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The Impact of Trade Liquidity on the Rates of Return from Emerging Market Shares Based on the Example of Poland, Austria and Hungary

Abstract: In relation to assets, liquidity generally relates to the ease by which an asset can be sold immediately after purchase without incurring losses of any kind. These losses could be due to price changes or various transaction costs. This can be seen with respect to various instruments (such as stocks or futures contracts), market segments, or even entire exchanges. The importance of liquidity has been acknowledged a long time ago. A considerable number of studies have investigated stock liquidity, providing evidence that more illiquid stocks have higher returns, which may be deemed an "illiquidity premium". This paper examines various factors which have an effect on liquidity by presenting the results of research concerning relations between liquidity and stock returns on the Warsaw Stock Exchange (WSE), the Budapest Stock Exchange (BSE) and the Vienna Stock Exchange (VSE). The main objective of the study is to determine whether there is a statistically significant relationship between the trading liquidity of the shares and the evolution of the rate of return on these shares. The applied research methodology is similar to that described by Datar, Naik and Radcliffe in their work "Liquidity and Stock Returns: An Alternative Test".

Keywords: illiquidity premium, capital market, liquidity of shares

JEL: G12, G15, G4, F30, F50

1. Introduction

The liquidity of trading has always played an important role for practitioners operating in capital markets, although in the initial stage of development of modern finance, it was not properly considered, due to the fact that it was simply seen as a theory. This situation has changed since the mid–1980s, when it was formalised to officially analyse the liquidity issue in the financial market. Amihud and Mendelson (1986a; 1986b), in a theoretical manner and through empirical research, demonstrated the existence of a relationship between the rate of return on shares and the liquidity measured by the spread[1] in the US market. Further research has confirmed the thesis that liquidity has a significant impact on stock prices and their rates of return (Shannon, Reilly, Schweihs, 2000; Chan, Faff, 2005). It is also common to say that the liquidity of shares exerts a significant influence on the rate of return (Cheng, 2007). Amihud (2002) in his work has emphasised that it is doubtful that there is one measure that will take into account all aspects of limited liquidity. Therefore, liquidity measures of assets are also called measures of commercial or transactional activity. This term can be applied to the following indicators: the number of transactions, the number of sold shares, the value of sold shares, the quotient of the number of shares sold and put up for sale, and the quotient of the value of shares sold and put up for sale (Chordia, Subrahmanyam, Anshuman, 2001). One of the natural measures of liquidity is, therefore, the turnover ratio. This ratio is considered the best of the simplest measures of liquidity due to the weak correlations with the market value of the company (Chordia, Roll, Subrahmanyam, 2000). The turnover ratio is simply the average number of shares being traded in a given period, divided by the number of shares outstanding during that period. It is particularly useful in all comparative analyses of the liquidity of capital assets. It is expressed by the formula:

$$Turnover_{it} = \frac{\sum_{j=1}^{d_t} vol_{ij}}{SO_{it}}, \tag{1}$$

where:
vol_{ij} – the average number of shares traded in the period t,
SO_{it} – the number of shares i in the period t.

Research using the turnover ratio was presented by Brennan and Subrahmanyan (1996), Bertsimas and Lo (1998), Acharya and Pedersen (2005) and Sadka (2006). Another measure of liquidity is the spread, which was used in one of the first studies on this issue from Amihud and Mendelson (1986b). There is much ev-

1 Spread is the difference between the best buy and sell offer before the conclusion of each transaction, weighted by the turnover value given in basis points.

idence that liquidity affects returns on assets. However, serious debate continues on the precise definition of liquidity and its role.

It is easy to see that several studies on the flow of liquidity have been conducted in the markets of developing countries. In general, the liquidity research in these markets has been conducted in the context of checking how selected factors will affect this liquidity and how the liquidity of trading will change under their influence (Będowska-Sójka, 2014; Brzeszczynski, Gajdka, Kutan, 2015). Many works concerning the Polish market focus on the utilisation of the classic Fama-French model (Czapkiewicz, Skalna, 2011; Olbryś, 2011) rather than using its modifications to explain some phenomena occurring in the Polish capital market. In an article from 2014, Mościbrodzka correctly notes that the research literature on the Fama-French model in the Polish market is rather sparse. However, the problem of liquidity of shares raised in the world literature by Pastor and Stambaugh (2003) and others (Naes, Skjeltorp, Ødegaard, 2011) and for the Polish market, e.g., in the works of Gajdka, Gniadkowska and Schabek (2010) or Kucharski (2010) has not been touched upon in many works. In the works of Łuniewska and Tarczyński (2007) and Klimczak (2013), the main focus is on the market and fundamental indicators (*ROE*, *ROA*, capitalisation, liquidity ratio) as well as other features of companies and their importance in valuation or investment decisions.

2. Characteristics of the stock markets of emerging countries

In order to better understand the phenomena occurring in the capital market of a given country, one should become acquainted with the basic characteristics of not only the capital markets examined but also the entire economies.

Founded in 1771, Wiener Börse AG, the company that operates the Vienna Stock Exchange, is one of the oldest stock exchanges in the world. Today, it is a modern, customer- and market-oriented company that plays a key role in the Austrian capital market. It is the driving force that contributes substantially to the further development of the local market.

The highly qualified and motivated employees of the Vienna Stock Exchange are the foundation that makes it possible for the company to attain its corporate goals, with its work being guided by the values of prudence, transparency and trust. The Vienna Stock Exchange engages in a continuous dialogue with its stakeholders, and all its activities are oriented towards their needs.[2]

2 https://www.wienerborse.at/en/about-us/vienna-stock-exchange/ [accessed: 26.07.2019].

As the successor to the first Hungarian stock exchange, founded more than 150 years ago in 1864, the Budapest Stock Exchange (BSE) plays a pivotal role in the capital markets of both Hungary and the Central Eastern European region. As a result of the dynamic growth it achieved after its re-establishment in 1990, the BSE now provides the highest level of service, in compliance with the standards of developed markets, to security issuers, traders and investors from around the world. In 2015, the National Bank of Hungary concluded a purchase agreement with the former owners of the Budapest Stock Exchange, the Austrian CEESEG AG and Österreichische Kontrollbank AG. As a result of this transaction, the MNB became the qualified majority shareholder in the BSE. Brought under national ownership, the BSE was required by its new owner to formulate a five-year strategy for 2016–2020 along the lines of capital market development objectives in order to set the priorities that will determine the direction of stock market development for years to come.[3]

The Warsaw Stock Exchange is one of the fastest-growing stock exchanges among the European regulated markets and alternative markets regulated by the stock exchanges, and the largest national stock exchange in the Central and Eastern Europe region. The trading system applicable on the WSE is characterised by the fact that the rates of individual financial instruments are determined based on the orders of buyers and sellers; hence, it is called an order-driven market. Currently, the Polish stock exchange is a significant capital market in Europe and a leader in Central and Eastern Europe, taking advantage of the development potential of the Polish economy and the dynamism of the Polish capital market.[4]

The description of the characteristics of the markets studied aims at a better understanding of the problem of the effectiveness of stock markets, which is important in the context of the entire study.

One of the comparison criteria for the analysed markets is the capitalisation of domestic companies listed in these markets. Table 1 presents changes in capitalisation over time for all the markets in question.

Table 1. Domestic market capitalisation (USD millions)

Exchange	2017			% change/Nov 16 (in USD)	% change/Nov 16 (in local cur)
	September	October	November		
Budapest	29.087.200	30.623.900	30.465.300	44.2	29.5
Warsaw	192.828.300	194.577.400	193.852.200	47.5	25.1
Vienna	142.326.800	145.781.400	146.457.700	51.5	35.4

Source: own study based on WFE data

3 https://www.bse.hu/site/Angol/Contents/About-Us/About-Budapest-Stock-Exchange/Introduction [accessed: 26.07.2019].

4 https://www.gpw.pl/o-spolce#historia [accessed: 26.07.2019].

Another criterion describing the importance of a given exchange is the size of transactions carried out on it, measured by the turnover value. The World Federation of Exchanges (WFE) distinguishes transactions carried out through electronic orders (EOB) of the stock market system – most transactions are carried out in this way. In addition, transactions are divided into those conducted on domestic and foreign shares. The list presented in Table 2 only includes electronic orders for both domestic and foreign shares.

Table 2. Value of share trading (USD millions)

Exchange	2017			Year-to-date	% change/ Jan/Nov 16 (in USD)	% change/ Jan/Nov 16 (in local cur)
	September	October	November			
Budapest	721.7	874.4	1130.2	9137.2	21.6	18.0
Warsaw	5075.2	5600.4	6033.0	58618.8	36.5	30.4
Vienna	2849.6	3361.5	3475.5	34802.3	23.3	20.8

Source: own study based on WFE data

Each of the analysed exchanges shows different tendencies as to the number of listed companies. The number of listed companies in each market is presented in Table 3.

Table 3. Number of listed companies

Exchange	2017 November			% change/Nov 16
	Total	Domestic companies	Foreign companies	
Budapest	41	41	0	–4.7
Warsaw	884	855	29	–1.3
Vienna	514	67	447	511.9

Source: own study based on WFE data

3. Data sources and selection of the test sample

Collecting relevant data is a very important element of the whole research work. While in the case of developed financial markets access to data is easier, in the case of emerging markets, this is not always the case. Therefore, in order to obtain the most accurate data, a number of databases have been sought from public institutions (e.g. the WSE, NBP, Central Statistical Office, Eurostat, or the World Bank) as well as private ones (e.g. Bloomberg, Reuters). In each case, the comments were analysed for the methodology used to calculate the selected data and their quality was thoroughly checked.

The study included companies from the Warsaw Stock Exchange in the WIG index at the end of 2017 (220 companies). For the Austrian market, the companies included in the ATX index at the end of 2017 (19 companies) are also subject to analysis, while for the Hungarian market, the companies included in the BUX index at the end of 2017 (15 companies) are also subject to analysis.

The survey was carried out on data from the period October 30, 2014 – December 31, 2017. Only companies whose shares were included in each of the indices at the end of 2017 were analysed and the Reuters database included quotations of shares of these companies in the entire audited period, i.e. from 30/10/2014 to 31/12/2017. The prices have been adjusted for capital changes in the type of subscription rights, dividends and splits. The survey was conducted first on monthly rates calculated on the basis of prices from the last day of each month. Then, for each action, the beta coefficient was calculated according to the regression equation:

$$R_i = \alpha_i + \beta_i \cdot R_M + u_i. \tag{2}$$

The calculations were made using the Generalised Least Squares Method (GLSM): the explained variable (R_i) was the surplus average monthly rate of return on shares[5], the explanatory variable (R_M) was the average excess rate of return from the WIG for the Polish market, the average excess rate of return from the BUX for the Hungarian market, and average excess ATX rate of return for the Vienna market for 60 months (5 years) preceding the analysed year, including this year ($T - 4$ to T, and $T \in (2011, 2014)$). The Euribor 1M rate was chosen as the rate of return on risk-free assets for the Austrian market, the WIBOR 1M rate was chosen as the rate of return on risk-free assets for the Polish market and the profitability of 10-Year Hungarian Bond Yield was chosen as the rate of return on risk-free assets for the Hungarian market (R_f).

Tables 4, 5 and 6 show the basic statistics of the data used in this study.

5 The excess rate of return is understood as the difference between the return on a given instrument and the rate of return on risk-free assets.

Table 4. Basic statistics of monthly data collected for the Polish market

	Turnover ratio	SPREAD	Capitalisation (in PLN)	Rate of return	P/BV	Momentum
Average	0.020	2.140	1.915.394.915.340	0.010	1.700	0.240
Median	0.010	1.520	21.4005.500.000	0.000	1.050	–0.120
Minimum	0.000	0.000	0.000	–0.920	0.000	–46.950
Maximum	8.770	83.820	55.387.500.000.000	2.890	292.160	105.580
Variance	0.010	7.160	38.487.311.662.426.900.000.000	0.010	26.970	5.050
Standard deviation	0.100	2.680	6.203.814.283.360	0.120	5.190	2.250
Coefficient of variation	424.500	125.060	323.890	1683.890	306.350	948.340
Slant	57.000	9.220	5.180	2.330	39.060	16.590
Kurtosis	4.465.060	174.530	28.600	36.890	1.818.780	642.320

Source: own study based on stock market statistics, https://www.gpw.pl/statystyki-gpw [accessed: 26.07.2019]

Table 5. Basic statistics of monthly data collected for the Hungarian market

	Turnover ratio	SPREAD	Capitalisation (in forint)	Rate of return	P/BV	Momentum
Average	0.030	1.990	324.590.721.071.500	2.170	0.020	5.000
Median	0.020	0.900	24.314.638.000.000	1.210	0.000	0.010
Minimum	0.000	0.060	229.460.000.000	0.130	–0.400	–2.680
Maximum	0.630	39.190	3.018.400.000.000.000	27.860	2.320	1.686.810
Variance	0.000	11.430	364.643.173.790.268.000.000.000.000	6.150	0.020	4.690.820
Standard deviation	0.050	3.380	603.856.914.997.480	2.480	0.150	68.490
Coefficient of variation	180.990	170.150	186.040	114.280	688.340	1.370.940
Slant	6.670	4.440	2.070	3.630	6.870	19.790
Kurtosis	59.730	29.100	3.570	23.550	80.800	426.690

Source: own study based on stock market statistics, https://www.bse.hu/ [accessed: 26.07.2019]

Table 6. Basic statistics of monthly data collected for the Austrian market

	Turnover ratio	SPREAD	Capitalisation (in EURO)	Rate of return	P/BV	Momentum
Average	0.028	0.266	3.453.145.384.592	1.395	–0.004	0.231
Median	0.026	0.181	2.458.240.000.000	0.990	0.001	0.025
Minimum	0.000	0.000	0.000	0.000	–0.524	–2.782
Maximum	0.134	3.621	17.289.818.200.000	6.146	0.532	16.842
Variance	0.000	0.084	9.758.682.549.956.900.000.000	1.336	0.010	1.128
Standard deviation	0.018	0.289	3.123.889.010.505	1.156	0.102	1.062
Coefficient of variation	65.260	108.887	90.465	82.874	–2.772.343	460.412
Slant	1.128	4.243	1.533	1.724	–1.33	4.530
Kurtosis	2.649	27.956	2.559	2.378	6.003	53.232

Source: own study based on stock market statistics, https://www.wienerborse.at/en/about-us/ [accessed: 26.07.2019]

4. Research methodology

The applied research methodology is similar to that described by Datar, Naik and Radcliffe (1998). The Generalised Least Squares Method is used for the calculation, which allows us to observe how the rates of return of a given asset change under the influence of changes in the turnover ratio (Shanken, 1992; Kandel, Stambaugh, 1995). In particular, they use the methodology of Litzenburger and Ramaswamy (1979), which is an improvement of the Fama and MacBeth model (1973). The original model of Fama and MacBeth (1973) is based on the analysis of portfolios of shares built according to the methodology proposed by them. However, in the research presented in this article, I encounter the problem that there is an insufficient number of securities listed on the WST, VSE and the BSE to create large and numerous portfolios according to Fama and MacBeth (1973). For these reasons, the article uses methodology formulated on the basis of individual rates of return based on the results of works criticising the portfolio approach.

In a study described by Datar, Naik and Radcliffe (1998), checking the relationship between the rate of return and the systematic risk measured by the beta factor, the company size measured as the logarithm of capitalisation and the turnover ratio was based on individual shares. The study was repeated using the spread as another measure of liquidity. In the case of capitalisation and liquidity, the decimal logarithm was used to take into account the literature suggested (Amihud, Mendelson, 1986b; Fama, French, 1993) non-linear relationship between these variables and the rates of return. The model is estimated according to the formula:

$$R_{it} = \gamma_{0t} + \gamma_{1t}\beta_{it} + \gamma_{2t}L_{it} + \gamma_{3t}\log(CAP)_{it-1} + \gamma_{4t}(P/BV)_{it-1} + \varepsilon_{it}, \quad i = 1, 2, \ldots, N_t, t = 1, 2, \ldots, T, \tag{3}$$

where:
R_{it} – rate of return on shares i in the month t,
β_{it} – share price factor i in the month t,
L_{it} – liquidity of shares i in the month t[6],
$(P/BV)_{it-1}$ – price to book value ratio in the month $t-1$,
$\log(CAP)_{it-1}$ – size of company i measured as the natural logarithm of capitalisation in the month $t-1$,
ε_{it} – the rest of the equation.

The next study presented in this work is based on the Pastor-Stambaugh model (Pastor, Stambaugh, 2003). The applied research methodology is similar to that described by Pastor and Stambaugh in the work *Liquidity Risk and Expected Stock*

6 Liquidity can be expressed as the turnover ratio or as the spread.

Returns. The model presented in their article is an extension of the model of Fama and French (1993) for a liquidity factor. However, due to the specifics of emerging markets, this methodology also needs to be modified accordingly. The original Pastor-Stambaugh model is based on the analysis of portfolios built according to the methodology proposed by Fama and MacBeth (1973). However, as has already been pointed out above, I encounter the problem that there is an insufficient number of securities listed on the analysed exchanges to create large and numerous portfolios according to the methodology proposed by Fama and MacBeth. Therefore, here also the methodology is formulated on the basis of individual actions based on the results of works criticising the portfolio approach (Litzenburger, Ramaswamy, 1979; Shanken, 1992).

Cross-sectional regressions at this stage of the study were made in the following way: for a given month, the monthly rate of return was calculated for each of the companies in each analysed market. This rate is explained by the following variables (values also calculated for each month):

1) measure of sensitivity (a parameter based on a regression based on time series) on the conversion of the stock market index of a given company – represented in the study by the classic beta factor,
2) the size of the company expressed by capitalisation,
3) the price to book value ratio of a given company,
4) measure of the liquidity of shares of a given company,
5) momentum indicator for a given company.[7]

In the case of capitalisation and momentum, the decimal logarithm was used to take into account the literature suggested non-linear relationship between these variables and rates of return (Amihud, Mendelson, 1986b; Fama, French, 1993). Then, the parameters of the model were estimated according to the formula:

$$R_{it} = \gamma_{0t} + \gamma_{1t}\beta_{it} + \gamma_{2t}L_{it} + \gamma_{3t}\log(CAP)_{it-1} + \gamma_{4t}(P/BV)_{it-1} + \gamma_{5t}\log(MOM)_{it} + \varepsilon_{it}, \quad i = 1, 2, \ldots, N_t, t = 1, 2, \ldots, T, \tag{4}$$

where:
$(MOM)_{it}$ – indicator of the momentum of shares i in the month t.

7 Momentum is one of the simplest indicators of technical analysis used to determine the state of the market (whether it is bought or sold). In general, this name cannot be explained, although it is sometimes called impetus by some. We calculate the momentum by subtracting from the price on a given day (closing prices) the price from before periods: $MOM = P_n - P_{n-k}$, where: P_n is the price of the shares from the n trading, P_{n-k} is the price of the shares from the quotation of k the session earlier than the n listing.

5. Results

The study on the impact of liquidity on the rate of return in each of the markets was first based on the model presented by Datar, Naik and Radcliffe (1998) using the liquidity measure which is the turnover ratio. Then, this study was repeated for all the markets, changing the measure of liquidity to the spread. In the next stage, an analysis of the impact of liquidity on the rate of return in each of the markets was made based on the methodology described by Pastor and Stambaugh (2003). Then, this study was repeated for all the markets, changing the measure of liquidity to the spread. Four studies were conducted for each of the markets.

Using the methodology described by Datar, Naik and Radcliffe (1998), the relationships between the rate of return and systematic risk measured by the beta coefficient, the company size measured by logarithm of capitalisation, the price to book value ratio and the turnover ratio (Model 1) for the collected data were obtained first and the results were described in Table 7.

Table 7. Estimation of Model 1 parameters and their corresponding p-value and t-student statistics

	Estimators	**Statistics t-student**	**p-value**
Austria			
A			
free term	0.01027	0.74178	0.45836
turnover ratio	0.34897	2.09140	0.03669
beta coefficient	0.01443	1.76908	0.07712
log(*Cap*)	–0.00494	–2.63516	0.00851
P/BV	0.00669	2.29999	0.02161
Hungary			
B			
free term	0.04408	0.84962	0.39574
turnover ratio	0.97116	11.94012	0.00000
beta coefficient	–0.00850	–0.63385	0.52632
log(*Cap*)	–0.00497	–0.96188	0.33634
P/BV	0.00274	1.47466	0.14061
Poland			
C			
free term	0.00268	1.32193	0.18621
turnover ratio	0.03414	3.48237	0.00050
beta coefficient	0.00590	2.88133	0.00397
log(*Cap*)	0.00000	–0.52421	0.60014
P/BV	–0.00025	–1.36490	0.17231

Source: own study

As can be seen from the calculations made in Table 7, parts A, B and C, based on data from the Austrian, Hungarian and Polish markets, the estimation of the

parameter referring to the turnover ratio is statistically significant at the level of 0.05. From the calculations made based on data from the Budapest Stock Exchange, it can be concluded that the estimations of parameters relating to the beta coefficient, the price to book value ratio and the company size measured by the logarithm of capitalisation are statistically insignificant at 0.05, i.e., the beta coefficient, the price to book value ratio and the size of the company do not significantly affect the rate of return in this market. However, as shown in Table 7, part C, in the calculations made based on data from the Polish market, the estimation of parameters relating to the beta coefficient is statistically significant at 0.05, the estimations of parameters relating to the price to book value ratio and the company size are statistically insignificant at 0.05. From the calculations made based on data from the Austrian market, it can be concluded that the estimations of parameters relating to the price to book value ratio and the company size are statistically significant at 0.05, only the estimation of parameters relating to the beta coefficient is statistically insignificant at 0.05.

As can be seen from the figures presented in Table 7, parts A, B and C, the calculations of standing parameters with liquidity variables in these markets are positive, i.e., an increase in liquidity should be accompanied by an increase in the rate of return. This is not consistent with the results of research obtained in highly developed markets. Additionally, the obtained results may confirm Fama's (1998) considerations regarding the effective market, as he has claimed that anomalies that occur in the capital market may have a small impact on the rate of return. This mainly concerns anomalies related to information that is available on the market, because sometimes in the short term there is the phenomenon of asymmetry of information that may cause an excessive reaction of the market to certain events (see: Ikenberry, Lakonishok, Vermaelen, 1995; Mitchell, Stafford, 2000).

The adjustment of the estimated model using data from the Vienna Stock Exchange to real data measured by the adjusted R2 ratio is 0.07. The adjustment of the estimated model on data from the Hungarian market to real data measured by the adjusted R2 ratio is 0.12. The adjustment of the estimated model using data from the Warsaw Stock Exchange to real data, measured by the adjusted R2 ratio is 0.0013.

The next stage of the study was to check whether liquidity measured by the spread exerts a significant influence on the rate of return in the markets of Austria, Hungary and Poland (Model 2). The results of these tests are presented in Table 8.

As can be seen from the calculations made in Table 8, parts B and C, based on data from both the Hungarian and Polish markets, the estimation of the parameter relating to the spread and the company size is statistically significant at 0.05. However, in the case of calculations made based on data from the Austrian market, the estimation of the parameter relating to the spread is not statistically significant at the level of 0.05, i.e., liquidity measured by the spread does not significantly af-

fect the rate of return in this market. In the case of other variables estimated on the basis of data from the Austrian market, they are statistically significant at the level of 0.05. As for the results obtained in the Hungarian market, the estimations of parameters relating to the beta coefficient and the price to book value ratio are statistically insignificant at 0.05, i.e., the beta coefficient and the price to book value ratio do not significantly affect the rate of return in this market. Furthermore, in the case of calculations made based on data from the Polish market, the estimation of parameters relating to the beta coefficient is statistically significant at 0.05, only the estimation of parameter relating to the price to book value ratio is statistically insignificant at 0.05 in this market.

Table 8. Estimation of Model 2 parameters and their corresponding p-value values and t-student statistics

	Estimators	**Statistics t-student**	**p-value**
Austria			
A			
free term	0.01049	0.75100	0.45279
SPREAD	0.00786	0.76708	0.44318
beta coefficient	0.02041	2.53589	0.01133
log(*Cap*)	–0.00481	–2.53223	0.01145
P/BV	0.00763	2.57362	0.01018
Hungary			
B			
free term	0.12655	2.13090	0.03334
SPREAD	–0.00264	–1.79733	0.07258
beta coefficient	0.02136	1.51814	0.12929
log(*Cap*)	–0.01101	–1.90381	0.05722
P/BV	0.00231	1.15030	0.25029
Poland			
C			
free term	0.01194	5.29827	0.00000
SPREAD	–0.00334	–8.99034	0.00000
beta coefficient	0.00500	2.44563	0.01447
log(*Cap*)	0.00000	–2.14720	0.03179
P/BV	–0.00030	–1.62638	0.10389

Source: own study

As can be seen from the figures presented in Table 8, parts B and C, calculations of standing parameters with liquidity variables in these markets are negative, i.e., an increase in liquidity should be accompanied by an increase in the rate of return. This is not in line with the results of research obtained in highly developed markets, because the spread is considered a measure of illiquidity. Such a situation may be caused by investors' lack of faith in a change of the downward

trend into the upward trend, which has been confirmed in research, among others, of Campbell, Lo and MacKinlay (1997), Szyszka (2003), or Czekaj, Woś and Żarnowski (2001). Such investors' behaviour and a lack of faith in a change in the market situation may affect the prices of shares and the liquidity of trading in them.

The adjustment of the estimated model using data from the Vienna Stock Exchange to real data measured by the adjusted R2 ratio is 0.004. The adjustment of the estimated model on data from the Hungarian market to real data measured by the adjusted R2 ratio is 0.004. The adjustment of the estimated model using data from the Warsaw Stock Exchange to real data measured by the adjusted R2 ratio is 0.006.

Then, based on the methodology described by Pastor and Stambaugh (2003), the relationship between the rate of return and systematic risk measured by the beta coefficient, the company size measured by capitalisation, the price-to-book ratio, the momentum index and liquidity expressed by the turnover ratio was obtained, giving the results described in Table 9 (model 3).

As in the case of Model 3, from the figures presented in Table 9, parts A, B and C, concerning data from Austria, Hungary and Poland, it follows that the estimation of the parameter referring to the turnover ratio is statistically significant at 0.05. From the calculations made based on data from the Budapest Stock Exchange, it can be concluded that the estimations of other parameters are statistically insignificant at 0.05, i.e., the beta coefficient, the price to book value ratio and the size of the company do not significantly affect the rate of obtained return in this market. However, as shown in Table 9, part C, in the calculations made based on data from the Polish market, the estimation of parameters relating to the beta coefficient is significant in the rate of return on the shares of a given company, the estimation of parameters relating to the price to book value ratio and the size of the company is statistically insignificant at 0.05 in this market. Furthermore, in the case of calculations made based on data from the Austrian market, the estimation of parameters relating to the beta coefficient is statistically insignificant at 0.05, the estimations of parameters relating to the price to book value ratio and the size of the company are statistically insignificant at 0.05 in this market. The estimation of the parameters related to the momentum index in none of the markets studied is statistically significant, i.e., the momentum index does not significantly affect the rate of return achieved in any of the markets.

As can be seen from the figures presented in Table 9, parts A, B and C, the standing figures for liquidity variables in these markets are positive, i.e., an increase in liquidity should be accompanied by an increase in the rate of return. This is not consistent with the results of research obtained in highly developed markets. Additionally, the obtained results may confirm Fama's (1998) considerations regarding the effective market, as he has claimed that anomalies that occur in the capital market may have a small impact on the rate of return. This mainly concerns anomalies related to information that is available on the market, because

sometimes in the short term there is the phenomenon of asymmetry of information that may cause an excessive reaction of the market to certain events (see: Ikenberry, Lakonishok, Vermaelen, 1995; Mitchell, Stafford, 2000).

Table 9. Estimation of Model 3 parameters and their corresponding p-value values and t-student statistics

	Estimators	Statistics t-student	p-value
Austria			
A			
free term	0.01067	0.76928	0.44187
turnover ratio	0.34885	2.09007	0.03681
beta coefficient	0.01423	1.74281	0.08161
log(*Cap*)	–0.00489	–2.60563	0.00928
P/BV	0.00662	2.27119	0.02330
log(*MOM*)	0.00362	0.52680	0.59843
Hungary			
B			
free term	0.04348	0.83673	0.40294
turnover ratio	0.97229	11.93221	0.00000
beta coefficient	–0.00865	–0.64372	0.51991
log(*Cap*)	–0.00489	–0.94292	0.34595
P/BV	0.00277	1.48513	0.13782
log(*MOM*)	0.00204	0.26504	0.79103
Poland			
C			
free term	0.00299	1.45119	0.14675
turnover ratio	0.03374	3.43667	0.00059
beta coefficient	0.00577	2.80819	0.00499
log(*Cap*)	0.00000	–0.47785	0.63276
P/BV	–0.00026	–1.39485	0.16308
log(*MOM*)	0.00200	0.83751	0.40232

Source: own study

The adjustment of the model estimated using data from the Vienna Stock Exchange to real data measured by the adjusted R2 ratio is 0.007. The adjustment of the estimated model on data from the Hungarian market to real data measured by the adjusted R2 ratio is 0.12. The adjustment of the estimated model using data from the Warsaw Stock Exchange to real data measured by the adjusted R2 ratio is 0.0013.

The last stage of the study was to check whether liquidity measured by the spread exerts a significant influence on the rate of return in the markets of Austria, Hungary and Poland (Model 4). The results of these studies are presented in Table 10.

Table 10. Estimation of Model 4 parameters and their corresponding p-value values and t-student statistics

	Estimators	Statistics t-student	p-value
Austria			
A			
free term	0.01088	0.77781	0.43682
SPREAD	0.00800	0.78025	0.43539
beta coefficient	0.02023	2.51045	0.01218
log(*Cap*)	–0.00476	–2.50533	0.01236
P/BV	0.00756	2.54712	0.01098
log(*MOM*)	0.00377	0.54819	0.58366
Hungary			
B			
free term	0.12733	2.14157	0.03247
SPREAD	–0.00264	–1.79751	0.07255
beta coefficient	0.02151	1.52741	0.12697
log(*Cap*)	–0.01113	–1.91965	0.05518
P/BV	0.00227	1.13184	0.25797
log(*MOM*)	–0.00279	–0.34144	0.73284
Poland			
C			
free term	0.01242	5.42816	0.00000
SPREAD	–0.00335	–9.01600	0.00000
beta coefficient	0.00480	2.33728	0.01944
log(*Cap*)	0.00000	–2.08687	0.03692
P/BV	–0.00031	–1.67233	0.09448
log(*MOM*)	0.00289	1.21723	0.22354

Source: own study

As in the case of Model 4, the figures presented in Table 10, parts B and C, concerning both the Hungarian and Polish market data show that the estimations of the parameter relating to the spread and the company size measured by the logarithm of capitalisation are statistically significant at 0.05. As can be seen from the calculations made in Table 10, parts B and C, based on data from both the Hungarian and Polish markets, the estimations of the parameter relating to the price to book value ratio and the beta coefficient are statistically insignificant at 0.05. However, in the case of calculations made based on data from the Austrian market, the estimation of the parameter relating to the spread is not statistically significant at the level of 0.05, i.e., the liquidity measured by the spread does not significantly affect the rate of return in this market. In the case of other variables estimated in the Austrian market data, they are statistically significant at the level of 0.05. Only the estimation of the parameters related to the momentum index is not statistically significant in any of the analysed markets, i.e., the momentum index does not significantly affect the rate of return achieved in any of the markets.

As can be seen from the figures presented in Table 10, parts B and C, calculations of standing parameters with liquidity variables in these markets are negative, i.e., an increase in liquidity should be accompanied by an increase in the rate of return. This is not in line with the results of research obtained in highly developed markets, because the spread is considered a measure of illiquidity.Such a situation may be caused by investors' lack of faith in a change of the downward trend into the upward trend, which has been confirmed in research of, among others, Campbell, Lo and MacKinlay (1997), Szyszka (2003) or Czekaj, Woś and Żarnowski (2001). Such investors' behaviour and a lack of faith in a change in the market situation may affect the prices of shares and the liquidity of trading in them.

The adjustment of the estimated model using data from the Vienna Stock Exchange to real data measured by the adjusted R2 ratio is 0.004. The adjustment of the estimated model on data from the Hungarian market to real data measured by the adjusted R2 ratio is 0.003. The adjustment of the estimated model using data from the Warsaw Stock Exchange to real data measured by the adjusted R2 ratio is 0.006.

Subsequently, tests were also carried out for years T and $T + 1$, to show the existence of a relationship between the rate of return from a given share in $T + 1$ and its liquidity, expressed either as the turnover ratio (Models 1 and 3) or as the spread (Models 2 and 4), in the T period. When variables containing time lags were introduced into the models presented by equations (2) and (3), no statistically significant results were obtained in any of the analysed cases, therefore their presentation was abandoned in this work.

6. Applications

The research presented in the article is a continuation of analyses conducted all over the world, and mainly in the most-developed capital market, in the United States. The methodology proposed by Western researchers, due to the specifics of emerging markets such as the small number of listed companies, short time series, problems related to low investor activity on the market, or the lack of easy access to market information and data, must be modified accordingly. For these reasons, this methodology had to be adapted to data obtained from the Warsaw Stock Exchange, the Vienna Stock Exchange and the Budapest Stock Exchange. Based on the study described by Datar, Naik and Radcliffe (1998), the relationship between the rate of return and the systematic risk measured by the beta coefficient, the company size measured by the logarithm of capitalisation and liquidity, expressed either as the turnover ratio (Model 1) or as the spread (Model 2), was checked. The next step was to analyse the impact of liquidity on the rate of return in each of the markets based on the methodology described by Pastor and Stam-

baugh (2003) using the liquidity measure which is the turnover ratio (Model 3) or the spread (Model 4).

When analysing liquidity expressed as the turnover ratio or as the spread based on data from the Polish and Hungarian markets, it can be noted that there is a statistically significant relationship between liquidity and the rate of return on shares listed in these markets, regardless of the tested model. On the other hand, as far as the Austrian market is concerned, the statistically significant relationship between liquidity and the rate of return occurs only when the liquidity is expressed by the turnover ratio. In the case of liquidity expressed as the spread, this dependence on the Vienna Stock Exchange does not occur.

Regarding the estimation of parameters relating to the beta coefficient and the size of the company measured by capitalisation, they do not have a significant impact on the rate of return on the shares of the company in the Hungarian market when analysed using most models. However, the calculations carried out on data from the Warsaw and Vienna stock exchanges show that the beta coefficient and the company size measured by capitalisation are important for the rate of return in these markets; the results were confirmed by all analysed models. In Models 3 and 4, it can be noted that the estimation of the parameters related to the momentum index in any of the markets studied is not statistically significant, i.e., the momentum index does not significantly affect the rate of return achieved in any of the markets.

Several separate studies conducted on data obtained for the Polish, Hungarian and Austrian markets using various measures describing liquidity confirm the hypothesis put forward at the beginning of the study that there is a statistically significant relationship between the liquidity of the share turnover and the rate of return on the share. Regardless of the liquidity measure chosen, in most cases, the relationship between the liquidity of turnover and the rate of return on the Warsaw Stock Exchange, the Vienna Stock Exchange and the Budapest Stock Exchange was confirmed. This allows us to draw the conclusion that another variable has been found which should be taken into account by investors and market analysts in the valuation of securities and the estimation of the return on investment.

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Wpływ płynności obrotu na kształtowanie się stopy zwrotu z akcji na rynkach wschodzących na przykładzie Polski, Austrii i Węgier

Streszczenie: Płynność aktywów na rynku kapitałowym rozumiana jest przez inwestorów jako łatwość, z jaką dany rodzaj aktywów można zamienić na środki pieniężne, czyli mówiąc najprościej – sprzedać. Płynność obrotu miała zawsze istotne znaczenie dla praktyków działających na rynkach kapitałowych, chociaż w początkowej fazie rozwoju współczesnych finansów nie była w należytym stopniu rozważana na gruncie teorii. Sytuacja ta zmieniła się w połowie lat osiemdziesiątych ubiegłego wieku, kiedy to zaczęto w sposób sformalizowany analizować zagadnienie płynności na rynku finansowym. Badania przedstawione w artykule są kontynuacją analiz prowadzonych na całym świecie, a głównie na najbardziej rozwiniętym rynku kapitałowym w Stanach Zjednoczonych. Metodyka zaproponowana przez Datara, Naika i Radcliffe'a w pracy *Liquidity and Stock Returns: An Alternative Test*, ze względu na specyfikę rynków wschodzących: małą liczbę notowanych spółek, krótkie szeregi czasowe, występowanie problemów związanych z małą aktywnością inwestorów na rynku czy brak łatwego dostępu do informacji i danych rynkowych, musi zostać odpowiednio zmodyfikowana i dostosowana do posiadanych danych pochodzących z Giełdy Papierów Wartościowych w Warszawie, giełdy w Wiedniu oraz giełdy w Budapeszcie.

Słowa kluczowe: premia braku płynności, rynek kapitałowy, płynność akcji

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