

IMPACT OF EXCHANGE RATES AND OIL PRICES ON THE VALUATION OF COMPANIES FROM THE TSL SECTOR

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Abstract: The transport, forwarding and logistics (TSL) sector in Poland has seen dynamic growth in recent years. Great attention is paid to road freight transport, which in 2011-2017 increased by almost 37%. The aim of the work was to examine the impact of macroeconomic variables, such as oil prices and USD / PLN and EUR / PLN exchange rates on the valuation of companies from the TSL sector in 2010–2018. For this purpose, spectral analysis was used. It was noted that companies most often reacted to changes in the USD / PLN exchange rate, and the least was observed in the case of changes in oil prices.

Keywords: TSL sector, cross-spectral analysis, exchange rates, crude oil.

1. Introduction

The valuation of a company's shares does not depend solely on the internal situation of the company, as external factors have a significant influence on it. One of the most important elements that shapes the share price of a listed company is the situation on world markets, as well as macroeconomic variables that affect profits generated by a company's operations. The problems of exchange rates, prices of raw materials and foreign trade are usually analysed in relation to countries (Gawlikowska-Hueckel, and Umiński, 2013). Adopting a given sector with potentially strong connections with the respondents draws attention to the occurrence of additional phenomena.

Economic growth, growing international trade exchange and the high level of foreign investments create excellent prospects for the development of the Polish market of transport and logistics services. After 2004, the moment in which Poland joined the European Union, an increase in the activity of Polish transport companies on the international arena was observed

– about half of Polish companies from this industry operated on international markets three years after Poland's accession to the community (Ślubowski, 2007). In addition, it is worth emphasising that the industry itself is of exceptional importance in creating many jobs and providing huge revenues to the State budget due to high taxes imposed mainly on fuels (Garncarz, 2015). The transport, forwarding and logistics (TSL) market is therefore an interesting space for reflection on the impact of changes in macroeconomic factors on a given economic sector.

This study researched the impact of changes in USD/PLN and EUR/PLN currency exchange rates and the costs of oil barrels on the valuation of shares of Polish companies in the transport, forwarding and logistics sectors. The selected variables are global, which means that a given country has no direct influence on the way they will be shaped, but they depend on many factors and the current political and economic situation in the world.

2. Purpose and methods

The aim of the study was to assess the impact of global variables on the prices of TSL index share prices. The data used in the study included the period from December 2010 to October 2018. The length of individual time series used for the analysis was determined by the availability of data on specific companies, and therefore the results of spectral analysis for individual relationships between selected variables and companies have different interpretations of the frequency of changes. Ten time series were used in the work: exchange rates USD/PLN, EUR/PLN, crude oil prices and valuations of seven companies from the TSL industry: PKP Cargo S.A., AVIA Solutions Group, EnterAir S.A., KDM Shipping Public Ltd., OT Logistic S.A., Trans Polonia S.A. and Zastal S.A.

Spectrum estimation is based on a set of empirical observations for the time series $\{y_t : t = 1, 2, \dots, T\}$, on the basis of which the inference of the stochastic process Y_t is carried out. One method of estimating the spectrum is to use the discrete Fourier transform, which for the series $\{y_t : t = 0, 1, \dots, T - 1\}$ is defined (and for $s = 0, 1, \dots, T-1$) as:

$$x_s = \sum_{t=0}^{T-1} y_t e^{-2\pi i s t / T}$$

After the Fourier transform, the Parseval equality was demonstrated (Talaga, Zieliński, 1986). Therefore, the periodogram function of the studied process can be described by the following formula:

$$f(w_s) = \frac{1}{2\pi} (\gamma_0 + 2 \sum_{j=1}^{T-1} \gamma_j \cos(jw_s))$$

where consecutive γ_j (for $j = 0, 1, \dots, T-1$) are values of autocorrelation coefficients in the attempt. In order to examine the relationship between two variables, it is necessary to analyse the stationary reciprocal spectrum (i.e. $cov(x_s; y_{s+j}) = cov(x_t; y_{t+j}) \forall (s, t, j)$) of the two-dimensional process $\begin{bmatrix} x_t \\ y_t \end{bmatrix}$, $t \in \mathbb{N}$. The spectrum function of such a process has the form (Łuczyński, 2015):

$$f(\omega) = \begin{bmatrix} f_{xx}(\omega) & f_{xy}(\omega) \\ f_{yx}(\omega) & f_{yy}(\omega) \end{bmatrix} = \frac{1}{2\pi} \sum_{j=-\infty}^{\infty} e^{-i\omega j} \Gamma(j)$$

$\Gamma(j)$ is the function of autocovariance of the discussed process that equals $\begin{bmatrix} \gamma_{xx}(j) & \gamma_{xy}(j) \\ \gamma_{yx}(j) & \gamma_{yy}(j) \end{bmatrix}$

where $\gamma_{xx}(j) = cov(x_t; x_{t-j})$, $\gamma_{xy}(j) = cov(x_t; y_{t-j})$, $\gamma_{yy}(j) = cov(y_t; y_{t-j})$, $\gamma_{yx}(j) = cov(y_t; x_{t-j})$ (Łuczyński, 2015). The diagonals of the spectral function of the discussed two-dimensional process are: the density of one-dimensional processes (x_t, y_t), which take the values respectively: $f_{xx}(\omega) = \frac{1}{2\pi} \sum_{j=-\infty}^{\infty} \gamma_{xx}(j) e^{-i\omega j}$, $f_{yy}(\omega) = \frac{1}{2\pi} \sum_{j=-\infty}^{\infty} \gamma_{yy}(j) e^{-i\omega j}$ and functions of mutual spectral density $f_{xy}(\omega) = \frac{1}{2\pi} \sum_{j=-\infty}^{\infty} \gamma_{xy}(j) e^{-i\omega j}$, $f_{yx}(\omega) = \frac{1}{2\pi} \sum_{j=-\infty}^{\infty} \gamma_{yx}(j) e^{-i\omega j}$.

The calculations also used a coefficient of multiple coherence allowing one to indicate the frequency components of two-time series that are correlated with each other (Mierzejewski, and Lampart, 2018). This takes values from 0 to 1.

In the next stage, the results of spectral density values of individual series were reviewed – their high value indicates the importance of a given frequency in shaping the overall dynamics of a given series. The last step was to calculate the values of time shifts for selected frequencies, which made it possible to assess the causality of the analysed relationships.

3. The role and impact of macroeconomic variables on the valuation of Polish companies in the TSL sector

This paper uses macroeconomic variables, such as the cost of a barrel of crude oil, as well as exchange rates USD/PLN and EUR/PLN, which may have a direct impact on the results of operations of enterprises providing transport, forwarding and logistics services.

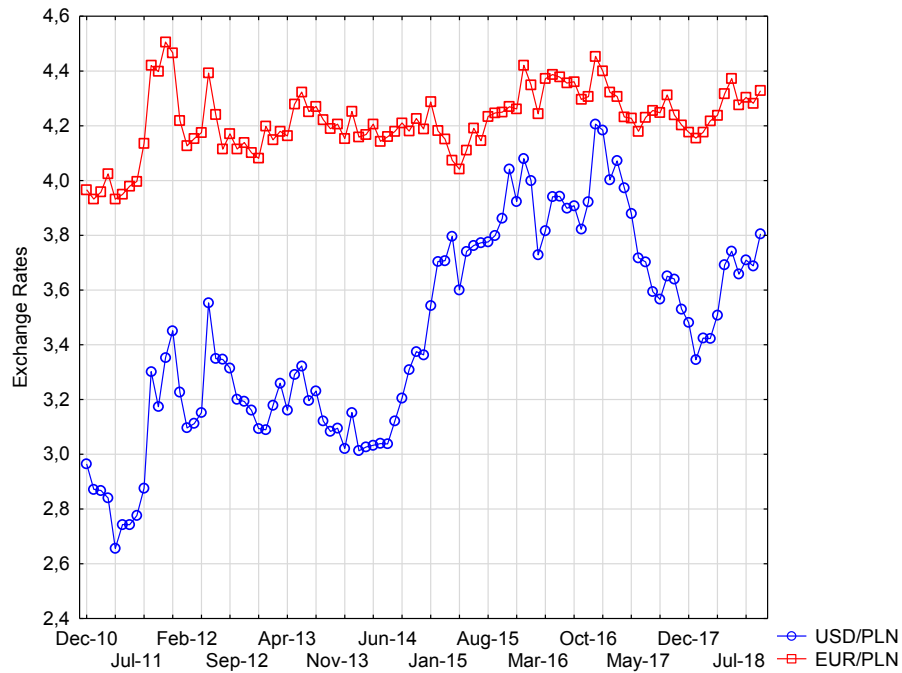


Figure 1. Exchange rates USD/PLN and EUR/PLN. Source: Own study based on data from the Financial Portal Investing.com, data accessed: 01 December 2018.

Figure 1 presents the exchange rates of USD/PLN and EUR/PLN in the period from December 2010 to October 2018. In December 2010, USD 1 was equal to PLN 2.965, and the highest value in the given period was in November 2016, when USD 1 was equal to PLN 4,2059, while at the end of 2018, the exchange rate fluctuated around 3.8 USD/PLN. Significantly lower fluctuations were observed in the EUR/PLN exchange rate from December 2010 to October 2018, where it rose only from 3.9665 to 4.3281 EUR/PLN.

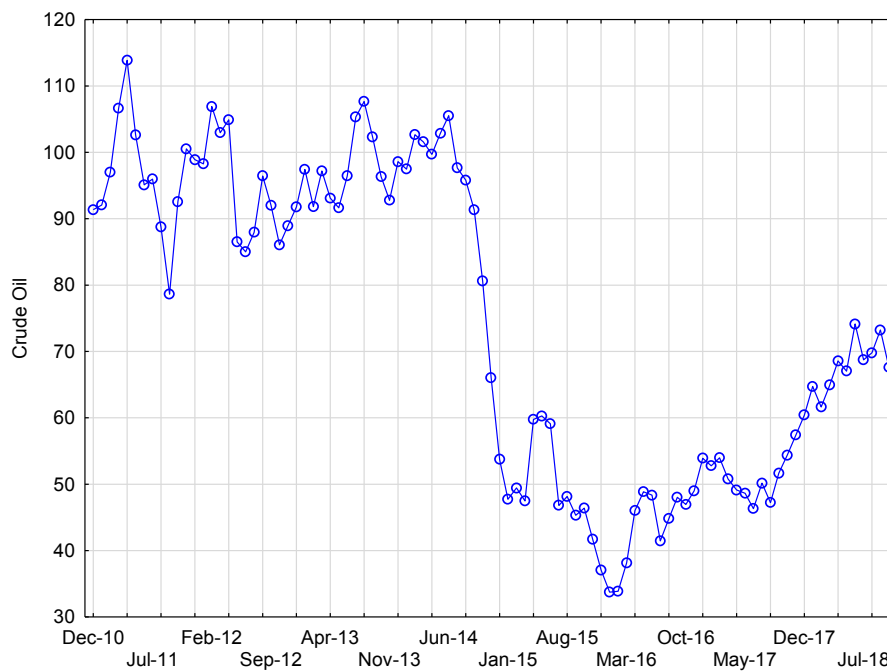


Figure 2. Prices of oil barrel. Source: own study based on data from the Financial Portal Investing.com, data accessed: 01 December 2018.

Figure 2 shows the price formation per barrel of crude oil from December 2010 to October 2018. In December 2010, a barrel cost 91.37 USD, while in October 2018, only 67.59 USD. The largest decrease was observed in the period from June to December 2014, when the price fell by nearly 50% from USD 105.53 to USD 53.73. The reasons for this decline were described, among others, in Baumeister and Kilian's *Understanding the Decline in Price* of June 2014, mainly concerning supply shocks in Libya, Iraq and the United States, as well as the demand shock caused by the unexpected weakening of the global economy towards the end 2014 (Baumeister, and Kilian, 2016).

In literature, much attention has been paid to the dependencies between oil and the transport sector (Rickwood, 2010; Kozłowski, Gajewski, and Pilichowska, 2016). It has been noticed that with the drop in fuel prices, the prices of transport services are decreasing. It was also noticed that crude oil, without significant prior investments, cannot be easily replaced by other liquid fuels in the short term, and it was concluded that the risk of possible oil price surges should be reduced in the future.

The TSL sector is one of the fastest growing in Poland and directly contributes to the steady growth of revenues from trade in services and the achievement in 2016 of a positive balance of the balance sheet at a level of PLN 61.4 billion. In this year, revenues obtained from providing services performed by Polish enterprises abroad reached a level of PLN 196.4 billion. The greatest impact on achieving this result was due to transport services, and in 2016, they increased to a level of PLN 53.2 billion, which constituted over 27% of the total in the structure of revenues from international trade in services provided by Polish enterprises (NBP, 2017).

The Polish transport sector has been particularly dynamic since 2014 (GUS, 2018). The chart below presents the volume of transported loads in tonne-kilometres by Polish transport companies.

Figure 3 illustrates the volumes of transported loads by Polish enterprises in 2011-2017. In 2011, Polish enterprises transported nearly 320,000 (million tonne-kilometres), while in 2017, this number increased to nearly 435,000, an increase of approximately 37% in just 6 years. What is important is that car transport companies providing the above services have to cope with numerous difficulties, such as EU regulations that directly affect Polish transport companies and a significant deficit of drivers on the Polish labour market. According to PWC estimates, there are around 600-650 thousand professionally active drivers in Poland, of which 500-550 thousand work in the road freight transport sector. The deficit is estimated at around 20%, which means that between 100 and 110 thousand drivers are missing. Every year, the inflow of new drivers oscillates between 5-7%, while abandoning the profession of a driver is planned by about 7% of employees, which means that the inflow of new drivers is insufficient, even to balance the departure from this profession (PWC, 2016). Given the steady growth of the transport sector, this problem is likely to increase. Another blow aimed at Polish car transport companies was legislation adopted on 3 December 2018 by the Council of the

European Union – the Mobility Package. As stated by the Polish Minister of Infrastructure, Andrzej Adamczyk, this Act contains disproportionate and protectionist regulations that are directed against international road transport, in particular at Polish carriers (Wawryszuk, 2018).

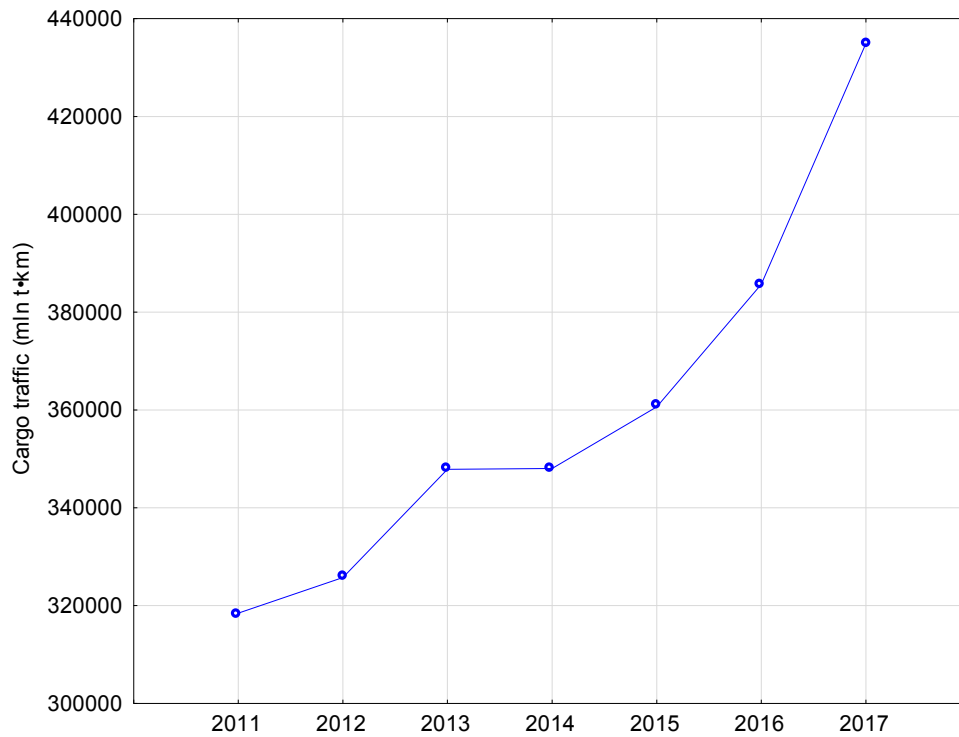


Figure 3. Cargo transport carried out by Polish enterprises (in million tonne-kilometres). Source: own study based on data from the Polish Central Statistical Office, data accessed: 01 December 2018.

Recently, environmental issues that have often been raised may hinder the further dynamic development of transport in Poland. In scientific literature, a lot of research has been devoted to the impact of transport on the environment (Badyda, 2010; Walendzik, Łepkowski and Nowacki, 2016; Puscaciu V., Mihalache and Puscaciu R., 2014). The authors of the research papers agree that transport is an indispensable part of the economic development of the world, but they also mention negative consequences for the environment, including air pollution, noise, the greenhouse effect and taking up more and more land, often included in valuable natural areas.

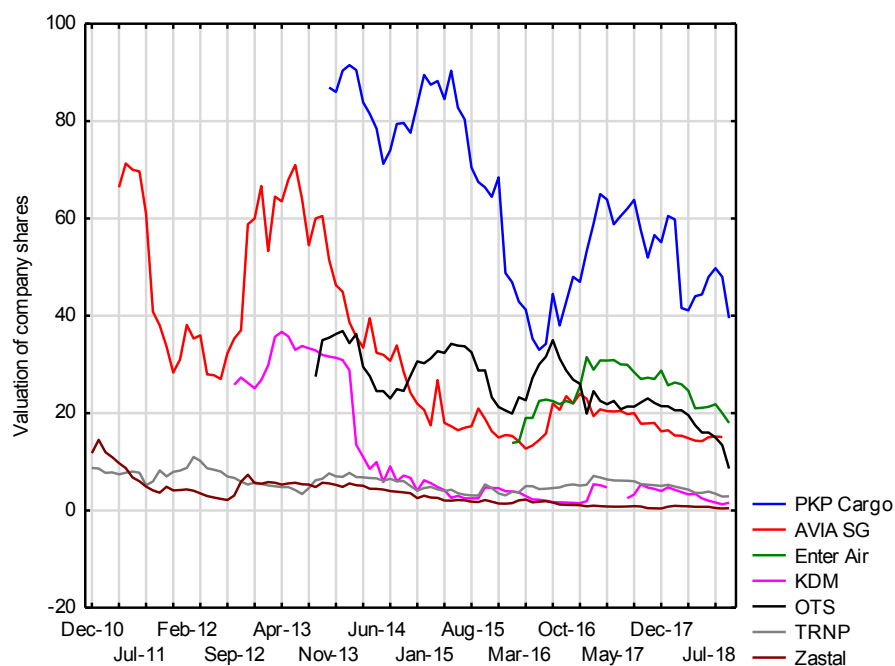


Figure 4. Valuation of shares of Polish companies from the TSL sector. Source: own study based on data from the Financial Portal Investing.com, data accessed: 01 December 2018.

Chart 4 presents the valuations of Polish companies from the TSL sector. From among selected companies, the smallest fluctuations were recorded by companies that are listed on the Warsaw Stock Exchange in the longest period: ZASTAL and TRNP. Most changes are observed in the case of PKP Cargo and AVIASG, while the shortest on the stock exchange, since only from February 2016, is the company EnterAir. The selected companies specialise in:

- PKP Cargo S.A. – logistics services, rail freight transport, freight forwarding.
- AVIA Solutions Group AB – aircraft servicing, pilot training, airport management.
- EnterAir S.A. – air transport services, pilot training.
- KDM Shipping Public Ltd. – sea and river transport services.
- OT Logistic S.A. – water and rail transport services, logistics, forwarding.
- Trans Polonia S.A. – car transport services of liquid fuels, chemicals, gases; logistics.
- Zastal S.A. – transport and forwarding services, production of containers, rolling stock, truck service.

4. Results of causality of selected macroeconomic variables

Based on the aforementioned dependencies, macroeconomic variables such as crude oil prices and USD/PLN and EUR/PLN foreign exchange rates were selected, which were used to assess the impact on the valuation of stocks of companies from the TSL sector.

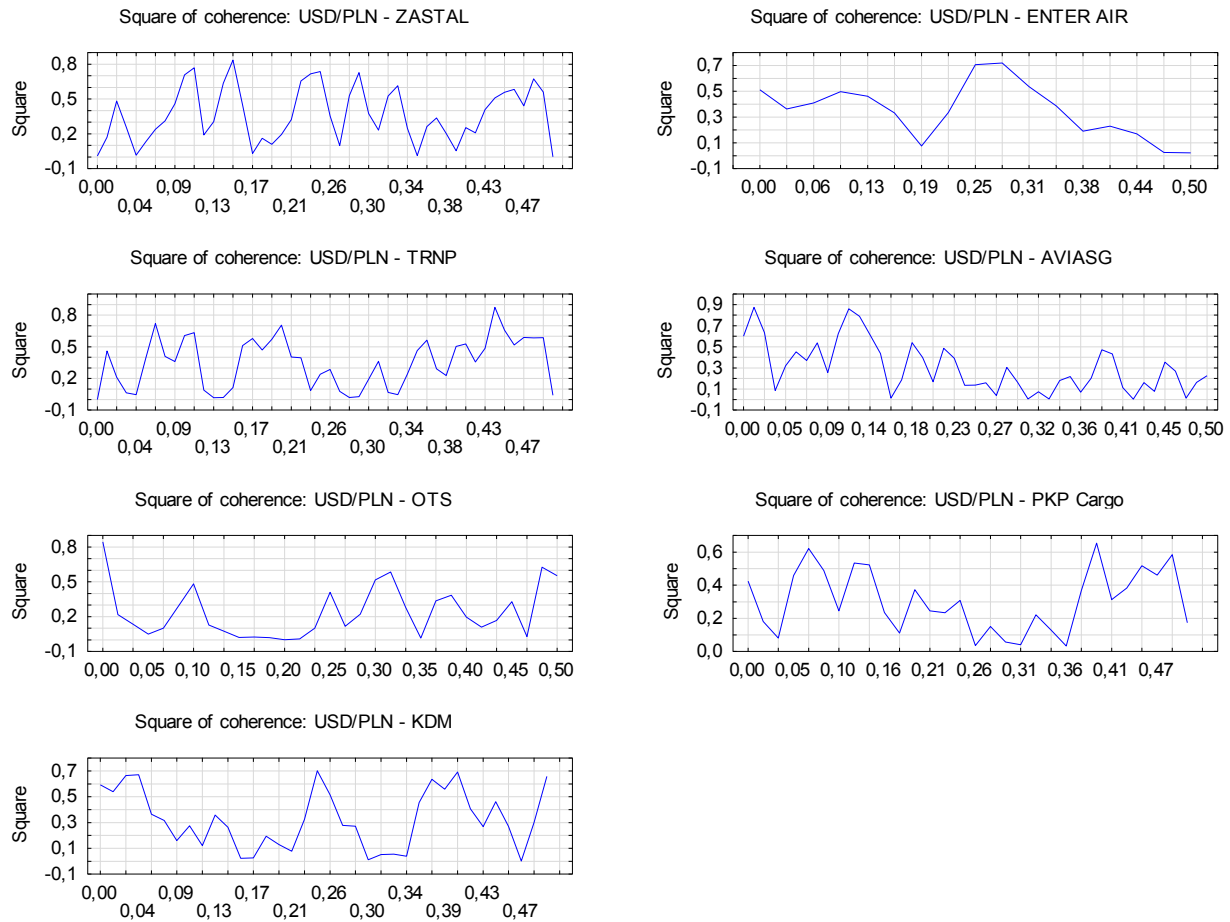


Figure 5. Square of coherence of changes in the exchange rate of USD / PLN and changes in share prices of selected companies. Source: own study based on data from the Financial Portal Investing.com, data accessed: 01 December 2018.

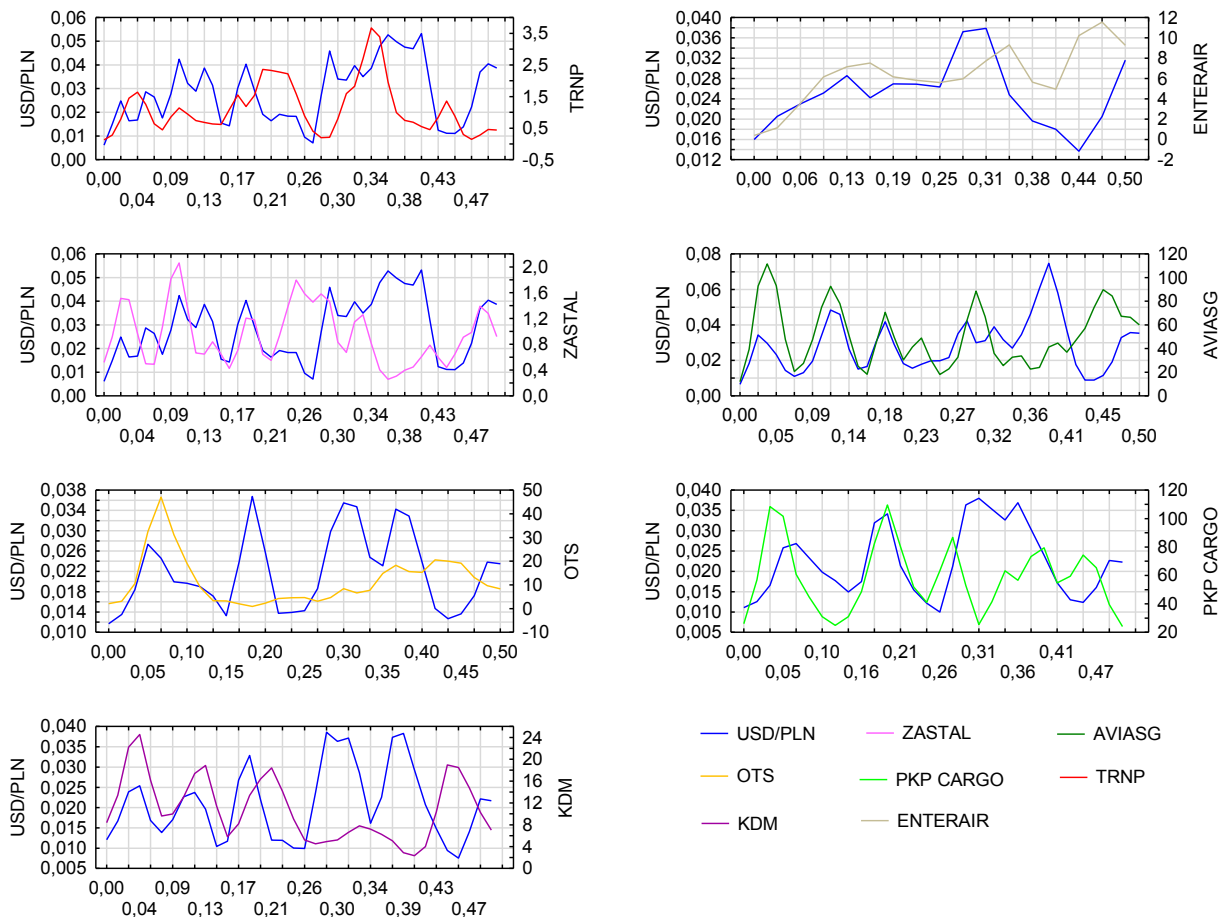


Figure 6. Spectral density of changes in the exchange rate of USD / PLN and changes in share prices of selected companies. Source: own study based on data from the Financial Portal Investing.com, data accessed: 01 December 2018.

The results presented in fig. 5 show that only two price variables (PKP Cargo and OTS) do not show any reaction to changes in the exchange rate of USD/PLN. In other cases, it is possible to indicate the significance of various change frequencies on stock exchange fluctuations. After combining the frequencies with the highest values of the coherence square and appropriately distinguishing values of density (figure 6) spectral, one can indicate the following time dependencies between the exchange rate of USD/PLN and the individual variables of share prices:

- with a frequency of 0.01 and 0.1 for AVIASG (7-year and 10-month fluctuations),
- with a frequency of 0.28 for ENTERAIR (4-month fluctuations),
- with a frequency of 0.24 for the company KDM (4-month fluctuations),
- with a frequency of 0.06 for TRNP (1.5-year fluctuations),
- with a frequency of 0.11, 0.15 and 0.24 for ZASTAL (10-, 7- and 4-month fluctuations).

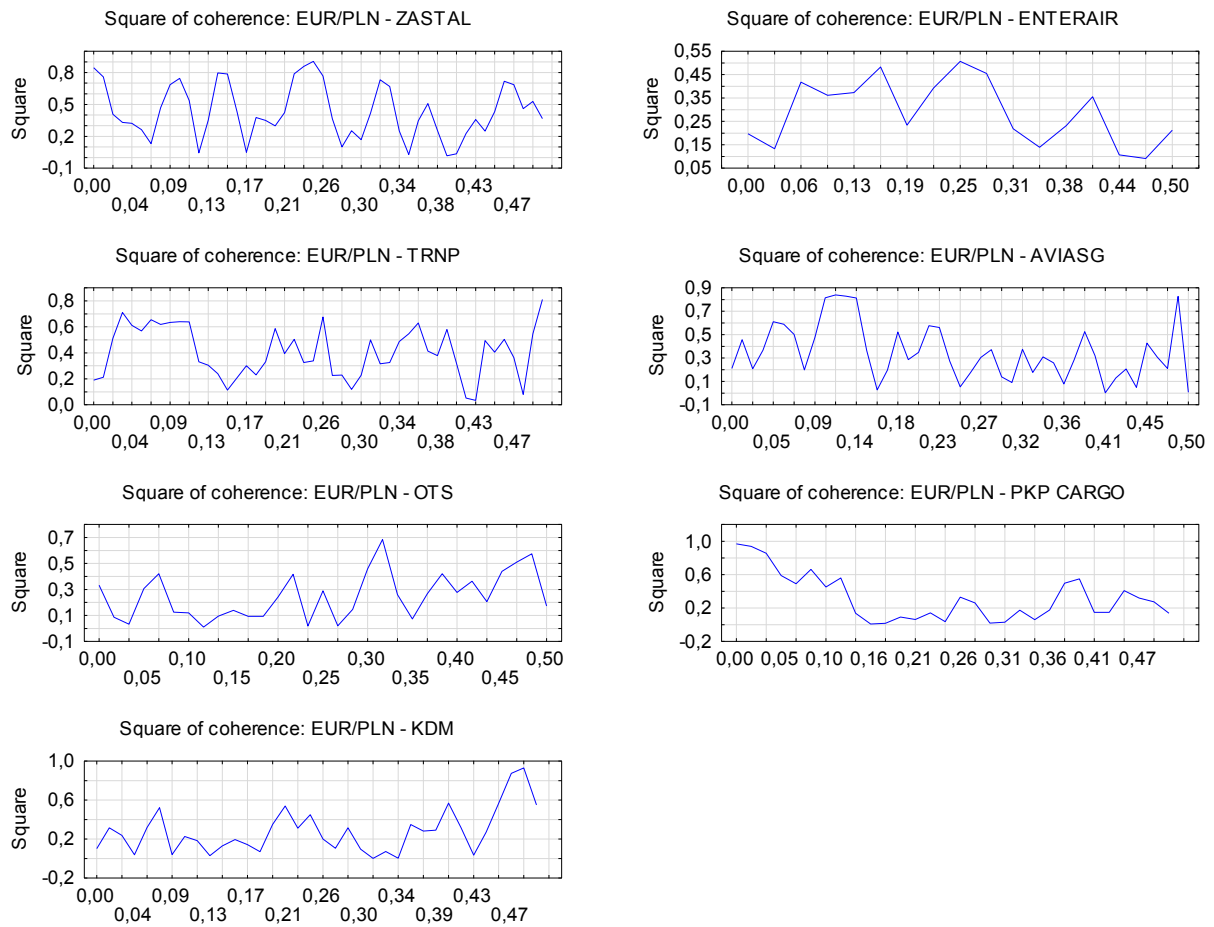


Figure 7. The square of coherence of changes in the exchange rate of EUR/PLN and changes in share prices of selected companies. Source: own study based on data from the Financial Portal Investing.com, data accessed: 01 December 2018.

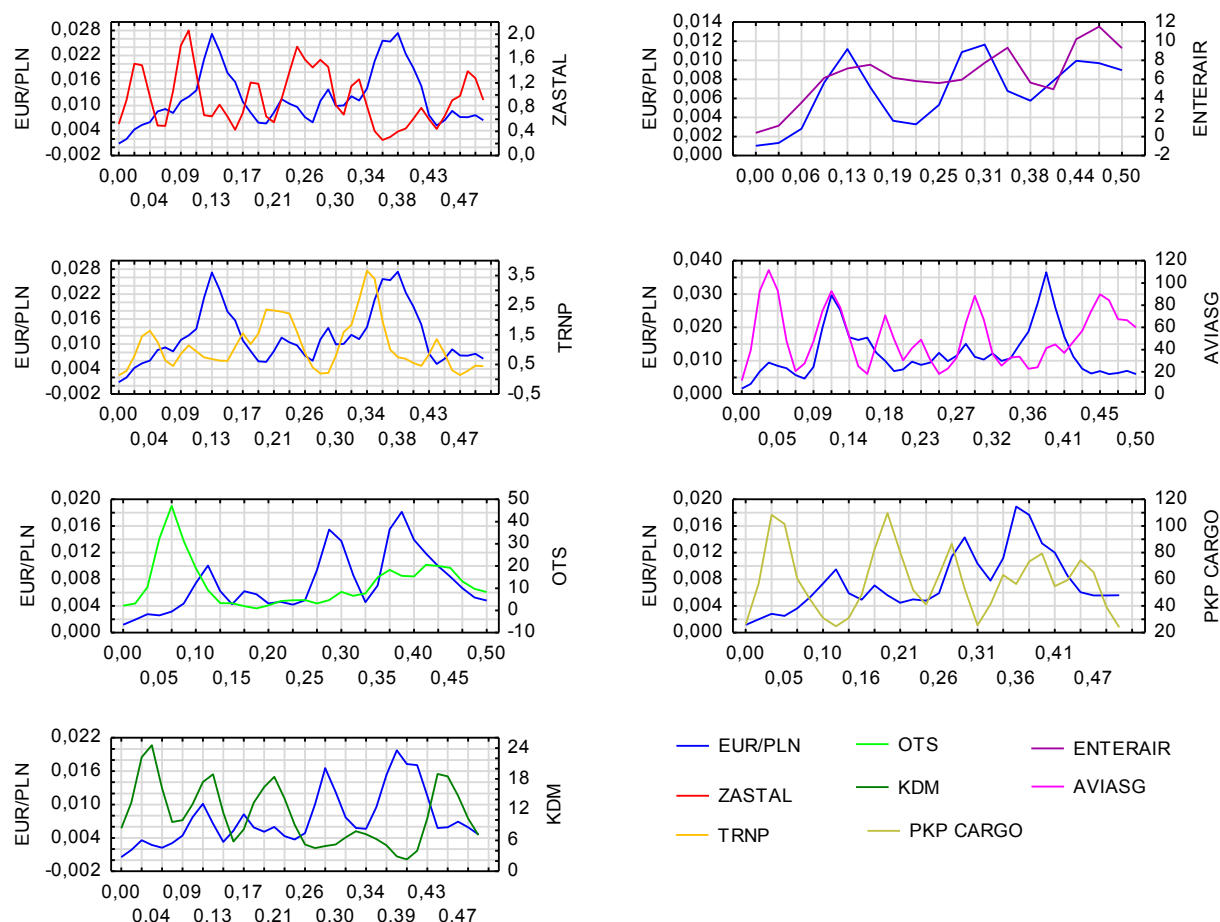


Figure 8. Spectral density of changes in the exchange rate of EUR/PLN and changes in the share prices of selected companies. Source: own study based on data from the Financial Portal Investing.com, data accessed: 01 December 2018

In the case of the study on the dependence of changes in share prices on changes in the EUR/PLN exchange rate, it was observed that as many as three of the surveyed lines (ENTERAIR, OTS and KDM) indicate no relationship between variables (low levels of the coherence square depicted in Figure 7). In other cases, after taking into account the values of spectral densities (figure 8), the following relationship between share prices and the exchange rate surveyed was recorded:

- with a frequency of 0.02 for the company PKP Cargo (5-year fluctuations),
- with a frequency of 0.11 for the company AVIA SG (9-month fluctuations),
- with a frequency of 0.03 for the company TRNP (2.5-year fluctuations),
- with a frequency of 0.01, 0.1, 0.14 and 0.24 for ZASTAL (8-year, 10-, 7- and 4-month fluctuations).

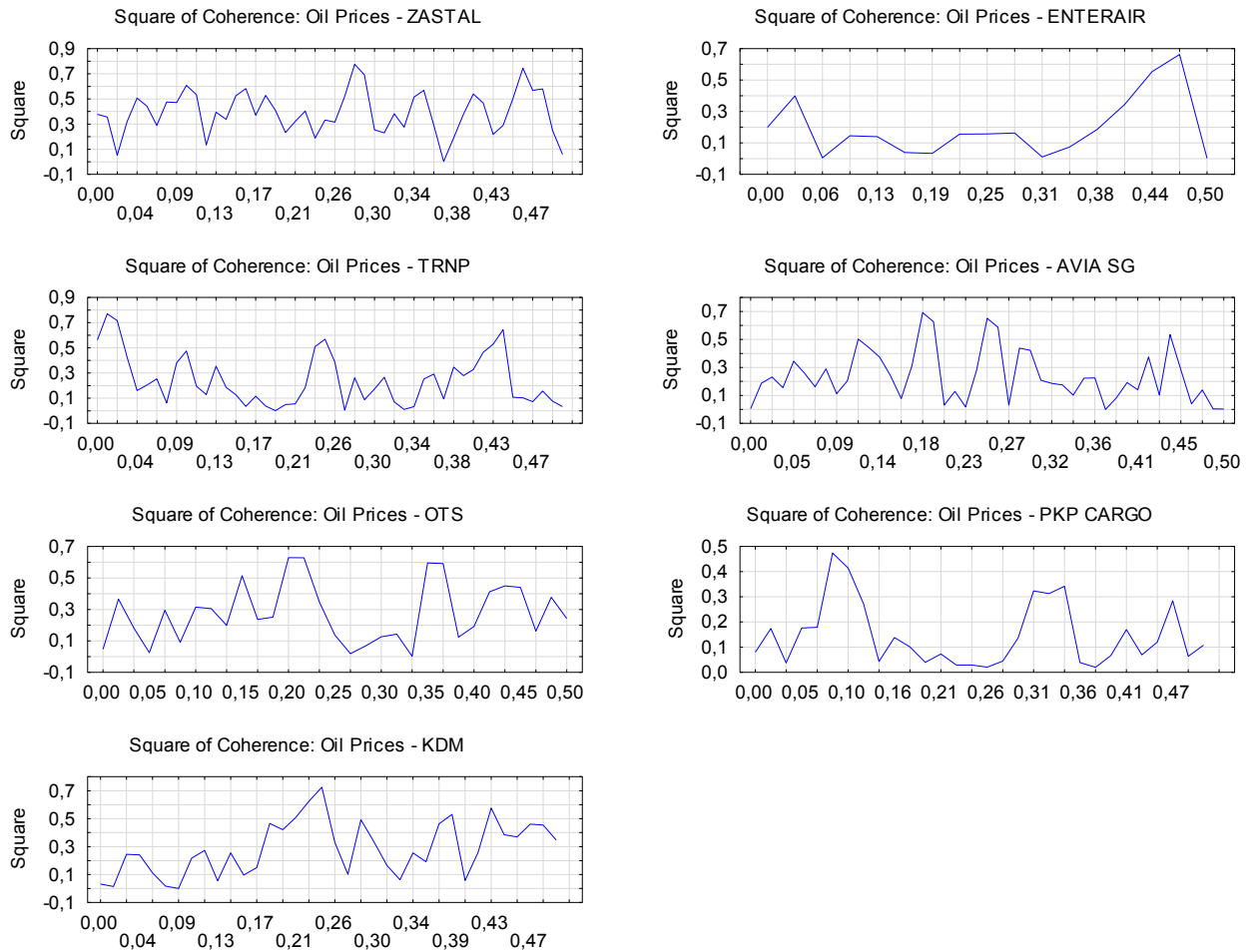


Figure 9. The square of coherence of changes in oil prices and changes in share prices of selected companies. Source: own study based on data from the Financial Portal Investing.com, data accessed: 01 December 2018.

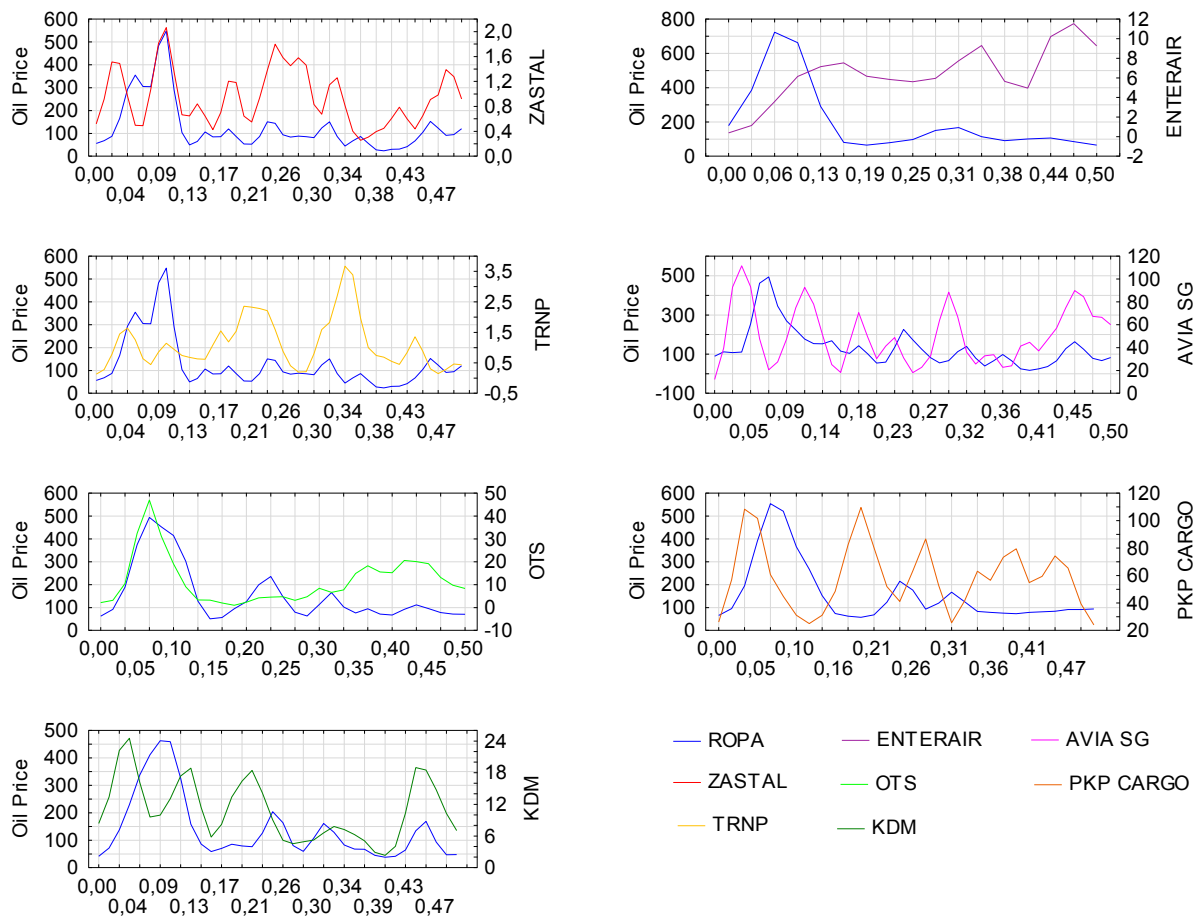


Figure 10. Spectral density of changes in oil prices and changes in share prices of selected companies. Source: own study based on data from the Financial Portal Investing.com, data accessed: 01 December 2018.

As illustrated in figure 9, the impact of changes in crude oil prices on international markets also showed the weakest impact on the shaping of selected share prices – as many as four of the seven surveyed companies (PKP Cargo, Avia SG, ENTERAIR and OTS) did not show any dependence on changes in prices of this commodity. In the case of the remaining companies, after taking into account the values of the spectral densities presented in figure 10, the following relationships were observed:

- with a frequency of 0.28 for ZASTAL (4-month fluctuations),
- with a frequency of 0.01 for TRNP (8-year fluctuations),
- with a frequency of 0.24 for KDM (4-month fluctuations).

It is worth noting, however, that in the case of all the selected relationships, the values of spectral densities indicated a weak relation between variables.

Table 1.
Delay values of selected dependencies (in months)

	Cycle length (months)	PKP Cargo	AVIASG	ENTERAIR	KDM	OTS	TRNP	ZASTAL
USD/PLN	4			3	-4			2
	7							-3
	9							7
	10		10					
	16						5	
	88		69					
EUR/PLN	4							3
	7							-3
	9		-8					
	10							8
	31						13	
	58	56						
OIL	4				1			-3
	94						-77	

* Positive values mean that the change in the macroeconomic variable preceded the change in the stock value; analogically, the negative values mean that the change in the stock value preceded the change in the macroeconomic variable.

Source: own study based on data from the Financial Portal Investing.com, data accessed: 01.12.2018.

Table 1 shows the delay values of selected dependencies. Negative values in cells mean the company's reaction to a given variable change following the specified time, whereas a positive value means a change in the company's share price before the change in the variable. The highest number of dependencies was demonstrated by ZASTAL, as changes in its value were delayed on average by 3 months from changes in EUR/PLN in the 3-month series, over 8 months in the 10-month series and 7 years in the 8-year series, and a 7-month change in the valuation of shares preceded the change of the exchange rate by an average of 3 months. Changes in the USD/PLN exchange rate also influenced the valuation of the company's shares; 2 months in the 4-month series, 7 months in the 9-month series, while in the case of a 7-month series, the change in the share valuation preceded the change in the exchange rate by an average of 3 months. In the discussed company, changes in the price of crude oil influenced changes in the valuation of shares, and in a 4-month period, the share price changed on average 3 months after the change in the price of oil. The valuations of Avia SG reacted only to the EUR/PLN exchange rate in a 10-month period and showed two positive dependencies on the USD/PLN exchange rate, while TRNP stock valuations reacted on a 8-year basis to changes in oil prices and showed positive dependencies in the 2.5-year series in the case of EUR/PLN exchange rate and 16-month to the USD/PLN exchange rate. PKP Cargo and EnterAir showed only one dependency; PKP Cargo to change the EUR / PLN rate in 5-year series, and EnterAir to change the USD/PLN rate in a 4-month series. OTS was the only company that did not show any dependencies between macroeconomic changes.

The emergence of environmental barriers to economic growth forced companies from the discussed industry to reorient the efficiency of transport, as a result of which they began to take into account the volatility of external factors in their costs more and more often (Michałowska, 2012). This information was included in annual reports. As presented in Table 1, the majority of the analysed relations did not indicate the existence of a relationship between the valuation of companies and the changes in the observed macroeconomic indicators. This may result from the proper flow of information to investors about the company's activities and actions taken to safeguard them against threats to macroeconomic changes (e.g. keeping factoring in current operations (Kręczmańska-Gigol, and Pajewska-Kwaśny, 2011)).

5. Summary

The aim of the study was to research the impact of macroeconomic variables, such as the price of crude oil and USD/PLN and EUR/PLN exchange rates, on the valuation of shares of companies from the TSL sector. The research was carried out using cross-spectral analysis and coefficient of multiple correlation, and the following conclusions were obtained:

1. In the case of the USD/PLN exchange rate, only PKP Cargo and OTS did not show any reactions to changes in the exchange rate, while three companies showed one dependence, Avia SG showed two dependencies, and ZASTAL three.
2. ZASTAL also reacted three times to changes in the EUR/PLN rate. PKP Cargo, Avia SG and TRNP showed one dependence, while the remaining three companies did not show any dependence.
3. The lowest prices of the company's shares were influenced by oil prices. KDM, TRNP and ZASTAL showed one dependence, while the remaining four companies showed no reaction to changes in crude oil prices.
4. ZASTAL (seven reactions) turned out to be the most susceptible to changes in macroeconomic variables, while the weakest was OTS (no reaction) and PKP Cargo (one reaction).
5. The results of the study showed a very weak occurrence of a company's price dependence on macroeconomic variables, which may indicate that the related risks are taken into account in the valuation of shares by investors.

The conducted research showed, despite the intuitive relationship between the TSL market and selected variables, that there are no clear relationships determining the valuation of the surveyed companies. The lack of this relationship may, however, result not only from the lack of dependencies, but also from the very nature of the valuation of listed companies, which, assuming complete information, will also include changes in exchange rates and commodity prices. This assumption may be the basis for continuing research on the subject.

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