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Transport companies based on their size and management type: has Covid-19 conditioned their solvency?

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ABSTRACT

Transport is one of the essential services contributing to a country's development. The global pandemic caused by Covid-19 has affected different sectors, one of the most affected being public transport services. In Spain there are several transport companies, some of them are public, and others are private. The main objective of this paper is to study the profitability, liquidity, and solvency situation of transport companies considering their size and type of management. The impact of the Covid-19 pandemic on transport companies will be analyzed too. After descriptive analysis of the companies by ratios, the Altman Z-score indicator has been used. This methodology has been used to assess whether the health crisis has compromised the solvency of these companies. The results have shown that privately managed companies are healthier and have a lower risk of insolvency than public companies. In addition, small companies were more solvent than big companies. This study is an essential contribution to the academic literature, public administration, and management of companies.

1. Introduction

The importance of the public transport sector in the economic structuring of cities is well known. Transport networks enable millions of journeys to be made worldwide, with different motivational patterns, like work, leisure, or study purposes. A study elaborated by Neirotti et al. (2014) argues that today's cities can be seen as complex systems, with a high volume of inhabitants concentrated in towns, where businesses, services, and means of transport are interconnected. Numerous studies evaluate this service, the operating companies' financing, and users' perception (Asensio & Matas, 2017; Cascajo et al., 2018; Romero & Monzon, 2018; Delgado et al., 2019; De Oña et al., 2021).

According to the study by Delgado et al. (2019), in Spain, there is a lack of regulation at the national level regarding the distribution of public subsidies to public transport companies. This means that public support varies depending on the operating

company's efficiency. This, of course, affects these companies' economic and financial structure. In Spain, there are several transport companies: some are publicly managed, and others are privately managed (De Rus, 1990). But the main requirement for all of them, regardless of their management, is to provide a quality, accessible and sustainable service (López & De Rus, 1995; Anguita et al., 2014). The impact of the pandemic on transport companies must be taken into account. Based on the study elaborated by Oliver et al. (2020), the habits of using public transport have changed, which is why the number of urban journeys in Spain has decreased by 80% compared to the years before the pandemic (Aloi et al., 2020; Awad-Núñez et al., 2021; Oliver et al., 2020), which has probably affected the profitability and solvency of these companies.

Taking all this into account, the main objective of this paper is to study the profitability, liquidity, and solvency situation of transport companies considering their size and type of management. The impact of the Covid-19 pandemic on transport companies will be analyzed too.

To achieve the objective, firstly, a descriptive analysis of the companies analyzed was carried out. Then, these companies were analyzed over the last five years using solvency, liquidity, and profitability ratios. First of all, the analyzed companies were classified by quartiles. Given the very different results by quartiles, further analysis of the results employing management type and size of the companies was carried out. To complete the analysis of transport companies based on their solvency or possibility of failure, the Z-score methodology by quartiles, type of management, and size of the companies has been used.

The main results indicate that public companies have a higher risk of insolvency than private companies. By size, it has been concluded that large companies are more prone to corporate insolvency and small companies are more solvent. In addition, it has been shown that the health crisis has affected transport companies as much as other companies in other sectors. This study is the first to analyze post-pandemic economic-financial data of transport companies in Spain, showing the evolution of these companies over the last five years, thus contributing significantly to the academic literature on the transport sector.

This study is organized as follows: the first part is the introduction, followed by an in-depth literature review of the importance of the public transport sector and its impact on the country's economy, as well as the impact it has experienced as a result of the Covid-19 pandemic. This literature review concludes with two hypotheses to be tested. The third section of the study details and justifies the sample selected for the analysis. Likewise, the variables defined and the methodology applied. Section four presents a discussion of the obtained results, and finally, the main conclusions and implications of the work are developed.

2. Literature background

2.1. Public transport importance and evolution

The evolution of cities has made it necessary to incorporate different means of transport to ensure the efficient mobility of citizens. Public transport plays an essential role as a means of transport since it is considered the most environmentally friendly

and healthy alternative (Chen et al., 2022; Gutiérrez et al., 2020). In a mobility that has been marked by the massive use of private vehicles, responsible for most of the emissions that generate environmental problems and, therefore, global climate change, it is essential to note that the use of private vehicles has been the primary source of emissions (Sun et al., 2018).

Public transport is a fundamental tool for achieving sustainable mobility in cities (Chen et al., 2022; European Commission, 2017). Therefore, promoting sustainable mobility is one of the main lines of action followed by the European Union as part of its sustainable mobility strategy. The reasons that attribute this role to public transport are that it promotes the economy and its use minimizes atmospheric and noise pollution, reducing congestion and accidents and facilitating social and territorial inclusion processes (López & De Rus, 1995; Schmöcker et al., 2004; Glaeser et al., 2008; Susniene, 2012; Anguita et al., 2014; Schilardi, 2014; Sun et al., 2018; Saif et al., 2018;). The study elaborated by Saif et al. (2018) highlights that the transport system has to be accessible to everyone, i.e., this service is not only marked by its performance but also by aspects such as social exclusion or public health, among others, thus highlighting its status as a public service.

In Spain's case, urban public transport by a surface is most important, as it is the mode chosen by the responsible authorities to provide mobility services in different cities (Observatorio de la Movilidad Metropolitana, 2020). This service is compulsory in towns with more than 50,000 inhabitants, according to Law 7/1985 of 2 April 1985, regulating the Bases of the Local Regime (Ley 7/1985, de 2 de abril, Reguladora de las Bases del Régimen Local). The formulas used for public service provision are direct management through municipal public companies and indirect administration, where private companies provide the service through an administrative concession. Municipal public companies are the most commonly used in large cities (De Rus, 1990; Torres & Pina, 1998). Whereas in smaller cities, private companies usually provide service under the concession (De Rus, 1990). The structure of service provision by public and private companies is similar when we analyze the transportation organization of our neighboring countries as follows Germany, France, and Italy (López & De Rus, 1995; Pina & Torres, 2001, Rhodes et al., 2012).

The companies that provide public transport services do not have an economic but a social purpose since they have to guarantee the displacement of all citizens. However, these displacements are not economically justified (Pina & Torres, 2001). The survival of these companies, where operating revenues do not cover their costs, is possible thanks to the fact that these companies are highly financed with public funds (Holmgren, 2013).

Various sources provide the financing of these companies: finalist subsidies or through program contracts of the General State Administration, funding from the Autonomous Communities, and local administration. The lack of stability and arbitrariness in the distribution of this funding, together with the managers' efforts, has meant that a transport funding bill is currently pending approval (Delgado et al., 2019). Hence, its main objective is to constitute a state fund for allocating resources to urban public transport within the framework of competencies attributed by the Constitution and the laws of the different Public Administrations (Proposición de Ley

de financiación del transporte público urbano y metropolitano, 2020). This need for funding has been further aggravated by the Covid-19 pandemic, where, according to official data, urban public transport has suffered several consecutive weeks of a 90% to 80% drop in occupancy (Aloi et al., 2020; Awad-Núñez et al., 2021; Tirachini & Cats, 2020). If not stabilized over time, this situation could threaten the service's sustainability and the cities (UITP, 2020).

In this context, studies related to service funding and service evaluation (De Rus, 1990; Martín et al., 2012; Anguita et al., 2014; Toledano et al., 2014; Monzón & Cascajo, 2015; Asensio & Matas, 2017; Basagaña et al., 2018; Cascajo et al., 2018; Romero & Monzon, 2018; Delgado et al., 2019; De Oña et al., 2021) have given way to papers related to the effect of Covid-19 and public transport (Beck et al., 2021) especially in terms of travel behavior (Awad-Núñez et al., 2021; Chen et al., 2022; Kłos-Adamkiewicz & Gutowski, 2022). However, no papers have been found that focus on how the Covid-19 pandemic has affected public transport companies' profitability, liquidity, and solvency.

2.2. Impact of Covid-19 on public transport in Spain

The emergence of Covid-19 in December 2019 and its rapid spread prompted most governments to take isolation and lockdown measures in their cities (Ribeiro-Navarrete et al., 2021). Through this measure, governments have attempted to avoid the number of deaths the virus was causing (Garcovich et al., 2020; Kłos-Adamkiewicz & Gutowski, 2022). In the case of Spain, the government adopted on 14 March 2020 the confinement of its population for several months (Ruiz-Roso et al., 2020). These actions limited both domestic and international travelers. These measures, coupled with the closure of non-essential trade, have caused significant damage to many economic sectors, leading to the closure of many businesses (Papadopoulos et al., 2020; Syriopoulos, 2020). But the pandemic impacted mobility, work, and people's behavior, which became a priority for governments and companies (Saura et al., 2021a; Saura et al., 2022a). Therefore, many studies have analyzed the impact of the pandemic on people's working and social lives and how it moves (Beck et al., 2021; Chen et al., 2022; Kłos-Adamkiewicz & Gutowski, 2022; Monterde-I-Bort et al., 2022). In the case of Spain, the pandemic caused the fall of GDP by almost 19% in the second quarter of the year (Maudos, 2020), affecting all sectors of the economy. One of the main sectors affected by the pandemic was and is the public transport sector since the number of urban journeys has decreased by 80% compared to mobility trends before Covid-19 (Aloi et al., 2020; Awad-Núñez et al., 2021; Oliver et al., 2020; Tirachini & Cats, 2020). This situation is caused by a significant increase in teleworking, temporary or permanent job losses, the decline of national and international tourism activities, and the decline of the tourism industry (Baldasano, 2020; Orro et al., 2020). Likewise, the change in mobility habits in favor of private transport (84.5% of journeys against 5.9% for public transport) has led to a decrease in the use of public transport (Oliver et al., 2020; Beck et al., 2021). These changes in habits are because some countries have discouraged the use of public transport, and users

perceive a higher risk of contagion on public transport than on private transport due to the more direct contact with other people (Beck et al., 2021; Tirachini & Cats, 2020)

These new mobility routines are oriented toward individual transportation patterns and the risk in sustainability that these entail (Beck et al., 2021; Monterde-I-Bort et al., 2022). This makes it necessary that governments try to take measures to reduce the impact of the pandemic on public transport, including measures carried out to reduce users' risk perception. In this regard, national law is being promoted to provide these companies with more and better funding so that they have the means to provide a safe and quality service for the users.

Taking this situation into account, we set out the hypotheses in the following section.

2.3. Hypothesis development

In this research study, we set out to test the hypotheses detailed in this section. As highlighted above, there are different ways to finance the public transport sector (Delgado et al., 2014). This makes it challenging to compare operating companies and decision-making in their management for the companies themselves and the public administration. Situations already described, such as the lack of a Transport Financing Law (De Rus, 1990), the different types of companies providing this service, both directly and privately managed (De Rus, 1990), the difference in their size and the characteristics of the municipalities where they operate (Torres & Pina, 1998), leads us to consider the first hypothesis of this research paper:

> H1: There is diversity in the profitability, liquidity, and solvency situation reflected by the operating companies in the public transport sector in Spain.

The current crisis caused by Covid-19 has impacted almost all sectors, including the transport sector, which has had a direct impact on it (Aloi et al., 2020; Awad-Núñez et al., 2021; Oliver et al., 2020; Tirachini & Cats, 2020). The upstream funding situation for this sector, which sometimes makes it very loss-making, and the measurement of the sustainability of the service (Toledano et al., 2014; Monzón & Cascajo, 2015; Asensio & Matas, 2017; Cascajo et al., 2018; Romero & Monzon, 2018). This paper attempts to test the second hypothesis:

> H2: Public transport companies have difficulties ensuring long-term solvency and continuity after Covid-19.

The following section describes the sample and the variables used for this study.

3. Sample, variables, and methodology

3.1. Sample and variables of the study

The sample of this study is composed of transport companies operating in Spain. Bearing that there is no complete list of the transport companies in Spain, it has not been possible to analyze all the companies in this sector. To obtain these companies' economic and financial data and access their annual accounts, a search for transport

companies has been carried out through the SABI database[1]. This database provides quantitative and qualitative information for Spanish businesses.

For 2020, there were 44 public transport companies with financial data available. These companies' financial data was analyzed for the last five years (2016-2020). According to the European Union Commission[2], company size can be defined by the number of employees, revenue, or total assets. In this study, the number of employees and total assets variables will be used to classify the size of the entities. Total assets seem the most appropriate for this sector because the amount of revenue generated by transport companies can be reflected in different headings of the profit and loss account and the balance sheet. This is because it will depend on whether they have received income via program contract, operating subsidy, or direct contribution from the public administration as a shareholder, making it difficult for the revenue to be homogeneous. It seems that the total assets will reflect more homogeneously the size of these companies, depending on the infrastructure they need to provide their service. Analyzing employees and total assets, Figure 1 shows the size and management of the companies analyzed in this study. (Figure 2)

As shown in Figure 1, 59% of the sample is medium enterprises. This means that total employees were under 250 and more than 50, and the total assets of these companies in the year under review were less than 43 million and more than 10 million. Meanwhile, 5% of the sample belongs to small enterprises; finally, big companies represent 36% of the sample, 16 companies. Of the sample, 68% corresponds to private companies that manage the service through public concessions.

Other information provided by the database was on the legal form of these companies. Thirty companies analyzed in this study have the legal form of a limited company, while the rest are companies with the legal structure of a limited partnership.

The main variables of the study are profitability, liquidity, and solvency since these ratios show first-hand knowledge of transport companies. Table 1 shows all the ratios used in this research.
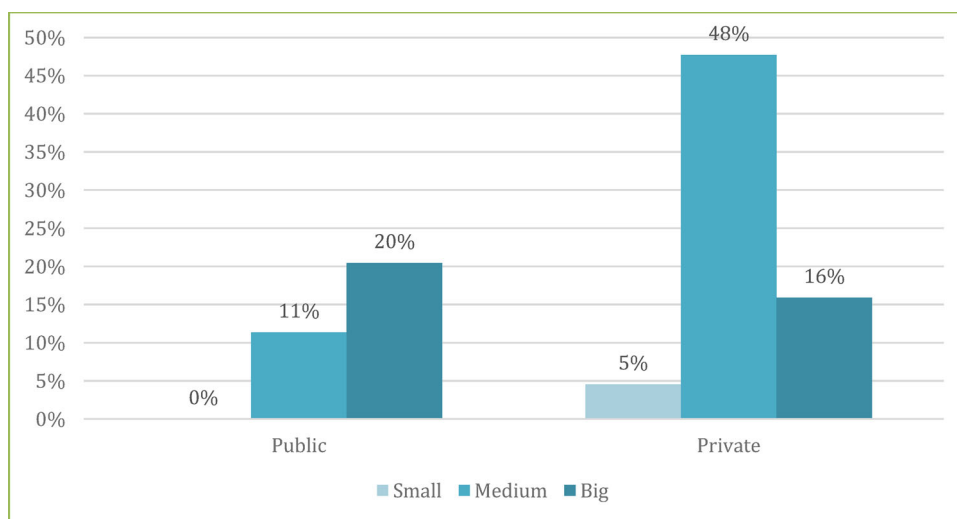
Figure 1. Size and management of public transport companies in Spain in 2020.
Source: own elaboration based on the SABI database
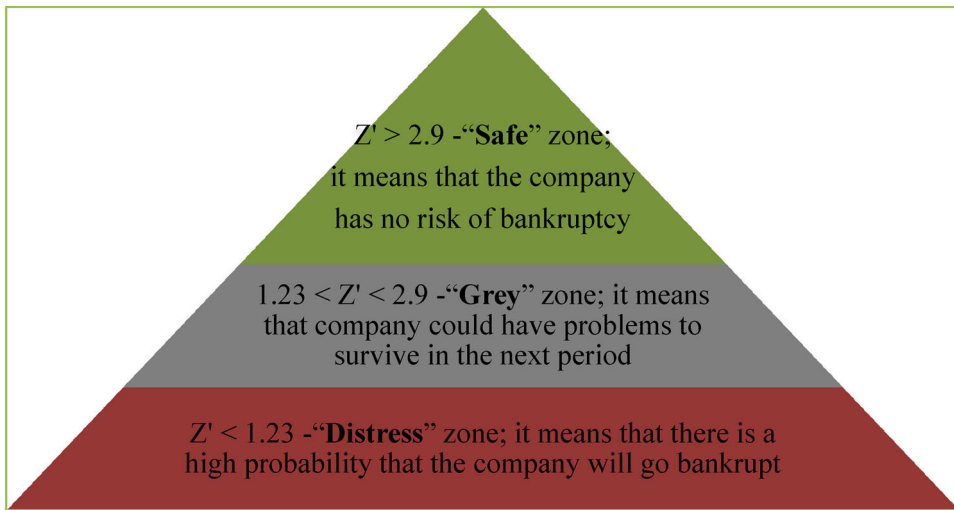
Figure 2. Z-score classification of the companies.
Source: own elaboration based on Altman (1968) and Altman et al. (2017).

Table 1. Description of the variables.

Liquidity	Solvency	Profitability
Current ratio = Current assets / Current liabilities	Debt to total assets ratio = Total liabilities /Total assets	Return on assets (ROA) = (Operating result / Total assets) *100
Quick ratio = (Current assets − Inventory) / Current liabilities	Equity ratio = Equity / Total assets	Return on equity (ROE) = (Net result / Equity) *100
Cash ratio = Cash and cash equivalent / Current liabilities	Basic funding ratio = (Non-current liabilities + Equity)/Non-current assets	Profit margin on sales = (Net income / Net sale) *100

Source: own elaboration based on Gelashvili et al. (2020).

As it is shown in Table 1, the variables of the study are clustered into three groups of ratios. The first group is Liquidity ratios, where the ability of the company to pay back its short-term liability is shown. The three ratios used in this group are used in various studies to see if the company has sufficient capacity to deal with its short-term debt (Saleem & Rehman, 2011; Madushanka & Jathurika, 2018). According to Dimitras et al. (1996), liquidity ratios are good indicators for predicting the failure of companies. The second group of ratios is solvency ratios. These ratios are the most important ones when analyzing the company's financial situation in the long-term period. In other words, solvency ratios analyze the companies' long-term survival (Carmona et al., 2013). The last group of the ratio belongs to profitability ratios. These ratios make it possible to determine a firm's profitability based on its economic resources (De Andrés, 2000; Retolaza et al., 2014). According to different studies (De Andrés, 2000; Segarra & Teruel, 2007; Situm, 2014), variables like size (measured as total assets) of the companies are essential to analyze the solvency and continuity of companies. According to Evans (1987), big companies are less likely to fail than small and medium enterprises. In addition to this, the ratios that make up the Z-score formula will be analyzed.

3.2. Methodology

The principal methodology for data analysis has been the Althman Z-score. Companies widely use this methodology to predict corporate insolvency (Gelashvili et al., 2020; Šverko Grdić et al., 2017). This analysis can classify companies as healthy, doubtful, and insolvent (Altman, 1968). Healthy companies are firms with no risk of bankruptcy, uncertain companies could have problems surviving in the next period, and insolvent companies are companies with a high probability of bankruptcy. Before analyzing the Z-score, an economic-financial analysis of the companies was carried out using the available ratio analysis for the last five years. The ratios give an overall picture of the companies analyzed (Gelashvili et al., 2020). To avoid generalizing the result, the outcomes of the ratios have been divided into quartiles and categorized by size (De Andrés, 2000; Segarra & Teruel, 2007; Situm, 2014) and type of service management, public or private (De Rus, 1990; Torres & Pina, 1998). After that, the result was contrasted with Z-score outcomes. In addition, a descriptive analysis of the quantitative and qualitative variables has been carried out.

4. Discussion of the results

4.1. Ratio analysis

Table 2 shows a descriptive analysis of the ratios used in this study. The descriptive analysis of the profitability ratios indicates that transport companies had profitability problems in 2020, as the three ratios analyzed are negative. In the previous years of the pandemic, the profitability variation was positive, except for the ROE of 2018, which was −36%. This result is due to the high negative results of two large companies, which in the end, has influenced the average ROE. This is why the standard deviation of the ratio in 2018 is so high.

The 2020 ROA result indicates that for every 100 euros invested in assets, average -of 4.75% of operating income was generated. This indicates that by their activity, these companies have not generated profitability. Similar is the case for the profitability of the shareholder's ROE. For every 100 euros invested, the result was, on average, −3.36. Therefore there was no profit for the shareholders. And lastly, the ratio of profit margin on sales is analyzed. The profit margin on sales shows what percentage of sales is left over after the business pays all expenses. In this case, this ratio has a

Table 2. Descriptive statistics.

	2016		2017		2018		2019		2020	
	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
ROA %	1.76	22.43	4.72	8.95	3.85	9.45	4.89	11.69	−4.75	16.17
ROE %	15.23	65.69	2.15	32.85	−36.00	185.46	12.53	89.02	−3.36	79.96
Profit margin on sales %	0.05	26.24	4.09	14.24	2.26	19.58	4.68	9.85	−11.95	34.61
Current ratio	2.05	1.97	2.01	1.87	2.01	1.66	2.14	1.68	2.12	1.74
Quick ratio	1.98	1.96	1.95	1.85	1.94	1.63	2.07	1.67	2.05	1.72
Cash ratio	0.95	1.70	0.86	1.37	0.68	1.16	0.68	0.98	0.73	1.21
Debt to total assets ratio	0.56	0.37	0.55	0.37	0.53	0.32	0.53	0.30	0.56	0.29
Equity ratio	0.44	0.37	0.43	0.37	0.45	0.32	0.47	0.30	0.44	0.29
Basic funding ratio	1.54	1.13	1.50	1.20	1.71	1.82	4.74	21.09	6.22	30.30

Source: own elaboration.

negative value of −11.95 for 2020. This result indicates that this kind of company, on average, had a problem paying their interest expenses. Although it has not been possible to show the minimum and maximum ratios in the table, the standard deviation indicates that they are companies that differ quite a lot in terms of results.

Another group of ratios summarizes the liquidity of public transport firms. The current ratio result shows that these companies can pay off their short-term liabilities with their current assets since their average has been around 2.00 for the last five years. This means that the current assets of these companies are more than twice more significant than their current liabilities. In the case of the quick ratio, the result is also around 2, meaning that these companies can pay their current liabilities without selling inventory. Regarding the cash ratio, the result over the last five years has varied between 0.68 and 0.95, indicating a high cash ratio. As the opportunity cost could be high, these companies, on average, have enough cash as they need. Of the difference in profitability ratios, in the case of liquidity ratios, there has been no problem in 2020.

The last block of ratios is long-term solvency ratios. The results show that the average debt to total assets and primary equity ratio remains almost unchanged. In contrast, the primary funding ratio has increased, especially in 2019 and 2020. This result means that transport companies, on average, have increased their solvency in the last two years, although the high standard deviation is noteworthy. Considering all this, we can say that public transport companies are solvent companies according to the analyzed period results.

Given this dispersion in the result, we cannot generalize the result. To see the results of these companies in more detail, the results have been divided into quartiles. On this basis, it will be better to see the analyzed companies' economic and financial situations.

4.1.1. Profitability ratios

To deepen the situation of public transport companies, we have used descriptive analysis by quartiles. The quartiles are the three values of the variable that divide a set of ordered data into four equal parts. Q1, Q2, and Q3 determine the values corresponding to 25%, 50%, and 75% of the data. Q2 coincides with the median.

Analyzing the ROA by quartiles (Table 3), we can see a big difference between Q1 and Q3. Even if the sample is not very large, there are companies with less than 1% economic profitability and others reaching up to 10% of ROA in the years under

Table 3. Descriptives of the profitability ratios by quartiles.

		2016	2017	2018	2019	2020
ROA %	Q1 − 25	0.33	0.71	0.78	0.77	−9.87
	Q2 − 50	3.75	5.76	3.19	2.44	0.03
	Q3 − 75	10.17	9.22	7.80	7.04	2.18
ROE %	Q1 − 25	0.30	0.74	0.13	0.47	−19.84
	Q2 − 50	6.73	8.53	3.51	4.84	−.44
	Q3 − 75	13.42	16.65	11.05	12.97	5.77
Profit margin on sales %	Q1 − 25	0.09	0.56	0.51	0.22	−16.67
	Q2 − 50	2.84	4.11	3.13	3.19	−3.49
	Q3 − 75	9.31	10.65	7.81	9.26	4.50

Source: own elaboration.

analysis. It's important to highlight the results of 2020. As we can see, the worst ROA results are in this year for the companies grouped in these three quartiles. In quartile 1, the result is negative (-9.87). In quartile 2 are the companies whose profitability in percentage is almost equal to 0 and finally, in quartile 3 are the companies that have reached a ROA of 2.18%, the lowest result of the last five years. This result difference is even more significant if we analyze the financial profitability of transport companies in Spain. Analyzing ROE, it is shown that there are groups of companies (Q1 and Q2) in 2020 that have negative profitability compared to previous years when there have been no financial profitability problems. This again indicates the pandemic's impact on companies in the sector. Analysing Q3 of 2020, we see that the result is 5.77%, which means that the companies that are grouped in this quartile have generated profit for their owners based on their primary activity. However, this profit is less than half of the previous years.

Generally, analyzed companies differ according to their profitability but do not present negative results. These results show that public transport companies are generally profitable according to their primary activity.

In Table 4, we have analyzed the above indicators categorized by size and type of transport service management (public and private). To this end, in Tables 4, 5, and 6, the mean difference test was applied to identify behavior under these two criteria. Specifically, the sample has been divided into smaller entities (small and medium entities) and larger entities.

In terms of profitability, it can be said that private companies are more profitable than public companies, and the latter has negative profitability. In this sense, smaller companies are more profitable than larger companies.

4.1.2. Liquidity ratios

The results shown in the description table showed that the analyzed companies were companies that had sufficient liquidity to meet their short-term debts during 2016-2020. Therefore, these firms are attractive to their creditors because their economic and financial situation enables them to have enough liquidity in the short term. To not generalize this result to all transport companies, the result has been divided by quartiles (Table 4).

Table 4. Descriptives of the profitability ratios by size and management.

Variable		ROA		ROE		Profit margin on sales	
Total sample	Mean	2.094		−1.890		2,957.320	
	St. Dev.	14.940		104.699		16,780.830	
Smaller entities	Mean	4.961		7.859		4,405.255	
	St. Dev.	12.581		67.877		21,098.79	
Larger entities	Mean	−2.548		−17.674		613.044	
	St. Dev.	17.211		144.988		3,155.404	
Public Management	Mean	−2.902		−9.969		534.721	
	St. Dev.	18.716		121.391		15,544.4	
Private Management	Mean	4.425		1.880		4,087.866	
	St. Dev.	12.192		96.139		17,261.26	
Mean difference test (p value)	Size	3.727***	(0.000)	1.766*	(0.079)	1.635**	(0.052)
	Manage	−3.473***	(0.000)	−0.781	(0.435)	−1.467**	(0.072)

Note: ***indicates 1% significance level. **indicates 5% significance level. *indicates 10% significance level.
Source: own elaboration.

Table 5. Descriptives of the liquidity ratios by size and management.

Variable		Current ratio		Quick ratio		Cash ratio	
Total sample	Mean	2.064		2.000		0.781	
	St. Dev.	1.771		1.754		1.299	
Smaller entities	Mean	2.513		2.457		0.974	
	St. Dev.	1.942		1.934		1.488	
Larger entities	Mean	1.337		1.260		0.467	
	St. Dev.	1.130		1.068		0.832	
Public management	Mean	1.742		1.648		0.670	
	St. Dev.	1.663		1.622		1.130	
Private management	Mean	2.215		2.165		0.832	
	St. Dev.	1.805		1.795		1.371	
Mean difference test (p value)	Size	5.047***	(0.000)	5.204***	(0.000)	2.857***	(0.005)
	Manage	−1.857**	(0.065)	−2.051**	(0.042)	−0.861	(0.390)

Note: ***indicates 1% significance level. **indicates 5% significance level. *indicates 10% significance level.
Source: own elaboration.

Table 6. Descriptives of the solvency ratios by size and management.

Variable		Debt to total assets ratio		Equity ratio		Basic funding ratio	
Total sample	Mean	0.543		0.447		3.141	
	St. Dev.	0.330		0.328		16.511	
Smaller entities	Mean	0.523		0.463		4.400	
	St. Dev.	0.366		0.365		20.927	
Larger entities	Mean	0.577		0.423		1.102	
	St. Dev.	0.259		0.259		0.378	
Public Management	Mean	0.518		0.482		1.456	
	St. Dev.	0.289		0.289		1.203	
Private Management	Mean	0.555		0.431		3.928	
	St. Dev.	0.347		0.345		19.951	
Mean difference test (p value)	Size	−1.192	(0.117)	0.873	(0.192)	1.443*	(0.075)
	Manage	−0.773	(0.440)	1.058	(0.291)	−1.035	(0.302)

Note: ***indicates 1% significance level. **indicates 5% significance level. *indicates 10% significance level.
Source: own elaboration.

Analyzing the current ratio result in the period of 2016-2020 in Q3, it can be seen that companies in this quartile have almost more than three times more liquid assets (around 3) than current liabilities. The Q2 result for the years analyzed is more significant than 1, indicating that the companies in this group have optimal liquidity. The worst result is for companies that are grouped in Q1, as they have liquidity problems, i.e., their current liabilities are higher than their current assets. It should be noted that there has been a steady increase in the current ratio in the five years analyzed, with the result being higher for three quartiles in 2020 than in any previous year analyzed. If we analyze the quick ratio, we can say that the result is in line with the results of the current ratio. Q2 and Q3 companies have enough liquidity to meet 100% of the debt without selling their stocks. In all cases, it should be taken into account that these companies will have very little stock, so there is not much difference in the results of these two ratios. The results of this ratio have evolved positively in the years analyzed. Analyzing the cash ratio, the group of Q1 companies from 2016 to 2020 is not keeping enough cash to fund its operations. Outcomes of Q3 have shown that these companies can pay at least 70% (70% of the lowest 2018 cash ratio result of the five years analyzed) of their current liabilities by cash. However, they could have a high opportunity cost that should be evaluated. In summary of the liquidity ratios, we can say that the companies grouped in the quartiles Q2 and Q3

are the companies with a reasonably high level of liquidity, being out of danger of suspension of payments. While the companies grouped in the Q1 quartile are companies with a low level of liquidity.

In Table 5, we have analyzed the above indicators categorized by size and type of transport service management (public and private).

The liquidity situation is more favorable in the case of private companies than in the case of publicly managed companies. This is probably a reflection of the delays that, on certain occasions, may occur in government payments in their contributions to these public management entities. In terms of size, smaller entities have a better liquidity situation in the three ratios analyzed, with a high significance level.

4.1.3. Solvency ratios

Solvency ratios analyze the long-term survival of companies. The descriptive results have shown that, on average, these companies had guaranteed long-term solvency. In this section, we will look more closely at this result to see whether there is much difference between the solvency of these companies by quartiles (Table 7).

Analyzing the long-term solvency ratios, we see that the highest values are found in the result for the year 2020. This means that transport companies have increased their long-term debt. This is an expected result, as the solvency ratios analyzed above showed an increase year on year, which means that companies decrease current liabilities but increase long-term liabilities. Analyzing the debt to total assets ratio by quartiles, the companies in Q1 have around 30% of their total assets financed by total liabilities. Meanwhile, the median of this ratio stands around 50% over the periods analyzed. The companies in Q3 indicate that around 80% of their assets are financed through debts. As we can see, this trend is increasing for companies in all quartiles. The equity ratio by quartiles shows that the companies grouped in Q3 finance around 70% of total assets through shareholder's equity. The result of Q2 is around 50% from 2016 to 2019, which is not bad, but in 2020 it dropped to 46%.

Meanwhile, other companies from Q1 finance around 23% of their assets through equity. This ratio will also show worse values in 2020. The results of the primary funding ratio have shown that all quartile results are at an optimal level. This result also indicates the high short-term solvency of these companies. Although this solvency was reduced in 2020, we can see the table for companies grouped in the Q3 quartile. (Table 8)

In Table 6, we have analyzed the above indicators categorized by size and type of transport service management (public and private).

Table 7. Descriptives of the liquidity ratios by quartiles.

		2016	2017	2018	2019	2020
Current ratio	Q1 − 25	0.80	0.85	0.86	0.87	.88
	Q2 − 50	1.20	1.28	1.34	1.55	1.62
	Q3 − 75	2.79	2.75	2.72	3.12	2.80
Quick ratio	Q1 − 25	0.74	0.79	0.83	0.82	0.80
	Q2 − 50	1.18	1.23	1.30	1.48	1.47
	Q3 − 75	2.77	2.65	2.68	2.88	2.80
Cash ratio	Q1 − 25	0.07	0.06	0.03	0.06	0.02
	Q2 − 50	0.26	0.32	0.31	0.31	0.23
	Q3 − 75	0.76	1.09	0.70	0.75	1.00

Source: own elaboration.

Table 8. Descriptives of the solvency ratios by quartiles.

		2016	2017	2018	2019	2020
Debt to total assets ratio	Q1 − 25	0.32	0.31	0.26	0.29	0.32
	Q2 − 50	0.48	0.48	0.49	0.44	0.54
	Q3 − 75	0.77	0.72	0.70	0.78	0.81
Equity ratio	Q1 − 25	0.23	0.25	0.24	0.22	0.19
	Q2 − 50	0.52	0.51	0.50	0.56	0.46
	Q3 − 75	0.68	0.68	0.71	0.71	0.68
Basic funding ratio	Q1 − 25	0.89	0.91	.95	0.96	0.94
	Q2 − 50	1.10	1.12	1.16	1.17	1.16
	Q3 − 75	1.89	1.86	1.94	2.32	1.79

Source: own elaboration.

Concerning solvency, there are no differences between public and private companies, nor in size, although smaller institutions are more solvent in terms of the primary funding ratio.

4.2. Z-score analysis

The Altman Z-score (1968) has been selected to measure the financial health of transport companies. Based on Altman's experience with companies in financial difficulties, an index was developed using five ratios and five weights to forecast the bankruptcy of listed manufacturing companies. This model has been adjusted over time, and the Z-score was adapted for companies not listed on secondary markets. As our sample is for non-listed companies, the model has the following formulation:

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$$

Where Z' is the index of bankruptcy; X1= (Current Assets-Current Liabilities)/ Total Assets; X2= Retained Earnings/Total Assets; X3= Earnings before Interest and Taxes/Total Assets; X4= Book Value of Equity/Total Liabilities; X5= Sales/Total Assets. Results of Z-score show that, in practice, companies can be classified into three different areas:

Considering all this, we have classified our sample according to the Z-score formula during the analyzed periods (Table 9). First, we will analyse the evolution of the companies classified in the 'safe' zone. In the period analyzed, it can be seen that the year in which most transport companies were classified as safe (32%) was 2016. This percentage has been in the range of 20%-25% in the following three years, dropping significantly in 2020 to 18%. This means that the number of companies classified in the 'safe' zone has been reduced over the years.

Table 9. Z-score result.

	2016		2017		2018		2019		2020	
Zscore	N	%	N	%	N	%	N	%	N	%
Safe zone	14	32%	9	20%	11	25%	10	23%	8	18%
Grey zone	20	45%	26	59%	23	52%	25	57%	17	39%
Distress zone	10	23%	9	20%	10	23%	9	20%	19	43%
Total	44	100%	44	100%	44	100%	44	100%	44	100%

Source: own elaboration.

Since the number of classified companies has fluctuated between 45% and 57%, falling to 39% in the most recent year reviewed, the examination of the companies classified in the 'grey' zone has revealed an evolution pattern that is comparable to that of the companies classified in the 'safe' zone (2020). In absolute numbers, we can say that from 20-26 companies, in 2020, the number of companies classified in the 'grey' zone has dropped to 17. This result implies that 17 companies from the sample probably will have problems of survive in the future, but this does not mean that they are going bankrupt. So these companies should take steps to avoid insolvency in the subsequent periods.

The last group of Z-score is the 'distress' zone, where there have been more changes in the last year analyzed. The number of companies classified in this area oscillated between 9-10, but as we can see in the table, in 2020, this number doubled to 19 companies. This is a worrying figure as it means 19 of the analyzed companies are likely to fail. In percentages, this number is 43% of the total 2020 sample.

Taking all this into account, we can say that public transport companies are generally solvent companies since most (57%) are classified in the safe and grey zones. Even though the outcomes were better in previous years of the pandemic, we compare the findings for 2019 and 2020, we can see that 35 out of the 44 enterprises in 2019 were categorized in these two zones, whereas only 25 companies were in these zones in 2020. This is a significant increase, although it should be borne in mind that 2020 was the year of the pandemic that caused problems for most companies in all sectors.

To get a more transparent and detailed picture of these companies, the Z-score has been compiled based on their management and size. Fourteen transport companies analyzed in this study are public companies, and 30 are privately managed. In terms of size, the number of companies analyzed has varied over the years, although the variation has not been very high. In the case of large companies, the number has remained the same over the years at 17, and only in 2020, the number has decreased by 16. Medium-sized companies have increased yearly, and small companies have decreased, except in 2022. The classification of companies by size has been done based on the number of employees and total assets. (Table 10)

If we analyze the companies by management and by Z-score zone, we see that private companies are more solvent and therefore have a better chance of surviving in the market. In the grey zone, the presence of both types of companies is around 50% of their total per category, and in this zone, there are no remarkable differences. Analyzing the distress zone, we see that public companies are more at risk of bankruptcy, and by 2020 the % of public companies in this group has almost doubled.

If we analyze the transport companies by size, we see that in the safe zone, there are no large companies in the last two years, which was previously two companies in 2016 and 2018 and 1 company in 2017. Small firms have also decreased their presence in this group, reaching 0 in the last two years. The most significant number of companies by size grouped in this zone are medium-sized companies, which have not exceeded number 10 in any year. Medium-sized companies have either followed a clear trend of increase or decrease. Analyzing the grey zone, it can be seen that the most significant percentage of large companies are clustered in this zone, but in 2020

Table 10. Z-score result by size and type of management.

Zscore			2016 N	2016 %	2017 N	2017 %	2018 N	2018 %	2019 N	2019 %	2020 N	2020 %
Safe zone	Management	Public	3	21%	3	21%	3	21%	2	14%	1	7%
		Private	11	37%	6	20%	8	27%	9	30%	7	23%
	Size	Small	3	60%	1	20%	1	33%	0	0%	0	0%
		Medium	9	41%	7	32%	8	33%	10	37%	8	31%
		Big	2	12%	1	6%	2	12%	0	0%	0	0%
Grey zone	Management	Public	6	43%	7	50%	7	50%	8	57%	5	36%
		Private	14	47%	19	63%	16	53%	12	40%	12	40%
	Size	Small	2	40%	3	60%	1	33%	0	0%	0	0%
		Medium	8	36%	12	55%	13	54%	12	44%	11	42%
		Big	10	59%	11	65%	9	53%	12	71%	6	38%
Distress zone	Management	Public	5	36%	4	29%	4	29%	4	29%	8	57%
		Private	5	17%	5	17%	6	20%	9	30%	11	37%
	Size	Small	0	0%	1	20%	1	33%	0	0%	2	100%
		Medium	5	23%	3	14%	3	13%	5	19%	7	27%
		Big	5	29%	5	29%	6	35%	5	29%	10	63%
Total			44	100%	44	100%	44	100%	44	100%	44	100%

•The % are of the total of each category per year (Total public companies = 14; total private companies = 30; total small companies 2016, 2017 = 5; total medium-sized companies =22; total big companies = 17; total small companies 2018 = 3; total medium-sized companies =24; total big companies = 17; total small companies 2019 = 0; total medium-sized companies =27; total big companies = 17; total small companies 2020 = 2; total medium-sized companies =26; total big companies = 16).
Source: own elaboration.

this was reduced, which has increased the presence of these companies in the distress zone. Specifically, in 2020 the number of big companies in the distressed zone has doubled compared to 2019. It should also be noted that before the health crisis, small companies were less represented in the bankruptcy group, although in 2020, the number of small companies in the distress zone increased. Even if this conclusion was anticipated given the effects of the health crisis, 2020 is the only year, after five years of analysis, showing no increase or decline trend.

5. Conclusions and implications

Following the study, we have verified that it is impossible to generalise conclusions about the profitability, liquidity, and solvency situation of public transport companies in Spain. For this reason, it has been necessary to complement the general analysis with an analysis by quartiles, size, and type of management to clarify some more specific conclusions, which are detailed below.

Because of the results obtained, we could say that public transport companies are generally profitable according to their primary activity. However, this has to be interpreted with caution, as these companies need public contributions to provide their service. Without them, the companies would not be able to survive. It would be interesting to analyze, in a continuation of this research, how these companies generate more or less profit, depending on their size, the municipality where the service is provided, and the public or private management, excluding the public contributions, received, to be able to conclude on their importance and dependence.

Despite the variations in outcomes from one company to the next for the year 2020, the quartile analysis demonstrates that the profitability was impacted, in varying degrees, by the Covid-19 epidemic for all of them. The number of trips and journeys

was considerably reduced, and the high fixed costs borne by these companies for the maintenance of their infrastructure continued to be borne by them. Differences are confirmed according to the type of management, with private companies showing higher profitability than public ones. In terms of size, smaller companies are more profitable than larger ones.

Regarding the liquidity situation, these companies, on average, have enough cash as they need. Of the difference in profitability ratios, in the case of liquidity ratios, there has been no problem in 2020. However, the fact of having a cash ratio of 0.78 (on average for the five periods analyzed) allows us to conclude that this situation may generate a relatively high opportunity cost due to the immobilization of liquid resources

When analyzed by quartiles, we find differences between companies. Companies with a comparatively strong level of liquidity that are not in danger of payment suspension are included in the Q2 and Q3 periods. At the same time, the companies grouped in the Q1 quartile are companies with a low level of liquidity. For such situations, the operating companies could seek the support of the municipality in question through 'comfort letters' against their creditors. According to the Cort of Auditors (Tribunal de Cuentas),) (2017), public sector corporate entities generally lack written rules regarding granting and issuing guarantees for third-party obligations and the subsequent control, monitoring, and assessment of the risks arising from the guarantees. In this regard, it is said that it would be advisable for there to be a prior authorization procedure by the government or ministry in question for this type of situation.

Differences have also been identified according to the type of management. Once again, private companies reflect a more favorable liquidity situation. In the case of size, smaller entities have a better liquidity situation in the three ratios analyzed, with a high significance level.

Regarding solvency analysis, the primary funding ratio has increased, especially in 2019 and 2020. Companies decrease current liabilities but increase long-term liabilities, and this trend is growing for companies in all quartiles. This situation reflects that these companies are forced to take on debt to maintain a constant renewal of their fleet and to ensure year after year the need for new investments in environmental sustainability (e.g., in the increasing use of hybrid or electric buses). Additionally, ongoing social adaptation to demands for universal accessibility, improved service quality, more frequent service, safety, and faster technical development, among other things (Delgado et al., 2019). On the other hand, as a consequence of the pandemic, they needed to increase these sources of long-term financing to strengthen their financial solvency and to be prepared to face possible losses in the following years. In the case of solvency, there are no differences between the type of management and size. However, smaller institutions are more solvent in the primary funding ratio.

All these results of descriptive studies show that the transport companies differ, so there is a difference between their profitability, solvency, and liquidity. In addition, the 2020 pandemic year has harmed these companies, considerably reducing their profitability. We can conclude that the study's hypotheses are accepted based on these results.

Regarding the Z-score analysis, we can conclude that, in general, public transportation companies are financially stable businesses because, among other things, the majority of them (57%) are categorized in the safe and grey zones and receive substantial financial support from the relevant public authorities. Based on Asensio y Matas (2017), most European cities have subsidies as the primary way of financing public transport, where the percentage of public transport costs covered by fare revenues is below 50%. However, businesses in the 'safe' and 'grey' zones had a 30% decline in 2020, the pandemic year, compared to the previous year, indicating the effect of Covid-19 on the solvency of businesses in this industry. Analyzing by type of management, private companies are more solvent and therefore have a better chance of surviving in the market. Analyzing the distress zone, we see that public companies are more at risk of bankruptcy, and by 2020 the % of public companies in this group has almost doubled. Before the health crisis, small companies were less represented in the bankruptcy group, although in 2020, the number of small companies in the distress zone increased.

The differences between public and private companies and by size can lead to greater efficiency in medium-sized companies that are privately managed through an administrative concession. At this point, it will be interesting to analyze, as a continuation of this study, whether it would be feasible to privatize it to achieve greater efficiency in the management of transport companies. This study shows the diversity of economic situations that can occur within the public transport sector, highlighting the importance for transport authorities to analyze the needs of each operating company based on the municipality where the service is provided. The operating concession generally cannot be compensated by providing other services. However, the service must continue to be guaranteed under the same conditions as in other municipalities, which are more profitable due to passenger demand.

In most cases, the private companies offering the service belong to large groups of transport operators (Gómez et al., 2014). In this way, the low profitability of some regions can be compensated for by other areas, and different services can also be offered, for example, in combination with intercity services. However, the unique needs of some municipalities or those that generate less attractive businesses should not be forgotten. Otherwise, operators could fail to comply with the public tender specifications for service provision.

As a continuation of this work, it would be interesting to carry out the analysis for several years after the onset of the pandemic. It will also be interesting to use user-generated content to complete and check the impact of new technologies and innovations, as several pieces of research underline its importance in different sectors of activity (Saura et al., 2021b; Saura et al., 2022b). Cascajo et al. (2018) say, 'if efficient public transport systems can be achieved in wealthy periods, they will be more resilient in periods of recession'.

Notes

1. https://sabi.bvdinfo.com
2. http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en

Disclosure statement

The authors declare no conflicts of interest and no violation of ethical standards in the course of this study.

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Data availability statement

The data underlying this article will be shared on reasonable request to the corresponding author.

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