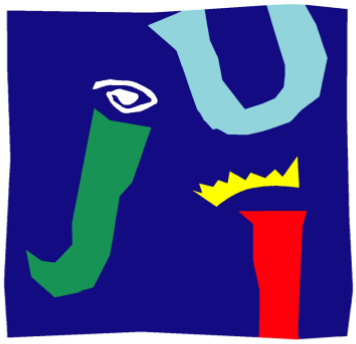

UNIVERSITAT JAUME·I

Bachelor's Thesis in Economics

"PRODUCTIVITY OF FIRMS IN THE FOOD AND BEVERAGE INDUSTRY: A SPAIN MODEL"

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ABSTRACT

This study analyses labour productivity in the food and beverage industry in Spain for the 17 autonomous communities, using data from 2020. It found that small and medium-sized enterprises (SMEs) are more productive than expected. Moreover, productivity is positively related to average employee cost, cash flow, firm fixed assets, rolling found and economic profitability, while it is negatively associated with indebtedness. Furthermore, it was observed that firms in the Aragon region show higher levels of labour productivity compared to firms in other autonomous communities. These results highlight the importance of firm size and geographical location on labour productivity in the food and beverage industry in Spain. These findings provide valuable information for improving efficiency in this key sector of the economy.

Keywords: Labour productivity, food, beverage, financial variables, region, size

JEL codes: L11, Q17, P33, O47, O14

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1. INTRODUCTION

Nowadays, labour productivity is a very relevant topic and has been the subject of empirical research by many researchers in order to identify the variables that influence its development in the market. In addition to empirical studies, debates and discussions on labour productivity have also taken place in different contexts, such as in the business, economic and social spheres.

Many experts consider productivity to be one of the key factors for economic growth and sustainable development of society because in a situation of high competition, it is essential for companies to improve their production efficiency in order to maintain or increase their market shares, which translates into increases in output without the need for an equivalent increase in the use of all kinds of inputs, including natural resources.

The aim of this paper is to analyse the factors that influence labour productivity in Spain in the food and beverage sectors, taking into account the different variables that characterise each company. To this end, a review of the existing literature will be carried out, as well as an empirical analysis.

In this way, this thesis will try to contribute knowledge and value to the discussion and study of labour productivity in the food and beverage sectors in Spain.

The food and beverage sectors are one of the most important industries in most economies, and the Spanish economy is no exception. These sectors represent an important source of employability and high value added (VA), so this project can provide an opportunity to understand one of the characteristics of the productive structure of the seventeen autonomous communities that make up the Spanish territory.

As mentioned above, productivity is a crucial factor for the success of any company, as it determines the capacity to produce goods and services from certain productive factors, that is their efficiency in the use of those productive resources. Understanding productivity as a term and the factors that cause it to fluctuate can help companies in the sector to identify areas for improvement and to implement measures to increase their efficiency and competitiveness in the industry.

The following graph shows a gradual and oscillating downward trend in the food, beverage and tobacco sectors[1] since the beginning of 2010, while in the same period of time the productivity of manufacturing industry and the total economy overcomes the recession of 2008 quickly, thus causing a rapid and constant upward trend. The fluctuations experienced by productivity in the food and beverage sectors are thought to be determined by those factors that may be related to productivity, which in this TFG will be the following: the sector in which the companies operate (food or beverage), the region (CCAA) and business concentration, foreign activity (whether they export or not), size (small, medium and large) and variables that reflect characteristics and economic indicators of the companies (collected in the annual accounts).

The uncertainty that has been generated in recent years in the manufacturing industry regarding the productivity of each sector and what makes it more or less productive, makes it attractive to study the food and beverage sector in Spain. Firstly, it should be noted that many empirical articles[2] have determined that the beverage sector is more productive than the food sector, this is due to the high mechanisation and automation of processes in this sector, as this leads to a large reduction in production costs and expenses, which allows this sector to obtain higher productivity than the food sector.

On the other hand, a large number of studies[3] have determined that the food sector is more productive than the beverage sector. These studies are based on the fact that in food production there is greater standardisation, that is to say, the production process can be standardised more than in the beverage sector, and they are also based on product diversification, as the food sector has a greater diversity of products compared to the beverage sector, so manufacturers can specialise in those products that provide them with greater productivity and efficiency.

[1] The latter is considering constant as it will not be taken into account throughout the thesis.
[2] See Delgado Gómez (2017), Barros and Santos (2019)
[3] See Grashuis (2015)

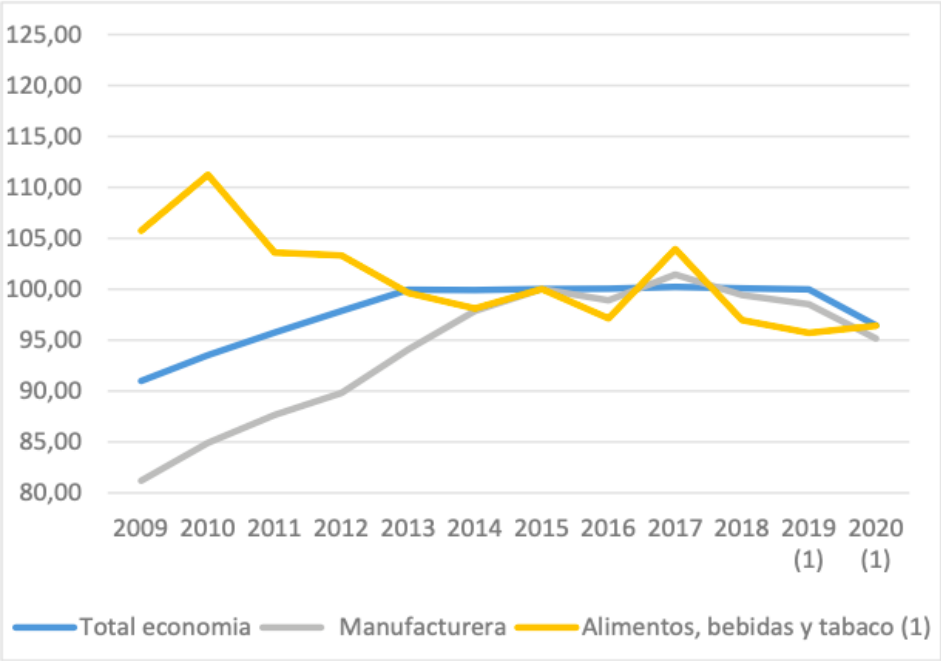

Figure 1. *Evolution of real productivity*, 2015=100 (2009-2020) Fuente: FIAB, informe económico 2020, pág. 46 National and Quarterly Accounts data from INE(1): Sectorial Model Estimations. CEPREDE

The article of the Central Directory of Companies published by the National Institute of Economy (INE), states that in 2020 the number of companies operating in the Spanish economy has increased, however in the manufacturing industry of food and beverages has decreased, which can be thought of as the main cause, in the atypical situation that the pandemic has left the Spanish economy.

Surprisingly, the reduction in business activity in this sector has not led to a reduction in productivity, but to an increase compared to the previous year. It is remarkable and can be assumed that as employment in the industry has declined, companies have readjusted their workforces to meet their requirements and thus increase productivity.

In addition to the above, Spain stands out for its international reputation, for its high quality food and drink offer and for its food culture. The production of the food and beverage manufacturing industry covers a wide variety of products where it is internationally known for the production of high quality oils and wines, which motivates even more, if possible, to carry out an analytical thesis of the business productivity of this sector.

The analysis of productivity and the factors that can affect it can be attractive and relevant in this sector, since it can be seen in an empirical way that affects the variable to be studied, by means of graphs, figures, tables, etc. The analysis will allow to contrast the hypotheses raised, as well as to see differences in productivity between the sector, the region, the size, the concentration, the activity and the explanatory characteristics that make up the productive structure of Spanish companies, which will help to generate a more solid knowledge and a greater robustness in the thesis.

2. LITERATURE REVIEW

To understand the background and the role of productivity in Spain we have reviewed the relevant literature. We will comment on the role of the different factors that make up our econometric model, in the previous literature.

2.1. PRODUCTIVITY – SIZE & EMPLOYEMENT RELATIONSHIP

Productivity can be defined as the relationship between the production obtained or output and the resources used to obtain it (one of them, employment), which allows it to be a quantitative variable (Wende, 2012).

There are different studies[4] that have investigated the relationship between labour productivity and firm size. Mixed results have been found, where some studies have found that larger firms tend to have higher labour productivity, while others have found that smaller firms can be equally or even more productive.
In the labour sphere, the size of a company is often measured in terms of its workforce, so the number of employees can be a reflection of the size of the organisation.

It should be noted that the aggregation of productivity in this study is key. The productivity of a particular sector is nothing more than the weighted average of the individual productivity of each of the companies that make up the sector under study.
The study by Garcia and Canales (2017), reflects that larger firms may have advantages in terms of economies of scale and a greater ability to invest in technology and human capital, and may have a better position to compete in the global market and greater bargaining power with suppliers, called "superstar" or "gazelles". As reflected by the

[4] See Gali (1999), Mendoza and Smith (2006), Hyunjoon L., Sangho K.(2009), García and Canales (2017)

authors, "superstar" firms tend to be more productive and can create jobs that offer higher wages. In addition, these firms can generate indirect jobs through their supply chain, resulting in a positive size-productivity ratio.

Another theory underpinning the productivity-size relationship is the real business cycle (RBC) theory (Mendoza and Smith, 2006), which presents technology shocks as the main drivers of productivity and labour demand, leading to increased employability. However, several studies have questioned the relationship being discussed. The first paper to question the positive relationship between employment and productivity was Gali (1999), who found a negative correlation between productivity and working hours (employment) due to technology shocks.

In the case of the study by Hyunjoon L., Sangho K. (2009), they find evidence similar to that of Gali, since the technology shocks in their model positively affect Korean productivity but negatively affect employment, that is to say, the productivity-employment relationship in this case is negative, although the analysis is based on the empirically proven prediction of RBC theory where productivity and employment share a positive relationship. As discussed above, this again casts doubt on the validity of the RBC studies.

Hyunjoon L. and Sangho K., in their study, highlight the importance of studying the relationship between employment and productivity in developing countries, as there is a limited literature on this topic. Furthermore, they encourage other researchers to further explore this relationship using data from other countries. Thus, as the authors suggest, this thesis will provide an answer to this relationship using data from manufacturing firms in the food and beverage industry in Spain, where it will be seen whether larger firms (higher employment) have higher productivity or, on the contrary, there is no clear trend.

2.2. PRODUCTIVITY – GEOGRAPHY RELATIONSHIP

Nowadays, there is a large body of research[5] suggesting that firms have a higher level of productivity in larger and densely populated urban areas.

[5] See Marshall (1920), Ciccone & Hall (1996), Henderson (2003), Veneables (2007), Graham and Kim (2007)

Such a trend has been related to agglomeration economies, which refer to the benefits that firms can derive from being in urban areas with high concentrations of firms, suppliers, customers and workers, allowing them to take advantage of specialisation in such areas (Marshall, 1920). So, the productivity-employment relationship is also related to productivity-geography since the concentration of firms and employees in the same geographical area can foster collaboration and knowledge sharing between them, which can lead to greater innovation and efficiency in production (Ciccone & Hall, 1996).

The presence of a large number of firms and employees can facilitate the identification of business opportunities and collaboration, which can contribute to a more dynamic and productive business environment (Henderson, 2003). In addition to Henderson's study, Martin et al. (2011) provide additional evidence on the positive effect of geographical concentration of firms in the same sector on productivity. This study focuses on French firms and examines how geographical proximity in the same industry has a positive and statistically significant effect on productivity, suggesting that they may benefit from agglomeration effects such as those mentioned in Henderson and Marshall's study.
On the other hand, it has been found that business concentration are particularly advantageous for smaller and medium-sized firms, as competition between companies of similar size may offer a more favourable scenario compared to competition between large firms and small and medium-sized firms.

Agglomeration economies refer to the economic benefits that are generated when firms and workers are concentrated in a certain geographical area. That is, a higher concentration of firms in a given area can attract talent and knowledge, which can benefit all firms in the same area, known as "absorptive capacity". These benefits mainly include increased efficiency in production, that is to say, improved productivity.

At the same time, there are also studies that have evidence that business geography and transport infrastructure have a significant effect on productivity. As argued by Veneables (2007), improvements in transport and optimal business location will increase productivity, as the strategic location of firms can have a significant impact on productivity, so that a good location can reduce transport costs and allow access to new markets.

Graham & Kim (2007) also argue for a positive relationship between business concentration and productivity, where improved transport infrastructure has the main

advantage of increasing accessibility to new economic agents, leading to agglomeration economies[6] and thus higher productivity.

2.3. FINANCIAL VARIABLES & PRODUCTIVITY

There are a large number of internal characteristics of a firm that affect labour productivity. In this section we will highlight business performance factors, this is to say, factors that we find in a company's annual accounts, which according to the existing literature are related to labour productivity.

For this purpose, a table has been drawn up that includes those factors or characteristics that have been extracted from the existing literature and that are going to be used throughout this thesis, which are related to labour productivity and the authors that support them.

Variables in this TFG	**Author(s) using these factors**
Own Founds, Intangible Assets	Sumanth(1999), Riggs(1998), Acevedo(2004), Propenko (1999), Guangzhou Hu A. (2000)
Rolling Found, Solvency Ratio, Fixed Liability	Anaya(2006), Avella y Fdez.(2003), Propenko(2005), Facultad de Ciencias Empresariales, Olavide (2013)
Other fixed Assets, Return on Capital, Indebtedness	Avella y Fernández(2003), Acevedo(2004), Steenhuis y Bruijn(2006)
EBITDA, Cash-flow, Economic Profitability	Productivity and Value Added among Large Andalusian Companies (2013)
Total assets per employee, Average cost of employee	Guisado González, Vila Alonso(2015), Facultad de Ciencias Empresariales (2013), Gema María Novo (2021)

Table 1. *Financial variables related to productivity. Own elaboration.*

[6] See previous paragraph. Explanation of agglomeration economies

In this dissertation they are called "financial variables" and are included in the Annual Accounts of the companies (in the balance sheet, profit and loss account...). In order to facilitate the identification of each one of them, these variables are detailed below:

- Own Founds. This is the amount of capital that the owners of the company have invested in the company
- Indebtedness. It represents the amount of debt the company has in relation to its assets.
- Economic profitability. Measures besiness efficiency in generating profits from *inputs.*
- Intangible assets. These are the intangible assets of the company, such as brands, research, business development, patents, rights, etc.
- Rolling found. A mesure of a company’s ability to finance its current operations.
- Average employee cost. Average cost of an employee to the company.
- Cashflow. The amount of cash that the company generates through its activity.
- EBITDA. It represents earnings before interest, impairments, depreciation, amostisation and taxes.
- Fixed liability. Reflects long-term debts of the firm.
- Other fixed assets. Physical assets of the company, such as buildings, machinery, land, etc.
- Return on capital. Measures the efficiency of the company to generate profits with the capital invested.
- Solvency ratio. A company’s ability to pay its debts and determines whether the company is in financial trouble.

2.4. PRODUCTIVITY – EXTERNAL ACTIVITY RELATIONSHIP

In the existing literature, it has been observed that there is a positive relationship between exporting and firm productivity. This relationship has been demonstrated in several studies such as Wagner (2005), Greenaway (2003) and the following.

One of the most cited studies on the relationship between exporting and productivity is Bernard and Jensen (1999), who analysed data from US manufacturing firms and found that firms that started exporting experienced a significant increase in productivity. In addition, Wagner and Zheng (2018), conducted the same study for China, where they found that Chinese exporting firms had 20% higher productivity than non-exporting firms.

A wealth of recent evidence has been collected showing that exporting firms perform better compared to those that focus only on the domestic market. A study by the Export Productivity Study Group in 2007 suggests that exporting firms tend to be more productive than those that only sell domestically.

There are two hypotheses to explain this positive relationship; The first hypothesis suggests that more productive firms are more likely to self-select into the export market. This is because selling products abroad entails additional costs, such as transportation, distribution and product adaptation costs to meet the needs of the foreign market. These costs can be a barrier to entry for less successful and less productive firms.

The second hypothesis focuses on the role of learning-by-exporting. It is suggested that exporting firms can learn from knowledge flows from international buyers and competitors, which may contribute to improving their performance after market entry (Bernard, Jensen & Wagner, 1999).

In Spain, exports have grown exponentially over the last ten years. According to Antrás (2016), the financial crisis and the great recession of 2008 unmasked major problems in the country's economic structure. In this sense, improving productivity through exports became a key objective to maintain the competitiveness of the Spanish territory.

Therefore, the positive relationship between labour productivity and exports suggests that Spanish firms need to improve their productivity to compete in the global market ("selection" effect), or that exporting firms have higher productivity levels than non-exporting firms ("export learning" effect)[7]

3. HIPOTHESIS

After a review of the literature, several hypotheses are presented below, which are supported by economic theory and previous studies. Throughout this thesis they will be taken into account and tested in the empirical analysis.

- **Hypothesis 1: Larger firms in the food and berverage sectors in Spain have higher labour productivity than smaller firms**.

A larger company can benefit from economies of scale and greater bargaining power with suppliers. It can also take advantage of advanced technologies and more efficient processes.
As predicted by the theory of the real business cycle, larger firms, in addition to having higher employment, can spread their costs over a larger number of products or services, which reduces their unit costs, thus increasing production efficiency, i.e. productivity. In addition to this, larger firms may have a more recognised brand name and greater market presence, which attracts more customers, and this can lead to an increase in production and consequently a greater need for employees, which can boost labour productivity.

- **Hypothesis 2: Firms operating in international markets will have higher productivity than those operating only in the domestic market.**

As predicted by economic theory and the wide range of studies detailed above[8], companies that operate in foreign or international markets have higher productivity. This is due to the competition that exists in foreign activity, so that companies that expand must have sufficient resources to able to compete and survive in the market,

[7] See Delgado et al. (2002), Ridaura (2014)
[8] Such as those by Bernard y Jensen (1999), Wagner (2002), Delgado et al. (2002), Ridaura (2014), Antrás (2016)

or else those companies that export will acquire knowledge from internationalization, wich can contribute to improving their productivity.

- **Hypothesis 3: Autonomous communities with higher business concentration will achieve higher productivity due to competition and agglomeration economies.**

As discussed above, the concentration of firms in the same geographical area can have a significant and positive impact on the labour productivity of firms. Through economies of agglomeration and the absorptive capacity of "follower" firms towards a "pioneer or leader" firm, they can share knowledge and grow in a faster and more sustainable way. Henderson's theory predicts that the higher the concentration, the more competition there is, which may lead the industry to look for alternatives and ways to increase its productivity[9]. In general, business concentration can be beneficial for labour productivity by allowing firms to access resources and expertise and to take advantage of competition and economies of scale.

- **Hypothesis 4: Ciertas variables y características financieras influirán positiva o negativamente en la productividad laboral de los sectores de alimentación y bebidas.**

As previously mentioned[10], in this study we have selected those financial variables of firms which, according to previous articles, are related to labour productivity. Table 2 below shows the expected signs of the relationship between these variables and productivity.

Dependient Variable	Quantitative Independent Variable	Economic Intuition
	Own Founds (*Fpropios)*	$\beta > 0$ **Positive expected ratio:** A company with higher capital may have a

[9]In this work, the Autonomous Communities have been classified according to greater or lesser business concentration, this is, the average number of companies in the set of communities has been found, representing the limit between the two types of classification.
[10] See 2.2 Productivity - Geography relationship.

		higher investment capacity and greater financial flexibility.
	Indebtedness *(Endeu)*	$\beta < 0$ **Negative expected ratio:** A higher level of indebtedness can lead to higher financial costs and therefore lower productivity.
	Economic Profitability *(Rentecon)*	$\beta > 0$ **Positive expected ratio:** A company with a higher economic profitability is more efficient in the use of its resources, which would increase productivity.
	Intangible Assets *(Inmintan)*	$\beta > 0$ **Positive expected ratio:** The greater the amount of intangible assets, the greater the competitive advantage and, therefore, the higher labor productivity.
	Other Fixed Assets *(Oactfij)*	$\beta > 0$ **Positive expected ratio:** A company with a higher number of fixed assets can have a higher production capacity and higher efficiency in the process.
Labour Productivity *(Productivity)*	Fixed Liability *(Pfijo)*	$\beta < 0$ **Negative expected ratio:** The fixed liabilities represent a constant financial burden for the company, which could limit its ability to invest in improvements and technology that increase labor productivity.
	Rolling Fund *(Fmaniob)*	$\beta > 0$ **Positive expected ratio:** A company with more working capital will be better able to finance its operations.

	Cashflow *(Cashflow)*	$\beta > 0$ **Positive expected ratio:** Cash flow represents the financial resources available to the company, which can be utilized to invest in initiatives that enhance labor productivity.
	EBITDA *(EBITDA)*	$\beta > 0$ **Positive expected ratio:** Una empresa con mayor EBITDA tiene mayor capacidad de reinversión y de generar beneficios a medio/largo plazo.
	Average Employee Cost *(Cteemplead)*	$\beta > 0$ **Positive expected ratio:** Firms with higher levels of staff spending will have higher productivity than those that do not invest that do not invest in this area.
	Return on Capital *(Rentcapempl)*	$\beta > 0$ **Positive expected ratio:** A company with a higher return on capital is more efficient in the use of its resources.
	Solvency Ratio *(Ratsolven)*	$\beta > 0$ **Positive expected ratio:** A company with a higher solvency ratio has a greater capacity ti finance its transactions

Table 2. *Expected signs of coefficients. Own elaboration*

4. DATA & METODOLOGY

After reviewing the bibliographical background that gave rise to this research and the main assumptions of this project, we proceed to set out the details of the data information and the technique and methodology used to carry out the study.

4.1. LABOUR PRODUCTIVITY

In this paper, labour productivity is of great importance since we are going to analyse the differences in labour productivity in Spain, but how is it measured? This variable was defined in point 2.1.1, where it was stated that productivity can be understood as the relationship between the quantity of product obtained and the quantity of productive factors.

In general terms, productivity measurement focuses on the output of labour, which involves determining the quantity of goods and services that a worker can produce in a specific period of time. This assessment makes it possible to quantify the performance of each worker and to analyse the effective use of the factors of production in the economy. In this sense, productivity is an important indicator of whether or not resources are being used efficiently.

Thus, to measure their productivity levels, organisations and companies usually analyse the relationship between the amount of resources used to produce goods or services and the number of units produced during a year. Some companies measure their productivity by the ratio between the value of the products sold and the amount of sales achieved in a year, together with the wages of the workers involved in the production and sales of those goods, that is to say a ratio between outputs and inputs.

When calculating productivity, it is essential to consider which concept of productivity is to be analysed, whether in physical terms, gross output value or value added. This study has used value added as a measure of productivity as this approach focuses on the contribution of a firm or industry to the final output, which provides a more accurate identification of the aspects that generate value. In this way, companies can make decisions to improve their profitability and performance.

As mentioned above, productivity is a measure that relates the output or production obtained to the input or resources used to generate it. So the formula would be:

$$Productivity = Output / Input \quad (1)$$

Therefore, in this study the output will be the total amount of value added generated by the firm on an annual basis. On the other hand, the input will be reflected as the number of employees that have participated in generating that added value, thus the labour productivity of each of the companies that make up the data panel will be found.

To calculate the added value of each of the companies, we followed the steps of the article by Fernández-Guevara (2011). This article is based on economic theory and formulates the value added as:

$$Value\ added = Turnover +/- Change\ in\ stocks\ of\ finished\ goods\ and\ work\ in\ progress + Other\ operating\ income - Procurements - Other\ operating\ costs \quad (2)$$

Once the output of the firm (2) has been found and the number of employees (input) has been calculated, the Value Added (VA) is divided by the total number of employees, thus finding the labour productivity:

$$Productivity = Added\ Value / Number\ of\ Employees \quad (3)$$

4.2. DATA USED

In order to see the differences in productivity and the factors that cause it to fluctuate (financial variables) between companies in the food and beverage sector in Spain, data have been collected from the seventeen autonomous communities[11] that make up the Spanish territory. Thus, the autonomous communities to be analysed are: Andalucía, Aragón, Principado de Asturias, Baleares, Canarias, Cantabria, Castilla y León, Castilla-La Mancha, Cataluña, Comunidad Valenciana, Extremadura, Galicia, Madrid, Murcia, Navarra, País Vasco y La Rioja. The database used to extract the necessary data is the Iberian Balance Sheet Analysis System (SABI). The information compiled in this database includes historical records of the annual accounts deposited by more than 1.3 million Spanish and Portuguese companies in the Mercantile Register. In addition, it is possible to access a wide range of data on this platform, from details on business activity, legal structure, age and name of the company to information on annual accounts, size of the workforce and a multitude of other additional data.

In order to carry out the analysis of the productivity of the Spanish companies extracted in SABI, the following selection criteria have been used to create qualitative, "dummy", or categorical variables:

1. Geographical. The analysis has been carried out in the seventeen autonomous communities, additionaly classifying them according to whether they present a greater or lesser business concentration. In this way, the distribution of companies in each region has been taken into account for its evaluation.[12]
2. By sector. The companies found have been classified into two sectors, food and beverage.
3. According to the size of the company. Three groups have been established according to the number of employees. Companies with fewer than 50 employees are considered *small firms,* those with between 50 and 250 employees are considered *medium-size firms*, and finally, those with more than 250 employees are considered *large firms*.

[11] The two autonomus cities of Ceuta and Melilla have been eliminated due to lack of information.

[12] In other words, the average business concentration of all the Autonomous Regions is 33.11, which means that those that exceed this concentration will be classified as communities of *higher concentration*, while those that do not will be communities of *lower concentration*.

4. By foreign activity. In other words, companies have been divided into exporters and non-exporters.

In this way, a "Boolean" (filtered) search has been carried out, with the different criteria to be fulfilled; firstly that the companies are located in Spain, that they are in activity (active), that in the National Classification of Economic Activities (CNAE) they have the number 10 for companies in the food sector, and 11 for the beverage sector, in addition a criterion has been added which filters out those companies with an operating income of more than 25 million €/year, with the aim of analysing the most relevant companies in the food and beverage sector.

It is worth noting that this last filter is commonly used in business research to focus on those companies with the highest market relevance. Companies that generate more than €25 million in operating revenues are often considered as relevant companies[13], and are more likely to have a greater impact on the market and the economy. In addition to this, these companies tend to have a larger amount of data available, which leads to an increase in the quality of the data obtained. Articles such as Gómez-Mejía et al., (2018) and a paper from the University of Olavide (2013), are some of the many articles in which the filter of companies with more than 25 million euros in operating revenues has been used.

In relation to the period to be studied, it is important to mention that SABI collects data up to the year 2022, although the massive lack of information in that year and in 2021 has resulted in an important limitation for the analysis as the latter requires a broad set of accurate information to be able to carry out rigorous and robust studies, so these limitations have led to carry out the present analysis with data from the year 2020 as it is the most recent year with available and complete data to be able to carry out a useful study. Thus, the data to be analysed will be collected in a cross-sectional or cross-sectional panel data.

By means of the established search criteria, a sample of 669 Spanish companies operating in the food and beverage sector was obtained. However, when calculating the labour productivity indicator, previously described[14], some companies hindered the

[13] Within these, they have been classified into small, medium and large firms.
[14] See 4.1 Labour Productivity

calculation because they did not have sufficient data, so the total number of companies to be analysed in this thesis is reflected in this table:

		ALIMENTOS	BEBIDAS
TOTAL EMPRESAS EXTRAIDAS SABI	669	584	85
EMPRESAS DESCARTADAS POR FALTA DE INFO	106	93	13
TOTAL EMPRESAS PARA EL ANÁLISIS	***563***	***491***	***72***

Table 3. *Table nª of companies analysed in the report.* Source: SABI. Own elaboration

Este número de empresas se puede considerar más que suficiente, y ayudará a una mejor comprensión de las diferencias de productividad en el sector manufacturero de alimentos y bebidas español.

Once the relevant companies had been extracted, also using the SABI database, we extracted those variables that, as theory predicts, have a relationship with productivity. In order to see how each of the variables affect labour productivity in this article, these variables have been detailed in the previous section[15]. Once all the necessary information has been collected, the total of the variables included in this study and their main characteristics have been reflected.

[15] See 2.3 Financial Variables and Productivity

4.3. ECONOMETRIC MODEL

Thus, taking as a reference the models proposed by certain authors in previous literature, which suggest that several microeconomic variables (in this case, financial variables) and other qualitative or categorical variables can influence the labour productivity of a company, we have chosen to use the following formulation of the econometric model:

$$
\begin{aligned}
Productivity_i &= \beta_0 + \beta_1 Ratsolven_i + \beta_2 Rentcapempl_i + \beta_3 Cteemplead_i \\
&+ \beta_4 EBITDA_i + \beta_5 Casflow_i + \beta_6 Fmaniob_i + \beta_7 Pfijo_i + \beta_8 Oactfij_i \\
&+ \beta_9 Inmintan_i + \beta_{10} Endeu_i + \beta_{11} Rentecon_i + \beta_{12} Fpropios_i \\
&+ \delta_{13} CCAA_{i_k} + \delta_{14} Sector_i + \delta_{15} Size_{i_r} + \delta_{16} Activityext_i \\
&+ \delta_{17} Concfirm_{i_k}{}^{16} + u_i
\end{aligned}
$$

$$
i = 1,2,\dots,563 \qquad k = 1,2,\dots,17 \qquad r = 1,2,3
$$

In relation to the sub-indexes of each of the variables. Firstly, *sub-index "i"* corresponds to the total number of companies that make up the data panel of this study. On the other hand, *sub-index "k"* includes the 17 autonomous communities. And finally, the *"r" sub-index* indicates the size of each of the 563 companies.

Following Wooldridge (2010), the construction of these sub-indices has been carried out in those qualitative variables that have more than two characteristics, that is to say the dichotomous variable $Activityext_i$ only captures whether or not the company exports. In contrast, the Size variable includes three types of measurement (small, medium and large), so it is very important to construct an index that takes into account the heterogeneity of the categorical variables in these cases.

Dependent Variable

- *Productivity*: Annual value representing the labour efficiency of companies. Expressed in thousands of euros (€ thousand) per employee during the period under study.

[16] La variable dicotómica Concfirm también presenta el subíndice k debido a que las empresas son clasificadas en si se encuentran en una ubicación de mayor o menor concentración empresarial. Es decir, se han utilizado las CCAA para realizar esta clasificación.

Independent Variable

- *Fpropios:* Expressed in thousand €
- *Endeudamiento*: Expressed in percentage points %
- *Rent_econ:* Expressed in percentage points %
- *Inm_intan:* Expressed in thousand €
- *Oact_fij:* Expressed in thousand €
- *Pfijo:* Expressed in thousand €
- *Fmaniob:* Expressed in thousand €
- *Cashflow:* Expressed in thousand €
- *EBITDA:* Expressed in thousand €
- *Cte_emplead:* Expressed in thousand €
- *Rent_capempl:* Expressed in percentage points %
- *Ratsolven:* Expressed in percentage points %

- *CCAA*: Categorical variable, it will take the value 1 for the community corresponding to each company and 0 for the remaining communities. $k = 1,2,\dots,17$. The 17 Autonomous Communities are included in this variable.
- *Concentration_firm*: Dichotomous variable, it will take the value 1 for the type of concentration in which each company is located (according to the Autonomous Community in which it is located) and 0 for the remaining one *(higher concentration, lower concentration)*
- *Activityext*: Dummy variable which will take the value 1 for the type of foreign activity that each company presents and 0 for the rest (*exporting, non-exporting*).
- *Size*: Categorical variable that will take the value of unity for the size corresponding to each company and 0 for the remaining ones. $n = 3$ *(large, medium, small)*
- *Sector:* Dummy variable taking the value 1 for the sector corresponding to each company and 0 for the remaining sector (*food, beverages*).

4.4. DESCRIPTIVE STATISTICS

After specifying the econometric model, this section will show the main statistics of the quantitative data of the analysis. Firstly, the univariate statistics are shown, followed by the correlation between the quantitative variables and productivity.

The main univariates statistics of this data set are:

Variable	Observ.	Mean	Std. Dev	Min	Max
Productivity	563	95.19335	125.2525	-297.4507	1389.293
Solvency Ratio	563	2.031714	4.764168	.071	110.346
Return on Capital	563	11.02183	33.08964	-229.539	552.635
Aver, Employee Cost	563	40.00871	15.99335	20.35983	234.5172
EBITDA	563	9407.497	19047.78	-26015	214878
Cashflow	563	8628.177	10247.48	-50364.07	212694.7
Rolling Found	563	26285.5	41856.75	-93575	445965.7
Fixed Liability	563	21403.79	70246.53	.19067	1042956
Other Fixed Assets	563	24326.37	122329.4	.64337	2079319
Intangble Assets	563	3590.619	17014.74	.00027	284158
Indebtedness	563	57.45126	33.93921	.906	655.758
Economic Profit.	563	5.438366	10.55735	-53.356	80.996
Own Founds	563	49638.47	115437.1	-407827	1462346

Table 4. *Summary of univariates statistics (quantitative variables)*

The relationship between the quantitative variables in the model is reflected in the Spearman correlation matrix:

	Productivity	*Solvency Ratio*	*Return on Capital*	*Average Employee Cost*	*EBITDA*	*Cashflow*
Productivity	**1.000**					
Solvency Ratio	**0.0353**	1.000				
Return on Capital	**0.2961**	-0.0078	1.000			
Aver, Employee Cost	**0.3189**	-0.0164	-0.0172	1.000		
EBITDA	**0.3739**	0.0053	0.1570	0.2736	1.000	
Cashflow	**0.4798**	-0.0010	0.1608	0.2844	0.9267	1.000
Rolling Found	**0.1537**	0.0458	0.0036	0.1262	0.5642	0.4996
Fixed Liability	**0.1918**	-0.0309	-0.0442	0.3466	0.5342	0.5226
Other Fixed Assets	**0.3028**	-0.0182	-0.0206	0.5975	0.4116	0.4539
Intangble Assets	**0.0138**	-0.0233	-0.0658	0.1787	0.2604	0.2348
Indebtedness	**-0.2333**	-0.1930	-0.0368	-0.0455	-0.1677	-0.1571
Economic Profit.	**0.4974**	0.0477	0.6425	-0.0135	0.3115	0.3178
Own Founds	**0.3015**	0.0424	-0.0094	0.4826	0.6733	0.6791

	Rolling Found	*Fixed Liability*	*Other Fixed Assets*	*Intangble Assets*	*Indebtedness*	*Economic Profit.*	*Own Founds*
Rolling Found	1.000						
Fixed Liability	0.3618	1.000					
Other Fixed Assets	0.1548	0.6891	1.000				
Intangble Assets	0.0823	0.4403	0.2127	1.000			
Indebtedness	-0.0392	0.1019	-0.0358	0.0342	1.000		
Economic Profit.	0.0354	-0.0709	-0.0194	-0.1352	-0.4041	1.000	
Own Founds	0.3760	0.4399	0.7652	0.2379	-0.3039	0.0854	1.000

Table 5. *Spearman matrix correlation.* Own elaboration.

Spearman's correlation matrix is a statistical tool used to assess the relationship between variables and is useful for identifying patterns or trends in data.

According to the results extracted from Table 2, there is a positive correlation between productivity and the solvency ratio, as well as the return on capital employed, average employee cost, EBITDA, cash flow, rolling found, other fixed assets, intangible fixed assets, economic profitability and own founds. And a negative correlation between the dependent variable and indebtedness. These interpretations are in line with the expected ones. However, the correlation between productivity and fixed liabilities is positive. It should be noted that the latter approximation may possibly be contaminated by the heterogeneity present across regions in our cross-sectional panel data.

Also, with regard to the explanatory variables, in general, slight/moderate correlation coefficients are observed, with economic profitability and cash flow having the highest levels of correlation with labour productivity.

4.5. PRODUCTIVITY DIFFERENCES

Having detailed the various descriptive statistics of the quantitative variables in this dissertation, this section will look at the descriptive statistics and the differences in labour productivity in the different groups of categorical variables that make up the panel data.

Variable	Obs	Mean	Std. Dev.	Min	Max
Andalucía	52	**96.278**	110.4988	-162.8679	706.6364
Aragón	25	**139.9882**	187.4907	19.48219	823.7654
Asturias	5	**66.57854**	14.74526	54.01632	91.40769
Baleares	2	**67.30578**	20.77496	52.61566	81.9959
Canarias	9	**43.94208**	21.65253	19.70479	89.07786
Cantabria	4	**57.41788**	11.04707	43.93031	69.15868
CastillayL~n	55	**103.8899**	92.12843	15.85584	458.2916
CastillaLa~a	38	**119.5506**	198.1786	27.30044	1259.317
Cataluña	115	**106.2702**	178.2595	-118.372	1389.293
ComunidadV~a	60	**78.38795**	54.03022	14.55085	279.8155
Extremadura	17	**82.17864**	36.60403	33.88596	177.7788
Galicia	46	**69.00894**	51.65162	-60.87996	260.7752
LaRioja	17	**92.34195**	75.05269	27.83832	333.4161
Madrid	40	**98.2756**	130.2653	22.57891	852.3448
Murcia	35	**79.33556**	61.96561	-41.08964	295.8173

Navarra	25	**81.18184**	64.43041	31.58897	241.6789
País Vasco	18	**107.5129**	137.3614	-297.4507	355.3478
Food	491	**91.20778**	128.4277	-162.8679	1389.293
Beverages	72	**122.3727**	97.42264	-297.4507	360.4565
Large	158	**63.98626**	36.78089	-44.05396	279.0091
Medium	267	**93.67152**	133.0799	-60.87996	1309.042
Small	66	**146.4075**	208.9818	-162.8679	1389.293
Export	467	**89.516**	99.38344	-118.372	1389.293
Non-export	96	**122.8113**	208.3966	-297.4507	1309.042
Majorconce~n	441	**95.39652**	129.1571	-162.8679	1389.293
Menorconce~n	120	**95.09082**	111.2779	-297.4507	823.7654

***Table 6**. Summary of univariates statistics (qualitative variables).* Own elaboration.

The column "Obs." in table 6 shows the total number of companies taken into account in this analysis. These companies are classified by region (CCAA), by size (large, medium and small), and according to the sector in which they operate (food and beverages). It also includes whether or not they export and the level of business concentration, that is to say, whether the company is located in an Autonomous Community with greater or lesser business concentration. That is to say, it collects the observations on the number of firms for each category variable in this thesis. Next, in the "Mean" column, the labour productivity averages of each of the qualitative variables are collected. The standard deviation is collected in the "Std. Dev." column, which indicates the deviation or variability in which the data points differ from the mean. Finally, the last two columns of the table represent the “minimum and maximum” of the data that make up each of the non-quantitative variables.

In the following, the focus will be on the differences in the means of labour productivity for each of the categorical variables.
In this statistical value, noticeable differences can be seen between the different categories of variables, which should be highlighted:

As for the average labour productivity of the seventeen Autonomous Communities we can see large differences between them, the arithmetic average of productivity in this group of dummy variables ranges from 43,94208 thousand € per worker (Canarias) to 139,9882 thousand € per worker (Aragón).

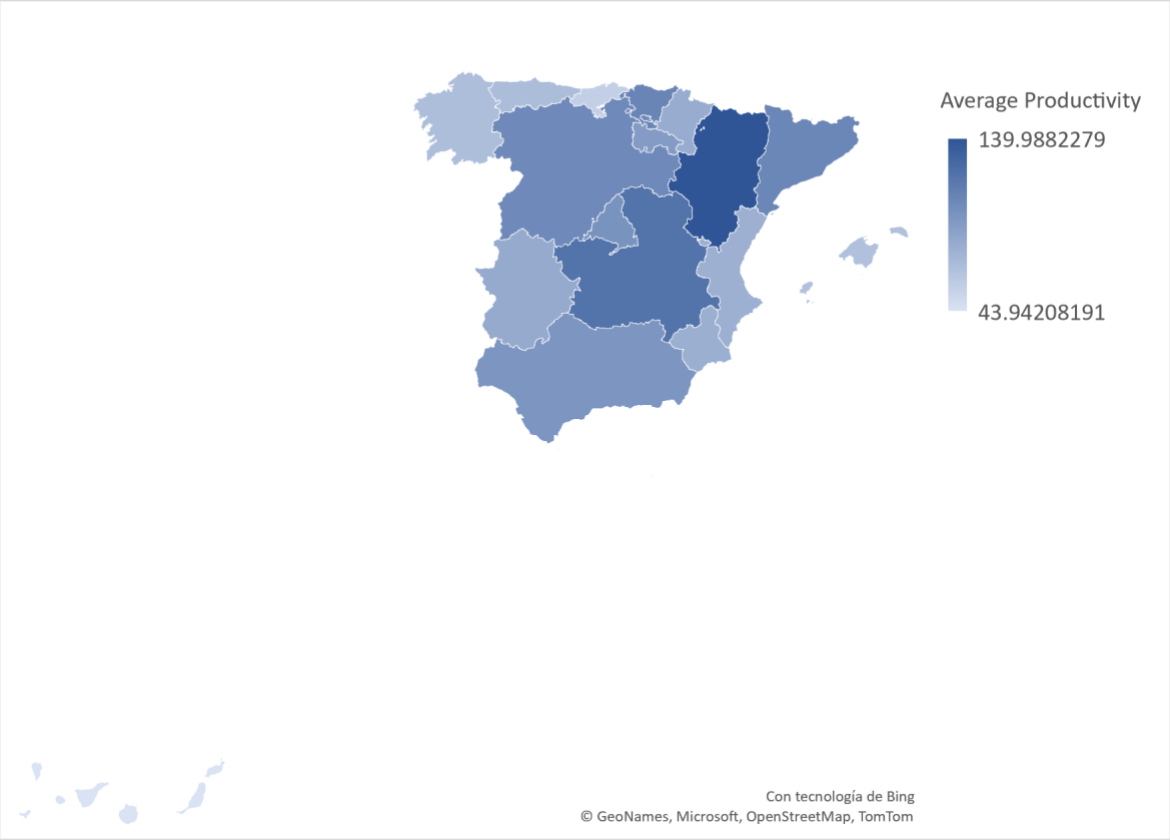

Figure 2. *"Heatmap" of productivity differences between the autonomous communities of Spain.* Own elaboration (EXCEL)

As reflected in the agri-food article by Cesa (2021), Aragon overcame the Covid-19 pandemic with flying colours, keeping its production and supply chains active and, therefore, mitigating the external problems and the effect of the crisis on the aragonese economy. In addition, the aragonese meat industry ranked first in terms of production value with a 42% weight in terms of gross value added (GVA), the food industry in this community contributed 90% of the total agri-food sector. In addition to this, Aragon is known for having a long tradition in agri-food production, as well as a well-established sector with a large logistics and transport infrastructure. Aragon also stands out for its strategic geographical location, with access to important international markets, this is due to its border with France which facilitates trade and export of agri-food products which can generate greater demand and business opportunities for companies in the region. The report also highlights investment in research and development (R&D) and the adoption of advanced technologies as factors for improving productivity in this region. For all these reasons, Aragon is the Spanish region with the highest labour productivity in our analysis.

On the other hand, the región with the lowest labour productivity is Canarias. This may be due to the fact that the Islas Canarias are geographically isolated from mainland Europe, which may imply many limitations for the region, such as higher transport costs for the import of inputs and for the export of outputs. Moreover, tourism is the key economic factor in Canarias, so this concentration on tourism supply may limit the diversification and specialisation of companies in other market segments and reduce competitiveness with other Spanish regions in the food and beverage sector. An important aspect highlighted in the FIAB report (2020) is the climatic conditions in the Islas Canarias, where agriculture and food production are affected by weather conditions (such as drought and the absence of fertile land), which greatly limits production and the ability of companies to supply and offer a greater variety of products.

In terms of the sector in which each company operates, a notable difference can be observed between the food and beverage sectors. In this thesis, the difference in average labour productivity between the beverage sector and the food sector reaches 32 thousand € per worker, with the beverage sector being more predominant than the food sector. As discussed in the "Introduction"[17] of this thesis, many studies have identified the beverage sector as a highly productive sector due to the higher added value obtained from production, as beverage production processes tend to be more complex, more automated and require more investment in intangible assets such as technology and research. Given these results, it could be argued that the beverage production process is more controlled and involves less waste due to the longer shelf life of the products as food production often involves a higher risk of waste due to the perishable nature of many food products and the need to transport and store them in appropriate conditions to avoid contamination and product degradation (Charley Rastle, 2007).

With regard to the size of the firms in our cross-sectional panel data, we observe a trend that is not in line with expectations. It is worth noting that the size-productivity debate has been the subject of debate for decades. According to an OECD study (2018), large firms generally have a more complex organisational and economic structure than small firms, which may lead to less flexibility in decision-making and, as a consequence, a slower ability of large firms to adapt to market changes and consumer preferences. On the other hand, small and medium-sized companies, by having a more uniform structure, can encourage workforce participation and collaboration, resulting in higher productivity.

[17] See Section 1.2

In addition to this, the report also argues that small and medium-sized companies have the ability to focus on a limited number of services, which allows them to specialise in one market segment and become more efficient and productive.

Next, the binary variable representing foreign activity in our analysis also does not coincide with the economic theory presented at the beginning of this thesis, where the export-productivity relationship was positive. One possible explanation for the results in Table 6 could be that non-exporting firms focus on more concentrated markets, localities or regions, and may have a better understanding of the needs and preferences of their regular consumers. In addition, non-exporting firms are less exposed to factors external to their market, which allows them to have greater stability in their operations. This may give them a competitive advantage over firms that do export, which could increase their labour productivity.

Finally, the average labour productivity of firms located in a region with higher business concentration is slightly higher, with a difference of €0,30 thousand per employee, than those located in regions with lower concentration. As Henderson predicts, the higher the concentration, the more competition there is, which may lead the industry to look for alternatives and ways to increase labour productivity.

5. ANALYSIS & RESULTS

Once the correlations and the corresponding statistics have been detailed, an Ordinary Least Squares (OLS) estimation will be carried out in order to see whether the variables of the model and the interpretations that have been discussed, both quantitative (economic factors or financial variables) and qualitative (size, region, sector, concentration and foreign activity), are significant for the behaviour of the dependent variable (labour productivity).

Given that we are dealing with a cross-section type of research, where data collected from different entities in a single year (2020) are analysed, and there are multiple *dummy variables*, the most appropriate choice for estimating this model would be to use the OLS method.

The econometric model mentioned above is presented below for proper estimation:

$$Productivity_i = \beta_0 + \beta_1 Ratsolven_i + \beta_2 Rentcapempl_i + \beta_3 Cteemplead_i + \beta_4 EBITDA_i + \beta_5 Casflow_i + \beta_6 Fmaniob_i + \beta_7 Pfijo_i + \beta_8 Oactfij_i + \beta_9 Inmintan_i + \beta_{10} Endeu_i + \beta_{11} Rentecon_i + \beta_{12} Fpropios_i + \delta_{13} CCAA_{i_k} + \delta_{14} Sector_i + \delta_{15} Size_{i_r} + \delta_{16} Activityext_i + \delta_{17} Concfirm_{i_k}[18] + u_i$$

Using the statistical programme Stata, the estimation of the model is obtained by means of deviations robust to heteroscedasticity so that the estimation is not biased and the results are reliable.

Productivity	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
Ratsolven	.2383815	.5118151	0.47	0.642	-.7670581	1.243821
Rentcapempl	-.0080266	.1583728	-0.05	0.960	-.3191434	.3030903
Cteemplead	1.143275	.4579606	2.50	0.013	.2436303	2.04292
EBITDA	-.0025144	.0019259	-1.31	0.192	-.0062977	.001269
Cashflow	.0049667	.0019203	2.59	0.010	.0011943	.008739
Fmaniob	.0003547	.0001428	2.48	0.013	.0000742	.0006352
Pfijo	-.0003581	.0002031	-1.76	0.078	-.0007571	.0000409
Oactfij	.0004372	.0001449	3.02	0.003	.0001527	.0007218
Inmintan	.0004022	.0003268	1.23	0.219	-.0002399	.0010442
Endeu	-.387716	.1954946	-1.98	0.048	-.7717569	-.003675
Rentecon	4.062022	1.28156	3.17	0.002	1.544451	6.579593
Fpropios	-.0004075	.0001697	-2.05	0.057	-.0007408	-.0000741
Andalucía	8.936087	13.28428	0.67	0.501	-17.16032	35.0325
Aragón	81.4378	36.86255	2.21	0.028	9.022852	153.8527
Asturias	63.24708	32.18309	1.97	0.051	.0247346	126.4694
Baleares	33.69992	30.64402	1.10	0.272	-26.49897	93.89882
Canarias	48.74085	29.40985	1.66	0.098	-9.033578	106.5153
Cantabria	27.27634	23.56694	1.16	0.248	-19.01993	73.57262
CastillayL~n	14.71769	12.31464	1.20	0.233	-9.473907	38.90929

[18] The categorical variable Concfirm also has the sub-index k because the firms are classified according to whether they are in a location of higher or lower business concentration. In other words, the CCAAs have been used for this classification.

CastillaLa~a	26.02304	14.51141	1.79	0.073	-2.484029	54.53011
Cataluña	16.02969	13.52737	1.18	0.237	-10.54426	42.60365
ComunidadV~a	3.868177	8.287432	0.47	0.641	-12.41214	20.14849
Extremadura	51.37265	25.35114	2.03	0.043	1.571381	101.1739
LaRioja	58.25208	26.68845	2.18	0.029	5.823727	110.6804
Madrid	11.6288	11.10981	1.05	0.296	-10.19596	33.45356
Murcia	7.80313	12.44975	0.63	0.531	-16.65388	32.26014
Navarra	68.27017	26.93734	2.53	0.012	15.35288	121.1875
País Vasco	72.7263	29.993	2.42	0.016	13.8063	131.6463
Alimentario	-16.10438	10.24308	-1.57	0.116	-36.22648	4.017729
Emp_peq	89.23876	26.90099	3.32	0.001	36.39287	142.0846
Emp_med	32.91287	7.254562	4.54	0.000	18.66158	47.16416
Exporta	-7.118262	11.12534	-0.64	0.523	-28.97353	14.737
Menorconce~n	-44.10645	23.05337	-1.98	0.051	-89.39385	1.180937
_cons	13.0203	28.31743	0.46	0.646	-42.60811	68.64872
R^2	0.56462					

***Table 7**. Pooled OLS estimation, robust standard desviations at heteroscedasticity.* Own elaboration.

Thus, according to this estimation method, many coefficients of the independent variables would be significant at a confidence level of 95% and even some of them at 99%.

Before interpreting the results obtained, it should be noted that since this is an estimated OLS analysis, causality cannot be interpreted directly, as ther may be unobserved variables that are related to the error term (u_i) and thus cause endogeneity in the model. This can be problematic because endogeneity can bias the estimated coefficients and lead to incorrect conclusions about causality. Therefore, appropriate interpretations will be considered with caution in the following, as other unobserved factors could be influencing the relationship between labour productivity and each of the quantitative variables.

Specifically, the quantitative variable "$Cteemplead_i$" is significant with 95% confidence. That is, an estimated slope of 1.143275 with a p-value of 0.013, so that a robust relationship has been obtained between the dependent variable and the average cost of employees, so that we have sufficient evidence to determine that, holding the

other variables constant, there will be a positive trend between this explanatory variable and labour productivity.

Next, the variable "$Cashflow_i$" is also significant at a 99% confidence level. With a coefficient of 0.0049667 and a p-value equal to 0.010, there is sufficient evidence to affirm that a higher level of cash flow is associated with higher levels of labour productivity.

"$Fmaniob_i$" also shows significance at 0.05, that is to say, at a risk of 5%. With a coefficient of 0.0003547 and the respective p-value equal to 0.013. As before, there is a statistically significant association between this variable and the explained variable. That is, "ceteris paribus", an increase in firms' working capital is related to an increase in labour productivity.

Another quantitative variable that is significant at 99% confidence is "$Oactfij_i$", where the slope estimate is 0.0004372 with a p-value of 0.003. Therefore, there is clear evidence to affirm that an increase in fixed assets can provide companies with more efficient tools for production, so that these increases will be associated with higher levels of labour productivity.

Indebtedness, "$Endeu_i$", is significant at 95%, with a coefficient estimate of -0.387716 and a respective p-value equal to 0.048. Thus, we are in a position to state that an increase in a firm's indebtedness will, as expected, mean a reduction in labour productivity levels. That is, a robust negative labour productivity - indebtedness relationship.

Economic profitability "$Rentecon_i$" is highly significant in the model, exceeding 99% confidence, i.e. less than 1% risk. But with respect to the interpretation of the coefficients, an additional problem arises in this case, since despite being controlled by other variables, there may be common determinants of profitability and productivity that generate a problem of endogeneity, which implies that the sense of causality is not clear. It should be noted that with the available data and the estimation method employed there are issues that we cannot resolve. The robustness of the estimation is evident, so we can only determine that the relationship between economic profitability and labour productivity is positive.

Again, following Wooldridge (2010), the exclusion of a category in a qualitative variable is based on linear regression theory and the need to avoid perfect collinearity or multicollinearity, as the inclusion of highly correlated variables may lead to inaccurate or biased results. If all the categories that make up a dummy or categorical variable are included in the regression to be estimated, this can lead to problems in the estimation of the coefficients and in the interpretation of the results. So, the exclusion of one of them ensures that there is no possibility of perfect collinearity between variables and that the estimates are precise. Therefore, the excluded category becomes and acts as a reference for the other categories that make up the qualitative variable, meaning that the estimated coefficients for the other categories will reflect their relationship with the reference (excluded) category.

In the framework of the econometric model of this analysis, certain categories have been excluded to avoid the collinearity problems explained above. In particular, the Autonomous Community of Galicia has been excluded for the variable $CCAA_{i_k}$, the beverage sector has been excluded for the variable $Sector_i$, large companies have been excluded for the variable $Size_{i_r}$, non-exporting companies has been excluded for the variable $Activityext_i$ and, finally, the highest business concentration has been excluded for the variable $Concfirm_{i_k}$. The exclusion of these categories will allow us to obtain an accurate estimate of the coefficients of the remaining categories in each variable, and will allow a better interpretation of the results between these variables and the dependent variable.

As for the interpretation of the results of the categorical variables, firstly, it can be observed that there are several autonomous communities where the coefficients are significant. One of them is Aragón, with an estimated coefficient of 81.4378 and a p-value equal to 0.028, so that, keeping the other variables of the regression constant, if a firm is located in Aragon its labour productivity will be 81,437 thousand €[19] more than if it is located in Galicia. The same occurs with Extremadura, which presents a coefficient of 51.3726 and its respective p-value equal to 0.043, so there is evidence that being located in Extremadura, "ceteris paribus", will give an increase in labour productivity of 51.372 thousand € with respect to Galicia. La Rioja is also significant at a 95% confidence level, with a coefficient of 58.152 and a p-value equal to 0.029, so that companies in La Rioja have a higher labour productivity than those in Galicia by 58.152 thousand €. Finally, the two communities that also show significance are Navarra and

[19] Throughout this work the dot (.) in the results, represent the decimals not thousands.

País Vasco, with estimated coefficients of 68.270 and 72.726, and a p-value equal to 0.012 and 0.016, respectively. So, there is sufficient evidence to show that companies in Navarra and País Vasco are more productive with a difference of 68.270 and 72.726 thousand €, respectively, compared to Galician companies.

In relation to business size, there are also significant differences, both small and medium-size firms are significant at almost 100% conficence level, with OLS estimated coefficients of 89.238 and 32.912, respectively, so we are able to afirm that, keeping the other variables of the model constant, “ceteris paribus”, medium-size firms are more productive than large firms with a difference of 32.912 thousand € and small firms with a p-value equal to 0.001, again, have higher productivity than the largest with a difference of 89.238 thousand € per worker.

Finally, the goodness-of-fit coefficient, better known as the “coefficient of determination”, has taken the value of $R^2 = 0.564$, which means that, more than 56% of the variability of labour productivity is explained by the variables that compound our econometric model. This value, following Snedecor & Cochran (1980), is a moderate – good value for the estimation, since the model explains half of the variability of the dependent variable, so it can be considered a good coefficient of determinaton.

6. CONCLUSIONS

In order to move on and analyse the conclusions of this study, it is necessary to recapitulate and recall the main motivations that drove and initiated the study. The main objective of this study was to analyse the factors that influence labour productivity in the food and beverage sectors, taking into account various variables that characterise each company, both categorical or dummy variables and quantitative variables.

This objective was motivated by several articles but above all by the importance of productivity in companies, as it is a crucial factor in achieving success and efficiency in an increasingly competitive market. On the other hand, the motivation to address this topic has also been driven by the unique behaviour of the sector over the last decade[20] compared to the rest of the economy, which makes it an attractive field for analysis and research.

This work has analysed seventeen possible factors that influence labour productivity in firms. At the beginning of this paper, a series of hypotheses, four to be precise, have been put forward on the expected relationships between these variables and labour productivity. Thanks to the results obtained by estimating the econometric model, it has been possible to answer the questions and hypotheses raised throughout this paper.

In constructing the panel data for this study, twelve quantitative variables were chosen, of which only six were found to be significant for labour productivity. This variables are: average employee cost, cashflow, indebtedness, other fixed assets, rolling found and economic profitability. In the case of the average employee cost, cashflow, other fixed assets, rolling found and economic profitability, there is a positive relationship, that is, increases in the value os these variables are associate with improvementsin labour productivity, while in the case of indebtedness it would be the opposite, since an increase of one percentage point in this variable would mean a decrease in labour productivity.

Taking into account the results presented by the estimation, we can analyse the various hypotheses proposed at the beginning of the study and discuss them.

[20] See Figure 1.

The first hypothesis proposed was that larger firms achieve higher productivity levels than smaller ones, that is to say a positive size-productivity relationship. Contrary to expectations, as we can see in the estimation results, we have not found evidence to confirm this hypothesis. This could be due to three reasons; first, as discussed above, empirical evidence suggests that small firms may have higher productivity than large firms due to their ability to be more flexible and specialised in their market. Secondly, as predicted by Gali (1999) demand fluctuations and the different nature of technological shocks faced by small firms may lead to this relationship as they are more exposed to external economic shocks and market changes. Finally, the method of extracting the SABI data could be another cause of this negative relationship between size and productivity as it could be biasing the estimation.[21]

The second hypothesis defended that those companies that export obtain higher levels of productivity than those that only operate in the domestic market. As can be seen in the estimation results, the export-productivity relationship is different from the expected one, since companies that operate in the domestic market have higher productivity than those that are exporters, with a difference of 7.118 thousand € per employee per year. With these indications we cannot validate the second hypothesis. However, it should be noted that this estimate is not significant, and data extraction limitations could alter these results.

The third hypothesis argues that autonomous communities with higher business concentration will achieve higher productivity due to competition and agglomeration economies. As predicted by the existing literature[22], this study meets the expectation with a difference of 44,106 €[23] per worker between firms located in a more concentrated community and those located in a less concentrated region. Although the estimation and the comparison of means[24] throw coefficients that coincide with those expected, these results according to the OLS estimation are not significant, so we do not have enough evidence to validate the present hypothesis.

The last hypothesis was the expected signs of correlation between financial variables and productivity. As we know, financial variables of the firms were chosen, which were tested in previous research articles and which were found to be related to

[21] See Limitations and Future research
[22] Marshall (1920), Ciccone and Hall (1996), Graham and Kim (2007), Veneables (2007), Martin et al. (2011)
[23] Unlike the dot, the comma represents the thousands.
[24] See 4.5 Productivity Differences

labour productivity. Of these twelve quantitative variables, only six of them are significant with the expected sign, that is half of the quantitative variables have met the expected.

With all the above results and the relevant discussions, we have sufficient evidence to conclude that the labour productivity of companies with an operating income of more than 25 million €/year in the food and beverage sectors in 2020 was determined (56.4%) positively by the average cost of employees, cash flow, fixed assets of the company, rolling found and economic profitability. And negatively by indebtedness. In addition to this, the estimation has allowed us to affirm that those companies located in Aragon and which are small (SMEs), are the ones that achieve the highest labour productivity, compared to those located in another autonomous community and which are of a different size.

Limitations and Future Research

Finally, it is important to highlight the limitations of this study in the course of its preparation and some advice for future research in this area.

Firstly, in the data extraction method, a requirement was introduced to extract data from companies with annual operating revenues of 25 million euros. 25 million. The aim was to collect data from the largest companies with the most information available. However, this may have biased our estimation, as many small companies were excluded from the model due to insufficient data volume.

This limitation may motivate other authors to include other variables that determine the size of a firm. However, it is important to keep in mind that obtaining data from less relevant firms in the market may be complicated, which may limit and restrict the scope of the study. Therefore, as discussed, future authors may consider including other variables that determine the size of a firm and allow for a wider inclusion of firms in the model.

Another limitation of this study has been the extraction of export information from firms. The origin of this dissertation was only the analysis of the relationship between exports and firm productivity. This was not possible as SABI suddenly no longer provides export information. That is, it does not reflect in which year a firm starts exporting, in which year it has stopped exporting, what percentage of its turnover is exported, etc.

Again, this may have intervened in our estimation and biased the relationship between labour productivity and export activity. A possible recommendation for future research would be to explore other sources of information on firm exports.

The last limitation is the possible potential presence of endogeneity in the OLS estimation, so further analysis would have to address this problem and try to establish the sense of causality with additional research methods.

The investigation of labour productivity in the manufacturing industry is fundamental to developing more efficient products and processes, and to promoting growth and competitiveness in countries. It is essential that future studies continue to explore different factors that may influence productivity.

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