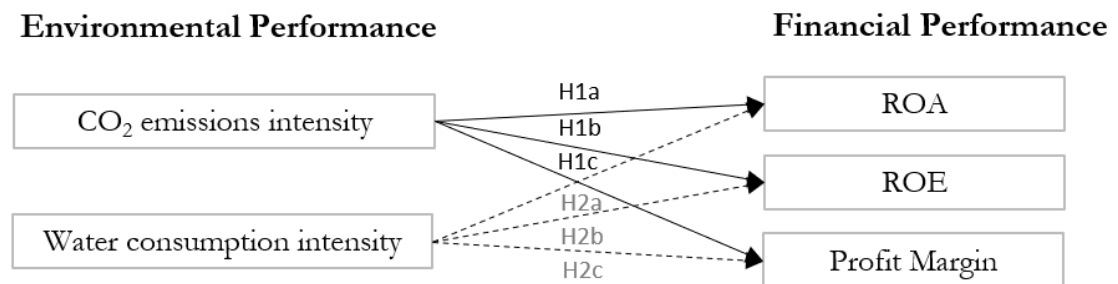
H2 a. Companies with less water consumption intensity have a better ROA.

H2 b. Companies with less water consumption intensity have a better ROE.

H2 c. Companies with less water consumption intensity have a better Profit Margin.

The model is condensed in the theoretical framework model represented in Figure 4.

Figure 4. Theoretical framework



3. Methodology

In this section it is explained the sample used and the selected variables. Finally, it is showed the statistical methods used to test the hypotheses presented before.

3.1. Sample and Data Collection

Like Tzouvanas et al. (2019), which developed a study about the manufacturing industry in Europe, this research is based only in online resources. Besides, Dragomir (2018) suggest that first it should be used quantitative EP data from external databases or if data is not relevant enough, collect data from corporate environment reports.

In this case, Environmental Performance indicators were extracted from annual reports or sustainability reports released by the companies, some directly from the company's website, others from the Sustainable Disclosure Database, and suitable for the scope of this study (please see Table 2).

All financial data (ROA, ROE and profit margin) and control variables were retrieved from Orbis. Orbis Europe is a database which contains comparable data from over 360 million of firms around the world.

There are 194.000 companies in the food and drink industries in EU, around 99,1% of the firms are small to medium enterprises and 0,9% are large companies, the ones responsible for 51,9% of turnover (FoodDrinkEurope, 2018).

This study analyses data from 308 companies from a universe of around 35.000 companies in the food Industry in 2018. Though, those 308 companies correspond to 35% (\$553 million/ \$1.577 million) of total food industry's turnover in Europe (Statista Market Forecast, 2020). The sample was reduced to 308 due to several restrictions:

- It was only considered firms with headquarters in Europe to homogenize the sample;
- Many factories available in the Orbis list were from the same corporation/ headquarters, thus it was necessary to eliminate duplicates;
- Several firms in that list were part of a corporation with headquarters overseas.

Furthermore, not all companies have available and up to date reports with the required sustainability indicators. This reduced the sample to 93 companies, that corresponds to 23% of this industry turnover, might indicate that large firms are more motivated in the release of Sustainability reports for stakeholders.

3.2. Variables Description

In terms of Environmental Performance indicators, it was extracted from company's reports the total amount of CO₂ emissions scope 1² and scope 2³ (1) and total water consumption (2) in 2018. After, it was calculated an indicator of intensity of CO₂ emissions and water consumption, which translates, respectively, the amount of CO₂ emitted per thousand of USD of operating revenue and the meter cubic of water consumed per thousand of USD of operating revenue (please see Table 2).

To analyse this theme, EP was the choice between the three CEM categories because it is the one that traduces more effective results (Graham and Potter, 2015; Albertini, 2013; Horváthová, 2010). Moreover, CO₂ emissions (4) and water consumption (5) are respectively, outputs and inputs indicators, the most used environmental impact measures (Dragomir, 2018; Gatimbu et al., 2018).

Concerning financial performance indicators, this study uses two market-based indicators – ROA (1) and ROE (2), both based on net income, - and one accounting based variable – Profit Margin (3), following Maqbool, (2019), Iwata and Okada (2011), and Li et al. (2017)' studies.

The control variables used were Industry (6), Size (7), Age (8), Region (9), Growth (10) and Leverage (11) (Graham and Potter, 2015; Vincent and Yusuff, 2020; Nizam, Dewandaru,,

² Scope 1, known as Direct Greenhouse Gas Emissions, accounts for Greenhouse Gas Emissions from sources that are owned or controlled by the reporting entity (Ecochain, 2020).

³ Scope 2 or Indirect Emissions from Energy are Greenhouse Gas Emissions produced in the generation electricity, steam, and heating/cooling, but accounted by the purchasing entity which uses these resources (Ecochain, 2020).

Nagayev and Nkoba, 2019; Gatimbu et al., 2018; Tzouvanas et al., 2019). The use of this variables allows controlling firms heterogeneity and the isolation of EP-FP relation.

Companies in the food industry have different type of processes (Graham and Potter, 2015), some with a greater dependence in water and for others the issue is emitting CO₂. Therefore, Industry (6) controls the different sectors to which the firm belong by classifying each with a NACE code.

The variable Size (7) is relevant because larger companies tend to feel more pressure from stakeholders when it comes to environment sustainability. Moreover, they may benefit from economies of scale. This variable is measure by the number of employees hired by company (Vincent and Yusuff, 2020; Nizam et al., 2019).

The Age (8) of a company is the number of years of the company since its foundation, representing the experience the firm has in the area (Gatimbu et al., 2018; Graham and Potter, 2015).

Region (9) refers to the country where there are located the firm's headquarters. Countries can have different legislation impacting differently on the effort of having better sustainable KPIs (Key Performance Indicators), on reporting CSR (Corporate Responsibility Report), etc.

Revenue Operating Growth (10) controls the variation of production (Gatimbu et al., 2018) and leverage (11) is a proxy of financial risk, relating company's debt to its equity (Vincent and Yusuff, 2020; Tzouvanas et al., 2019).

Table 2. Variables description

	Variable	Scale	Calculation	Source	Description
Dependent variables (FP)	(1) ROA_Net	0%-100%	-	Orbis	ROA using Net income (%) 2018
	(2) ROE_Net	0%-100%	-	Orbis	ROE using Net income (%) 2018
	(3) Profit Margin (ProfitM)	0%-100%	-	Orbis	Profit Margin (%) 2018
Independent variables (EP)	(4) Indicator- CO ₂ emissions Scope 1&2 intensity (EmissionsRev)	Tonnes (t) per thousand dollar (k\$)	Tonness of CO ₂ / Operating Revenue 2018	Company reports, Orbis	Tonnes of CO ₂ Scope 1&2 emitted per k\$ of operating revenue
	(5) Indicator- Water consumption intensity (WaterRev)	Cubic meters (m ³) per thousand dollar (k\$)	Tonnes of CO ₂ / Operating Revenue 2018	Company reports, Orbis	M ³ of water consumed k\$ of operating revenue
Control Variabels	(6) Industry (Ind)	NACE code	-	Orbis	NACE code
	(7) Size (NEmp)	Number of employees	-	Orbis	Number of employees in 2018
	(8) Age (CAge)	Number of years	Today year (2020) - Company's foundation year	Orbis	Number of years since foundation
	(9) Region (Reg)	ISO Code	-	Orbis	ISO Code
	(10) Growth (Gwth)	Percentage	Operating revenue 2018/Operating revenue 2017-1	Orbis	Growth of the operating revenue
	(11) Leverage (Lev)	Percentage	-	Orbis	Gearing%

3.3. Methodological Approach

The linear model, in specific the Ordinary Least Squares (OLS) regression, is a technique used by several authors studying the EP-FP relation (Qian and Xing, 2018; Gatimbu et al., 2018; Gonenc and Scholtens, 2017; Graham and Potter, 2015; Salama, 2005). Since many assumptions of the linear model are not satisfied, we have performed the tests recommended in Peña and Slate (2006), resorting to the quantile regression and targeting the median of the dependent variables. Also, we follow a similar method as the one used by Tzouvanas et al. (2019), which did not use the OLS because this method ignores that EP-FP nexus might change considerably across the different conditional distributions.

Therefore, we selected the quantile regressions to test the hypotheses and see if financial variables can be explained by the environmental indicators by running the following regression:

$$FP_{i,t} = \beta_0 + \beta_1 EmissionsRev_{i,t} + \beta_2 WaterRev_{i,t} + \beta_3 Firm\ Control_{i,t} + \epsilon_{i,t}$$

Where $FP_{i,t}$ represents all three financial variables ROA_Net, ROE_Net, ProfitM for each firm i in the year t , in this case 2018. Firm Control represents all control variables: Ind, NEmp, CAge, Reg, Gwth and Lev.

As mentioned previously, companies from different industries (Liu, 2020) and located in different geographical regions (Wagner, 2001) show distinguished results in the study of EP and FP relation. So, we explore further if there are different EP-FP relation in the several sectors of the food industry and if can exist different results when comparing distinct regions.

Many studies centred their researches in one industry (Tzouvanas et al., 2019; Iwata and Okada, 2011) or studied different industries and compared them (Liu, 2020; Salama, 2004). Though, so far food industry was studied as a whole, and conclusions have been heterogeneous (see chapter 2.3.).

Moreover, studies usually use data from a country. For example, Song et al. (2017) study concerns only data from China, Li et al. (2017) confronts merely US variables and Graham and Potter (2015) used only UK sources. Others amplified their geographical area to regions (Tzoucanas et al., 2019) or did not restrict geographically at all (Vincent and Yusuff, 2020;

Gonenc and Scholtens, 2017). Thus, geographical location can impact EP and FP relation, but not all authors address this topic.

Therefore, we created two clusters to test Pearson and the Spearman correlation method between the EP and FP variables:

1. Industry Cluster

This was created to test if inside the food can exist different conclusions when studying EP-FP nexus. Consequently, the data was divided in three different groups with more homogeneous manufacturing process:

- Manufacture of Dairy;
- Other Manufacturers;
- Process and Preserving.

In fact, inside the food industry there are different sectors, for example, manufacture of dairy, manufacture of sugar, coffee or chocolate, and processing and preserving of fish, meat, or vegetables. Each industry has specific features, some need greater amounts of water to produce a ton of product and, others have a longer process and in consequence emit bigger amounts of carbon dioxide (Figure 5 and 6).

2. Region Cluster

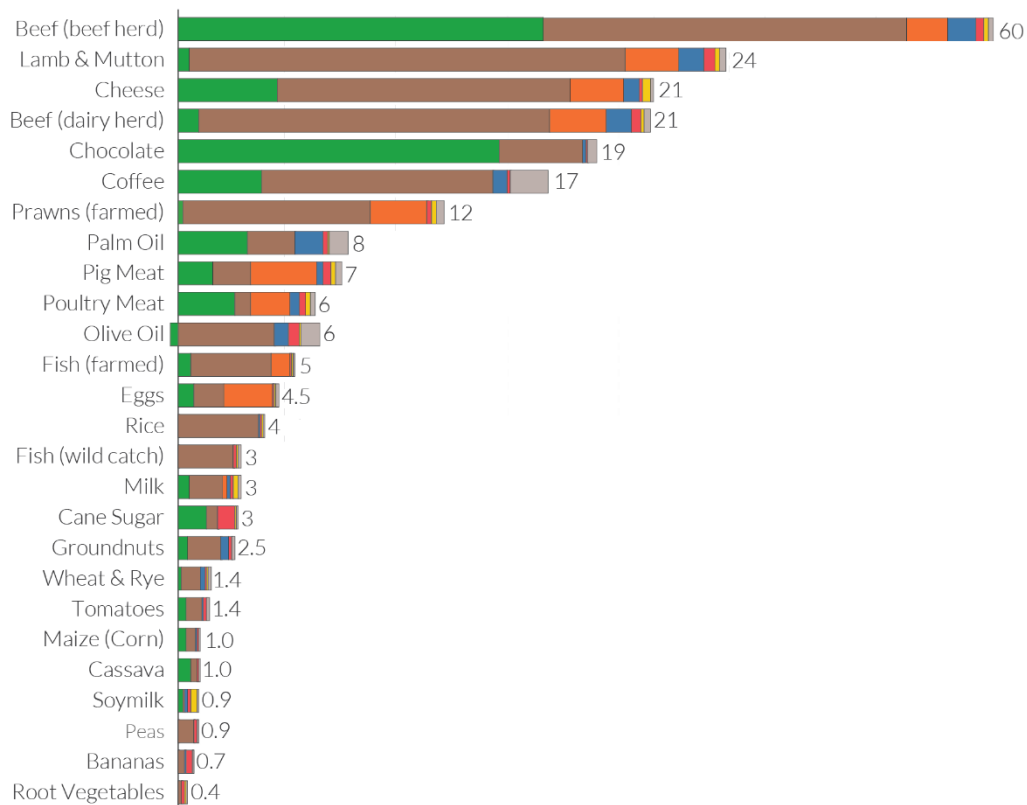
This cluster is relevant to diagnose if distinguished regions in Europe can affect the EP-FP relation. The data was grouped in three regions considering the location of the firm's headquarters:

- North Europe;
- Central Europe;
- South Europe.

Actually, Esty and Porter (2001) found that more developed countries have better environmental performance. Additionally, when comparing countries with similar levels of development, like Portugal and Spain, they saw significant differences in environmental regulatory quality ranking and concluded that countries with more aggressive market-oriented economies can outpace those with a more interventionist economy.

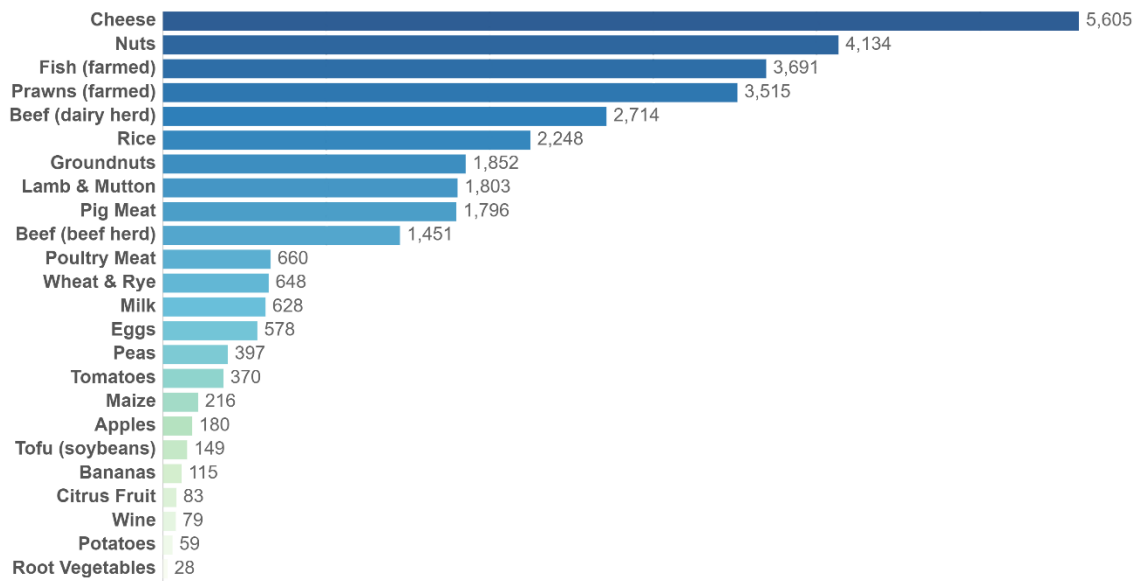
Consequently, separating the data into European regions can be interesting in order to understand if the food industry has a better environmental performance in the most developed countries in Europe and if differences between economies might at some extent justify the performance gaps.

Figure 5. Kilograms of greenhouse gas emissions per kilogram of food product



Adapted from: Our World in Data, 2020.

Figure 6. Liters of freshwater withdrawals per kilogram of food product



Adapted from: Our World in Data, 2020.

4. Empirical Results

In this chapter it is performed the analysis of the collected data and the hypotheses are tested. Then, the results found from the correlation analysis are discussed and the main takeaways retrieved.

4.1. Descriptive Statistics

As mentioned before, 93 firms reported environmental indicators, meaning that 215 out of 308 companies did not report the environmental indicators selected in this study.

Although, 34 out of 215 companies had sustainability reports, they lacked the EP variables required for this study or they did not release the 2018 report. Therefore, from the 308 companies analysed, there is evidence of a lack of firm's commitment in reporting environmental performance in this industry, where 59% (181 companies) did not report in any way this data.

Nevertheless, it is true that in the last decade more companies worldwide have been reporting their efforts towards sustainability, for instance by reporting CO₂ emissions (Appendix 1), but many companies, specially smaller firms, might be postponing this matter because of the costs associated with reporting (Nizam et al, 2019).

The most representative sectors in this sample are the manufacturers of dairy products (19 firms), followed by Processing and preserving of meat and production of meat products (NACE code 101) and Manufacture of cocoa, chocolate and sugar confectionery (NACE code 1082) both represented by 9 firms, as showed in Table 3.

Moreover, the sample is mainly constituted from firms with headquartes in Germany (DE), Italy (IT) and Netherlands (NL), representing 33 of the 93 companies on the sample (please see Table 4).

Table 3. Sector's description

NACE code	Number of companies	Description
101	9	Processing and preserving of meat and production of meat products
102	8	Processing and preserving of fish, crustaceans and molluscs
103	3	Processing and preserving of fruit and vegetables
104	7	Manufacture of vegetable and animal oils and fats
105	19	Manufacture of dairy products
106	2	Manufacture of grain mill products, starches and starch products
107	5	Manufacture of bakery and farinaceous products
108	39	Manufacture of other food products
1081	7	Manufacture of sugar
1082	9	Manufacture of cocoa, chocolate and sugar confectionery
1083	6	Processing of tea and coffee
1089	17	Manufacture of other food products n.e.c.
109	1	Manufacture of prepared animal feeds

Table 4. Sector's region and country

Countries	Number of companies	Europe Region
GB	9	North (33)
FI	7	
NO	6	
DK	6	
IE	3	
SE	2	
DE	12	Central (39)
NL	10	
FR	6	
CH	4	
AT	3	
PL	2	
BE	1	
LU	1	
IT	11	South (21)
ES	6	
GR	2	
HR	2	

In terms of quantitative data, some firms were missing the values for some variables, reason why several variables have less than 93 observations, as presented in Table 5.

Concerning financial variables, the sample is diverse, including for instance firms with negative and positive Profit Margin. ROE is on average 12% and is the FP variable where firms diverge the most, registering the highest standard deviation of the three what corresponds to 15%. Regarding environmental variables, EmissionsRev do not vary as much as WaterRev. This happens because some manufacturing processes can be more water dependent.

Furthermore, this sample is constituted mainly for mature firms, in total they have an average age of 91 years old and the oldest has 689 years old. As a matter of fact, 62 firms have more than 50 years old. Additionally, these firms are falling on average 3% in operating revenue 2018 versus 2017. Moreover, the companies in the sample are highly leveraged, meaning that they can translate to investors high financial risk.

Table 5. Descriptive statistics of quantitative variables

Variables	Unit	Number of Observations	Average	Standard Deviation	Maximum	Minimum
ROA_Net	%	92	5,34	5,69	27,98	-10,31
ROE_Net	%	92	12,47	15,37	79,45	-21,01
ProfitM	%	91	6,81	9,02	39,26	-11,46
EmissionsRev	Tonnes per K\$	83	0,15	0,30	2,14	0,00
WaterRev	M ³ per K\$	62	3,79	8,20	43,91	0,01
NEmp	Number of employees	91	12 267	36 816	308 000	52
CAge	Years	93	91	85	689	5
Gwth	%	92	-3,17	9,99	31,32	-29,22
Lev	%	92	87,45	84,26	597,78	2,00

4.2. Results

In this chapter it is presented the results from the tests undertaken and they are analysed and discussed. Also, we finished this chapter by indicating some important implications of this study for both academy and all stakeholders – managers, governments, society and future generations.

4.2.1. Quantile Regression

This section describes and analyses a regression in order to assess the relation among financial performance measures (ROA_Net, ROE_Net and ProfitM) and seven variables (EmissionsRev, WaterRev, Reg, NEmp, Cage, Lev and Gwth), which relationships were raised during the literature review process. Through the data collected, we performed the quantile regression, using the quantreg from RStudio software.

In Table 6 we report the results of the regression, indicating the coefficient estimates (Coef.), lower bounds (Lw bd) and upper bounds (Up bd) of the confidence intervals (level of confidence of 90%). Confidence intervals that do not contain zero correspond to parameters that are significant at a 10% level of significance.

From this model, it should be highlighted the significant results found in WaterRev and Gwth, mainly affecting ROA_Net. Although many variables are not statistically significant, this circumstance occurs also similar literature (Tzouvanas et al., 2019; Li et al., 2019).

Therefore, for the first hypothesis (*H1*) - Companies with less CO₂ intensity have a higher financial performance - the results are inconclusive. Concerning the second hypothesis (*H2*), the *H2 a.* - Companies with less water consumption intensity have a better ROA – is rejected, what appears to be happening is the opposite, according with the evidence in Table 6. If the intensity of water consumption grows 1%, ROA increases 0,2% (Coef. WaterRev x ROA_Net = 0,02). The remaining hypothesis *H2 b.* and *H2 c.* are inconclusive as well.

In contrast with Li et al. (2019), we found positive relation between water consumption intensity and ROA contradicting their findings in the consumer staples industry. Moreover, CO₂ emissions intensity showed inconclusive results, which might be explained by the mix

of different production process included in the food industry. This issue is supported by Gonenc and Scholtens, who found that in some sectors of the Fossil industry emission reduction can have more relevance than in other sectors of the same industry. Also, in the manufacturing industry there have been contradictory results, some proved CO₂ emissions intensity are significant and positive related to financial indicators (Rokhmawati et al., 2015), others found the opposite (Iwata and Okada, 2011). The following chapter address the different results obtained for sectors in this industry.

Table 6. Quantile regression results

	ROA_Net			ROE_Net			ProfitM		
	Coef.	Lw bd	Up bd	Coef.	Lw bd	Up bd	Coef.	Lw bd	Up bd
Intercept	-0,092	-0,511	0,094	-0,742	-1,537	0,280	-0,587	-0,900	-0,123
Reg	0,000	0,000	0,001	0,001	0,000	0,002	0,001	0,000	0,001
NEmp	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
CAge	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Lev	-0,005	-0,015	0,013	0,018	-0,022	0,119	-0,003	-0,010	0,002
Gwth	0,180*	0,019	0,439	0,259	-0,003	1,197	0,174*	0,082	0,511
EmissionsRev	0,001	-0,216	0,090	0,019	-0,751	0,130	-0,003	-0,161	0,257
WaterRev	0,002**	0,001	0,005	0,005	-0,002	0,007	0,002	-0,001	0,009

Notes: * p<0,05, ** p<0,1

4.2.2. Industry Cluster

Pearson and Spearman correlation analysis was made to test the EP (EmissionRev and WaterRev) and FP (ROA_Net, ROE_Net and ProfitM) relation for each cluster of the food industry and the results are presented on Table 7.

Concerning the CO₂ emissions intensity indicator, the results from the correlation analysis are inconclusive and not significant. The three clusters created did not give evidence of the existence of a relation between CO₂ intensity and ROA, ROE or Profit Margin. Hence, was not possible to infer any conclusion for the first hypothesis (*H1*).

Nonetheless, when studying each sector separately some results were found. For instance, the cluster Other Manufactures aggregate several types of productions, such as sugar, chocolate, tea, coffee and others, but when separated in their specific production sectors, with similar industrial processes, some show clear evidence of EP-FP relation like

manufactures of sugar (Appendix 2). The manufacturers of sugar with less intensity CO₂ emission have superior financial results.

From the correlation analysis done (Table 7) it can be inferred that in manufacture of dairy, water consumption intensity has a negative significant impact in all three financial performance indicators. Therefore, dairy companies consuming more efficiently water, benefit from a better financial performance. In fact, cheese is the food product consuming more liters of freshwater withdrawals per kilogram of food product (Figure 6), what shows that cheese production is a heavily consumer of water when compared to other foods, and that water is relevant resource in its production process. Therefore, being more efficient in the use of water in this industry allows saving costs in resources, one of the advantages of adopting better environmental practices (Lankoski, 2000; Reinhardt, 2000; Ambec and Lanoie, 2008).

In the Processing and Preserving sector of food industry, water consumption intensity has a positive and significant relation with financial performance indicators, meaning that firms consuming more efficiently water, have worst financial performance. Processing and Preserving includes companies dedicated to process and preserving of fish, meat, or vegetables/fruits. Fish processors are the firms that more justify these findings since the more fish is produced, more water is needed, for example, in aquaculture there is regulations defining a minimum quantity of water needed for each fish produced (FAO standards). Meanwhile, fruit and vegetable producers react inversely because bigger producers can benefit from economies of scale (Appendix 2).

Other Manufacturers cluster did not show evidence of this relation because it aggregates several different production processes. In fact, when different types of productions are separated, some showed that less intensive water users have better financials, for example the manufacturers of cocoa, chocolate and sugar confectionery, but others like manufacturers of bakery and farinaceous products indicated that FP is greater when the water consumption efficiency is higher (Appendix 2).

Therefore, the second hypothesis (H2) can be supported for some sectors in the food industry. Studies analysing the impact of EP in FP in the food industry did not reach a consensual conclusion, what can be explained by the differences inside this industry.

These findings are in line with Graham and Potter (2015), who uncovered that different sectors of food industry in UK relate differently with environmental performance. Likewise, in line with Li et al. (2019) we found that different EP variables impact differently in FP variables depending on the business area in study.

Table 7. Industry clusters: Pearson and Spearman correlation

Industry	EP \ FP	ROE_Net		ROA_Net		ProfitM	
		R-Pearson	R-Spearman	R-Pearson	R-Spearman	R-Pearson	R-Spearman
Manufacture of dairy products	EmissionsRev	-0,200	-0,091	-0,212	-0,309	-0,180	-0,184
	WaterRev	-0,436	-0,495**	-0,479**	-0,659*	-0,455	-0,703**
Other manufactures	EmissionsRev	-0,005	-0,049	0,237	0,036	0,112	0,026
	WaterRev	0,151	-0,027	0,169	0,142	0,004	0,106
Processing and preserving	EmissionsRev	0,114	-0,121	0,235	-0,096	0,391	-0,065
	WaterRev	0,655*	0,165	0,782*	0,179	0,960*	0,324

Notes: * $p < 0,05$, ** $p < 0,1$

4.2.3. Region Cluster

In this section the data was grouped in three regions- North, Central and South Europe- considering the location of the firm's headquarters. Esty and Porter (2001) triggered the study of this cluster by suggesting that countries with different levels of development, perform differently in terms of sustainability.

North Europe has a better SDG index and score better Environmental Regulatory Regime Index when compared with countries in the South (Appendix 3). Moreover, countries with a better GDP per capita like Germany, Sweden, France (North and Central Europe) have a better environmental regulatory regime than South countries such as Italy, Spain and Portugal (Appendix 4 and 5).

The objective is to see if different kinds of regulations, economies, and levels of development can impact the relation between EP and FP. Therefore, a correlation analysis was made to test the relation between the EP and FP variables for each region (Table 8).

In terms of emission efficiency, North and Central Europe do not show significant and conclusive data to explain EP and FP relation. The only country of the North and Central

regions registering high and negative correlation between EmissionRev and financial indicators was France, the remaining have shy results as exhibited in Appendix 6.

Though, there is significant evidence that companies with less efficient emission of CO₂ have a better Profit Margin in South Europe. However, the two most representative countries in the South Europe cluster- Spain and Italy- have contradictory behaviour (Appendix 6). Spain shows positive relation between those variables and is the country explaining this result, but Italy registers a negative nexus between WaterRev and ProfitM.

Therefore, the first hypothesis *H1* - Companies with less CO₂ intensity have a higher financial performance - is inconclusive for the region clusters as it was for the industry clusters.

Moreover, it can be inferred by the results that less water efficient firms in the North countries have negative financial performance. Mostly, this is explained by the type of industries present in this region, several from the processing and preserving of fish sector (the more their production grow, the more water they need).

Additionally, in South Europe, water efficient firms have significant better ROE. However, this was the only financial variable indicating significant results.

Although, for Norther countries it seems to be evidence proving *H2*- Companies with less water consumption intensity have a higher financial performance- the main reason explaining this behaviour might not be the region, instead it is possibly the industry. Moreover, Finland, one of the North countries in the sample, registered contradictory results when compared to its region (Appendix 6).

The findings are in line with Aras et al. (2010), studying a group of countries without differentiating or selecting a sector, lead to inconclusive results. Moreover, literature that develop studies per country and per sector usually find significant results to report (Alexopoulos et al., 2018, Song et al., 2017, Li et al., 2017, Nishitani et al., 2017).

Table 8. Region clusters: Pearson and Spearman correlation

Europe Region	EP \ FP	ROE_Net		ROA_Net		ProfitM	
		R-Pearson	R-Spearman	R-Pearson	R-Spearman	R-Pearson	R-Spearman
North	EmissionsRev	-0,080	-0,263	0,095	-0,195	0,199	-0,063
	WaterRev	0,471**	0,218	0,711*	0,068	0,610	0,015
Central	EmissionsRev	0,045	0,081	0,157	0,092	0,085	0,093
	WaterRev	-0,024	-0,124	0,066	-0,040	0,046	0,018
South	EmissionsRev	-0,100	-0,335	0,314	-0,121	0,509*	0,001
	WaterRev	-0,117	-0,502*	0,083	-0,326	0,087	-0,150

Notes: * $p < 0,05$, ** $p < 0,01$

4.3. Theoretical and Practical Implications

This study allowed to enrich the existing literature by exploring further the EP-FP nexus in a specific industry, which is a necessity to develop clear conclusions in this topic. Moreover, it is the first time addressing the food industry in Europe, a very relevant industry for this region.

Nonetheless, we examined the food industry in Europe, but we decided to explore further the subindustries and the regions in Europe to understand how relevant this can be. In fact, we are the firsts comparing the food industry and its subindustries in Europe and the takeaways are very interesting and can lead future research exploring more the subindustries/sectors, which are key to find accurate conclusions relevant for stakeholders. Moreover, many studies so far explored industries in a region, but we were the first comparing EP-FP by different regions.

Additionally, sustainability is a topic of great concern nowadays and younger generations are creating a lot noise about this topic, but companies and governments are facing difficulties tackling this issue. Food industry is constituted mainly by smaller companies and they face more constraints in sustainability reporting, so governments should support firms to develop these reports and help each firm pursuing environmental goals in order to attain the Sustainable Development Goals created by the United Nations. In particular, food industry is not only in the centre of debate concerning environment (e.g. palm sugar, beef production,

etc), but is also in the base of issues such as hunger and poverty, making it crucial to manage better the use of resources in this industry for the future and present generations.

Ideally, governments together with international organizations should develop a strategic plan for each sector with well-established objectives for each environmental KPIs more relevant for that sector and country, that KPIs can be the variables used in this study- water consumption intensity or CO₂ emissions intensity - or others. On the other hand, managers should take responsibility on these issues and act on it and governments should compensate (penalize) companies that are following (not following) the guidelines established. By doing this, governments would stimulate further interest of the firms in this issue and would attain results in the short/medium term. Moreover, companies would see that environmental performance clearly impact their financial performance.

5. Conclusion

After several years of discussion about the relation between Environmental Performance and Financial Performance, literature has not presented consensual conclusion. Few studies have investigated this relation in the food industry and so far, the conclusions are mixed.

Food industry in general cannot explain the relation between EP and FP. The first question tested was inconclusive for the quantile regression and the clusters correlation. However, some countries have registered high correlations between these variables. This is possibly explained by the type of sectors that dominate in these countries, more than the type of regulation. Moreover, food industry is very dependent on geographical specifications, such as seaboard, climate, weather, and soil, which explains why in some countries some sectors of the food industry are more representative.

For the second hypothesis we found contradictory results. In the quantile regression the water consumption intensity and ROA showed a positive relation and reject the hypothesis, but after exploring this relation by clusters the hypothesis is supported for Manufacturers of Dairy Products sector. For firms dedicated to Process and Preserving, the results contradict the hypothesis and are in line with the quantile regression, demonstrating that firms with less water consumption intensity have a lower financial performance. Also, the Other Manufacturers cluster highlights the importance of separating sector for types of production processes because if we analyse each sector of this cluster, we might find significant results, but without separating them is not possible to take conclusions.

Furthermore, it can be inferred from this study that water consumption intensity seems to have a clearer relation with company's financials than CO₂ emissions. The nature of these variables is different, water use is an input variable and CO₂ emissions is an output indicator, meaning that water is one of the resources used in the production process, therefore impacting more directly the firm's costs. CO₂ emissions could have been taken as an input if energy consumption were chosen as variable. Nonetheless, is interesting to see that a variable such as CO₂ emissions, the most common variable considered in environmental performance rankings, sustainability reports and performance evaluations, does not show a clear relation with FP.

Moreover, reputation is mentioned by many authors as variable capable of excel financial performance. In food industry, CO₂ emissions might not impact company's reputation as in other industries. Although, emissions are the most regulated variable, this does not mean there is the most valued environmental initiative for stakeholders of this industry.

In summary, this study demonstrates that different sectors in the food industry register different EP-FP relation, depending on the production process behind each good and highlights the importance of choosing the environmental KPI's most relevant for the sector analysed in order to find significant results.

6. Limitations and Future Research

The aim of this chapter is presenting the main limitations of this study and ways of surpassing these issues in future research, as well as what can be further explored concerning the topic EP-FP relation.

This study explored more than 300 firm's reports, but few had available the same environmental indicators, which reduced the sample to 93. Thus, if obtainable, it is advised the use of environmental rankings or databases to support the analyses with a bigger sample.

In the future it is recommended that studies investigate further this relation in subindustries of the food industry and/or other industries. More than restricting sample to a geographical area, this study show that it is of most importance to explore a sector since different manufacturing process have different needs and are affected by distinct pressures.

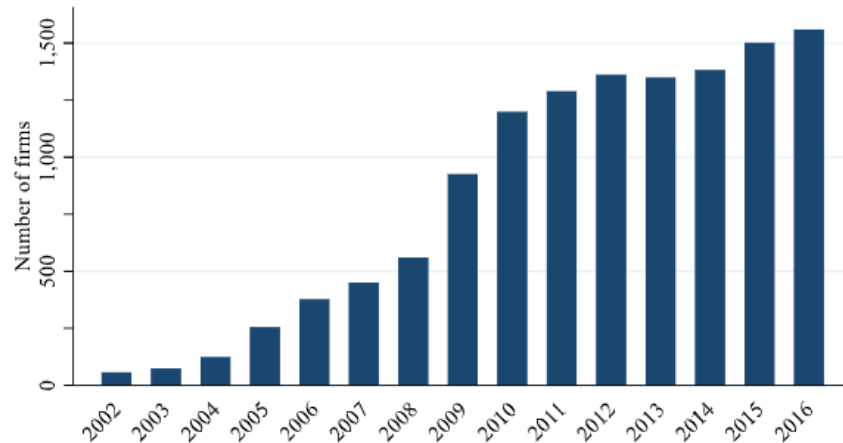
Additionally, exploring more environmental variables such as waste food, waste water, water recycled or energy consumption should allow further understanding of the possible relations among EP and FP. Also, concerning the choice of variables, input variables can have more straightforward results since impact more directly in the costs of the firm and consequently in the financials. Although, this does not mean that output variables are less relevant, these variables are possibly more important in terms of organization's reputation and, depending on the industry, might affect more/less firm's financials.

Many studies adopted as EP indicator a score obtained by rankings or databases, which do not allow the understanding of what EP variables are leading the positive or negative impact on the different FP variables. Future research can benefit from taking this approach because it translates better the reality and the possible practical implications.

Moreover, future research can explore the evolution of the EP-FP relation throughout several years, to further understand if after some years environmental performance indicators have greater impact in FP.

7. Appendices

Appendix 1. Number of non-financial firms reporting Scope 1 CO₂e emissions, with available data on good output and inputs



Source: Trinks et al., 2020.

Appendix 2. Pearson correlation by industry sectors

Industry	NACE Code	Description	Variable	ROE_Net	ROA_Net	ProfitM
Processing and preserving	101	Processing and preserving of meat and production of meat products	EmissionsRev	- 0,139	- 0,073	- 0,175
			WaterRev	- 0,256	- 0,243	- 0,327
	102	Processing and preserving of fish, crustaceans and molluscs	EmissionsRev	- 0,127	0,124	0,430
			WaterRev	0,995	0,997	0,999
	104	Manufacture of vegetable and animal oils and fats	EmissionsRev	- 0,228	0,397	0,165
			WaterRev	0,156	0,929	0,737
Manufacture of dairy	105	Manufacture of dairy products	EmissionsRev	- 0,201	- 0,210	- 0,170
			WaterRev	- 0,436	- 0,476	- 0,442
Other manufactures	107	Manufacture of bakery and farinaceous products	EmissionsRev	- 0,622	- 0,425	0,422
			WaterRev	0,614	0,842	0,633
	1081	Manufacture of sugar	EmissionsRev	0,728	0,726	0,635
			WaterRev	0,593	0,598	0,610
	1082	Manufacture of cocoa, chocolate and sugar confectionery	EmissionsRev	- 0,059	- 0,095	- 0,163
			WaterRev	- 0,331	- 0,512	- 0,083
	1083	Processing of tea and coffee	EmissionsRev	- 0,261	- 0,142	0,842
			WaterRev	- 1,000	- 1,000	1,000
	1089	Manufacture of other food products n.e.c.	EmissionsRev	0,127	0,313	0,149
			WaterRev	- 0,306	- 0,077	- 0,258

Appendix 3. SDG index for the European Union

	RANK	COUNTRY	SCORE	
	1	Denmark	79.8	
	2	Sweden	79.4	
	3	Finland	79.1	
	4	Austria	76.7	
	5	Germany	75.3	
	6	France	74.7	
	7	Netherlands	71.8	
	8	Czech Republic	71.8	
	9	Slovenia	71.7	
	10	Estonia	70.4	
	11	Belgium	70.3	
	12	United Kingdom	70.2	
	13	Ireland	68.2	
	14	Spain	66.8	
	15	Portugal	66.2	
	16	Poland	66.1	
	17	Luxembourg	66.0	
	18	Italy	65.3	
	19	Slovak Republic	65.2	
	20	Latvia	65.2	
	21	Hungary	65.1	
	22	Croatia	63.2	
	23	Lithuania	62.6	
	24	Malta	62.3	
	25	Greece	58.9	
	26	Bulgaria	57.1	
	27	Romania	55.9	
	28	Cyprus	55.0	
		European Union*	70.1	

*Population-weighted average
Source: Authors' calculations

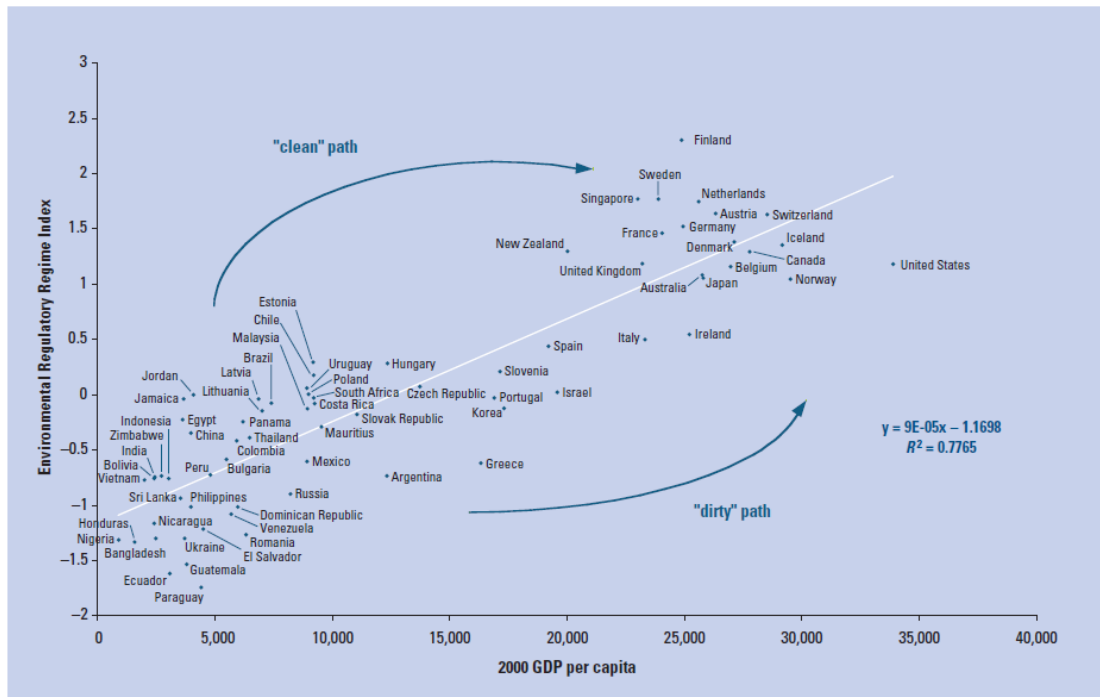
Source: Europe Sustainable Development Report, 2019.

Appendix 4. Environmental Regulatory Regime Index

Rank	Country	Score	Rank	Country	Score
1	Finland	2.303	37	Korea	-0.121
2	Sweden	1.772	38	Malaysia	-0.127
3	Singapore	1.771	39	Lithuania	-0.146
4	Netherlands	1.747	40	Slovak Republic	-0.177
5	Austria	1.641	41	Egypt	-0.224
6	Switzerland	1.631	42	Panama	-0.242
7	Germany	1.522	43	Mauritius	-0.290
8	France	1.464	44	China	-0.348
9	Denmark	1.384	45	Thailand	-0.389
10	Iceland	1.354	46	Colombia	-0.416
11	New Zealand	1.299	47	Bulgaria	-0.584
12	Canada	1.297	48	Mexico	-0.602
13	United Kingdom	1.185	49	Greece	-0.619
14	United States	1.184	50	Peru	-0.722
15	Belgium	1.159	51	Argentina	-0.732
16	Australia	1.083	52	Zimbabwe	-0.732
17	Japan	1.057	53	Bolivia	-0.743
18	Norway	1.045	54	Indonesia	-0.758
19	Ireland	0.546	55	India	-0.759
20	Italy	0.498	56	Vietnam	-0.770
21	Spain	0.437	57	Russia	-0.895
22	Estonia	0.296	58	Sri Lanka	-0.936
23	Hungary	0.283	59	Philippines	-1.014
24	Slovenia	0.209	60	Dominican Republic	-1.014
25	Chile	0.177	61	Venezuela	-1.079
26	Czech Republic	0.073	62	Nicaragua	-1.164
27	Uruguay	0.059	63	El Salvador	-1.215
28	Israel	0.021	64	Romania	-1.268
29	Poland	0.005	65	Ukraine	-1.297
30	Jordan	0.002	66	Honduras	-1.300
31	Portugal	-0.028	67	Nigeria	-1.314
32	South Africa	-0.029	68	Bangladesh	-1.331
33	Latvia	-0.036	69	Guatemala	-1.532
34	Jamaica	-0.037	70	Ecuador	-1.616
35	Brazil	-0.077	71	Paraguay	-1.743
36	Costa Rica	-0.078			

Source: Esty and Porter, 2001.

Appendix 5. Relationship between the Environmental Regulatory Regime Index and GDP per capita



Source: Esty and Porter, 2001.

Appendix 6. Pearson correlation by countries

Region	ISO Code	Variable	ROE_Net	ROA_Net	ProfitM
North	Denmark	EmissionsRev	- 0,091	0,573	0,519
		WaterRev	- 0,846	- 0,709	- 0,573
	Finland	EmissionsRev	- 0,133	- 0,070	0,097
		WaterRev	0,926	0,558	- 0,124
	Norway	EmissionsRev	0,066	0,198	0,367
		WaterRev	1,000	1,000	1,000
Central	Germany	EmissionsRev	- 0,226	- 0,276	- 0,371
		WaterRev	0,418	0,383	0,352
	Netherland	EmissionsRev	0,058	- 0,019	0,795
		WaterRev	- 0,534	- 0,436	- 0,277
	United Kingdom	EmissionsRev	- 0,128	- 0,121	- 0,051
		WaterRev	- 0,369	- 0,291	- 0,224
	France	EmissionsRev	- 0,690	- 0,707	- 0,575
		WaterRev	0,150	0,068	- 0,287
South	Spain	EmissionsRev	- 0,455	0,449	0,838
		WaterRev	- 0,556	- 0,164	0,134
	Italy	EmissionsRev	- 0,185	- 0,169	- 0,333
		WaterRev	0,115	0,348	0,246

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Annex

Annex 1. Database used in this paper with 2018 variables.

Company	Reg	Ind	NEmp	CAge	Lev	Gwth	ROE _Net	ROA _Net	ProfitM	Emissions Rev	Water Rev
X1	CH	1089	308 000	154	86%	3%	17%	7%	15%	0,06	0,10
X2	FR	1051	105 783	101	129%	-6%	14%	5%	10%	0,05	1,53
X3	GB	1089	137 014	85	11%	-3%	9%	7%	8%	0,20	41,28
X4	NL	1051	23 769	138	37%	-9%	4%	2%	3%	0,09	0,00
X5	IT	1082	35 146	74	171%	-1%	23%	7%	8%	0,06	0,40
X6	DK	1051	19 190	20	91%	-4%	12%	4%	3%	0,06	2,42
X7	DK	1013	27 921	22	182%	-4%	18%	5%	3%	0,04	1,10
X8	DE	1081	19 219	94	66%	-10%	-21%	-10%	-11%	0,12	0,32
X9	IE	1089	25 255	48	66%	-2%	13%	6%	9%	0,00	0,00
X10	NL	1013	12 147	26	133%	2%	12%	4%	3%	0,04	0,41
X11	CH	1082	11 570	24	67%	2%	16%	6%	7%	1,18	0,14
X12	NL	1083	15 910	5	71%	-3%	7%	4%	13%	0,89	0,00
X13	FR	1051	19 888	64	92%	-4%	4%	1%	2%	0,00	2,71
X14	NL	1082	2 097	61	369%	-13%	14%	8%	4%	0,11	0,00
X15	FR	1051		30	93%	-5%	0%	0%	0%	0,74	0,00
X16	NL	1013	11 800	90	32%	-12%	2%	1%	0%	0,03	0,08
X17	CH	1082	14 570	175	39%	5%	11%	7%	14%	0,03	0,09
X18	NO	1020	14 537	14	54%	-3%	20%	11%	19%	0,05	20,25
X19	IT	1073	8 427	143	52%	-5%	21%	9%	9%	0,09	18,76
X20	FR	1051	12 637	99	77%	-6%	4%	2%	4%	0,06	1,37
X21	IE	1051	4 157	23	63%	10%	15%	7%	8%	0,12	0,00
X22	GB	1081	4 121	99	43%	-5%	12%	6%	9%	0,75	0,00
X23	FI	1089	17 663	100	105%	0%	12%	5%	6%	0,21	2,65
X24	CH	1051	6 151	113	35%	2%	14%	8%	8%	0,03	0,00
X25	IE	1089	11 680	29	90%	7%	5%	2%	1%	0,04	0,00
X26	FR	1039	10 655	73	105%	-2%	10%	3%	3%	0,06	4,25
X27	SE	1042	3 609	102	48%	-4%	15%	7%	7%	0,12	0,85
X28	ES	1081	7 153	22	38%	1%	6%	4%	8%	0,22	6,54
X29	AT	1081	9 191	32	31%	-11%	2%	1%	2%	0,33	0,53
X30	GB	1091	2 654	124	22%	4%	9%	7%	3%	0,06	0,00
X31	NO	1051		92	65%	-3%	16%	8%	6%	0,03	0,00
X32	GB	1089	4 813	5	120%	6%	8%	3%	10%	0,05	1,93
X33	IT	1012	7 078	62	324%	-6%	0%	0%	0%	0,10	2,79
X34	LU	1041	15 116	25	67%	12%	4%	2%	2%	0,14	0,00
X35	NL	1081	3 744	124	9%	-3%	0%	0%	0%	0,00	0,00
X36	GB	1089	19 842	34	63%	-4%	12%	5%	4%	0,07	0,00
X37	NO	1020	4 589	121	47%	1%	20%	12%	22%	0,05	0,00

X38	IT	1083	3 836	125	47%	-14%	4%	2%	7%	0,01	0,00
X39	GB	1013	6 338	46	3%	31%	15%	11%	6%	0,05	0,69
X40	FI	1051	4 259	115	78%	-3%	-5%	-2%	-2%	0,04	2,63
X41	GB	1012	10 061	77	24%	-2%	23%	11%	4%	0,07	2,17
X42	FI	1011	7 179	107	96%	-9%	-16%	-6%	-3%	0,06	2,11
X43	DE	1089	4 782	49	109%	-4%	14%	6%	4%	0,19	3,09
X44	FI	1011	4 460	117	51%	-4%	4%	2%	2%	0,07	1,94
X45	DE	1089	2 286	111	74%	4%	-1%	0%	1%	0,01	0,00
X46	DE	1081	3 208	23	32%	-22%	-3%	-2%	-4%	0,30	0,00
X47	NO	1020	1 479	36,2	114%	-1%	39%	24%	39%	0,01	43,91
X48	DK	1089	3 151	146	109%	2%	30%	12%	27%	0,04	1,16
X49	DK	1089	3 151	146	109%	2%	30%	12%	27%	0,04	1,16
X50	PL	1051	3 433	92	23%	-2%	1%	1%	0%	0,05	1,84
X51	DE	1041	1 479	181	24%	-22%	3%	2%	0%	0,00	0,01
X52	DE	1071	5 592	332	21%	-1%	7%	5%	4%	0,00	0,00
X53	ES	1020	10 512	60	598%	-11%	5%	1%	2%	0,00	1,75
X54	GB	1089	4 053	44	107%	17%	1%	0%	3%	0,06	0,00
X55	IT	1083	3 359	47	98%	-11%	6%	2%	3%	0,05	0,00
X56	NL	1082	2 040	101	67%	-5%	10%	6%	8%	0,17	3,70
X57	ES	1089	4 609	45	24%	-1%	16%	12%	18%	0,56	0,11
X58	IT	1030	2 804	44	118%	-5%	-3%	-1%	-1%	0,09	5,92
X59	NO	1020	819	28	83%	1%	25%	12%	17%	0,04	0,00
X60	FR	1013	3 937	115	112%	1%	6%	2%	2%	0,03	1,19
X61	ES	1041	261	22	219%	-14%	27%	4%	1%	0,05	0,54
X62	DK	1020	2 228	30	131%	-11%	9%	3%	5%	0,00	3,10
X63	DE	1089	4 052	62	11%		14%	11%	9%	0,03	0,00
X64	IT	1039	754	66	103%	-2%	11%	4%	5%	0,07	3,37
X65	DE	1050	682	68	94%	-11%	12%	4%	2%	0,04	1,41
X66	DE	1050	682	68	94%	-11%	12%	4%	2%	0,04	1,41
X67	NL	1051	1 350	255	34%	-4%	14%	7%	8%	0,01	0,54
X68	PL	1042	840	19	58%	-3%	13%	9%	5%	0,17	1,39
X69	SE	1082	2 998	158	82%	-7%	12%	5%	9%	0,05	0,00
X70	GB	1051	1 097	39	88%	24%	61%	28%	39%	0,06	0,96
X71	HR	1042	3 982	108	4%	1%	8%	6%	5%	0,02	1,17
X72	IT	1083	1 292	87	121%	-2%	13%	5%	4%	0,01	0,08
X73	DK	1020	1 073	52	33%	-20%	24%	17%	37%	0,16	0,00
X74	NL	1081	7 041	27	89%	-21%	-5%	-2%	-4%	0,00	4,84
X75	ES	1082	984	77	336%	-3%	50%	8%	3%	0,05	0,37
X76	IT	1052	1 194	72	119%	-3%	14%	5%	5%	0,05	1,37
X77	NO	1020	573	25	13%	10%	28%	18%	34%	0,22	0,00
X78	ES	1089	590	80	18%	-2%	16%	12%	12%	0,09	4,13
X79	FI	1051	319	81	2%	-29%	10%	9%	11%	0,00	0,49
X80	GR	1051	1 179	68	136%	-4%	-5%	-2%	-2%	0,15	4,20
X81	FI	1089	594	90	7%	-28%	-7%	-5%	-3%	0,07	0,00
X82	DE	1050	634	118	57%	-9%	-4%	-2%	-1%	0,01	1,06

X83	DE	1041	473	110	41%	-28%	12%	4%	3%	0,06	0,41
X84	BE	1083	1 196	219	79%	-1%	10%	4%	6%	0,02	0,00
X85	AT	1083	650	158	79%	0%	16%	7%	0%	0,02	0,05
X86	IT	1082	296	74	156%	2%	25%	7%	9%	0,00	0,86
X87	IT	1072	583	69	159%	3%	2%	1%	1%	0,09	0,99
X88	HR	1089	2 607	109	45%	-4%	7%	4%	6%	0,06	0,62
X89	AT	1061	298	139	98%	-4%	16%	14%	9%	2,14	0,00
X90	GR	1061	281	238	60%	-4%	1%	1%	1%	0,23	0,00
X91	DE	1071	1 091	689	89%	-5%	10%	5%	4%	0,04	0,22
X92	NL	1082	71	15	71%	31%	77%	12%	6%	0,27	0,00
X93	FI	1071	52	106	0%	3%	79%	11%	2%	0,03	15,38