KMÜ Sosyal ve Ekonomik Araştırmalar Dergisi (KMUSEKAD)
KMU Journal of Social and Economic Research
Yıl/Year: 2024, 26(47): 1455-1465

Geliş/Received: 08.05.2024
Kabul/Accepted: 02.12.2024

THE FINANCIAL BENCHMARKING OF GLOBAL RAILWAY COMPANIES

İsmail Çağrı ÖZCAN[1]

Abstract

The railway industry, traditionally under public ownership and management, has witnessed an increasing emphasis on performance measurement due to the commercialization, corporatization, and privatization trends over the past four decades. Most relevant studies in the performance measurement of rail companies adopt non-parametric methods like data envelopment analysis (DEA), which largely rely on operational and physical characteristics. Using an international sample of 39 railway companies from 12 countries from 4 continents, this study clusters publicly traded railway companies with respect to their financial characteristics such as capital structure management, profitability, cost efficiency, and investment management with the aim of a financial benchmarking. The findings highlight the effectiveness of cluster analysis in comparing the financial performances of rail companies and demonstrate its applicability to other sectors.

Keywords: Financial Performance, Capital Structure Management, Profitability, Cost Efficiency, Investment Management, Railway Industry, Cluster Analysis.
JEL Classification: G31, G32, L25

KÜRESEL DEMİRYOLU ŞİRKETLERİNİN FİNANSAL KIYASLAMASI

Öz

Son kırk yılda ticarileşme, şirketleşme ve özelleştirme eğilimlerinin etkisiyle geleneksel olarak kamu mülkiyetinde ve yönetiminde olan demiryolu endüstrisi, performans ölçümüne giderek daha fazla önem verilen bir sektör haline gelmiştir. Demiryolu şirketlerinin performansını ölçme konusundaki ilgili çalışmaların çoğu, veri zarflama analizi gibi parametrik olmayan yöntemleri uygulamakta ve büyük ölçüde operasyonel ve fiziki parametrelere dayanmaktadır. Bu çalışma, 4 kıtadan ve 12 ülkeden toplam 39 demiryolu şirketinden oluşan uluslararası bir örneklem kullanarak, demiryolu şirketlerini sermaye yapısı yönetimi, karlılık, maliyet verimliliği ve yatırım verimliliği gibi finansal özelliklerine göre gruplamakta ve finansal performanslarını kıyaslamaktadır. Çalışmanın sonuçları, kümeleme analizi yönteminin demiryolu şirketlerinin finansal performanslarını değerlendirmede etkin bir yöntem olduğunu ve yöntemin diğer sektörlere de uygulanabileceğini göstermektedir.

Anahtar Kelimeler: Finansal Performans, Sermaye Yapısı Yönetimi, Karlılık, Maliyet Verimliliği, Yatırım Yönetimi, Demiryolu Sektörü, Kümeleme Analizi.
JEL Sınıflandırması: G31, G32, L25

[1] Doç. Dr., Ankara Yıldırım Beyazıt Üniversitesi, Havacılık ve Uzay Bilimleri Fakültesi, Havacılık Yönetimi Bölümü, e-posta: icozcan@aybu.edu.tr, ORCID iD: https://orcid.org/0000-0002-3809-1847

1. INTRODUCTION

The railway industry has traditionally been characterized by public ownership and management simply because its unprofitable structure has created a barrier to entry for private entrepreneurs. During this period, performance measurement was not a priority at the agenda of the policy makers. Instead, they focused on the financial sustainability of the rail operations, which were continuously in need of public subsidy and equity injection. However, following the trends of commercialisation, corporatisation and privatisation, performance measurement (especially financial performance) in rail industry has become a crucial aspect.

Performance measurement at the rail companies offers significant benefits for a wide range of stakeholders. Primarily, it serves as a useful tool for evaluating the performance of the managers of the rail companies. From the creditors and equity investors point of view, performance measurement is both necessary and critical to shape their lending and equity decisons. Moreover, from the perspective of public revenue, improved financial performance of the rail companies turns into higher corporate tax payments and (where the government still hold an equity) dividend payments to the government treasury as the shareholder. Likewise, regulators should ensure a minimum safety and security performance level in the rail industry, which depends on the financial sustainabilty of the industry. When the rail companies can reflect their financial profit into lower fares, this can positively impact the customers of the rail companies like passengers and companies demanding rail freight services. For all these reasons, performance measurement in rail industry has become a popular topic both in the business world and academia.

The studies focusing on the performance measurement of rail companies have adopted a wide array of techniques and variables ranging from non-parametric methods like data envelopment analysis utilizing physical and operational variables (such as number of rail cars and locomotives) to trend analysis examining the changes in some basic financial metrics such as profitability, stock performance, and sales volume. This study aims to contribute to this literature by utilizing cluster analysis, which is a less explored method and provides a group of advantages over alternative performance measurement methods (such as pointing out hidden patterns and enabling a more focused analysis), to group global railway companies based on their financial variables and provide a financial benchmark. More concretely, the research question of this paper is: “What parameters can be used to benchmark the financial performance of the global railway companies?”. To achieve this objective, financial data from 39 rail companies from 12 countries from 4 continents are used to compute financial variables such as investment management, cost efficiency, profitability, and capital structure management. Subsequently, these rail companies are categorized into three distinct groups using cluster analysis. The findings of the study highlight the effectiveness of cluster analysis as an alternative approach for grouping rail companies based on financial parameters and serving as a tool for financial benchmarking.

This paper consists of five sections. Following the introduction, the second section provides an overview of studies and main methods on performance measurement of rail companies. The third section explains the dataset and methodology used in the analysis. While the fourth section summarises the empirical findings of the analyses, the final section provides a general assessment and discusses policy implications.

2. LITERATURE REVIEW

Performance measurement of an enterprise has many dimensions. It is not only a concern for the managers of the enterprise but also it produces important information for various stakeholders, such

as the shareholders and employees of the enterprise where the measurement is conducted, customers, suppliers, business partners, unions, regulators, government agencies, and non-profit stakeholders. From this perspective, performance measurement in rail enterprises (which generally have a public ownership) is of the interest not only to the transportation ministries to which they are affiliated but also to rail passengers, companies moving their freight by rail, and finance ministries that collect taxes from rail enterprises, logistics operators, exporters, and tourism enterprises which are directly affected by rail industry performance.

There are several main categories of performance measurement methods used by railway companies. The first category includes studies based on data envelopment analysis, which generally rely on traffic data, physical asssets (number of locomotives and rail cars), and some other operational parameters of rail companies. In these studies, data such as rail passenger and freight traffic are on the output side of the analyses, while parameters such as number of rail cars and locomotives and total energy use constitute inputs for the analysis. The efficiency scores calculated at the end determine the efficiency levels of the rail companies. Numerous articles worldwide have been published on efficiency measurements of rail companies using data envelopment analysis (DEA). Using a sample of 28 freight rail companies from the Slovak Republic, Mazanec (2018) adopted a DEA methodology to measure their performance. The input variables included in the DEA model were ratios such as non-current assets/total assets, current assets/total assets, debt/ total assets, cash liquidity, added value/sales volume, and assets turnover. His findings pointed out a general inefficiency in the rail freight industry. Likewise, Wanke et all. (2018) employed a multi-activity network DEA methodology to measure the performance of railway companies from six Asian countries. They used the number of passengers coaches, double-track railway route length, locomotives ready for operation, and the number of freight wagons as the inputs and rail-passenger-km, freight-km, and number of railway accidents as the outputs of the DEA model. Their findings suggested that Chinese railways were in need of enhancing passenger-operation efficiency whereas there was a room for improvement for other countries regarding rail freight efficiency. Le et all. (2022) compared the operational efficiency and financial performance of 18 rail lines run by seven rail companies in the Tokyo Metropolitan Area. They conducted line-level analyses of operational efficiency, cost efficiency, and revenue efficiency using DEA and Tobit regressions. The findings indicated that the quality of service can be taken into account by integrating in-vehicle congestion levels into assessments of operational efficiency.

In the second group of studies on rail performance, researchers either focus on the historical changes in key performance indicators or they use a cros-sectonal data to take a snapshot. Mizutani and Shoji (1997) compared the financial performance of urban rail systems in the United States and Japan. Using regression methodology, they used three parameters (operating revenue-cost ratio, farebox recovery ratio, and fare revenue percentage to total revenue) to measure the financial performance. They explained the higher profitability of Japanese rail operators through a group of factors like differences in urban structure (population density), productivity differences, wages, and the ownerhip structure. In a complementary study, Mizutani and (1997) examined the performance changes after the privatization of Japan national railway. Their findings indicated that improvements have been documented in terms of financial performance, service quality, labor productivity, and operating costs. To document the performance changes after the privatization of Japan Railway companies, Mizutani (1999) used a large group performance indicator such as operating revenue cost ratio, average fare, wage, labour productivity, and average operating costs. He documented an efficiency increase since the start of railway reform in 1987. Using data coming from 10 European rail freight companies, Wiegmans and Donders (2007) benchmarked their performances based on a group of performance parameters like employee productivity, sales productivity, and railcar productivity. The authors then reported the best

and worst performing European rail freight companies. Similarly, after examining the financial performance of Sri Lanka Railways over the 1977-2018 period, Danthanarayana and Kumarage (2021) indicated that the declining market for freight transportation relative to passenger transportation, the quick increase in fuel prices, and the rise in salaries and wages were the primary causes of poor financial performance despite increases in traffic and fares. To investigate the Georgian Railway Holding's key financial and economic performance indicators, Gondauri and Moistsrapishvili (2019) examined the economic contribution made by the railway industry to the Georgian economy over the 2006-2019 period. Their findings based on a correlation analysis methodology showed that the annual average geometric growth in Georgian Railway Holding's EBITDA was declining but still the sector is critical in terms of the development of the country. Rather than focusing on rail industry alone, Hofmann and Lampe (2013) compared the financial ratios of 150 logistics service providers, which consisted of 19 railway companies. The 150 logistics service providers examined were divided into the six groups (sea freight, railway, trucking, CEP (courier, express, parcel services), logistics service provider (LSP), third party LSP, and fourth party LSP). After this classification, the researchers evaluated the performance variations among these groups based on their asset structure, capital structure, liquidity, and profitability. As a last part of the study, Hofmann and Lampe (2013) implemented a correlation analysis as well. Their findings suggested that the railway industry had high tangibility and therefore low assest flexibility from the asset structure point of view whereas its capital structure heavily relied on long term debt. Guilherme and Cavenaghi (2017) employed a rather different approach (Balanced Scorecard), which relied on semi-structured interviews and an overview of the existing documentation, to measure the performance of the rail freight transportation companies. They made a case study using a Brazilian railroad company and concluded that the balanced scorecard approach could be applicable for performance measurement in rail industry.

Within the context of Türkiye, a small group of studies have analyzed the performance of the rail operations. Kazancıoğlu (2012), for example, adopted a DEA methodology to investigate the efficiency of The State Railways of the Republic of Turkey (TSR). He adopted the railway length per 10,000 people, the railway length per 1,000 square kilometers, passenger-kilometers, and passenger count as the inputs and the frequency of people traveling by railways as the output in his Model 1. In Model 2, he used the number of employees per track length, total operating expenses, subsidies as the inputs and total operating revenues as the output. A comparison of the performance of TSR with its counterparts from other European countries suggested that TSR was the least efficient rail operator according to both Model 1 and 2, when the constant return to scale is assumed.

Perçin and Çakır (2012) also used a DEA methodology to measure the performance of TSR between 1975 and 2010. They included passenger vehicle capacity, freight carrying capacity, and the number of employees as the inputs and passenger-km and netton-km for the outputs of the DEA analysis. They documented that the year 2010 was the most efficient year for TCDD, while the year 1982 was the least efficient.

Yıldız (2023) adopted an approach similar to that of Kazancıoğlu (2012) when analzing the efficiency performance of TSR. Like Kazancıoğlu (2012), Yıldız (2023) compared the efficiency of rail operations in Türkiye with those from a group of European countries over the 2011-2020 period. He used network length, wagon volume, and train movements as the inputs and passengers transported and goods transported as the outputs. The results of the DEA-Malmquist Index method documented a productivity decrease, which he linked with the COVID-1P epidemic in Türkiye, France, Italy, and some other countries.

Lastly, using a dataset complied by Turkish Central Bank, Dikmen (2023) evaluated the financial performance of enterprises operating in freight transportation by rail in Türkiye. Her findings based on the TOPSIS analysis indicated that in 2018 the railway freight transportation sector exhibited the highest financial performance, whereas 2009 was determined to be the year with the lowest performance.

3. DATA SET AND METHODOLOGY

3.1. Methodology

This study aims at clustering publicly traded global rail companies based on their financial performance indicators. The methodology adopted, cluster analysis, relies on assigning the objects with similar characteristics to the same groups. In other words, an object in a group (cluster) created with this method should be more similar to other objects in its cluster than to those in other clusters. It is essential for the clusters to be as homogeneous as possible. Relevant statistical tests are employed to ensure this homogeneity in cluster studies. The expectation here is to group the rail companies in a way that the clusters will provide a financial benchmark for the rail industry.

To cluster the rail companies, we use the following financial variables:

- Capital structure management
- Profitability
- Cost efficiency
- Investment management

After clustering the rail companies based on these four financial variables, we employ Mann-Whitney test to statistically verify that the clusters are different from each other.

3.2. Data Set

The dataset, which we gathered using the Bloomberg database, consists of publicly traded rail companies. We use data coming from the year 2015, which provides us the highest number of observations and free from the significant impact of the COVID-19 pandemic. It covers the financial variables of the of 39 rail companies from 12 countries from 4 continents. Table 1 depicts the definitions and descriptive statistics of the financial variables used in the analysis.

Table 1. The Definitions and Descriptive Statistics of the Financial Variables Used

Variable	Definition	Mean	Standart Deviation	Minimum	Maximum
Capital structure management	The ratio of total liabilities to total assets (financial leverage)	0.6154	0.1802	0.1408	0.9419
Profitability	The ratio of pretax income to operating expenses	1.2043	3.3342	0.0112	20.5339
Cost efficiency	The ratio of operating expenses to the total number of employes	0.1537	0.2212	0.0001	1.2289
Investment management	The ratio of total capital to the pretax income	1.70e+08	2.13e+08	1735174	9.03e+08

4. EMPRICAL RESULTS

As shown in Table 2, the cluster analysis produced three clusters. Cluster 1 and Cluster 2 entirely consist of Japanese rail companies while Cluster 3 consists of 24 rail companies from 12 countries. The

homogeneity of the Clusters 1 and 2 regarding the country of origin of the rail companies might be taken as a signal for the successful outcome of the cluster analysis.

Table 3 reports the descriptive statistics of each variable with respect to their clusters. The bottom three rows of Table 3 shows mean values of the net sales, total assets, and total capital for each of the three clusters to make a scale comparison among the clusters. These three rows respresenting three variables for the scales of the rail companies suggest that the average size is decreasing from Cluster 1 to Cluster 3.

The first variable in Table 3, capital structure management, has a fluctuation pattern. While Cluster 1 has a mean capital structure management (financial leverage) value of 0.5683, this value increases to 0.7013 and 0.6480 for Cluster 2 and Cluster 3, respectively. This implies that the rail companies in Cluster 1 have the lowest financial leverage when compared with those in Cluster 2 and Cluster 3. This lower financial leverage can be explained by the fact that the rail companies in Cluster 1 have the largest scale and therefore might be less dependent on debt.

Profitability, which we calculate by dividing the pre-tax income to operating expenses, is the second variable in Table 3. A closer look at the profitability ratios among the three clusters reveals that the profitability of the rail companies is decreasing from Cluster 1 to Cluster 3. While Cluster 1 has a mean profitability ratio of 1.3117, this figure decreases to 1.1698 and 0.4833 for Cluster 2 and Cluster 3, respectively. When we make a profitability comparison in terms of scale, we observe that larger rail companies tend to be more profitable. The huge economies of scale and large fixed costs in the rail industry might be the underlying reason for this tendency.

Table 2. The Results of Cluster Analysis

Cluster 1	Country	Cluster 2	Country	Cluster 3	Country
Keikyu Corp	Japan	East Japan Railway	Japan	Asciano	Australia
Kobe Electric Railway	Japan	Keifuku Electric Railroad	Japan	Aurizon	Australia
Kyushu Railway	Japan	Keisei Electric Railway	Japan	Burlington Northern Santa Fe	The United States
		Nagoya Railroad	Japan	BVZ Holding	Switzerland
		Nankai Electric Railway	Japan	Canadian National Railway	Canada
		Nishi-Nippon Railroad	Japan	Canadian Pacific Railway	Canada
		Odakyu Electric Railway	Japan	Central Japan Railway	Japan
		Sanyo Electric Railway	Japan	CSX Corp	The United States
		Shin-Keisei Electric Railway	Japan	Daqin Railway	China
		Tobu Railway Co	Japan	Firstgroup PLC	The United Kingdom
		Tokyu Corp	Japan	Genesee & Wyoming	The United States
		West Japan Ralway Co	Japan	Getlink SE	France
				Go-Ahead Group PLC	The United Kingdom
				Grupo Mexico	Mexico
				Guangshen Railway	China

	Halang Railway	Vietnam
	Jungfraubahn Holding	Switzerland
	Kansas City Southern	The United States
	MRS Logistica	Brazil
	MTR Corp	Hong Kong
	National Express Group	The United Kingdom
	Norfolk Southern Corp	The United States
	Union Pacific Corp	The United States
	TWC Enterprises	Canada

The third variable in Table 3 is the cost efficiency, which is measured by the ratio of operating expenses to the total number of employes. Regarding this parameter, our findings show that cost efficiency is decreasing from Cluster 1 to Cluster 2 and then to Cluster 3. This implies that larger rail companies tend to have higher operating expense per worker, which is somewhat against the economies of scale. A possible explanation of this finding might be the service differentiation in larger rail companies. Smaller rail companies might focus on a limited number of rail services whereas larger rail companies might add various rail services ranging from passenger and freight transport to station operations, track management, and other complementing commercial activities such as hotels, restaurants, and retail operations. This might increase the per worker operating expenses but as long as the profitability is increasing as well, such an increase in per capita operating expenses might not be an issue. As noted above, the larger rail companies tend to be more profitable. Therefore, they can easily tolerate the higher operating cost per employee.

The last variable in Table 3, the investment management variable (which equals to the ratio of total capital to the pretax income) is increasing with the increasing size of the rail companies (from Cluster 1 to Cluster 2 and then to Cluster 3). This finding suggest that the total capital is growing faster than the pretax income in smaller rail companies. This is somewhat expected when the high level of fixed assets in the rail industry is taken into account. More concretely, investments in rail industry (especially those in rail tracks and stations) fail to generate enough income for smaller rail companies, which in turn increases their ratios of total capital to the pretax income.

Table 3. The Descriptive Statistics of the Clusters

Variable		**Cluster 1**	**Cluster 2**	**Cluster 3**
Capital structure management	Mean	0.5682825	0.7013366	0.6480334
	Std, Dev,	0.1967208	0.058374	0.2843111
	Min	0.1408437	0.549381	0.3240429
	Max	0.9418833	0.780111	0.8559138
Profitability	Mean	1.31171	1.1698	0.4833077
	Std, Dev,	4.140537	1.544207	0.164419
	Min	0.0111524	0.0969233	0.3303124
	Max	20.53391	5.461538	0.65716
Cost efficiency	Mean	0.2393375	0.0200209	0.003938
	Std, Dev,	0.2448635	0.0448644	0.0009906
	Min	0.0050947	0.0001476	0.0030556

	Max	1.22888	0.160221	0.0050096
Investment management	Mean	2.90e+07	3.23e+08	6.91e+08
	Std, Dev,	3.59e+07	6.50e+07	1.91e+08
	Min	1735174	2.49e+08	5.35e+08
	Max	1.60e+08	4.67e+08	9.03e+08
Sales	Mean	9695.947	648.9992	232.5933
Total Assets	Mean	1.79e+10	1.56e+10	7.69e+09
Total Capital	Mean	2.40e+10	1.82e+10	1.01e+10

In the final stage of the analysis, whether the difference between clusters is statistically significant or not has been checked using the Mann-Whitney test, Table 4 presents the results of the respective Mann-Whitney test, According to the results reported in Table 4, Cluster 1 and Cluster 2 statistically differentiate in terms of all the financial variables (capital structure management, profitability, cost efficiency, and investment management) adopted, When we look at the Cluster 1 and Cluster 3 pair, Mann-Whitney test suggests that these two clusters are statistically different in terms of cost efficiency and investment management but no statistically difference is documented for capital structure management and profitability, Lastly, the examination of Cluster 1 and Cluster 3 pair reveals that these two clusters are statistically different only in terms of investment management, Considering the relatively low number of rail companies in the sample, we can infer that the results of the Mann-Whitney test are satisfactory in terms of the difference among the clusters,

Tablo 4: The Results of the Mann-Whitney Test

Variable	**Cluster pair 1-2**	**Cluster pair 1-3**	**Cluster pair 2-3**
Capital structure management	0.0089***	0.3159	0.4705
Profitability	0.0268**	0.3545	0.3123
Cost efficiency	0.0000***	0.0055***	0.5637
Investment management	0.0000***	0.0055***	0.0094***

Notes: (1) ***, **, and * stand for significance levels at 1%, 5%, and 10%, respectively, (2) Number of observations: 39

5. CONCLUSION AND POLICY IMPLICATIONS

This study examines how the financial benchmarking of the rail companies can be carried out using cluster analysis, The dataset, wihich consists of 39 rail companies from 12 countries from 4 continents, comes from the Bloomberg database, Four financial variables (capital structure management, profitability, cost efficiency, and investment management) are used to cluster the rail companies, After the cluster analysis, we ended up with three clusters,

The results of the study indicate that as the size of the rail company increases, rail companies tend to exhibit better financial performance, In addition, smaller rail companies tend to have higher financial leverage, Regarding the cost efficiency, our cluster analysis indicated that the ratio of operating expenses to the total number of employes decreases with decreasing size, This might be explained by the service differentiation in larger rail companies, Lastly, we report that smaller rail companies are more likely to have higher total capital to the pretax income ratios, implying that the pace of the increase

in income is smaller than that of the total capital in smaller rail companies, Our findings suggest that size matters in railway industry and managers of the railways should try to increase their size to achieve improved financial performance,

This article demonstrates that cluster analysis could be a viable method for comparing the financial performance of the rail companies, This successful implementation can also be applied to other transport modes as well in the future studies, Likewise, apart from using financial ratios, a group of operational ratios and physical features can be used in the future.

Ethical Statement

"The Financial Benchmarking of Global Railway Companies", the rules of Research and Publication Ethics were followed during the writing and publishing processes of the study and the data obtained for the study were not tampered with. Ethics committee permission is not required for the study.

Contribution Rate Declaration

All work contribution belongs to the author as he/she is the only author in the study.

Conflict Statement

This study did not lead to any individual or institutional/organizational conflict of interest.

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Extended Abstract

The Financial Benchmarking of Global Railway Companies

Aim: With the trends of commercialization, corporatization, and privatization, performance measurement, especially financial performance, has become crucial in the rail industry, Measuring performance in rail companies offers various benefits to stakeholders, It helps evaluate the performance of company managers and when rail companies turn their financial gains into lower fares, it benefits customers, including passengers and companies using rail freight services, This study aims to contribute to this literature by utilizing cluster analysis, a less explored method, to group global rail companies based on financial variables and provide a financial benchmark,

Literature Review: Performance measurement in an enterprise is multidimensional and not only concerns managers but also provides crucial information for various stakeholders, In the case of rail companies, which are typically publicly owned, performance measurement is of interest to transportation ministries, rail passengers, freight companies, finance ministries, logistics operators, exporters, tourism enterprises, and other stakeholders directly affected by the rail industry's performance,

Several major categories of performance measurement methods are prominent in rail companies, The first category includes studies based on data envelopment analysis (DEA), which typically utilize traffic data, physical assets (such as the number of locomotives and rail cars), and other operational parameters, These studies calculate efficiency scores to determine the efficiency levels of rail companies, Examples include Mazanec (2018), Wanke et al, (2018), and Le et al, (2022),

The second group of studies focuses on historical changes in major performance indicators or uses cross-sectional data for analysis, For example, Mizutani and Shoji (1997) compared the financial performance of urban rail systems in the United States and Japan, while Mizutani (1999) documented the performance changes after the privatization of Japan's national railway, Wiegmans and Donders (2007) benchmarked the performance of 10 European rail freight companies based on various performance parameters, and Danthanarayana and Kumarage (2021) analyzed the financial performance of Sri Lanka Railways over a 41-year period, Similarly, Gondauri and Moistsrapishvili (2019) examined the financial and economic performance indicators of Georgian Railway Holding over a 13-year period, Additionally, Hofmann and Lampe (2013) compared the financial ratios of 19 railway companies with those of other logistics service providers,

In the context of Turkey, a small group of studies has analyzed the performance of rail operations, Perçin and Çakır (2012), Kazancıoğlu (2012) and Yıldız (2023) used DEA to investigate performance of The State Railways of the Republic of Turkey (TCDD), Dikmen (2023), on the other hand, evaluated the financial performance of enterprises operating in rail freight transportation in Turkey using TOPSIS analysis,

Design/Methodology/Approach: The methodology adopted, cluster analysis, relies on assigning the objects with similar characteristics to the same groups, In other words, an object in a group (cluster) created with this method should be more similar to other objects in its cluster than to those in other clusters, It is essential for the clusters to be as homogeneous as possible, Relevant statistical tests are employed to ensure this homogeneity in cluster studies, The expectation here is railways will be grouped in such a way that the clusters will provide a financial benchmark for the rail industry,

Financial data from 39 rail companies from 12 countries across four continents were used to compute financial variables such as investment management, cost efficiency, profitability, and capital structure management, The rail companies are then categorized into three distinct groups using cluster analysis, After clustering the rail companies based on these four financial variables, we employ Mann-Whitney test to statistically verify that the clusters are different from each other,

Findings: The findings suggest that as rail companies increase in size, they tend to demonstrate better financial performance, Additionally, smaller rail companies tend to have higher financial leverage, In terms of cost efficiency, our cluster analysis reveals that the ratio of operating expenses to the total number of employees decreases with decreasing size, This could be attributed to service differentiation in larger rail companies, Finally, we observe that smaller rail companies are more likely to have higher ratios of total capital to pretax income, indicating that the increase in income is slower than that of total capital in smaller rail companies,

Conclusion: This article demonstrates that cluster analysis can be an effective method for comparing the financial performance of rail companies, This successful application could also be replicated in future studies focusing on other modes of transportation, The findings highlight the efficacy of cluster analysis as an alternative approach for grouping rail companies based on financial parameters and as a tool for financial benchmarking.