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INVESTIGATION OF STOCK ILLIQUIDITY ON CENTRAL AND SOUTH EAST EUROPEAN MARKETS IN NAÏVE PORTFOLIO FRAMEWORK

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Abstract

This paper questions existence of illiquidity premium on 8 Central and South East European stock markets. Using the ILLIQ illiquidity measure proposed by Amihud (2002) we investigate liquidity of each stock. Naïve portfolio diversification is applied in forming liquidity sorted portfolios. These portfolios were formed using daily data in the half-year period and in the second part of analysis by using daily data within one month. Performance of these portfolios was observed in the half-year period out of the sample. This approach gave additional information pointing that each period had different set of stocks which were defined as less or more liquid. Contrary to previous researches we could not confirm existence of illiquidity premium on these stock markets since stock returns of illiquid portfolio and liquid portfolio do not show statistically significant difference in case of all eight countries and all observed portfolios. In addition, we conducted detailed analysis for Poland and Bulgaria using monthly data. These results confirmed previous findings suggesting that observation of liquidity has no impact on portfolio return in the next month.

Keywords: emerging markets, illiquidity premium, stock returns, ILLIQ, Central and South East Europe

1. INTRODUCTION

Amihud and Mendelson (1986) stated that liquidity is in practice of portfolio investment an important attribute of stocks but despite its evident importance in practice the role of liquidity in capital markets is hardly reflected in academic research. A recent area of interest among both financial economists and market practitioners has been the measurement of liquidity and its impact on asset prices. Aitken et al. (1997) report that there are 68 illiquidity measures in literature and they are all weakly correlated. This kind of diversity in liquidity measures leads investors to different conclusions which can give unwanted results in portfolio investment. Some measures by itself are not easy to calculate and require many microstructure data as bid-ask spread (Amihud et al., 1989). Many relevant researches are done on US data observing liquidity sorted portfolios which give predictable results. On observed markets in Central and South East Europe there is no large number of quality stocks to be traded with. In this paper is applied simple approach based on naïve portfolio diversification and small dataset which consists of twelve highest positioned stocks in every market index. To asses stock liquidity we use ILLIQ (Amihud, 2002).

We construct liquidity sorted portfolios for 8 Central and South European Stock Markets: Croatia, Hungary, Chez Republic, Poland, Germany, Bulgaria, Romania and Turkey. From every market 12 stocks were selected according to their weight in market index. In this paper is used naïve portfolio diversification since it according to many authors has many advantagesin contrast to Markowitz model (Markowitz, 1952). Size of single portfolio is limited to 5 due to size of these markets and conclusions of Tang (2004). According to Tang (2004) in a infinite population a portfolio size of 4 is necessary to eliminate 75% of diversifiable risk. Standard textbooks of Investment/Financial Management teach that although portfolio diversification can help reduce investment risk without sacrificing the expected rate of return, the benefit of diversification is exhausted with a portfolio size of 10 –15. Since by then, most of the diversifiable risk is eliminated, leaving only the portion of systematic risk. Tang examines the issue on naïve (equal weight) diversification and analytically shows that for an infinite population of stocks, a portfolio size of 20 is required to eliminate 95% of the diversifiable risk on average. However, an addition of 80 stocks (i.e., a size of 100) is required to eliminate an extra 4% (i.e., 99% total) of diversifiable risk. This result depends neither on the investment horizons, sampling periods nor the markets involved.

According to data from Federation of European Securities Exchanges at the end of January of 2011 on German stock exchange were 681 companies with listed shares on Warsaw stock exchange 581, Bulgarian stock exchange 380 and on Croatian market 246. Emerging markets are thin what can be concluded from observing market capitalization and number of listed companies (Pagano, 1989). At the end of January stock OTP on Hungarian stock exchange occupied 62,11% of total turnover in that month and on Chez stock market stock CHEZ occupied 38,68% of total turnover while on German and Turkish stock market these

numbers relating the turnover of most traded stocks are much smaller; Siemens 8,27% and Garanti Bankasi 7,16%. Common situation on these markets is absence of quality stocks to be traded with what makes a big pressure on the demand for stocks of good companies. This problem stated earlier Pagano (1989) discussing that emerging markets are thin. The demand is usually pointed to few good stocks what makes pressure to the price.The Croatian stock market is very small in terms of market capitalization and in the number of listed shares. Common problems that occur are infrequent trading and domination of few stocks which are frequently traded. On these markets the majority of trading during the longer periods is reserved for few quality stocks. For example, on Zagreb Stock Exchange (ZSE, Croatia) two most frequent traded companies: telecom and gas company occupied 38% of total traded value in 2011. First five most traded companies in the same period occupied 50.7% of total traded value on ZSE.

According to Bekaert et al. (2007), another problem on these markets are long non-trading periods associated with greater illiquidity effects. These markets have another problem which also can be related to liquidity (Bakeart et al., 2007), as we move to the lower ranked stocks in national stock index we can see that these stocks have shorter non-trading periods. For example stock KONZUM which ranked twelve in national stock index does not have 250 daily observations in one year period but 221 and 224 observations.

Although Markowitz's (1952) mean–variance framework provides the basic concept of modern portfolio theory and is still widely used in practice today in asset allocation and active portfolio management, individual investors tend to use naive diversification rather than sophisticated diversification. For example, Liang and Weisbenner (2002) find that investors follow the naive 1/*N* strategy to allocate their wealth across assets indicating that workers appear to put 1/N of their contributions in company stock, where "N" is the total number of investment options. Markowiz model or mean–variance model is optimization model that gives more weight to those assets that contribute to higher mean–variance efficiency. Compared with the optimal portfolio, the most appealing feature of the 1/*N* portfolio is simplicity since it does not require calculation of stock returns and risk.

The paper is organized as follows: in the introduction liquidity problem on observed markets is defined. In the second part of this paper we define ILLIQ which is applied to asses liquidity of observed stocks, concept of naïve portfolio diversification and methodology of observing portfolio performance in the out of sample period. Using the ILLIQ measure first proposed by Amihud (2002) we measure liquidity of single stock using daily stock returns. In the next step stocks are sorted into two portfolios according to value of ILLIQ ratio; portfolio of more liquid and portfolio of less liquid stocks for every market. These portfolios are observed in out of sample period and results of conducted analysis are presented in fourth part of this paper. In conclusion we draw most important conclusions.

2. PREVIOUS RESEARCHES

Many authors used different approaches for measuring stock illiquidity and questioned impact of illiquidity on assets pricing. The literature argues that liquidity should play a role on emerging stock markets where securities and investors are scarce and trading volumes are lower than on developed markets. Pastor and Stambaugh, (2003) define liquidity as the ability to trade large quantities quickly, at low cost, and without moving the price. Chai et al. (2010) define depth as the ability of the market to absorb a large quantity of trade without having a large impact on price. Tightness refers to the cost of transactions, such as the bid–ask spread. Pagano (1989) predicted a positive relation between volatility and market thinness or illiquidity explaining that thin markets cannot accommodate temporary bulges of buy or sell orders without large price movements. Thus market thinness tends to increase the volatility of assets prices and their tendency to react adversely to the orders of traders - two features that are obviously unappealing to investors (Pagano, 1989).

Amihud (2002) examined the average ratio of the daily absolute return to the dollar trading volume on that day for the U.S. market. It can be interpreted as the daily price response associated with one dollar trading volume thus serving as a rough measure of price impact. Author found that stock returns are negatively related over time to contemporaneous unexpected illiquidity, suggesting that illiquidity affects more strongly firms with smaller market capitalization. Bekaert et al. (2007) found that local market liquidity is important driver of expected returns in emerging markets. They concluded that there is no consistent pattern in the correlation between estimates of conditional volatility and the liquidity measure. According to them correlation is as often positive as it is negative, though economically small in most cases. On average, correlation is effectively zero.

Miralles and Miralles (2006) used illiquidity ratio (Amihud, 2002) as the best proxy for illiquidity on Spanish stock market. They concluded that systematic illiquidity should be a key ingredient of asset pricing.

According to Bekaert et al. (2007) long periods of consecutive non-trading days should be associated with greater illiquidity effects than non consecutive periods. They employed the zero measures defined simply as the proportion of zero daily returns averaged over moths. The fact that the zero measure correlates negatively with turnover is indirect evidence supporting that longer periods of consecutive non-trading are associated with greater illiquidity effects. Their measure attempts to take this return catch up effect into account (Bekaert et al., 2007). Bekaert et al. in their research did not take into account Central and South East European emerging markets.

Lischewski and Voronkova (2012) investigate whether liquidity helps explaining stock returns in Poland. They concluded that liquidity is not a priced factor on the Polish market. This may potentially have important implications for making accurate inferences with regard to asset pricing as liquidity is deemed to

be particularly important in the context of emerging markets where the number of securities, number of traders and efficiency of trading mechanisms is likely to be lower than in the developed markets (Lischewski and Voronkova, 2012).

Portfolios are constructed using naïve portfolio diversification which according to recent researches has many appealing characteristics. DeMiguel et al. (2009) found that out-of-sample results of the sample-based mean-variance strategy is much lower than that of the 1/N strategy, indicating that the errors in estimating means and covariances erode all the gains from optimal, relative to naive, diversification. They also concluded that the various extensions to the sample-based mean-variance model that have been proposed in the literature to deal with the problem of estimation error typically do not outperform the 1/N benchmark.

Cherian et al. (2011) applied simple liquidity based portfolio forming strategy, portfolios of less liquid and more liquid stocks were formed. Portfolios are reconstituted at the end of prior month and the constituents are held constant through the next month. Authors demonstrate that illiquid stocks, on average, outperform liquid stocks.

Tu and Zohu (2011) provide new theory-based portfolio strategies which are the combinations of the naive 1/N rule with the sophisticated theory-based strategies. Their study reexamines usefulness of the investment theory and shows that combining portfolio rules can potentially add significant value in portfolio management under estimation errors.

Brown et al. (2013) questioned why optimal diversification cannot outperform naive diversification. They focus on the tail risk exposure of the 1/*N* strategy rather than the estimation error of the optimal strategy. They concluded that the naive diversification strategy outperforms the optimal diversification strategy.

3. DATA AND METHODOLOGY

We construct liquidity sorted portfolios for 8 Central and South European Stock Markets: Croatia, Hungary, Chez Republic, Poland, Germany, Bulgaria, Romania and Turkey and present the results of an easily-implementable, liquidity-driven trading strategy.

From every market 12 stocks were selected according to their weight in market index. Data for this study include information on stock returns and traded volumes for 86 stocks which are selected as twelve highest ranked stocks from every national index. Data consist of exactly 500 daily observations for each stock in period from the beginning of November 2009 to the end of October 2011. Illiquidity measure used in this study is calculated from the daily data on returns and volume that are readily available over long periods of time for most markets.

In this research we use well known Amihud's proxy for illiquidity *ILLIQ* for each stock:

$$ILLIQ_i = \frac{1}{I}\sum_{t=1}^{I} |R_{it}| / V_{it} P_{ti} \quad (1)$$

Where R_{it} is the daily return on stock i on day t, V_{it} is the respective daily volume, P_{it} is the price of stock i on day t and is the number of days for which data are available for stock i. In literature *ILLIQ* is often referred as measure of price impact (*PI*). Daily return is calculated in continuous time:

$$R_{it} = \ln\left(P_{it} / P_{i,t-1}\right) \quad (2)$$

If illiquidity is indeed awarded by a return premium it would be interesting to examine investment strategy based on the observation of illiquidity to gain illiquidity premium. We sort stocks in two equally weighted portfolios of five stocks according to value of ILLIQ measure and observe portfolios in following six month period. This methodology was applied by Cherian et al. (2011). Illiquidity is observed using six month and one month periods as in Aitken and Comerton-Forde (2003).

Following the findings of Amihud (2002) we form a hypothesis: illiquidity portfolios have higher returns in out of sample period than portfolios composed of liquid stocks.

We construct 32 portfolios based on observing ILLIQ of single stock in the previous six month period and observe Cumulative Abnormal Returns (CARs) of constructed portfolios in the following six month period. Benchmark portfolio for each market is equally weighted portfolio of twelve stocks included in corresponding national index.

Abnormal returns are calculated for each portfolio in following six month period. At first daily returns of every portfolio are calculated. Every portfolio consists of five stocks where every stock in portfolio has weight 1/N, in our case 0,20. Abnormal returns are calculated for every portfolio according to the following equation:

$$AR_{it} = PR_{it} - MR_t \quad (3)$$

where AR_{it} is the abnormal return of portfolio i in time t and, PR_{it} return of portfolio i in time t, MR_t is the expected return on market portfolio on day t.

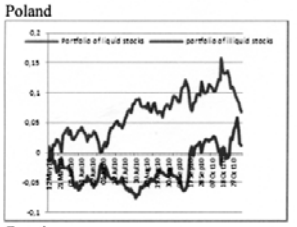
Cumulative abnormal returns (CARs) are calculated by aggregating daily ARs over time. Cumulative abnormal daily returns are calculated as follows:

$$CAR_{T_0}^{T_1} = \sum_{T_0}^{T_1} AR_t \quad (4)$$

4. RESULTS

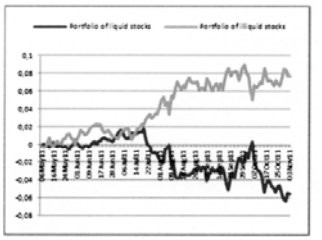
In this section are presented results of out of sample performance of liquidity sorted portfolios first in the following six month period and afterwards in following one month period.

Poland

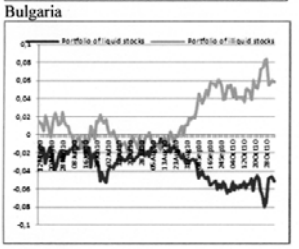


Croatia

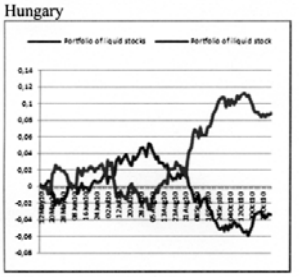
Czech Republic



Bulgaria



Hungary



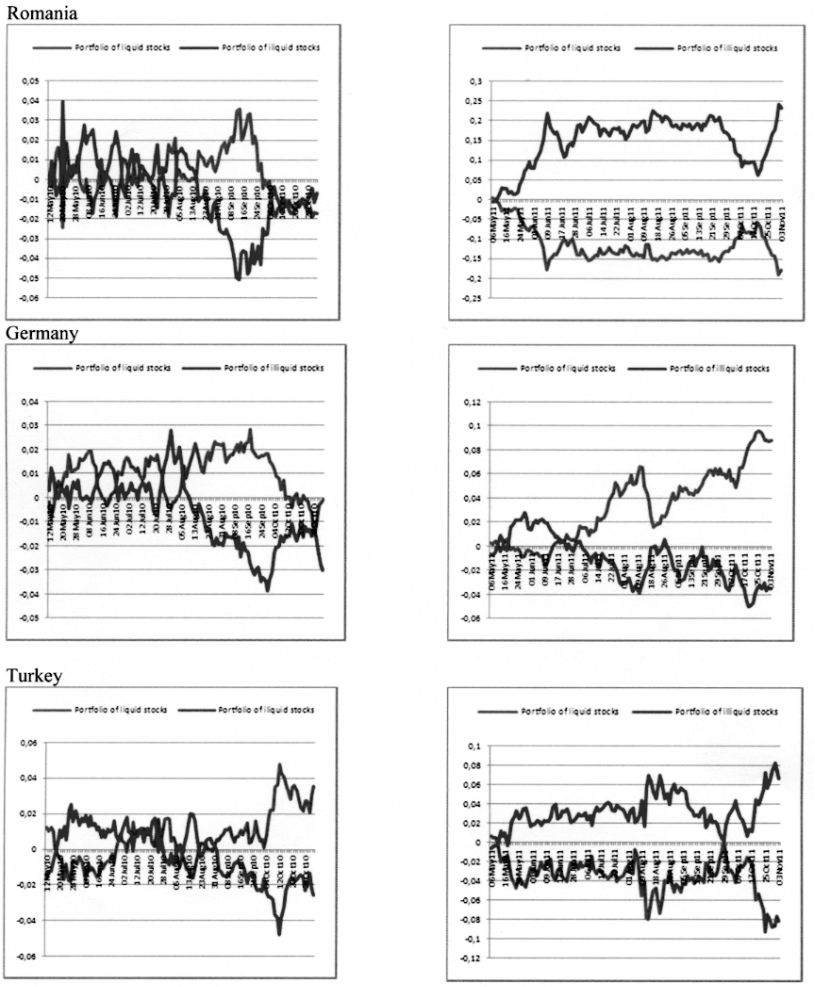


Fig. 1: CARs of two portfolios: portfolio composed of more liquid stocks and portfolio composed of less liquid stocks in two sub periods. First sub period: May- November 2010 (first column) and second May- November 2011 (second column).

Source: Authors calculations

Through inspection of charts in Fig. 1 it can be seen that in 7 cases CARs of illiquid portfolios graphically dominate liquid portfolios in the out of sample period. In the next step t-test was applied to confirm if there exists statistically significant difference between expected return of portfolio composed of more liquid stocks and portfolio composed of less liquid stocks. Daily portfolio returns are calculated in the out of sample period for every observed portfolio, what gives 125 daily portfolio returns for each liquid or illiquid portfolio. Results of t-test showed that there is no statistically significant difference between

expected return of more liquid and less liquid portfolio for all 16 datasets which are showed graphically above. Another problem that occurs from these results is that through comparison of content of liquid and illiquid portfolios for all eight markets it can be seen that only for three markets Chez Republic, Hungary and Romania content of liquid and illiquid portfolio in second sub period remained unchanged.

Table 1

Portfolio returns and risks of observed portfolios of liquid and illiquid stocks in the six month period

	Portfolio of more liquid stocks		Portfolio of less liquid stocks		Market portfolio	
	Return	Standard deviation of portfolio return	Return	Standard deviation of portfolio return	Return	Standard deviation of portfolio return
CRO1	-0,00106	0,007685	0,000085	0,008537	-0,000198	0,007958
CRO2	-0,00268	0,011721	-0,000170	0,013629	-0,001380	0,011054
CEZ1	-0,00047	0,010015	0,000592	0,010767	-0,00013	0,010011
CEZ2	-0,00302	0,018704	-0,00198	0,016827	-0,00258	0,017281
BUL1	-0,00098	0,013779	-0,0001	0,013557	-0,00057	0,010865
BUL2	-0,00269	0,013038	-0,00187	0,016225	-0,00235	0,012676
HUN1	-0,00019	0,013297	0,000778	0,013239	7,59E-05	0,01167
HUN2	-0,00175	0,016838	-0,00436	0,019223	-0,00316	0,015529
ROM1	-0,00046	0,022511	-0,00037	0,014722	-0,00032	0,017703
ROM2	-0,00172	0,017922	0,001534	0,029386	-0,00031	0,019713
GER1	0,000751	0,009869	0,000518	0,013098	0,000758	0,010878
GER2	-0,00121	0,021517	-0,00218	0,018563	-0,0019	0,020479
TUR1	0,00297	0,01619	0,002483	0,012018	0,002687	0,013126
TUR2	-0,00182	0,025213	-0,00065	0,015258	-0,00117	0,018085

Source: Authors calculations

Using results from Table1 t-test was performed; results confirmed that there is no statistically significant difference between expected returns of liquid and illiquid portfolios. Using t-test risks of liquid and illiquid portfolio were also observed. Results showed that there exists no statistically significant difference between risk of less liquid and more liquid portfolios.

In the second part of our analysis we selected two countries; Poland where liquidity portfolios overperforme illiquidity portfolios in both periods and Bulgaria where illiquidity portfolio over performs liquidity portfolio in whole period. Through inspection of ILLIQ in previous 30 days period we form portfolio of less liquid and portfolio of more liquid stocks and evaluate their performance in the following 30 days period. This analysis is performed repeatedly for the whole dataset. Results of expected returns and standard deviations of resulting portfolios are given in Table 2 and Table 3.

Table 2

Portfolio returns and risks of observed liquid and illiquid portfolios in one month period - Poland

		Portfolio of more liquid stocks		Portfolio ofless liquid stocks	
		Return	Standard deviation of portfolio return	Return	Standard deviation of portfolio return
23Dec09	05Feb10	-0,03459	0,161139	0,003251	0,012865
22Mar10	05May10	0,001239	0,015192	0,001777	0,014787
18Jun10	29Jul10	0,002013	0,011662	-2,5E-05	0,008727
10Sep10	21Oct10	0,003268	0,011819	0,002956	0,018281
07Dec10	19Jan11	0,000809	0,015692	-0,00355	0,013916
03Mar11	13Apr11	0,000949	0,012286	-0,00285	0,009785
31May11	12Jul11	-0,00257	0,012396	-0,00506	0,010446
25Aug11	05Oct11	-0,00556	0,031854	-0,00648	0,016308

Source: Authors calculations

Table 3

Portfolio returns and risks of observed liquid and illiquid portfolios in one month period – Bulgaria

		Portfolio of more liquid stocks		Portfolio of less liquid stocks	
		Return	Standard deviation of portfolio return	Return	Standard deviation of portfolio return
23Dec09	05Feb10	0,001104	0,008185	0,00077	0,007119
22Mar10	05May10	-0,00095	0,005369	-0,00074	0,006552
18Jun10	29Jul10	0,001247	0,012972	0,000174	0,010705
10Sep10	21Oct10	-0,00215	0,01744	-0,001	0,012312
07Dec10	19Jan11	0,001309	0,005842	0,006119	0,012381
03Mar11	13Apr11	0,00081	0,00822	0,001837	0,009586
31May11	12Jul11	0,001238	0,008629	0,00018	0,010655
25Aug11	05Oct11	-0,00303	0,013822	-0,00405	0,015946

Source: Authors calculations

Results of t-test confirm previous findings indicating that there exists no statistically significant difference in expected stock returns between less liquid and more liquid portfolio. Only one period in case of Bulgaria - December 2010 till January 2011 shows statistically significant difference in stock return between less liquid and more liquid portfolio. Results of t-test show that there is no statistically significant difference between risk of liquid and illiquid portfolios. Greatest problem that occurs in such short period is that combination of liquid and illiquid stocks changes from one month to another. Observing ILLIQ of single stock in 30 days period is valid only in that period.

5. CONCLUSIONS

Most important feature of liquid stock is the possibility of selling the stock immediately without moving the price too much. There exist numerous papers concerning liquidity mostly referring to US data. In this paper usefulness of observing illiquidity on Central and South East European emerging markets using most referred illiquidity measure Amihud's ILLIQ is examined.

It is evident that these markets are thin and few quality stocks occupy most trading on these markets, some stocks have longer non trading periods. We apply simple liquidity based naïve portfolio composition which is easily applicable and conclude that by observing illiquidity through ILLIQ investors cannot expect illiquidity premium on observed markets.

Our results do not support foundings of Amihud (2002), Miralles and Miralles (2006) and Cherian (2011) but confirm the founding of Lischewski and Voronkova (2012) who rejected illiquidity as a pricing factor for Polish stock market. Our results support the findings of Lo and McKinlay (1990) who pointed out that besides extensive evidence from the U.S. market there is limited evidence regarding the importance of illiquidity as risk factor in other markets.

Amihud (2002), Miralles and Miralles (2006) and Lischewski and Voronkova (2012) analyze liquidity using standard CAPM and the Fama-French three-factor model within a time series context. Liquidity proxy used in these papers is Amihud's ILLIQ.

We observe ILLIQ measure in two six month sub-periods (125 daily observations) and 8 monthly periods using methodology as in Cherian et al. (2011). Cherian et al. (2011) concluded that liquidity affects financial market performance and as a consequence, has implications for both portfolio construction and risk management for US market. We applied the same methodology on CEE markets and rejected existence of illiquidity premium as in Lischewski and Voronkova (2012).

Additional problem that occurs is that in these two sub-periods ILLIQ gives different information on stock liquidity. This problem especially complicates when observing liquidity in one month period (30 observations) when composition of more liquid and less liquid portfolio is constantly changing in all eight datasets for Poland and Bulgaria. These results draw important questions; what is a reasonable period in which investor should observe illiquidity and afterwards, how long portfolios should be held to gain possible illiquidity premium. Results do not confirm existence of illiquidity premium on German stock market as well as on other observed Central and South East European stock markets. These results confirm notion of Johnson (2008) who concluded that higher level of activity may not unambiguously indicate healthier markets accommodating risk transfer.

Many authors pointed out that liquidity is expected to be particularly important on emerging markets. Surprisingly, this does not prove true for stocks

traded on CEE markets. These results question the importance of observing stock illiquidity using most accepted liquidity measure Amihud's ILLIQ. These markets are different in; number of securities, number of quality securities, number of traders and infrequent trading giving a need for further redefinition of measurement of liquidity on these markets.

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ISTRAŽIVANJE NELIKVIDNOSTI DIONICA NA TRŽIŠTIMA KAPITALA SREDIŠNJE I JUGOISTOČNE EUROPE U KONTEKSTU NAIVNOG PRISTUPA OBLIKOVANJU PORTFELJA

Sažetak

U ovom radu preispituje se postojanje premije za nelikvidnost na osam tržišta kapitala u središnjoj i jugoistočnoj Europi. Za procjenu nelikvidnosti pojedinačne dionice primijenjen je ILLIQ Amihud (2002). Pri oblikovanju portfelja dionica koji se temelji na sortiranju dionica prema likvidnosti primijenjen je pristup naivne diversifikacije portfelja. Portfelji su oblikovani na temelju promatranja dnevnih podataka u polugodišnjem razdoblju, a zatim i u razdoblju od mjesec dana. Karakteristike ovih portfelja su promatrane u polugodišnjem razdoblju izvan uzorka. Ovakav pristup dao je i dodatne informacije o sastavu portfelja, pri čemu se u svakom periodu različiti skup dionica smatra manje ili više likvidnim. Suprotno ranijim istraživanjima, nije dokazana prisutnost premije za nelikvidnost na ovim tržištima jer povrat i likvidnih i manje likvidnih portfelja ne pokazuje statistički značajnu razliku u primjeru svih osam zemalja i svih promatranih portfelja. Provedena je dodatna detaljna analiza na bugarskom i poljskom tržištu na temelju mjesečnih podataka. Ovi rezultati potvrdili su prijašnje nalaze potvrđujući da promatranje nelikvidnosti nema utjecaja na povrat portfelja u sljedećem mjesecu.

Ključne riječi: izranjajuća tržišta kapitala, premija za nelikvidnost, povrati dionica, ILLIQ, središnja i jugoistočna Europa

JEL klasifikacija: G11, G15