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Investment in environmental protection in the textile sector: Influence of legal, environmental and economic-financial factors

Inversión en protección medioambiental en el sector textil: Influencia de factores legales, medioambientales y económico-financieros

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Abstract

The textile sector has gone through numerous crises, nevertheless, is currently one of the strongest sectors in Spain. In spite of, it is the second most polluting industry not only in the country but also in the world due to the production of lots of waste products. In particular, according to data from the National Institute of Statistics (2018), this sector emits a total of 850 million tons of CO2 per year worldwide. Due to the magnitude of the problem, this project analyses what factors may be affecting to the investment in environmental protection of this sector in Spain, in order to establish guidelines to follow in the future to alleviate this situation. For this, a bivariate correlation analysis and a regression analysis have been carried out, in order to verify if the factors that have been discovered throughout the study are influencing the investment in environmental protection of the sector. The results show that a higher revenue collection from environmental service seem to be affecting in a negative way to the textile sector and the level of CO2 emissions of this sector promotes the investment to combat the problem.

Investment, Environmental Protection, Textile Sector, Sustainability

Resumen

El sector textil, ha sufrido numerosas crisis, sin embargo, es uno de los más fuertes en España. A pesar de ello, se posiciona como la segunda industria más contaminante no solo a nivel nacional sino también mundial, debido al alto grado de residuos que produce. Según datos del Instituto Nacional de Estadística (2018) este sector emite un total de 850 millones de toneladas de CO2 anualmente en todo el mundo. Debido a la magnitud del problema, este trabajo analiza qué factores pueden estar afectando a la inversión en protección ambiental del sector en España, para poder establecer una serie de recomendaciones para el futuro para aliviar esta situación. Para ello, se ha llevado a cabo un análisis de correlación bivariante y un análisis de regresión, con el fin de comprobar si los distintos factores que se han ido descubriendo a lo largo del estudio, están influyendo en la inversión en protección ambiental del sector. Los resultados muestran que una mayor recaudación de impuestos ambientales parece afectar negativamente a la inversión y que el nivel de emisiones de CO2 del sector textil, fomenta la inversión para combatir el problema.

Inversión, Protección Ambiental, Sector Textil, Sostenibilidad

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1. Introduction

Currently, the protection and care of the environment is an issue that is gaining prominence. Society is increasingly aware of the environmental damage that is being caused, the negative impact that business activities have on the planet and the need to carry out collective actions in order to achieve a more sustainable planet (Gallizo Larraz, 2006; Broega, Jordão, & Martins, 2017).

Environmental pollution is the result of poor management of natural resources, and translates into such harmful effects as the emission of greenhouse gases (GHG) or deforestation. Even if renewable resources are used, but with uncontrolled consumption and at a great pace it will not have positive effects (Jacobs, 1996). In 2015, the Spanish economy emitted 338.6 million tons of GHG, of which 24.34% of tons are the result of manufacturing industries (Instituto Nacional de Estadistica, 2018).

The textile sector, formed by the textile industry, clothing, leather and footwear, is the second most polluting on the planet (after the oil industry) as it emits a total of 850 million tons of CO2 annually. These data are worrisome if we take into account the study by Carrera-Gallisà (2017) that shows how the growth of the population leads to an increase in textile consumption per capita and with it a greater consumption of natural resources and a greater generation of waste.

All polluting human and productive activities seriously affect the ecosystem, generating negative changes both globally and locally, such as temperature rises (causing health effects as indicated by Ballester et al. (2014)), increases in the level of the sea, wear of the ozone layer, natural disasters, loss of ecosystem services, etc. (Del Brío González, Jesús Ángel & Cimadevilla, 2001). However, at the business level there are certain positive developments. In this sense, there is an improvement in the internal and external transparency of companies committed to sustainable development. Specifically, they make available to the interested parties reports on their operation in this aspect, through Eco-Management and Audit Scheme or Community Regulation of Eco-management and Eco-audit (EMAS) (Ministry of Agriculture and Fisheries, Food and Environment. Government of Spain, 2018).

In this line and focusing on the textile sector, Valverde (2018) points out how this sector is increasingly adding to sustainable fashion. One example is the international group Slow Fashion Next created in 2011, whose objective is to promote sustainability through a balance between society, fashion and nature. In this sense, it is emphasized how textile waste goes to third countries that can not take measures to treat them and, therefore, there are eliminated and generate harmful gases that contribute to aggravate environmental problems.

It should be noted that producing in a "green" way may involve producing at a much slower and more expensive pace, but with the right technology, the production process could be much cheaper and, in addition, the cleanest production in the textile sector saves energy and water and reduce waste (Casallas, Cortes and Martinez, 2018).

Technology is essential for a good control of time, costs and quality and, therefore, the textile sector needs to improve in this area constantly. Although at the beginning it will mean an additional investment, in the long run, technological innovations will lead to an increase in profit, since it will be cheaper to produce and, therefore, supply will increase and more will be produced for each price level (Couñago Garrido, 2009). Also, it should be mentioned that a reduction in costs does not imply that prices fall, companies can decide to keep it to obtain a profit margin that allows a reinvestment (López & Martín, 2012).

From the Public Administrations the formento of the environmental protection also seems to be an objective thus, in Spain, the State every year establishes a budget in Investigation and Development to incentivar to the companies to improve this aspect, through subsidies and helps Spain it was placed in 2015 as the eleventh country that made the most investments in innovation, representing 3.2%, behind the pharmaceutical industry (20%) (Ministry of Economy, Industry and Competitiveness, 2018).

When we talk about economic sectors such as textiles it is important to take into account consumers. In this sense, the population is increasingly aware and this has led to an increase in awareness and interest regarding environmental issues, especially since 2015, creating a greater social preference in favor of protection.

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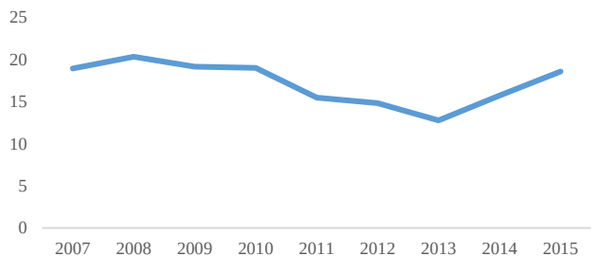
Environmental (González Alvarado and Martín Granados, 2018) which may cause the demand for sustainable products to increase. Knowing the acceptance of consumers or their willingness to pay is fundamental, as indicated by Ramos (2002). However, since 2009 and until 2013 there seems to be less interest in finding information on environmental issues (Graphic 1). This may be due to the strong economic crisis undergone at that time, where environmental protection could have gone into the background.

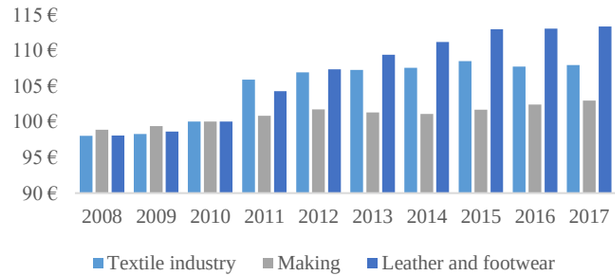
The data of Graphic 1 was obtained from the means of the results, from 2007 to 2015, of searches on environmental issues: sustainable development, wastewater, pollution, sustainable fashion, sustainability and circular economy. The numbers reflect the search interest in relation to the maximum value of a graphic in a given region and period. A value of 100 indicates the maximum popularity of a term, 50 that a term is half popular in relation to the maximum value and 0 that there was not enough data of the term.



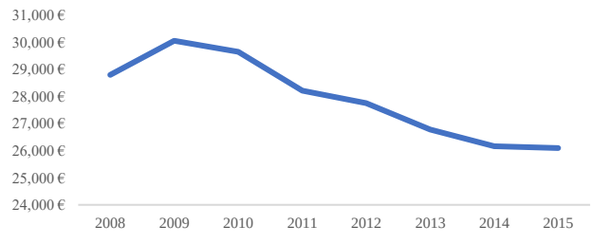
Graphic 1 Evolution of interest in environmental issues in Spain
Source: self made through data collected in Google trends (2018)

In the case of fashion consumers, they do not always know how harmful this activity is, although, without realizing it, their decisions play an essential role when it comes to improving the sustainability of companies (Manzano Zambruno, 2014) because they can make they are more transparent and responsible. The purchase decision does not only depend on consumer awareness, since consuming green labeled garments is much more expensive (Parro, 2017). This means that customers opt for the cheapest option to be able to afford to buy clothes more times a year, which causes the demand for sustainable products to be reduced. In fact, family spending in the textile sector in 2015 has dropped considerably by 33.35%, despite the fact that fashion is still the fourth best consumed in Spain, after transport, housing and food.

This decrease in textile consumption may be due, among other things, to the price, which has been increasing considerably since the beginning of the crisis, especially leather and footwear (Graphic 2) and the evolution of income per household (Graphic 3), which has been reduced by 9.36% from 2008 to 2015.



Graphic 2 Evolution of the Price Index by sector
Source: self made through data collected in the INE (2018)



Graphic 3 Evolution of national income by household
Source: Business association of textile, accessories and leather trade (2015)

Therefore, if the prices of the goods increase and the incomes of the households decrease, the expense of the families has to be reduced in some way in the consumption and in a decrease of the quantity demanded for each price, when the products are considered of the textile sector as "normal goods" (Couñago Garrido, 2009).

Waste & Resources Action Program (2018), says that you need to improve shopping habits, learn to care for and keep clothes for longer periods of time, in addition to recycling when they no longer serve or donate is important if you want to make the most of the garments and thus increase the environmental benefits.

It is evident that the protection and care of the environment is a global challenge, which will affect future generations more than it does in the present and that, therefore, all agents must be involved and be Participants in the design and implementation of practices that lead to an improvement in the care of natural and environmental resources.

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Based on the comments, the objective of this paper is to study the possible factors that may influence the investment in environmental protection of the textile sector, in addition to publicizing its impact on the environment. This is a matter of great importance since it is necessary to bear in mind that the companies study carefully in what to invest their capital to grow and improve, but sometimes they leave aside such important environmental issues.

Based on this objective, our study analyzes whether environmental regulation, the level of polluting emissions and the turnover of the textile sector have significant effects on the level of environmental protection of companies (measured through the investment perform). That is, the following hypothesis is developed: the investment in environmental protection is explained by the variables "Environmental taxes", "CO2 emissions" and "Turnover" of the sector and all of them are related to each other. To validate this hypothesis, a quantitative analysis based on the results obtained through a multiple linear regression model, developed after the corresponding analysis of correlations between the variables, will be carried out.

The added value of our study is to focus the analysis from a different perspective to that of the literature consulted, in which some authors analyze what factors affect CO2 emissions and their behavior, based on economic growth and environmental regulation (Torras & Boyce, 1998; Balsalobre-Lorente, 2018) but do not focus on the level of environmental protection or investment in such protection.

The work consists of six blocks, including the introduction: in section 2, the textile sector is made known through a general study of the historical and current perspective in Spain, together with the explanation of the characteristics of each one of the subsectors that form it; the impact of the sector on the environment is discussed and what are the reasons why it is one of the most polluting sectors and the relevant factors are presented to advance towards the sustainability of the textile sector (factors that will be taken as variables when perform the analysis). Subsequently, section 3 explains the main objective of the work, the hypothesis and the methodology that will be carried out to analyze the variables.

In section 4 the results obtained are presented and, finally, in section 5 reference is made to the conclusions of the work, gathering the bibliographic references used in section 6.

2. Evolution of the textile sector, environmental consequences and relevant factors for sustainability

2.1. Historical and current perspective

At the beginning of the 70s, the textile sector received numerous aids (Costa & Duch, 2005). It tried to favor national production against foreign competition and have a good productive capacity. In general, this decade is characterized by great productive growth, by the signing of the important Multifibre Agreement that provides countries with direct control of textile imports and by the good economic situation in Spain. At the end of the 70s and the beginning of the 80s a strong crisis was unleashed, especially due to the fall in investment and international competitiveness (Costa & Duch, 2005, CITYC, CCOO, & UGT, 2009).

In the 80s seeing the situation, the government decided to address an industrial reconversion, as the only alternative to get out of the crisis and the textile sector took its measures of industrial and financial sanitation since "this sector was the one that most needed adapt to new technologies " (Garaben, 1984). To all this, it must be added that the great international competition provoked a strong pressure towards the local industry, focusing on the internal markets. In the mid-1980s, Spain became part of the European Economic Community and, little by little, imports increased due to the increase in the offer of cheaper and higher quality products from developing countries (CITYC et al., 2009; Costa & Duch, 2005).

In the nineties, this sector was again affected by an economic crisis, which caused a fall in the demand for consumer goods, in addition to the disappearance of numerous producers and manufacturers, despite the fact that there was a certain recovery was not strong enough (Costa & Duch, 2005; CITYC et al., 2009).

In 2005, the Multifibre Agreement ceased to be carried out and Spanish textile companies were allowed to adapt better to foreign trade. Therefore, the crises that this industry has gone through have led to a profound restructuring (Costa & Duch, 2005).

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The textile sector has been immersed in several crises that have affected its volume of total companies (Molina, 2017). As shown in Table 1, there is a decrease in the total number of companies dedicated to this activity in recent years that is largely due to the strong general economic crisis suffered by Spain from 2008 to 2015.

Year	Total (in units)
2007	26.792
2008	25.133
2009	22.881
2010	21.545
2011	20.854
2012	19.763
2013	19.302
2014	19.494
2015	19.441
2016	19.726

Table 1 Evolution of the total number of companies in the textile, clothing, leather and footwear industries
Source: Economic Development Institute of the Principality of Asturias (2018)

Since the beginning of the crisis, the number of companies has gradually fallen, reaching a minimum of a total of 19,302 companies in 2013, when in 2007 it reached a total of 26,792, that is, it was reduced in seven years. 26.94%. From 2007 to 2016 a total of 26.37% was reduced, however, in 2016 you can see how this sector takes a bit more strength reaching almost reaching again a total of 20,000 companies.

The textile sector is developed throughout the Spanish territory, but there are different areas where there is more or less influence. In 2016, the Valencian Community has the largest number of companies in this industry, followed by Catalonia, Andalusia and Madrid; on the other hand, Ceuta and Melilla, Cantabria and Extremadura have the lowest number of companies (Instituto de Desarrollo Económico del Principado de Asturias, 2018).

In terms of turnover, (Graphic 4) we can see how sales have been hit by the strong crisis because, just at the beginning of this, in 2007, the textile sector collected a total of 23,246,868 €, amount that goes down by 36.03% until the year 2015.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Textile industry	8.10	6.27	4.93	5.29	5.03	4.96	5.20	5.25	5.52
Making	7.56	7.32	6.36	5.82	5.76	4.74	4.85	4.43	4.73
Leather and footwear	7.58	4.37	3.05	3.83	4.06	3.55	3.94	4.39	4.62

Graphic 4 Evolution of the turnover by sector of the textile industry, of leather and shoemaking in Spain
Source: Economic Development Institute of the Principality of Asturias (2018)

It should also be noted that the five main countries to which exports of the textile sector have been destined have been France, Italy, Portugal, Germany and the United Kingdom. On the other hand, the five main countries to which Spain has allocated its imports in the textile sector have been China, Bangladesh, Turkey, Italy and Morocco.

Both exports and imports have increased considerably in the last decade. However, the balance has suffered highs and lows throughout this stage, although always maintaining negative values, that is, imports have always exceeded exports. The best balance value was achieved in 2013, reaching a total of - € 2,747,330.4, a figure that was not reached since 2003, however, the worst data was reached in 2008, with the beginning of the economic crisis reaching a total balance of - € 6,541,703.59 (Instituto de Desarrollo Económico del Principado de Asturias, 2018).

2.2. The environmental impact of the textile sector and the path towards its reduction

Converting raw materials into garments has very negative environmental consequences and reducing these consequences means making production longer and more complex along with increasing costs and delivery times. Producing sustainably becomes, therefore, a challenge for textile companies (Shen, Li, Dong & Perry, 2017).

In the textile sector (CNAE-13) it is necessary to differentiate a series of activities, first, those that are related to raw materials and second, those that are related to the type of transformation that will be carried out. In addition, in these stages we must highlight the garment sector (CNAE-14) as this is part of the textile sector's production process.

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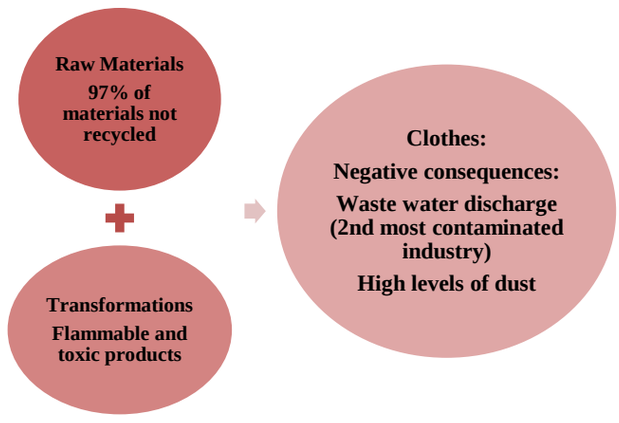
These activities are developed through various stages such as the preparation of raw materials, spinning and weaving, making and distribution (Consulting and Training Projects, 2007), stages in which the fashion industry deals with materials and ready-made articles that make use of a set of harmful materials for the environment (Oliva, 2003). With regard to the leather and footwear sector (CNAE-15), the fabric comes from the skins of animals, which are transformed thanks to a series of processes such as obtaining the raw material, preparing the skin and tanning and using the leather (McCann, 2012). In addition, the footwear industry works with a wide variety of materials ranging from leather, plastic or wood, among others. Each of the processes of leather and shoes, carries with it negative consequences not only environmental but also for health due to flammable products such as toxic solvents, used in adhesives and cleaners, or the high concentrations of dust that are created in the atmosphere (McCann, 2012) causing environmental damage that is often irreversible over water, soil and air (Martinez Diaz, Borda & Smith, 2018).

Based on the above, compared to other commercial sectors, the environmental impact of this sector is particularly high, being the second most polluting in the world after the oil industry. The main problem is related to the discharge of wastewater, as they carry with them a high level of contamination due to the fiber finish, and all kinds of chemical products that are used for their transformation. The United Nations Organization (2018) explains how the textile sector is the second largest wastewater produced in the world. In particular, to produce a garment it is necessary to make use of approximately 200 tons of water and 20% of the industrial pollution of water worldwide is due to the dyeing and treatment of textiles (Ellen Macarthur Foundation, 2017).

The Ellen MacArthur Foundation offers us a study in which it states that the textile industry generates waste that equals 50,000 million plastic bottles per year, and 97% of the raw materials used come from non-recycled elements (the plastic represents 63%, cotton 26% and other materials 11%) and less than 2% comes from materials that are recycled. In addition, it should be noted that approximately 53 million tons of fiber are produced, of which 12% are discarded throughout the process and only 13% of the material is recycled after use.

These processes have a negative impact, both on people and on the environment, negative effects on farmers, workers in factories and the environment. Large amounts of water resources are used, high volumes of waste are produced and polluted in an obvious way deriving devastating consequences for the environment and for people (Luque González, 2018). The textile industry depends for the most part on non-renewable resources. Specifically, in this industry 70% of the fibers used are synthetic and artificial and are made with materials such as acrylic, cellulose, polyamide or polyester among others.

But, sustainability is increasingly present in large companies at the time of manufacturing their products, as well as in the economic or government, which means that when it comes to produce, and other alternatives are sought. An example of this is organic cotton, which has already been used by numerous companies, such as Inditex and H & M, but "making use of organic raw materials is not enough, as there is still an excessive use of water and energy" (Riaño, Riera, P. Gestal, De Angelis y Marin-Camp, 2016). Polyester is the most used fiber in this industry and this has great consequences. When they wash, they release microfibers that, as they are not biodegradable, end up in rivers and marine organisms such as plankton. This means that it affects the aquatic environment since plankton, among others, is the food of numerous marine species. And, finally they end up in people when they eat fish or seafood. But not only polyester generates negative effects, also, fibers such as cotton have serious environmental consequences (due to the use of fertilizers) although, to a lesser extent (Perry, 2018).



Graphic 5 Production process of the textile sector and the consequences for the environment
Source: self made based on Riaño, Riera, P. Gestal, De Angelis and Marin-Camp (2016), Ellen Macarthur Foundation (2017) and Perry (2018))

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The fact that the production process of the textile sector has negative consequences for the environment (Graphic 5) is due, among other things, to the phenomenon "Fast fashion". This phenomenon refers to the rapid rotation of the supply with respect to garments, new collections in very short periods of time, at low prices and of low quality that make the clients feel attracted to replace the clothes constantly what entails an increase in textile waste (Barrios, 2012). "The big" Fast fashion "chains will never be sustainable" (Gómez, 2015).

Gómez (2015) says that making this industry 100% sustainable is not a simple process since it makes great use of water, energy and chemical elements that affect the ecosystem in the short and long term and mitigate those consequences entails a long process.

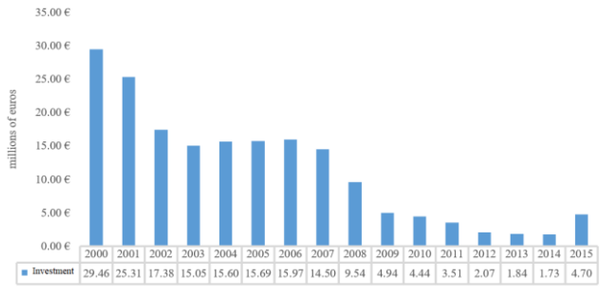
2.3. Factors that contribute to facilitate the process towards sustainability in the textile sector

Next, some of the factors that can favor the sustainability of the textile industry are identified. First, the level of investment in environmental protection will be a key aspect that can be influenced by other aspects such as the turnover of companies, CO2 emissions, and environmental taxes. This section discusses what your contribution may be when it comes to making the activities developed and the products made in the textile sector more sustainable.

2.3.1. Investment in environmental protection

To reduce the level of pollution in the textile sector, many companies invest in environmental protection, as this investment allows them to make their activities more sustainable. As shown in Graphic 6, the total investment in environmental protection reached its highest figure (with respect to the analyzed data) in the year 2000, reaching a total of €25,307,553.

In the following year this figure fell considerably, specifically by 31.32%. From there, the investment remains more or less constant until 2007, when the crisis period begins, and the figure drops to € 9,544,479. The decline continues until 2014 when it starts to resurface, reaching € 4,689,348. The data between the year 2000 and 2008 have been collected in the Galician Institute of Statistics (2018) and from 2008 to 2015 by the Instituto Nacional de Estadística (2018).



Graphic 6 Evolution of the total investment in environmental protection in the Spanish textile sector
Source: self made through data collected in the INE and IGE (2018; 2018)

Organizations that apply environmental measures improve their image and can respond to the new needs of their clients, thus obtaining a competitive advantage (Salas Canales, 2018), an additional reason for investment in this area, in addition to the contribution with the environment.

2.3.2. Environmental taxes

Environmental taxes have been one of the control instruments most traditionally applied as a tool to achieve certain environmental objectives (Magadán and Rivas, 2003). Specifically, taxes have been introduced in order to mitigate pollution and encourage the proper use of natural resources. That is, the polluter has to pay these taxes.

This can be a factor that influences companies when investing more or less in the environment, since paying more taxes will mean that they have less capital to invest. On the other hand, they can also influence the sustainability of companies because the higher these taxes are, the companies will be able to become aware and will be encouraged to carry out an activity that is more respectful with the environment.

As seen in the following Graphic 7, environmental taxes have suffered increases and decreases in the period to be analyzed (2000-2015), with 2015 being the year in which the highest amount was collected with a total of € 20,857,000,000 representing 8.6% of the total taxes of the Spanish economy. On the other hand, the lowest value was reached in the period prior to the crisis, in the year 2000 with a total of € 13,870,000,000.

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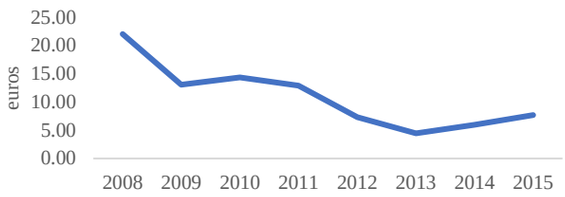


Graphic 7 Evolution Environmental taxes in Spain
Source: European Statistical Office (2018)

These data show the total collection of environmental taxes for the total of industries in Spain in the aforementioned time period, therefore, when the collection of environmental taxes decreases, it may mean that companies are improving their management in terms of environmental protection therefore, they are supported by those companies that do not carry out sustainable activities. On the other hand, when the collection of environmental taxes increases, it could mean that companies are doing activities that are harmful to health and the environment.

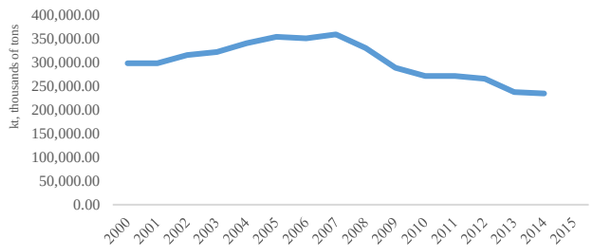
2.3.3. CO2 emissions

The textile industry generates a high level of CO2 emissions. These emissions, as reported by Balsalobre-Lorente, Shahbaz, Roubaud, & Farhani (2018), are related to economic growth, in such a way that as the economy grows, more investment will be made in innovation. This will allow an improvement in the factors and productive processes of the activity and, in turn, improve in this aspect will mean a reduction in the levels of CO_2 emissions.

However, "there is evidence to suggest that the increase in economic activity does not always guarantee environmental quality" (Balsalobre-Lorente, Shahbaz, Roubaud, & Farhani, 2018). In addition, "adequate environmental regulation could accelerate effectively the technological changes capable of reducing pollution" (Torras & Boyce, 1998).

According to the latest data compiled in the INE of 2014, (Graphic 8) the evolution of CO2 emissions in the textile sector in Spain have decreased in the period of time 2000-2014, with 2007 being the year in which more emissions of gases have occurred and the year 2014 the least. These data have been obtained through the National Institute of Statistics (2018) where first the emissions of the sector have been extracted between the years 2008 and 2014.

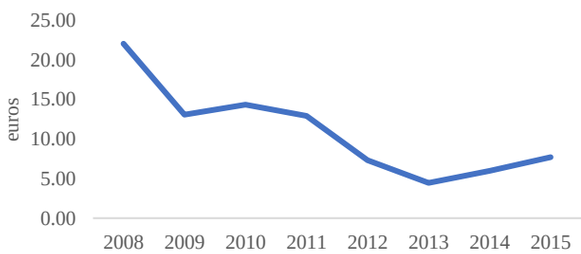
Once this step was taken, the percentage they represent with respect to the total CO_2 emissions emitted by all Spanish industries in the 2008-2014 period was calculated, finally, multiplying said percentage to the total and obtaining an estimate of how much was issued between the years 2000 - 2014.



Graphic 8 Evolution of CO2 emissions in the textile, clothing, leather and footwear industries
Source: self made through data collected in the INE (2018)

This drop in emissions may be due to the increase in environmental awareness, as well as to standards such as the Kyoto Protocol, which, as the Organization for Ecology and Development (2018) has, promotes the reduction of Greenhouse Gases (GHG) to through the so-called emission rights. This works in such a way that each member country has a limit of emission rights, that is, it can issue up to a certain percentage. If it goes beyond that limit, it must buy emission rights in order to emit more gases than initially considered. On the other hand, if all the rights are not used, they can be sold to other countries, creating the "Emissions Trading".

According to the data shown in Graphic 9, which have been collected by the European System of CO2 Trading (2018), the prices of emission rights decrease considerably from 2008 to 2015 and this is due to the excess of supply and falling demand for rights (Planelles, 2017).



Graphic 9 Evolution of prices of GHG emission rights
Source: European CO2 Negotiation System (2018)

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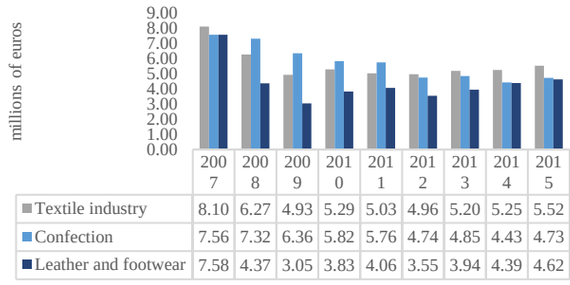
2.3.4. Business figure

Heras and Arana (2011) find that companies with better financial returns are more likely to have certifications such as ISO 14001. In order to analyze this effect in the available data sample, the turnover is used as a proxy. This variable has already been discussed when talking about the current perspective of the sector, showing in Graphic 4, how sales have been hit by the strong crisis since 2007. Since that year, when the textile sector collected a total of € 23,246.868, turnover decreased by 36.03% until 2015.



	2007	2008	2009	2010	2011	2012	2013	2014	2015
Textile industry	8.10	6.27	4.93	5.29	5.03	4.96	5.20	5.25	5.52
Confection	7.56	7.32	6.36	5.82	5.76	4.74	4.85	4.43	4.73
Leather and footwear	7.58	4.37	3.05	3.83	4.06	3.55	3.94	4.39	4.62

Graphic 4 Evolution of the turnover by sector of the textile industry, of leather and shoemaking in Spain
Source: Economic Development Institute of the Principality of Asturias (2018)

3. Methodology

Taking into account all that has been mentioned up to now and, above all, the importance of the environment, the main objective of this work is to analyze how the factors mentioned in section 2.3 above can affect the investment made by companies of the textile sector in environmental protection in the period of time 2000-2015.

Specifically, the works of Balsalobre-Lorente (2018) and Torras and Boyce (1998) are taken as a basis, where the authors analyze what factors affect CO2 emissions and analyze the behavior of these emissions, based on economic growth and environmental regulation, among others. Their conclusions indicate that it is evident that the indicators are related.

At this point, it should be noted that the novelty of our study is to focus the analysis from another perspective. Given the importance of investing in environmental protection for the sustainability of business activities, the object of the study is to observe which economic, legal and environmental variables can influence their variation in an efficient manner.

Based on this objective, the following hypothesis is developed.

Hypothesis: The investment in environmental protection is explained by the variables CO2 emissions, environmental taxes and turnover of the sector and all of them are related to each other.

To study the hypothesis, an econometric analysis will be carried out with the IBM SPSS Statistics 24 program, starting with a bivariate correlation analysis between the variables and culminating with the elaboration of a multiple linear regression model and the analysis of the results obtained through of said model.

In particular, it is analyzed if the level of polluting emissions, environmental regulation and the turnover of the textile sector have significant effects on the level of environmental protection of companies, measured through the investment they make. This process will be carried out taking into account the following variables related to the textile sector:

– Total investment in environmental protection (euros).
– Environmental taxes (euros)
– CO2 emissions (kt)
– Business figure (euros)

As economic variables, turnover has been selected because the better the development and evolution of the company, the willingness to invest in environmental protection will be greater. Regarding legal factors, environmental taxes have been selected since the level of taxes assumed by a company may be a reflection of its position on the opportunities to invest in environmental protection. Regarding the environmental variables, CO_2 emissions have been selected, because authors such as Balsalobre-Lorente, Shahbaz, Roubaud, & Farhani (2018) already highlight its importance when explaining economic growth, which shows a incentive to reduce these polluting emissions thus investing in environmental protection. In addition, it should be added that the availability of sectoral data has been an aspect that has also been taken into account when selecting model variables.

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The data has been obtained from various sources, as discussed in section 2.3. In the case of the total investment in environmental protection in the Spanish textile sector, the data were obtained in the INE and IGE; the data on CO2 emissions were obtained from the INE for the period 2008-2014, the percentage they represent was calculated with respect to the total CO2 emissions emitted by all Spanish industries in the period 2008-2014 and this percentage was multiplied by total to obtain an estimate of how much was issued in the total period considered since 2000; Regarding environmental taxes in Spain, these data were extracted from the European Statistical Office and data on the turnover were taken from the Economic Development Institute of the Principality of Asturias (2018).

Regarding the treatment of these data, the econometric analysis carried out is discussed below.

3.1. Bivariate correlation

First, a bivariate correlation was carried out. The aim is to observe whether or not there is a relationship between the variables "x" and "y", as well as the direction of the relationship (positive or negative) and the intensity of this (the degree). If there is a relationship between the variables, knowing the value of one can anticipate the other. If the relation between the variables is positive, it indicates that both vary in the same sense, so that if one increases the other will also. On the contrary, if it is a negative relationship, both variables will vary in the opposite direction. To observe the degree of the relationship there are several coefficients such as Pearson, Tau-b Kendall and Spearman. In this case, the Pearson correlation coefficient will be used. This coefficient allows us to measure the intensity of the relationship between the variables in a range of -1 to 1 (Merino & Díaz, C Miguel Ángel Ruíz, 2006):

$$r_{xy} = \frac{\sum xy}{n s_x s_y} \quad (1)$$

Equation 1 shows the Pearson correlation coefficient (r_{xy}). Within the equation, in the numerator the "x" shows the referential scores of the variable investment in environmental protection, which come from subtracting the direct scores minus the arithmetic mean. $(xi - \bar{x})$.

As for "and", on the one hand, it will refer to the differential scores of the turnover, on the other, to the referential scores of the environmental taxes and finally to the referential scores of the variable CO2 emissions. In the denominator, sx and s refer to the standard deviations of the variables respectively and n to the number of samples.

Regarding the possible results of this coefficient, we indicate the following:

- If $r_{xy} = 1$, there will be a positive perfect linear relationship. The closer to 1 the relationship will have a positive trend.
- If $r_{xy} = 0$, there will be no relationship between the variables.
- If $r_{xy} = -1$, there will be a perfect negative linear relationship. When closer to -1, the relationship will have a negative tendency.

The correlation coefficient has a property: r_{xy}^2, which is called the coefficient of determination. This coefficient indicates what both variables have in common, or otherwise, the variance proportion of "y" explained by "x".

3.2. Multiple linear regression

The linear regression model is a method used to analyze the dependency ratio between different quantitative variables or, in other words, the way in which they relate to each other. There are different types depending on how many variables are going to be analyzed, if there are two variables, the simple linear regression model will be used and if, on the contrary, more than two variables will be analyzed, it will be the multiple linear regression model. In this case, it will be a multiple linear regression model of ordinary least squares where the relationship will be quantified by the Pearson correlation coefficient (Cea, 2002; Merino, Díaz & Ruíz, 2006).

We will predict the values of the independent variables to obtain the value of the dependent variable through the formulation of the equation that will represent the linear association that exists between the variables that are going to be included. The goodness of the fit of the model and its significance will be analyzed to determine the relationship that exists between the variables. It is necessary to point out that in the regression we can distinguish the dependent variable, which represents the one whose variability we want to analyze, and the independent variables that explain the variability of the dependent.

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Based on the aforementioned theory, the analysis focuses on four variables: total investment in environmental protection (dependent), environmental taxes (independent), CO2 emissions from the textile sector (independent) and turnover (independent). This model, therefore, is used in order to quantitatively show the degree of relationship between the dependent variable and the independent variables, that is, to know the value of the dependent variable from certain values that form the series of independent variables (Cea, 2002; Merino et al., 2006)

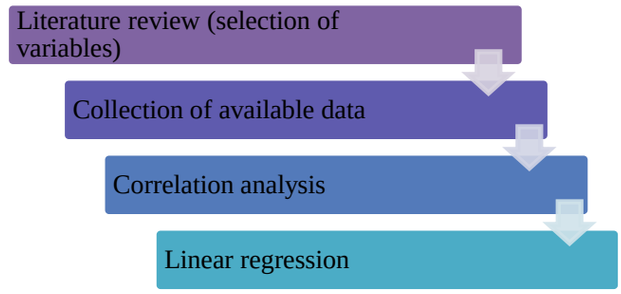
$$Y_i=b_0+b_1X_{1i}+b_2X_{2i}+b_3X_{3i}+e_i \quad (2)$$

Where, Y_i, equation (2) represents the dependent variable (total investment in environmental protection) and this is formed with the linear combination of the independent variables that are the X_i such that, X_1 is the variable environmental taxes, X2 is the variable CO2 emissions and X_3 the variable turnover. Add that the a represents a constant and that the b_1, b_2 and b_3 are the coefficients that accompany the independent variables and represent the weight they have in the equation. To finish, e_i "is the random component that collects everything that the other independent variables do not explain" (Merino et al., 2006).

$\boldsymbol{Y_i}$	Total, investment in environmental protection of the sector
$\boldsymbol{X_1}$	Environmental taxes
$\boldsymbol{X_2}$	CO2 emissions from the sector
$\boldsymbol{X_3}$	Number of businesses in the sector
$\boldsymbol{b_1}$	Coefficient of environmental taxes
$\boldsymbol{b_2}$	Coefficient of CO2 emissions
$\boldsymbol{b_3}$	Coefficient of the turnover
$\boldsymbol{e_i}$	Random component

Table 2 Composition of the regression equation
Source: self made

Therefore, the strategy that has been followed to carry out the exploratory approach can be summarized in the process collected in the following graphic (Graphic 10):



Graphic 10 Process of the exploratory approach
Source: Self Made

4. Results

4.1. Exploratory analysis: the matrix of correlations

To begin the explanation of the results, an analysis of bivariate correlations will be carried out, where, as Cea (2002) points out, so that the effects of the independent variables in the dependent variable can be measured more precisely they will select those variables that do not have an excessively high correlation because "it causes the estimation of the coefficients to be less precise".

		Investment	Environmental taxes	CO2 emissions	Business figure
Investment	Pearson Correlation	1	-,659**	,586*	,922**
	Next (bilateral)		,006	,022	,000
	N	16	16	15	16
Environmental taxes	Pearson Correlation	-,659**	1	-,073	-,497
	Next (bilateral)	,006		,797	,050
	N	16	16	15	16
CO2 emissions	Pearson Correlation	,586*	-,073	1	,762**
	Next (bilateral)	,022	,797		,001
	N	15	15	15	15
Business figure	Pearson Correlation	,922**	-,497	,762**	1
	Next (bilateral)	,000	,050	,001	
	N	16	16	15	16
	Next (bilateral)	,000	,015	,034	,000
	N	16	16	15	16
** Correlation is significant for the bilateral 0.01 level). *. Correlation is significant for the 0.05 level (bilateral).					

Table 3 Correlation matrix
Source: Own elaboration based on the bivariate correlation model obtained with IBM SPSS Statistics

As can be seen in Table 3, CO2 emissions and investment show a significant correlation since p = 0.022 <0.05 and also the relationship of these two variables is a positive linear relationship because r_{xy}= 0.586," that is, the variable CO2 emissions explains 34% of the investment, since r_{xy}^2 = 0.343 and, they vary in the same direction, so that as CO2 emissions increase (or decrease) it also increases (or decrease) the investment.

Environmental taxes and investment, in turn, present a very significant correlation since p = 0.006 <0.01 and, unlike CO2 emissions and turnover, it has a negative linear relationship r_{xy} = -0.659. This means that when the investment variable increases (decreases) the environmental taxes decrease (increase) explaining 43% of the investment variable since r_{xy}^2 = 0.434.

The turnover and the investment show a very significant correlation as well, p <0.01, in addition to having an almost perfect positive linear relationship, since the value of the coefficient is very close to 1 r_{xy} = 0.922. To understand this relationship, this can be explained in such a way that if the turnover of the sector increases (or decreases), as a result the investment will also increase (or decrease). Turnover, therefore, explains 85% of the investment variable since r_{xy}^2 = 0.85.

As has been mentioned, an excessively high correlation, such as that between turnover and investment, "causes the estimation of the coefficients to be less precise" (Cea, 2002), so to measure the effects more precisely of the independent variables in the dependent variable only those variables that do not have an excessively high correlation will be selected. In this case, environmental taxes and CO2 emissions, but not the turnover.

	Factors	Expected effects
Investment in environmental protection	Environmental taxes	Negative
	CO2 emissions	Positive
	Business figure	Positive

Table 4 Impacts of the factors that can influence the investment in environmental protection of the textile sector
Source: Own elaboration through the multiple linear regression model obtained with IBM SPSS Statistics 24

4.2. The regression equation

Taking into account the correlation that exists between the variables, the multiple linear regression analysis will be performed to know the shape of the relationship, that is, which is the dependent variable and which independent ones.

Based on the theory analyzed, it is considered that the dependent variable Yi is the investment in environmental protection and the independent variables (X1) and (X2) environmental taxes and CO2 emissions respectively. As explained in section 4.1. the turnover will no longer be included as a dependent variable in the model because it presented an excessively high correlation with the investment in environmental protection. We start by calculating the regression equation, whose coefficients are observed in Table 4.

Model		Non-standardized coefficients		
		B	Typical error	
1	(Constant)	28.373.570,960	16.914.742,770	
	Environmental taxes	-,003	,001	
	CO2 emissions	4,286	1,219	
Model		**Standardized coefficients**	**T**	**Next .**
		Beta		
1	(Constant)		1,677	,119
	Environmental taxes	-,613	-3,983	,002
	CO2 emissions	,541	3,516	,004

Table 5 Coefficients of the regression equation
Source: Own elaboration through the multiple linear regression model obtained with IBM SPSS Statistics 24

Therefore, the resulting regression equation would be the following:

$$\text{Investment} = 28{,}373{,}570{,}960 - 0.003 * \text{Environmental Taxes} + 4{,}286 * \text{CO2 emissions} \quad (3)$$

The non-standardized coefficients, the "B" represent the value of the coefficients that form the previous equation. These provide more accurate information than the Pearson correlation coefficient, since they indicate how much the dependent variable varies when one of the independent variables varies one unit, keeping the others constant.

The order in the origin (28,373,570.96): represents the constant and determines what is the estimated value of the investment if you could cancel the variables environmental taxes and CO2 emissions.

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Taxes (-0.003): it is a negative coefficient which means that the estimated relation between the dependent variable (investment) and the independent variable (taxes) is inverse. That is, the variable Taxes indicates that if everything else is kept constant an increase (decrease) of € 1,000,000 in said variable, will correspond to a decrease (increase) of € 3,000 in investment. CO_2 emissions (4,286): it is a positive coefficient, therefore, the estimated relationship between the dependent variable (investment) and the independent variable (CO2 emissions) is direct. That is, the CO2 emissions variable indicates that if everything else remains constant an increase (decrease) of a KT in said variable, corresponds to an increase (decrease) of € 4,286,000 in Investment.

4.3. Evaluation of the model

Finally, "once the regression equation is estimated, it is interesting to know how well the model obtained predicts the variability of the dependent variable" (Cea, 2002). For this, the goodness of fit and the significance of the model will be observed.

4.3.1. Goodness of fit

Model	R	R square	R squared adjusted	Typical error of the estimate
1	,847[a]	,717	,670	5.000.240,539
a. Predictors: (Constant), CO2 emissions, environmental taxes.				

Table 6 Summary of the multiple linear regression model
Source: 0wn elaboration through the multiple linear regression model obtained with IBM SPSS Statistics 24

As can be seen, in Table 5, $R^2 = 0.717$ this means that 71% of the variation in the variable "Investment" can be explained by the variation suffered by the variables "Environmental taxes" and "CO2 emissions". 28.3% of the variability remains unexplained due to variables that have not been considered.

This value of R^2 has a series of limitations, so it is considered that in order to measure the goodness of the adjustment it will be more accurate to analyze the adjusted R^2, since this corrects the overestimation that may exist in R^2. Therefore, in this case, $R^2\alpha = 0.670$ which means that the variables "Environmental taxes" and "CO2 emissions" explain 67% of the variance of the variable Investment.

As this value is close to the unit, it can be said that there is a good fit.

4.3.2. Significance of the analysis

This section tries to show, through the results obtained in Table 6, the effect that the variables "Environmental taxes" and "CO_2 emissions" have in the prediction of the variable "Investment". Therefore, the following hypotheses are proposed to know whether the model is explanatory or not:

$H_0: \beta_1 = \beta_2 = 0$
$H_1: \beta_1 \neq \beta_2 \neq 0$

Where H_0 is the null hypothesis and its rejection means that the model is explanatory and statistically significant; and where H_1 is the alternative hypothesis. To know how significant the model is, you have to know the value of the F.

Model		Sum of squares	gl	Half quadratic	F	Next
1	**Regression**	760.486.158.800.000	2	380.243.079.400.000	15,208	,001[b]
	Residual	300.028.865.400.000	12	25.002.405.450.000		
	Total	1.060.515.024.000.000	14			
a. Dependent variable: Investment. b. Predictors: (Constant), CO2 emissions, environmental taxes.						

Table 7 ANOVA
Source: Own elaboration through the multiple linear regression model obtained with IBM SPSS Statistics 24

As noted, the level of significance is p = 0.001, which indicates a high level of significance. The probability of success if you reject H_0 is 99.99%. This means that the model is explanatory and that there is a significant linear relationship between the variables.

All this can lead us to reason that companies in the textile sector make the decision to invest in environmental protection based on variables such as "Environmental taxes" and "CO2 emissions", because these show a high degree of significance with respect to to "Investment".

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5. Conclusions

Companies carefully study what to invest their capital to grow and improve as much as possible throughout their lives, but sometimes they leave out issues as important as the environment. Therefore, the main objective of this work has been to show what factors can influence companies in the textile sector, when investing in environmental protection. In particular, legal factors such as environmental taxes, economic factors such as the turnover of the sector and environmental factors such as CO2 emissions have been taken into account.

As mentioned in section 2, the historical evolution of the textile sector in Spain has been characterized by the large number of crises that it has had to go through, being these reasons for the great restructuring that subsequently suffered. At the same time, it was considered important to show what is the impact that this industry has on the environment; highlighting that it is the second most polluting planet, due to the large amount of waste generated. In order to study this problem, factors that may be influencing investment in environmental protection by companies have been identified.

Taking into account the analyzed factors, in section 3 the hypothesis has been put forward that the investment in environmental protection can be explained by the variables "Environmental taxes", "CO2 emissions", and "Turnover" of the sector and, that they are all related to each other. This hypothesis has been explained through a bivariate correlation analysis and the elaboration of a multiple linear regression model.

In this regard, through the results obtained in section 4, it is concluded that legal factors may be playing a very important role. The variable environmental taxes is a proxy variable that indicates, as already mentioned, the total collection of environmental taxes for the total of industries in Spain and not only in the sector. This variable, therefore, explains part of the variation in investment in environmental protection since, on the one hand, paying more taxes will mean that companies have less capital to invest and, on the other hand, that they pay environmental taxes will mean that they are not carrying out a sustainable activity. Specifically, it is observed that, when more has been collected, there is less investment in environmental protection.

Therefore, taxes can be an incentive for companies to be more sustainable, because they will not be interested in paying taxes that can be saved. It should be noted that taxes are the ones that explain the investment, that is to say, as tax collection decreases means that companies in the textile sector invest more in sustainability, since these taxes have been introduced in order to reduce the level of pollution.

On the other hand, environmental factors also explain much of the investment. Appropriate environmental regulation could accelerate effectively the technological changes capable of reducing pollution. As has been observed, as CO2 emissions increase, investment in protection also increases, so it is concluded that this may be due to limitations such as the Kyoto protocol where each member country has a limit on emission rights. How many more gases are emitted by these countries, these will have to buy more emission rights, that is, it is invested to be able to emit more harmful gases.

Therefore, to try to design more effective future policies in terms of promoting investment in environmental protection, the following should be recommended.

– The economic incentives are not clear enough, so it would be advisable to take into account more economic variables so that the results are more accurate.

– Environmental variables have more weight than the legislative ones, because the results obtained indicate that taxing is not the most effective. On the contrary, the regulations relating to CO2 emissions, how the Kyoto Protocol can work. That is, the regulations that are most effective could be those that raise awareness and not those that have a sole purpose of collection. Therefore, it would be advisable to analyze other legislative variables that could be more specific.

The model of this work has been carried out with respect to the temporal period 2000 - 2015, that is to say with a total of 16 observations. This sample size is considered sufficient because, as explained by Cea (2002), the criterion of having 5 to 10 times more cases than independent variables is met. In this case, the analysis is formed by two independent variables, therefore, it could be said that the minimum number of observations is reached.

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However, the results would be more solid with a larger sample, although in this case, it has not been possible since the INE only offers data at the sector level for that temporary period.

For future analyzes carried out with respect to this topic, it would be interesting to cover a greater number of significant variables that may affect investment in environmental protection of the textile sector, to take into account other aspects that may influence, as much or more, than those already analyzed in this work. Another interesting topic would be to see the relationship between different economic sectors in Spain with respect to environmental protection and what could be the degree of complementarity between them in this aspect.

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