Analyzing the Correlation Between Logistic Companies' Revenues and the Dynamics of the S&P 500 Index in the Light of Accelerated Digitization

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The objective of this study is to examine the complex relationship between the revenues of logistics companies in the US market and the performance of the S&P 500 Index between 2009 and 2022. Through a comprehensive analysis, the study aimed to identify correlations and key patterns that could shed light on the impact of logistics companies on the performance of the S&P 500 Index. Key findings show a correlation coefficient of -0.18, suggesting a moderate negative correlation between logistics company earnings and movements in the S&P 500 Index. Notable trends emerged in key years, particularly 2020 and 2021, highlighting the resilience and responsiveness of logistics earnings to broader economic and market changes.

Keywords: digitization, logistics, S&P Index, business, global market

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1 Introduction

Traditional market as we know it from the past has undergone substantial transformation in the past two decades. Technological innovations, and not least the Internet, have changed the traditional ground rules (Dorčák et. al. 2015). The transport industry is a key sector for national economic and social development. Modern transport has become an important economic activity for human civilization. The transport industry is one of the main components of globalization, contributing significantly to the economy and playing a key role in daily activities around the world (Boqiang et. al, 2013).

To achieve effective business performance, it is essential to ensure a balance between the needs, requirements and expectations of the users of a particular service. It is necessary to carry out continuous measurements and to try to determine the planned set of values to be achieved. Logistics plays a very important role in all this, providing answers to questions of efficiency and optimization, considering the indicators that most influence rationalization (Stević et. al, 2017). On the one hand, the transport subsystem of logistics represents the largest percentage of logistics costs, and, on the other hand, it allows the purpose and objectives of logistics to be achieved because it affects the economic system of each country. To rationalize the logistics costs incurred in carrying out the various transport activities, good management is needed to identify appropriate strategies. Micro, small, and medium enterprises are suitable and interesting when considering the adoption of business process management strategies. In this context, the assessment of human resources is important because it influences the definition of business processes and their structuring, which according to Dobrosavljevic and Uroševic (2019).

The Global Industry Classification System (GICS) has 11 stock market sectors in its taxonomy. It further breaks down these 11 sectors into 24 industry groups, 68 industries, and 157 sub-industries. Companies which have transport in their core of business are part of the US index the S&P 500 Index. The index is categorized into 11 sectors, representing distinct classifications for the companies it monitors. These sectors encompass a wide range of industries, including healthcare, technology, energy, real estate, and more. The term "S&P" originates from Standard & Poor's, with the index tracking the performance of 500 large-cap U.S. companies. The industrial sector is very diverse and includes several sub-sectors such as aerospace

and defense, mechanical engineering, construction, transport and industrial conglomerates. The transportation segment includes companies involved in various modes of transportation such as airlines, logistics, railways, and shipping. Moreover, Warren Buffett advises investors to consistently invest in a low-cost S&P 500 index fund, emphasizing the importance of maintaining this strategy during both favorable and challenging market conditions. He further suggests that this approach is sound even for those who may not possess financial expertise, underscoring the simplicity and effectiveness of a long-term investment strategy in the S&P 500. Berkshire Hathaway Warren's company was considered in research by Pollák and others (2021) as a reference point in the analysis of search results and reputation scores. Although it did not outperform its parent company in general search results, its overall online presence and impact on reputation scores based on search results was considered. As a conglomerate with no individual brands, Berkshire Hathaway's reputation was reflected indirectly through its various investments and holdings, which provided a unique perspective in the study. In the context of this study, hypotheses go beyond mere conjecture, they are methodologically designed to explore, confirm, or refine underlying assumptions. The dynamic nature of financial markets requires a high approach, and our hypotheses are designed to reveal patterns, and trends in industrial sector.

(H0): There is no significant correlation between the annual revenue growth of logistics companies in the S&P 500 and the yearly changes in the S&P 500 index.

(H1): There is a significant correlation between the annual revenue growth of logistics companies in the S&P 500 and the yearly changes in the S&P 500 index.

2 Current state of knowledge of the analyzed issue

The original studies on financial contagion were based on Pearson's correlation coefficient, and researchers compared the Pearson's coefficients during the crisis and in normal times between financial markets. If the correlation coefficient is larger during a crisis, it means that there is a financial contagion effect. To explore methods for testing the behavior of financial contagion based on the joint movement of different market asset prices (Zhu et. al. 2018). Ang and Chen (2002) applied the asymmetric multivariate GARCH-M model to analyze the financial contagion. Bae et al. (2003) used the Multivariate Logistic regression to analyze extreme events

between different areas to examine the financial contagion. But all co-movement analysis only examined the existence of contagion, does not give the extent and trends of contagion. Haldane (2013) explored the relationships between network complexity, diversity, and financial fragility from the perspective of network ecology and epidemiology and presented the reasons for the fragility of the structure of the financial system. Another way to investigate possible effects of the pandemic on businesses is to analyze stock prices, in contrast to other data sources, they allow for the estimation of the consequences of an event without long observation periods (Ramelli & Wagner, 2020). According to the theory of efficient markets, stock prices represent the expected present discounted value of dividends changes in stock prices are the result of changing expectations about future returns and risks (Fama, 1970; West, 1988). The study from Paetsch and others (2017) critically analyses differences and synthesizes of different devices and types of digital traffic on the overall performance of mobile networks. At the same time, the study examines the correlation between mobile network dynamics and broader financial market trends. The research, which proposes a new framework for mobile data, aims to address the growing disconnect between network capacity, usage patterns and the underlying value of data. In addition, researchers claimed that freight distribution and transportation activities are as one of the primary sources of greenhouse gas emission (GHG) and high consumption of energy (Kim and Han, 2023). International Energy Agency claims that global carbon emission from transportation modes is around 24% of the total emission.

3 Materials and Methods

The main objective of this research was to examine the relationship between the revenues of logistics companies in the US market and the trends observed in the S&P 500 Index over the last 14 years (2009-2022). To achieve this objective, data was obtained from the US Securities and Exchange Commission, specifically using information available in 10-K annual reports.

The first step in the analysis was to calculate year-on-year growth rates. This method allowed a quick calculation of year-over-year growth rates for each year and for each individual company. The research then proceeded to calculate the average growth rate for each year, aggregated across all companies considered. This methodology was used to gain a comprehensive understanding of the annual revenue dynamics of

logistics companies in the US market and to see how these trends correlated with the broader movements observed in the S&P 500 Index over the 14-year period.

YoY Growth Rate=((Current Year Value-Previous Year Value) / Previous Year Value)×100

A correlation analysis was then carried out comparing the percentage sales growth of each company in the S&P 500 Index with the percentage change in the S&P 500 Index over several years. The aim of this analytical approach was to determine the extent to which the earnings performance of individual companies is consistent with the overall trends in the broader market. Correlation, as used in this study, is a statistical technique used to quantify the strength and direction of a linear relationship between two variables. The main correlation coefficient used in this context is the Pearson correlation coefficient, which is a widely accepted metric for such analyses.

In our case, the average revenue growth of logistic companies might be the dependent variable, and the yearly growth rate of the S&P 500 index is the independent variable.

Table 1: Investigated subjects

Name of the company	**Industry**
United Parcel Service	transportation
Union Pacific Railroad	transportation
CSX Transportation	transportation
Federal Express	transportation
Norfolk	transportation
Old Dominion Freight Line	transportation
Delta Air Lines	airlines/transportation
J.B. Hunt Transport Services	transportation
Southwest Airlines Co	airlines/transportation
Expeditors International of Washington	transportation
C.H. Robinson Worldwide	transportation

Source: own processing based on The Global Industry Classification System (GICS)

4 Results and discussion

The data was subjected to analysis, the following table presents the results of the regression statistical analysis. Subsequently, the results are discussed in the context of the topic.

Table 2: Results of statistical testing

Regression Statistics	
Multiple R	-0,188074619
R Square	0,035372062
Adjusted R Square	-0,052321386
Standard Error	13,16915066
Observations	14

Source: own processing

Given the weak negative correlation, it can be interpreted that as the annual growth rate of the S&P 500 Index rises, the average revenue growth of the 11 listed logistics companies tends to fall slightly on average and vice versa. However, the correlation is not strong, and the relationship does not have high predictive power. The weak negative correlation may indicate that the earnings growth of logistics companies does not accurately reflect the overall market trends represented by the S&P 500 index. Overall, the correlation coefficient of -0.18807 indicates a weak negative relationship between the average earnings growth of logistics companies in the S&P 500 Index and the annual growth rate of the S&P 500 Index.

The effects of the 2008 financial crisis continued to be felt in 2011 and had a lasting impact on businesses. Companies faced major challenges during this period because of the global economic slowdown. The resulting reduction in demand for transport, particularly in the manufacturing sector, had a significant impact on shipping volumes. The volatility of fuel prices during this period was an additional challenge that had a noticeable impact on the operating costs of these companies. In addition, the prevailing economic uncertainty and fluctuating patterns of international trade have introduced an additional layer of complexity that has potentially affected logistics companies' revenue streams. As a result, there has been an industry-wide

initiative as companies have begun to implement comprehensive transformation plans. These strategic efforts have required significant expenditure to upgrade infrastructure and adapt to evolving market trends. In the years that followed, a significant shift towards technology investment and a proactive attitude towards adapting to new trends in the industry emerged as important drivers of sales dynamics. This was a period of transformation, characterized by strategic investments in technology by companies. The emergence of the COVID-19 pandemic in recent years has led to a paradigm shift in consumer behavior. The significant increase in e-commerce activity has acted as a major catalyst, positively impacting parcel volumes for logistics companies. Increased demand for home delivery, coupled with significant changes in consumer preferences.

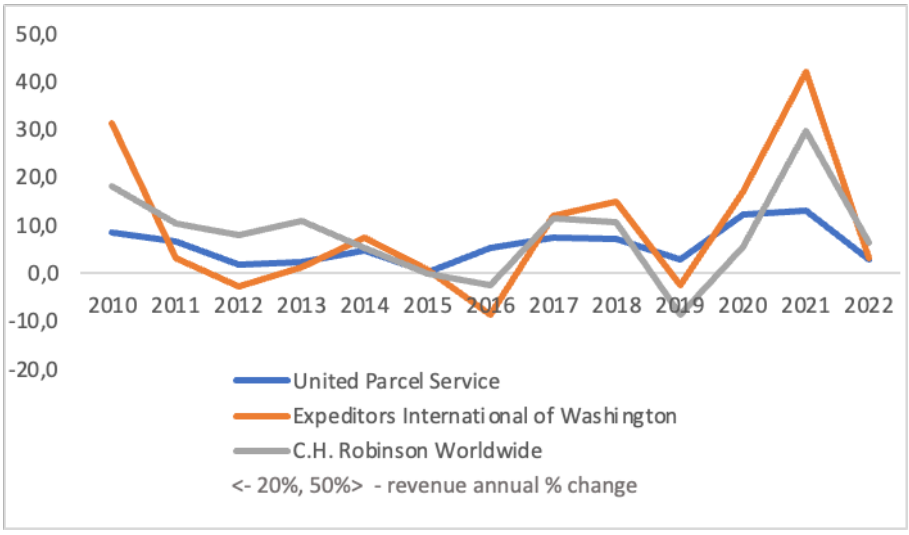

Figure 1: Revenue percentage growth
Source: own processing, specifically using information available in 10-K annual reports

The aerospace industry experienced a period of recovery in 2010, indicating that the effects of the global financial crisis have been overcome. The two controlled companies, like their partners, benefited from the improving economic climate. In particular, the recovery was underpinned by increased consumer confidence and a recovery in business travel. This joint drive contributed to a stabilization of sales, which were characterized by the companies' renewed travel activity. However, the subsequent emergence of the COVID-19 pandemic in the following years brought

about a significant change in the operating environment for both Delta and Southwest. This period was characterized by a sharp decline in demand for air travel, accompanied by an increase in flight cancellations and major operational problems. The imposition of government restrictions, widespread lockouts and pervasive global uncertainty had a profound impact on passenger behavior and led to visible changes in travel decisions. The resulting environment, characterized by an unprecedented confluence of external factors, has significantly eroded the once stable revenue performance of these airlines.

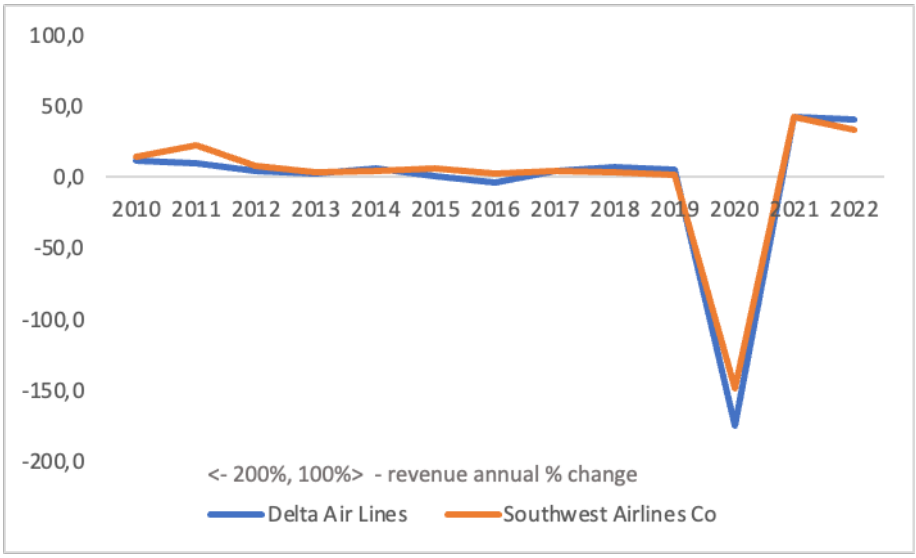

Figure 2: Revenue percentage growth
Source: own processing, specifically using information available in 10-K annual reports

5 Conclusion

In summary, the objective of this research was to clarify the complex relationship between the annual earnings growth of logistics companies within the S&P 500 Index and the corresponding annual changes in the S&P 500 Index. The focus was on assessing the existence and significance of the correlation between these variables. The obtained correlation coefficient of -0,18 indicates a weak negative correlation. Although this correlation is statistically significant, its magnitude suggests that the annual earnings growth of logistics companies in the S&P 500

Index is only moderately related to the annual changes in the S&P 500 Index. 2011, characterized by a global economic slowdown, and the following years 2020-2021, characterized by the unprecedented impact of the COVID-19 pandemic on the global economy, were identified as the critical years for this analysis. This was a critical time for the annual revenue growth dynamics of logistics companies and the broader market, represented by the S&P500 Index. With respect to the hypotheses formulated, the research results lead us to reject the null hypothesis (H0), which implies the absence of a significant correlation, and to accept the alternative hypothesis (H1), which implies a statistically significant correlation. Although the correlation is statistically detectable, the weak nature of the correlation highlights the importance of considering other factors and nuances that contribute to the complex dynamics of the logistics sector within the broader financial environment. The correlation between annual earnings growth and the S&P 500 Index was the primary focus of the research. Other relevant factors such as industry-specific dynamics, geopolitical events and regulatory changes were not part of the analysis and may therefore limit the scope of the findings.

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