Received: 5 November 2009; Accepted: 29 January 2010.
DOI: 10.2298/PAN1003349Z
Scientific review

Boško Živković

Faculty of Economics,
University of Belgrade,
Serbia
boskoz@one.ekof.bg.ac.rs

Jelena Minović

Faculty for Banking, Insurance and Finance,
Belgrade Banking Academy,
Union University,
Serbia
jelena.minovic@gmail.com

Illiquidity of Frontier Financial Market: Case of Serbia

Summary: The paper explores illiquidity of the Serbian financial market for the period of 2005-2009. The financial market in Serbia is, by its type, a frontier market. We used daily data from the BELEXline index, as well as all stocks within this index in examined timeframe, provided by the Belgrade Stock Exchange. Results of this paper suggest that level of market liquidity is low and persistent in Serbia. Additionally, results confirm that time-varying illiquidity and its volatility is highly unstable in this market. This is the first paper that analyses liquidity issues in case of Serbia. It identifies different periods and shows that, in most cases, ups and downs in foreign investors' participation leads to dramatic falls and rises in market illiquidity and its volatility.

Key words: Frontier market, Illiquidity, Volatility of illiquidity, Conditional standard deviation.

JEL: G10.

Apart from old and developed markets, there are the so-called emerging markets. These are primarily markets in Asia and Latin America. A new group of markets has lately been defined in Eastern and South-Eastern European countries, the so-called frontier markets (Dragan Šestović and Mladen Latković 1998). Frontier or pre-emerging markets are to, in any of the forthcoming evolution phases only, share similar levels of liquidity, and similar risk and outputs characteristics with emerging markets. Frontier markets are, thus, neither considered to be developed nor emerging. Typical examples of frontier markets, among others, are Serbia, Croatia, Bulgaria, Kazakhstan, Nigeria, Sri Lanka and Vietnam. We have focused in this paper on liquidity issues on frontier markets and the Serbian stock market in particular. The main hypothesis is that level of liquidity is low and persistent on this stock market. Another hypothesis is that time-varying illiquidity and its volatility is highly unstable in the Serbian market.

Liquidity of a market is characterized by the ability of investors to buy and sell securities easily. Illiquidity occurs when an asset or securities cannot be quickly converted into cash (Andrew Clark 2008). Put another way, market liquidity refers to the ability to undertake transactions in such a way as to adjust portfolios and risk profiles without disturbing underlying prices (Andrew Crockett 2008).

Undoubtedly, liquidity has an effect on assets value (see papers by Yakov Amihud 2002; Luboš Pástor and Robert F. Stambaugh 2003; Viral V. Acharya and Lasse Heje Pedersen 2005; Ronnie Sadka 2006; Geert Bekaert, Campbell R. Harvey, and Christian Lundblad 2007; etc.). This is why it is one the most favorable characteristics required by investors. Liquidity on a stock exchange is generated by so called market makers. Speculative investors and market makers are key players that bring

about market or assets liquidity (Gur Huberman and Dominika Halka 2001). Indeed, liquidity is a prerequisite for investors (both individuals and institutions) to get returns from expected changes in prices. They, in turn, generate demands enabling liquidity. One of key difficulties any investor might face on a frontier market is a low level of market liquidity. While such markets are typically open and available for foreign investors, low liquidity often hinders a more serious level of investments by institutional investors (see a survey by Punam Chuhan 1994). It is often thought that a low level of liquidity is, therefore, one of key issues typical for small frontier markets.

Measuring market liquidity is not a trivial issue[1]. Bekaert, Harvey and Lundblad (2007) analyze measuring of liquidity for 19 emerging equity markets. Clark (2008) studies history and measurement of liquidity risk in frontier markets. Many of the more sophisticated measures of (il)liquidity[2] could not be used for estimation of liquidity of the Serbian frontier market, because of the lack of data and specific features of this market. Lesmond (2005) concludes that any measuring of liquidity has its advantages and disadvantages when used for estimation of liquidity among countries or within a country. Models based on the volume such as Amihud's measure and turnover could be misleading in case of weak liquidity markets. This shortage is practically manifested in a reduced scope of revenues affecting turnover, as well as null returns influencing Amihud's measuring. Findings by Lesmond (2005), Bekaert, Harvey, and Lundblad (2007) show that turnover is not a sustainable measure of liquidity in emerging markets. It is neither a good measure for estimation of liquidity among countries nor within each respective country. Lesmond (2005) points out that it is very important to select an appropriate measure of liquidity because these measures are necessary for adequate estimation of the market efficiency. Selection of an appropriate measure of liquidity for frontier capital markets is a key issue for empirical analysis.

We shall in this paper focus on illiquidity of the Serbian financial market for the period of October, 2005 – July, 2009. We have used daily data from the BELEX*line* index, as well as daily data for individual stocks within this index. The return of the market is the return of the capitalization-weighted index, BELEX*line*. We have chosen the price impact measure of Bekaert et al. (2007) to measure illiquidity. The authors applied this illiquidity measure for emerging markets, and it turned out reliable in estimation of illiquidity of these markets. Market return and market illiquidity measures in case of Serbia have been separately considered aiming at getting individual dynamics over time. We have used univariate Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model (by Tim Bollerslev 1986) in order to capture time variation of the volatility of illiquidity. This paper identifies different periods and shows that, in most cases, ups and downs in foreign investors' participation have led to dramatic falls and rises in market illiquidity and its volatility.

[1] See papers by Albert S. Kyle (1985), Amihud (2002), Richard Roll (1984), Sanford Jay Grossman and Merton H. Miller (1988), David A. Lesmond, Joseph P. Ogden, and Charles A. Trzcinka (1999), Pástor and Stambaugh (2003), Acharya and Pedersen (2005), Tarun Chordia, Roll, and Avanidhar Subrahmanyam (2000, 2008), Sadka (2006), Huberman and Halka (2001), and others.

[2] Some of the most common of (il)liquidity measures are the following: Turnover, Bid-Ask spread, Roll's model (1984), Kyle's measure (1985), LOT's model (named by Lesmond, Ogden, and Trzcinka 1999), Amihud's measure (2002), Pástor-Stambaugh factor (2003), and others.

The rest of the paper has been divided into the following sections: Section 1 exploring phenomenology of emerging and frontier financial markets; Section 2 presenting data and introducing our empirical methodology; Section 3 analyzing main results concerning illiquidity and its volatility in the Serbian market and Section 4 – a conclusion.

1. Phenomenology of Frontier Financial Market

Most emerging and frontier markets, even those in developed economies, are inefficient. It quite often reflects in the size of the market, poor trading scope, and quality of information. Hence, a low trading rate makes a significant number of securities illiquid, which leads to inefficiency. Low trading rate is one of the reasons explaining why frontier markets show serious deviations from the market efficiency (Latković 2001). Liquidity is an important factor of stability and efficiency of the financial market (Jennifer Huang and Jiang Wang 2007). Chordia, Roll, and Subrahmanyam (2008) investigated liquidity and market efficiency. Crockett (2008) analyzed market liquidity and financial stability. In frontier markets liquidity is not only low but also discontinuous. Several weeks may pass between two subsequent trades. Such a situation is certainly not common for traded securities in developed capital markets (Latković 2001). However, frontier markets have some specific features that cannot be found in developed markets.

Main problems of frontier markets which impact market liquidity are the following: a small number of stocks with significant capitalization, a small number of outstanding shares, infrequent and irregular trading, etc. Additionally, there are typical short time series of past trades, lack of transparency and readily accessible information about traded companies, as well as occurrence of the so-called invisible forms of risk, among which illiquidity is the most important one. Due to all these factors frontier markets suffer from an increased level of systematic risk (Latković and Zoran Barac 1999).

The Belgrade Stock Exchange was the first re-established stock exchange after the World War II in East Europe (1989). Nevertheless, it was an organization without rules of the game until early 2002. That very year the market began operating in more or less standard manner. Shares issued as a result of insider privatization model have been main classes of assets traded on this market. A large portion of the total capitalization on the Serbian frontier market is highly illiquid, i.e. many companies are listed on the exchange just de-jure rather than de-facto. In addition, only a small percentage of the company's assets is typically floated. While this is characteristic of almost all economies in transition, the Serbian market, in comparison with many other transition markets, may be even more illiquid.

The Serbian frontier market is a one-way market, having in mind the supply and demand. It means that main sellers of shares are individual owners, who have obtained shares, often for free, within the mass privatization procedure. Main buyers of shares on this market come from the enterprise sector. Their goal is to take over companies or acquire substantial stakes in companies. This leads to significant concentration of ownership and emptying of this market, in particular. The main reason for this phenomenon is the fact that this market essentially does not operate as stocks market, but as a takeover market of market companies (Boško Živković et al. 2005).

Foreign investors showed an active interest in emerging markets before the global economic crisis. Lured by promised higher returns, they explored opportunities in emerging markets as well, with a relatively modest success. Frontier markets being small in size and their poor liquidity are the main reasons for arisen interest in frontier markets (Chuhan 1994). Slavica Penev and Matija Rojec (2004) discover main obstacles to foreign direct investment flows into the South-East Europe region: high investment risks, lack of adequate physical infrastructure, delays in bank restructuring and rehabilitation, underdeveloped financial markets, delays in large–scale privatization and enterprise reform, inadequate development level of institutional infrastructure, administrative barriers to foreign direct investment and unfavorable legal environment.

Lack of liquidity was one of main challenges the Belgrade Stock Exchange was facing, even during intense periods of trading. In the course of 2008, the first step towards boosting liquidity was made by developing and implementing the market maker concept. Market makers are expected to facilitate order execution especially for retail investors. Market making operations, which involve simultaneous and continuous placement of buy and sell orders, have significantly increased liquidity of stocks (The Belgrade Stock Exchange 2009b).

Market liquidity can also be affected by asymmetric information. For instance, when information on company's successful innovation leading to increased sales and profit is accessed by only a small number of investors, they will conduct a massive purchase of the associated stock, leading to misbalanced price formation process. This will further on stimulate distortion on the market liquidity in general (Erie Fabrian and Aldrin Herwany 2008). Deep information asymmetry between the buyer and the seller is found on the Serbian frontier market (Živković et al. 2005).

2. Data and Methodology

We have daily returns for individual stocks within the BELEX*line* index, trading in the Serbian discontinuous market from October, 2005 until July, 2009.[3] Daily returns would be estimated (daily returns are calculated as difference in log price at closing) for a huge collection of companies from Serbia (over 200 companies). Return of the market is a return of capitalization-weighted index, BELEX*line*, which entails all stocks available on a particular day in the sample.

The Belgrade Stock Exchange has calculated and published index BELEX*line* since 2 April 2007, as a benchmark for monitoring broad market movements[4]. The BELEX*line* index is descriptive, in the statistical sense, and not investible (mean of return on this index is zero, Table 2 in Appendix). The index weighting is based on market capitalization. In addition, only a small percentage of the company's assets are typically floated in Serbia. Change in the level of capitalization is not a representative measure of a frontier market's liquidity. Due to illiquidity of belonging se-

[3] **The Belgrade Stock Exchange**. 2009c. Used time series. http://www.belex.rs/trgovanje/indeksi/belexline/korpa (accessed July 14, 2009).

[4] The Belgrade Stock Exchange index was created in December 2005 and published under the official name BELEX*fm*. It was decided, due to market related circumstances, that this index should be replaced with a new general index BELEX*line,* which would more precisely describe market tendencies.

curities, index composition is often modified, which is why index is not the best choice for the market proxy. However, we do not have a better market proxy and consequently have to use the BELEX*line* index.

We use the price impact (PI) measure suggested by Bekaert, Harvey, and Lundblad (2007) in order to measure illiquidity. This measure aims at incorporating potential price impact by using length of a non-trading (or zero return) interval (Bekaert, Harvey, and Lundblad 2007). Our price impact illiquidity measure is based on the software program within the Microsoft Access package. This program enabled specification of a selected illiquidity measure. As a check, we also computed a value-weighted[5] illiquidity measure of BELEX*line* index. Sadka (2006), and Acharya and Pedersen (2003) suggest that computing the market illiquidity as an equal-weighted average is perhaps more appropriate than a value-weighted average since liquid firms are over represented in the sample. A value-weighted average would further worsen this problem because it would substantially represent the largest of firms in the sample.

We have therefore modeled market illiquidity as a stochastic price impact process. Series of market returns and market illiquidity measures in the Serbian case are separately considered aiming at getting their individual dynamics over time. In addition to this, series of buy-sell orders[6] are identified for both individual and institutional investors (see Figure 3).

A selected illiquidity measure (PI) value ranges from 0 to 1; with the value closer to 1 denoting extremely high market illiquidity. Bekaert, Harvey, and Lundblad (2007) found that Indonesia is the least liquid country according to the value of PI measure (mean of PI = 0.776). Taiwan has a mean of PI measure = 0.158, implying that Taiwan is the most liquid country of all 19 analyzed emerging markets. We have established some critical values aiming at testing our low liquidity level hypothesis. PI's average value for all 19 analyzed emerging markets was 0.552 in Bekaert, Harvey, and Lundblad (2007). We have then decided to denote all values of PI measure above 0.552 as low liquidity. We may see from Table 2 in Appendix that the mean of illiquidity measures is 0.605, indicating that the Serbian market is illiquid. Low liquidity level hypothesis of the Serbian market cannot be rejected. We calculated an average value of PI measure in order to compare illiquidity for each respective year (see Table 6 in Appendix). The most illiquid year was 2006 (mean of PI = 0.735), while the least illiquid year was 2007 (mean of PI = 0.460). The standard deviation of illiquidity measures is 0.174 (Table 2 in Appendix). To test instability of illiquidity and its volatility hypothesis, we have to use ARMA-GARCH analysis. The hypothesis will be rejected unless our series adequately meet the GARCH process requirements. In other words, if any ARCH effect is left after specifying the GARCH process.

[5] Bekaert, Harvey, and Lundblad (2007) used capitalization-weighted or value-weighted illiquidity measure, too. Amihud (2002), Pástor and Stambaugh (2003), Acharya and Pedersen (2004), Sadka (2006), and others used an equal-weighted illiquidity measure.

[6] **The Belgrade Stock Exchange**. 2009c. Used time series.
http://www.belex.rs/trgovanje/ucesce_stranaca (accessed July 14, 2009).

Before we proceed with modeling, we have to make sure that our series of returns for all analyzed companies within the BELEX*line* index and the illiquidity measures of the BELEX*line* index are stationary. This is done by testing for the presence of a unit root utilizing Augmented Dickey Fuller test (ADF). This test's regressions clearly support the presence of a unit root factor in the log data of the BELEX*line* index. Furthermore, the ADF statistics for the daily log returns (i.e. the first differences), and daily illiquidity measures of the BELEX*line* index, show that both series are stationary (see Table 1 in Appendix). Then, our log returns and series of illiquidity measures were tested against normal distribution, having used descriptive statistics (skewness, kurtosis, Jarque-Bera normality test etc. in Table 2 in Appendix). According to Table 2 it can be seen that the series of log returns on the BELEX*line* index have positive skewness coefficient which means that distribution of log returns has a long right tail. The kurtosis coefficient of these log returns exceeds 3, so the distribution of this series is peaked (leptokurtic) relative to the normal. On the other hand, the series of illiquidity measures on the BELEX*line* index has negative skewness coefficient which means that distribution of market illiquidity has a long left tail. The kurtosis coefficient of this illiquidity measure is less than 3, the distribution of this series is flat (platykurtic) relative to the normal. The value of the Jarque-Bera normality test is very high and probability is significantly low for both analyzed series, so the null hypothesis of a normal distribution should be rejected. Thus, according to the results presented in Table 2 in the Appendix, we see that series of market returns and series of market illiquidity are not normally distributed. We have then applied Autoregressive Moving Average (ARMA) analysis for the log return and illiquidity measures of the BELEX*line* index in order to obtain a residual series, which is free of serial correlation. We specified ARMA models, which minimize information criteria. It is known that Schwarz's criterion (SIC) correctly identifies an ARMA model, whereas Akaike's criterion (AIC) tends to over fit the model. According to SIC criterion, ARMA (1,3) process was chosen for the log returns and ARMA(4,2) was chosen for the illiquidity measures of the BELEX*line* index. It is clear from Table 3 that the residuals obtained from ARMA models for both series are not normally distributed, because the normality assumption is rejected at the 5% significance level if JB>5.99. However, even if the distribution of the residuals is not normal, the estimates are still consistent under quasi-maximum likelihood (QML) assumptions. This method is used in estimation of the parameters in volatility models.

After specifying a mean equation by testing serial dependence in the data and building an ARMA model for the log returns and illiquidity measures of the BELEX*line* index, the residuals of the mean equation were used to test ARCH effects. Also, the residuals had to be tested for the absence of autocorrelation (Table 3 in Appendix). Table 3 shows that the Ljung-Box (Q) test is not significant for residuals of both series, which means that the residuals behave like a white noise process. Then, the Q-statistics are significant for squared residuals across all lag lengths for return and illiquidity series, and the presence of ARCH effects was inferred in both series. On the other hand, the Lagrange multiplier (LM) test shows strong ARCH effects for return (with $F(5.94)=32.77$, $p<.001$) and illiquidity series (with $F(5.93)=3.45$, $p<.01$). Then, a volatility model was specified provided that ARCH effects were statistically signif-

icant and performed a joint estimation of the mean and volatility equations (see Table 4 in Appendix). So, we examined volatility of return series and volatility of illiquidity series for the BELEX*line* index (see Table 4 in Appendix). In other words, we estimated univariate GARCH models, within program package Eviews, Version 6.0, in order to get estimated conditional volatility of the corresponding series of residuals.

Several combinations of GARCH(p,q) models were tested such as ARCH(2), GARCH(2,1), and GARCH(1,2). It is known that GARCH(1,1) is equal to $\mathrm{ARCH}(\infty)$. Each model was inconsistent, i.e. GARCH(1,1) model proved the most suitable one for log return and illiquidity measure of the BELEX*line* index. According to findings in Table 4 in the Appendix, it can be concluded that the log returns follow the ARMA(1,3)-IGARCH(1,1) model, and the illiquidity measures of the BELEX*line* index follow the ARMA(4,2)-GARCH(1,1) model. The results in Table 4 for both series show that all GARCH coefficients are statistically significant. The sum of ARCH and GARCH coefficients is close to one, for the log returns of the BELEX*line* index. This suggests the persistence of ARCH effects in the datasets and, hence, implies that current information remains important for forecasts of conditional variances at all horizons. This special type of GARCH model is termed as an Integrated GARCH (IGARCH). It means that if the residuals of the log returns follow an IGARCH process, then the unconditional variance of the residuals is infinite. The fitted models can be checked by using the standardized residuals and its squared process. The values of Q-statistics with significantly low p-values (less than 10%) of the standardized residual series for the log returns of the BELEX*line* index imply that there is autocorrelation. It suggests that we have less associated liquidity equilibrium[7]. Finally, the Ljung-Box statistics (Table 5 in Appendix) of standardized residuals and those of its squared show that models are adequate for describing the heteroscedasticity of the data. The ARCH test was applied on the standardized residuals to see if there are any ARCH effects left. Both the F-statistic and the LM-statistic are insignificant, suggesting no ARCH effects for both series of log returns and illiquidity measures of the BELEX*line* index, up to order 5 or 10 (see Table 5 in Appendix). Thus, we conclude that our hypothesis about instability of illiquidity and its volatility can not be rejected.

3. Illiquidity Behavior on Serbian Financial Market

We shall focus in this section on some of the main reasons of high illiquidity and its volatility. The main purpose of this section is to identify different time periods illiquidity rise on the Serbian market. We assume that foreign investors are the main cause of high/low illiquidity and its volatility on the Serbian market. Fluctuating behavior of foreign investors was thus followed by fluctuations in stock prices of the major continuously traded stocks as well as the stock market index (BELEX*line*).

In Figures 1 and 2 we plot daily log returns and daily illiquidity measures of the BELEX*line* index. In Figure 3 we plot series of buy-sell orders for individual and institutional investors.

[7] Grossman and Miller (1988) found that the less the autocorrelation value of stock return, the higher the associated liquidity equilibrium.

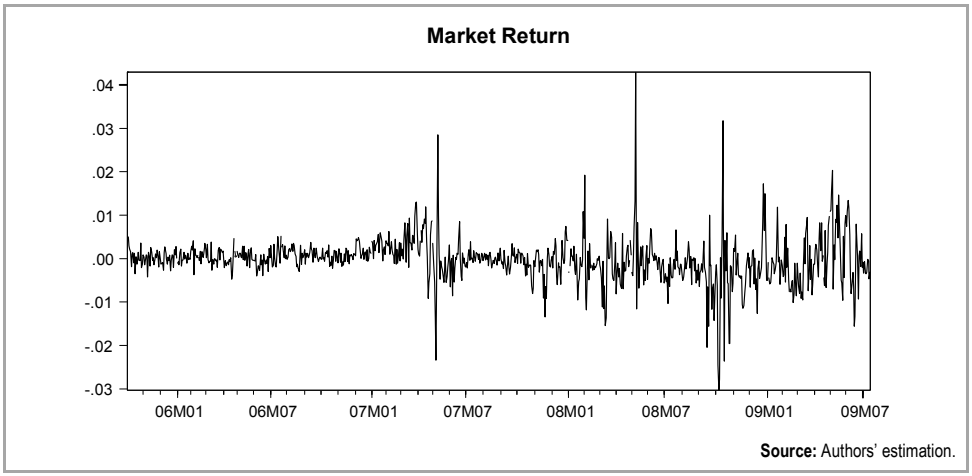

Figure 1 The Graph of Daily Capitalization-Weighted log Returns of the BELEX*line* Index

Comparison of plots of returns with plots of illiquidity proves that market illiquidity is significantly less stable than market returns (from Table 2 we see that PI has a greater standard deviation than market return, 0.174 vs. 0.005). We have, nonetheless, empirically documented that time-varying illiquidity is highly unstable and persistent in the Serbian market.[8]

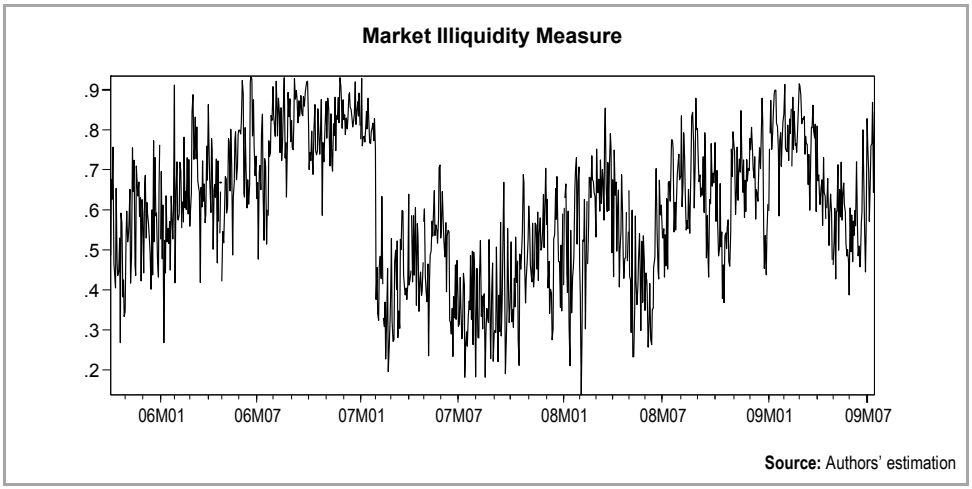

Figure 2 The Graph of Daily Value-Weighted Illiquidity Measures of the BELEX*line* Index

Since 2004 foreign investors have increasingly participated in trading at the Belgrade Stock Exchange, but the upward trend slowed down at the beginning of

[8] It should be noted that persistence of liquidity is empirically documented by Amihud (2002), Chordia, Roll, and Subrahmanyam (2000), Joel Hasbrouck and Duane J. Seppi (2001), Huberman and Halka (2001), and Pástor and Stambaugh (2003), Acharya and Pedersen (2005), and others.

2007 (see Figure 3) due to a large inflow of new domestic investors, who pushed the participation of foreign investors below the level of 50% (The Belgrade Stock Exchange 2007). As it was mentioned before, it is evident in Figure 3 that the Serbian market is a one-way market. This means that the main sellers of shares are individual owners who have obtained shares, often for free, within the mass privatization procedure. Before we start an elaborate analysis of operations on the Serbian capital market, it is very important to notice that the biggest emptying of this market took place in May 2007 and October 2008. The emptying mechanism operates in the following way: during the period of concentration the trade in given shares gains speed and the number of transactions increases up to the point where a sizeable or a controlling stake is formed; after that the trade in these shares declines. Since demand is falling, the price of the shares is falling as well (Živković et al. 2005).

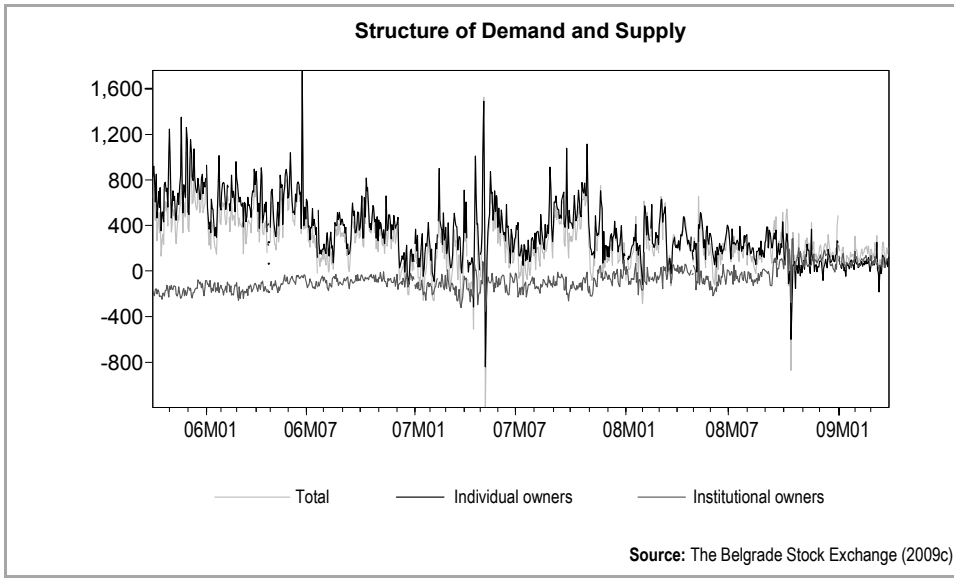

Figure 3 The Graph of Daily Structure of Demand and Supply for Individual and Institutional Investors

In Figures 4 and 5 we plot the daily conditional standard deviations of log returns and illiquidity measures of the BELEX*line* index, respectively.

In addition to visual inspection Figures 4 and 5 prove that conditional standard deviations of returns and illiquidity of the market index BELEX*line* exhibit significant changes over time. Therefore, these standard deviations are very unstable over time. The market's illiquidity is more volatile than the logs of market returns. It is commonly thought that this instability of illiquidity (Figure 2) and its volatility (Figure 5) are, therefore, the key problems areas facing small frontier markets.

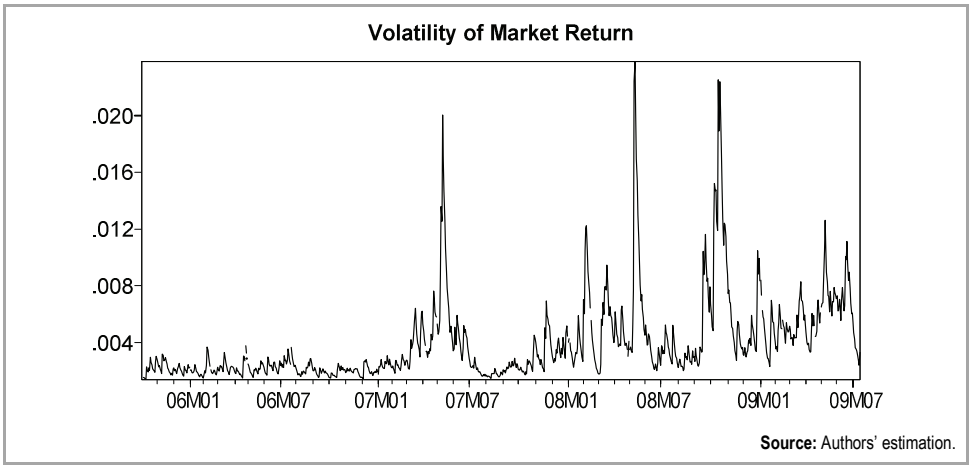

Figure 4 The Conditional Standard Deviation from GARCH Process for log Returns of the BELEX-*line* Index on Daily Basis

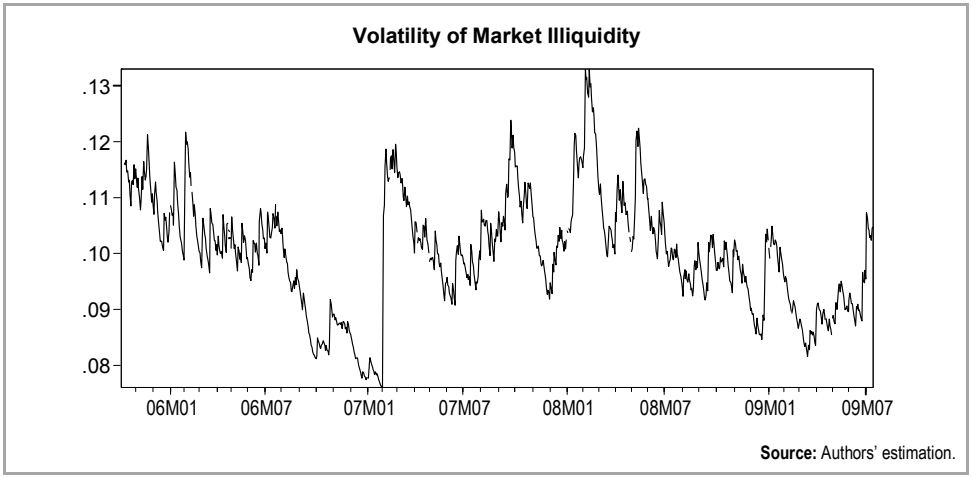

Figure 5 The Conditional Standard Deviation from GARCH Process for Illiquidity Measures of the BELEX*line* Index on Daily Basis

Key notions follow: In the last quarter of 2005 (especially on 30 November), a slight fall of illiquidity is evident (Figure 2) and its volatility (Figure 5). In this period, compared to the regional indices, the BELEX*fm* index scored the strongest dynamics of growth, attracting new, both domestic and foreign investors to the Serbian share market (see Figure 3) (The Belgrade Stock Exchange 2005). So, the course of the year 2005 can be considered the first demand boom on the Serbian equity market. Several events contributed to higher demand for shares: a budget surplus in the first quarter of 2005, then a number of new, high quality shares was introduced. All these

have contributed to the warming up of the investment climate, particularly on behalf of foreign institutional investors. Their entry into the Serbian market was an incentive to domestic individual investors to start buying the most attractive shares on the continuous market, as well. An increased activity of foreign investment funds led to a quick rise in demand. This group was joined by domestic institutional and individual investors (see Figure 3). The inflow of demand resulted in higher prices. An important event in the evolution of the market was the appearance of small individual investors who for the first time appeared as relevant buyers of shares on the continuous market (Živković et al. 2005).

In the first quarter of 2006 (January-March), the rise of volatility of illiquidity can be identified (Figure 5) as caused by the drop in foreign investors participation (see Figure 3). In that period there was a boom on Serbian financial market. Generally, in the first and the second quarters of 2006, there was a considerable turnover on the stock exchange, which reflected the increase in the value of return of the trade index (mid May, in Figure 1) as well as the decrease of market illiquidity (Figure 2). By the end of the second quarter (particularly in July 2006) a fall in illiquidity can be seen (Figure 2), as well as the increase of market returns (Figure 1). The reason for the market growth in that period was that foreign investors participation in trading on the Belgrade Stock Exchange was advancing in 2006 (particularly in July, see Figure 3) in absolute and relative values. During the first and second quarter, foreign investors kept their participation steady between 50 and 70% with the climb at the beginning of the last quarter (The Belgrade Stock Exchange 2006).

At the end of the third and beginning of the fourth quarter of 2006 (particularly in October), there was a slight fall of illiquidity and its volatility (Figures 2 and 5) which can be associated with passing the new Constitution of the Republic of Serbia, which slightly influenced the rise of foreign investors participation (Figure 3).

In the last quarter of 2006, there was a big drop in the foreign investors participation (particularly in December 2006, see Figure 3) mainly due to the turnover, to which domestic investors contributed. This drop in the foreign investor's participation would directly influence a significant increase of illiquidity (Figure 2), as well as the increase of the volatility of illiquidity (Figure 5), in the period November-December 2006. Also, the value of the market return in the last quarter was very low (Figure 1).

In the first quarter of 2007 (especially January, 2007), an extreme fall of illiquidity is evident (see Figure 2) as well as its volatility (see Figure 5). The trend from the end of 2006 continued and reached its peak in the first months of 2007, when the interest in trading at the stock exchange considerably increased (Figure 3). The opening of investment and pension funds further boosted the market, which in turn attracted an even bigger number of new participants, particularly domestic professional and small investors. In the period when the market experienced its historical peak, small domestic investors increased their participation (these investors indeed made decisions on investing in conditions of deep information asymmetry) in the turnover 10 times in comparison to the same period in the previous year, and on the purchase side their participation accounted for 25% (The Belgrade Stock Exchange 2007). The BELEX*fm* index had growth rate by 15.4% of its last December

value from 2006 (Figure 1). The turnover practically tripled in this period if compared with the same period in 2006 (The Belgrade Stock Exchange 2007). In Figure 5 an extreme growth of the volatility of illiquidity can be seen in the period February-March 2007. During that period there were political turbulences in Serbia. Due to insecurity there was a drop in foreign investor's participation as it can be seen in Figure 3 in this period.

During the second quarter of 2007 (particularly in May), foreign investors hastily withdrew from the Serbian market due to uncertainty, which is accompanied by withdrawal of local investors (see peak in emptying the market, Figure 3). This "withdrawal" effect is mainly visible with the most liquid stocks and it would affect the increase of market illiquidity (Figure 2). On the other hand, there was an increase in the volatility of returns (Figure 4) as well as a fall in the volatility of illiquidity (Figure 5) on May 2007.

In the third quarter of 2007 (July-September), the situation at the stock exchange was good, and prices rose sharply. In Figure 1 it can be seen that the market yield rose, while in Figure 2 it is evident that illiquidity fell significantly (Figure 2) as well as its volatility (Figure 5). Practically, in that period the market was liquid. Having in mind all that was said before, it can be concluded that a short-term growth of the market at that time was not founded in the economy.

In the last quarter of 2007, a slight increase in foreign investments can be seen on the sell side, primarily because of a growing uncertainty, above all due to the political situation, resulting in a significant fall in the turnover during that period (The Belgrade Stock Exchange 2007). That would affect the increase of the market illiquidity (Figure 2) and its volatility (Figure 5), especially in November 2007. During this period there was a decrease in the value of the market returns (Figure 1), as well as the rise in volatility of market return (Figure 4).

In general, during the course of the year 2007, illiquidity of the Serbian market was at the lowest level (mean of PI = 0.460, Table 6 in Appendix) if compared with other years given in the sample (Figure 2, and Table 6). In 2007 the number of natural entities participating in trading significantly increased. The importance of natural entities on capital markets is reflected in a large number of low value transactions, which contribute to the liquidity of individual securities and consequently to the liquidity of the market. In that year, Serbia's investment inflows reached $5.4 bn, buttressing its robust growth in gross domestic product that has averaged 7.3 per cent over the past three years[9]. The rise in the turnover and the number of transactions in 2007 was mostly due to the retail investors participating for the first time in such a large number on the domestic capital market, as well as to the opening of new investment and pension funds. According to the data released by the Ministry of Finance of the Republic of Serbia, direct foreign investments amounted to EUR 960m since October 2007. A steady increase in foreign investments was recorded at the Belgrade Stock Exchange, which in 2007 amounted to RSD 36 billion (The Belgrade Stock Exchange 2007).

[9] **Financial Times**. 2007. "Where risks are low and profits high." May 30. http://www.ft.com/cms/s/0/1d5b8db6-0dfd-11dc-8219-000b5df10621.html?nclick_check=1

In the first quarter of 2008, the market responded in a negative and volatile manner (Figure 4) causing the index to drop by 25.86% during the first quarter, losing 17.72% in March alone (Figure 1), the biggest monthly drop ever recorded (The Belgrade Stock Exchange 2008). In this period (February-March) there was an increase of illiquidity (Figure 2) and its volatility (Figure 5). On the other hand, during that period market emptying effect was evident as well (see Figure 3). However, increased uncertainty on the market discouraged foreign institutional investors and they withdrew which resulted in the withdrawal of domestic individual investors.

The second quarter of 2008, brought certain stabilization and positive result of 3.75% for the BELEX*line*, and historical daily high recorded on May 12 (Figure 1), which would reflect in sharp fall of illiquidity (Figure 2) and its volatility (Figure 5). In May 2008, the largest number of transactions was recorded and amounted to 12,314. On the other hand, in May 2008 as it can be seen in Figure 4 the volatility of market returns reached its peak. This can be associated with the appearance of excess returns which are not justified by information gathered on the market. As there is a certain information asymmetry on the Serbian frontier market, so in that period domestic individual investors were involved in demand side (Figure 3). That leads to the significant concentration of ownership (Figure 3). The highest turnover was recorded in June 2008, amounting to EUR 12.4 million, i.e. just above one billion RSD (The Belgrade Stock Exchange 2008). That would cause a drop of illiquidity (Figure 2) and its volatility (Figure 5) in that period.

In the third quarter of 2008 (particularly in August), there was a sudden growth of the illiquidity of the Serbian market (see Figure 2). The total number of transactions in August was the lowest observed (The Belgrade Stock Exchange 2008).

In the last quarter of 2008, worsening of the global financial crisis reflected on the domestic market in a reduced interest in trading, particularly in the second half of 2008 when the turnover and transactions was substantially lower. Consequently, relative participation of foreign investors on the sell side rose, falling on the buy side and generating a strong negative signal of the withdrawal of foreign investors from the market (see Figure 3 the last big peak downwards in October 2008), which only aggravated the already negative effects of the global crisis (The Belgrade Stock Exchange 2008). Domestic individual investors who were dominant by then withdrew from the market and sold shares acquired in privatization (emptying of Serbian market on Figure 3). The lowest monthly turnover in the last three years in the amount of 5 billion RSD was realized in November (sudden growth of illiquidity, Figure 2). In Figure 4, volatility of market return was evident in October-November 2008. However, the movement of the BELEX*line* index in the second half of 2008 was greatly affected by the events on the global financial market (the third big peak in Figure 1). On December 22, 2008 there was a growth of market illiquidity (Figure 2) and its volatility (Figure 5), as well as the decline of market returns in Figure 1, what is also recorded as the annual minimum. So, in the conditions of global financial crisis, Serbia experienced a decline in domestic demand through a decline in public and private spending caused by a fall in earnings and credit availability. According to the data of the Ministry of Finance, direct foreign investments in 2008 were somewhat higher

than in the previous year, but the level of EUR 1.7b was half the level of the record-holding 2006. The worsening of liquidation and more expensive borrowing led to a slowdown of the financial sector, while the growing insecurity of the general population resulted in the reduction of bank savings. A growth in illiquidity (Figure 2) is also reflected in the total number of realized transactions, which reached the lowest level since the introduction of electronic trading at the Belgrade Stock Exchange (The Belgrade Stock Exchange 2008).

Generally speaking, in 2008 there was great volatility of both market returns and market illiquidity (Figures 4 and 5). These observations are in accordance with the real activities on the market: the world financial crises, a fall in economic activity by foreign investors, the state intervention in the private sector, tightening of regulation and political instability in Serbia, degradation of the investment rating of the country, frequent oscillations of the exchange rate of the local currency, delays of public companies' privatization through IPOs. In 2008, the total turnover decrease by 56.4%, and there was decrease in the total number of transactions by 60% (The Belgrade Stock Exchange 2009a).

In the first quarter of 2009, the movement of the BELEX*line* index started in a volatile manner (The Belgrade Stock Exchange 2009a), see Figure 4. The beginning of the year 2009 brought about extremely low turnover in securities at the stock exchange. Participation of the foreign investors in the total value of turnover is reduced in this period (Figure 3). Having in mind extremely low value of the total turnover in January 2009 which amounted to 1.4 million RSD, it is easy to notice that values of the turnover of the foreign investors are far less than the usual ones, reflecting the potentially new trend in fluctuation of these indicators, due to the activities on the global market (The Belgrade Stock Exchange 2009a). In January-February 2009, as it can be seen in Figures 2 and 5, the growth of market illiquidity and its volatility, respectively, is evident. This period represents the peak of the crises in the Serbian market.

In the second quarter of 2009 (particularly in April and May), foreign investors were more active as the buyers of the shares and not the sellers. It is a positive step forward, having in mind that from December 2008 till April 2009 foreign investors were more agile on the sell side (The Belgrade Stock Exchange 2009b). Significant growth in foreign investor's participation affects drop in market illiquidity (Figure 2) and its volatility (Figure 5) in this period. In May 2009, the BELEX*line* noted growth by 26.38% (see Figure 1). Also, the number of transactions in May almost doubled in comparison with that in April (The Belgrade Stock Exchange 2009b). On the other hand, a growth in volatility of market return is evident in May 2009. Reoccurrence of drop in market illiquidity (Figure 2) and its volatility (Figure 5) can be seen in June 2009. The reason can be found in the fact that in June 2009 three more securities got market makers[10]. Market operations, which involve simultaneous and

[10] On June 15, 2009, Sinteza Invest Group a.d. Belgrade has conducted market making operations for shares of the issuer Veterinarski zavod a.d. Subotica. M&V Investments a.d. Novi Sad operates as a market maker for shares of the issuer Metalac a.d. Gornji Milanovac from June 22, 2009. The third market maker in June 2009 – Synergy Capital a.d. Belgrade signed the contract and will start to make market for Energoprojekt holding a.d. Belgrade shares as of July 6, 2009.

continuous placement of buy and sell orders, significantly increase the liquidity of those shares (The Belgrade Stock Exchange 2009b). That would reflect the increase of market returns (Figure 1) thus reducing volatility of market returns (Figure 4).

4. Concluding Remarks

This paper explored illiquidity of the Serbian frontier financial market in the period: October 2005-July 2009. This is the first paper that has analyzed liquidity issues in the case of Serbia. As the measure of illiquidity we used the price impact measure suggested by Bekaert, Harvey, and Lundblad (2007). Our results suggest that the level of market liquidity is low and persistent. It is commonly thought that a low level of liquidity is, therefore, one of the key problem areas facing small frontier markets. The results confirm that time-varying illiquidity and its volatility are very unstable in this market. The paper elaborates causes of extremely high market illiquidity and its volatility as well as growth/fall of returns in the observed period. In most cases, the cause of the dramatic falls and rises in market illiquidity and its volatility is the growth and fall in the foreign investor's participation. This group of investors has brought/taken liquidity to/from the Serbian market.

Future research should examine the impact of illiquidity and liquidity risk in explaining price formation in the Serbian market, as a frontier market. We wish to investigate whether investors are compensated for holding frontier-markets' assets whose returns are sensitive to liquidity risk.

References

Acharya, Viral V., and Lasse Heje Pedersen. 2005. "Asset Pricing with Liquidity Risk." *Journal of Financial Economics*, 77(2): 375-410.

Amihud, Yakov. 2002. "Illiquidity and Stock Returns: Cross Section and Time Series Effects." *Journal of Financial Markets*, 5(1): 31-56.

Bekaert, Geert, Campbell R. Harvey, and Christian Lundblad. 2007. "Liquidity and Expected Returns: Lessons from Emerging Markets." *The Review of Financial Studies*, 20(6): 1783 - 1831.

The Belgrade Stock Exchange. 2005. The Belgrade Stock Exchange Annual Report 2005. http://www.belex.rs/files/proizvodi_i_usluge/Godisnji_Izvestaj_2005.pdf.

The Belgrade Stock Exchange. 2006. The Belgrade Stock Exchange Annual Report 2006. http://www.belex.rs/files/proizvodi_i_usluge/Godisnji_Izvestaj_20062.pdf.

The Belgrade Stock Exchange. 2007. The Belgrade Stock Exchange Annual Report 2007. http://www.belex.rs/files/proizvodi_i_usluge/Godisnji_Izvestaj_2007.pdf.

The Belgrade Stock Exchange. 2008. The Belgrade Stock Exchange Annual Report 2008. http://www.belex.rs/files/proizvodi_i_usluge/BB_Godisnji%20izvestaj%202008.pdf.

The Belgrade Stock Exchange. 2009a. The Belgrade Stock Exchange Bulletin (March, 2009). http://www.belex.rs/files/e-bilteni/BSE-Bulletin-March09.No1.pdf.

The Belgrade Stock Exchange. 2009b. The Belgrade Stock Exchange Bulletin (July, 2009). http://www.belex.rs/files/e-bilteni/BSE-Bulletin-July09.pdf.

Bollerslev, Tim. 1986. "Generalized Autoregressive Conditional Heteroskedasticity." *Journal of Econometrics*, 31(3): 307-327.

Chordia, Tarun, Richard Roll, and Avanidhar Subrahmanyam. 2000. "Commonality in Liquidity." *Journal of Financial Economics*, 56(1): 3–28.

Chordia, Tarun, Richard Roll, and Avanidhar Subrahmanyam. 2008. "Liquidity and Market Efficiency." *Journal of Financial Economics*, 87(2): 249–268.

Chuhan, **Punam**. 1994. *Are Institutional Investors an Important Source of Portfolio Investment in Emerging Markets?* Washington, D.C.: International Economics Department, World Bank.

Clark, Andrew. 2008. "Liquidity Risk in Frontier Markets - History, Measurement and a New Approach." Thomson Reuters. http://thomsonreuters.com/content/financial/pdf/i_and_a/liquidity_risk.pdf.

Crockett, Andrew. 2008. "Market Liquidity and Financial Stability." Banque de France, *Financial Stability Review – Special Issue on Liquidity*, 11: 13-18.

Fabrian, Erie, and Aldrin Herwany. 2008. "Liquidity Measurement Based on Bid-Ask Spread, Trading Frequency, and Liquidity Ratio: The Use of GARCH Model on Jakarta Stock Exchange (JSX)." http://ssrn.com/abstract=1264704.

Grossman, Sanford Jay, and Merton H. Miller. 1988. "Liquidity and Market Structure." *Journal of Finance*, 43(3): 617-633.

Hasbrouck, Joel, and Duane J. Seppi. 2001. "Common Factors in Prices, Order Flows and Liquidity." *Journal of Financial Economics*, 59(3): 383-411.

Huang, Jennifer, and Jiang Wang. 2007. "Market Liquidity, Asset Prices, and Welfare." Finance Workshop, ChicagoBooth. http://www.chicagogsb.edu/research/workshops/finance/docs/Huang-Liquidity.pdf.

Huberman, Gur, and Dominika Halka. 2001. "Systematic Liquidity." *Journal of Financial Research*, 24(2): 161-178.

Kyle, Albert S. 1985. "Continuous Auctions and Insider Trading." *Econometrica*, 53(6): 1315-1335.

Latković, Mladen. 2001. "Nesinhrono trgovanje i proračun sistematskog rizika." Unpublished paper. http://www.phy.hr/~laci/art/beta.pdf.

Latković, Mladen, and Zoran Barac. 1999. "Optimizacija dioničkih portfelja na rubnim tržištim kapitala." http://www.phy.hr/~laci/art/portfolio.pdf.

Lesmond, David A. 2005. "Liquidity of Emerging Markets." *Journal of Financial Economics*, 77(2): 411-452.

Lesmond, David A., Joseph P. Ogden, Charles A. Trzcinka. 1999. "A New Estimate of Transaction Costs." *Review of Financial Studies*, 12(5): 1113-1141.

Pástor, Luboš, and Robert F. Stambaugh. 2003. "Liquidity Risk and Expected Stock Returns." *Journal of Political Economy*, 111(3): 642–685.

Penev, Slavica, and Matija Rojec. 2004. "Foreign Direct Investment and the Investment Climate in South-East Europe." *Economic Annals*, 49(163): 71–92.

Roll, Richard. 1984. "A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market." *Journal of Finance*, 39(4): 1127-39.

Sadka, Ronnie. 2006. "Momentum and Post-Earnings-Announcement Drift Anomalies: The Role of Liquidity Risk." *Journal of Financial Economics*, 80(2): 309-349.

Šestović, Dragan, and Mladen Latković. 1998. "Modeliranje volatilnosti vrijednosnica na Zagrebačkoj burzi." *Economic Review*, 49(4–5): 292–303.

Živković, Boško, Branko Urošević, Dragana Cvijanović, and Mikica Drenovak. 2005. "Serbia's Financial Market: 2000-2005." *Quarterly Monitor*, 1: 65-72.

Appendix

Table 1 The Results of Testing a Unit Root for Daily log Data, Daily log Returns as well as Daily Illiquidity Measures of the BELEXline Index, Respectively. The Null Hypothesis H_0: Unit Root Exists in the Process; the Alternative Hypothesis: The Process is Stationary

Series	ADF Test	level	Critical Value	H_0
$p_{M,t}$	-0.62	5%	-3.41	accepted
$R_{M,t}$	-19.59	5%	-3.41	*rejected*
$PI_{M,t}$	-5.03	5%	-3.41	*rejected*

Notes: $p_{M,t}$ = logBELEX*line*; $R_{M,t}$ = dlog(BELEX*line*); $PI_{M,t}$ = PI_BELEX*line*.

Source: Authors' estimation.

Table 2 Descriptive Statistics for Daily log Data, then for Daily log Returns, as well as for Daily Illiquidity Measures of the BELEX*line* Index, Respectively

Series	Mean	Max	Min	S.D.	S	K	JB	Prob	Obs
$p_{M,t}$	3.375	3.700	2.925	0.206	-0.409	2.340	43.725	0.000	949
$R_{M,t}$	-0.000	0.043	-0.030	0.005	0.366	14.140	4922.935	0.000	948
$PI_{M,t}$	0.605	0.934	0.138	0.174	-0.222	2.265	29.136	0.000	947

Notes: $p_{M,t}$ = logBELEX*line*; $R_{M,t}$ = dlog(BELEX*line*); $PI_{M,t}$ = PI_BELEX*line*; S.D.= Standrad Deviation; S=the coefficient of skewness; K=the coefficient of kurtosis; JB= the Jarque-Bera test.

Source: Authors' estimation.

Table 3 The Ljung-Box Statistics of Residuals and Squared Residuals of log Returns and of Illiquidity Measures in ARMA Models and Test for ARCH Effect, as well as the Jarque-Bera (JB) Normality Test of Residuals Obtaind from ARMA Models

The Ljung-Box Statistics					*ARCH-LM(5) test*		*The JB Test*
series	Q(10)	Q(35)	$Q^2(10)$	$Q^2(35)$	F-stat	Obs*R^2	JB
$R_{M,t}$	5.907 (0.434)	41.354 (0.101)	252.62 (0.000)	281.22 (0.000)	32.774 (0.000)	140.349 (0.000)	6772.002 (0.000)
$PI_{M,t}$	6.3274 (0.787)	33.642 (0.534)	26.359 (0.003)	57.245 (0.010)	3.4523 (0.0043)	17.0569 (0.0044)	10.838 (0.004)

Notes: $R_{M,t}$ = dlog(BELEX*line*); $PI_{M,t}$ = PI_BELEX*line*. The number in parentheses denotes *p*-value.

Source: Authors' estimation.

Table 4 A Joint Estimation of the Mean and Volatility Equations for Series of BELEX*line* Returns and BELEX*line* Illiquidity

BELEX*line*	**log return**				**PI measure**			
Mean Equation								
	Coeff.	S.E.	z-Stat	Prob.	Coeff.	S.E.	z-Stat	Prob.
C	0.001	0.000	1.101	0.271	0.642	0.059	10.803	0.000
AR(1)	0.982	0.011	92.445	0.000	0.252	0.051	4.993	0.000
AR(2)	-	-	-	-	1.070	0.045	23.719	0.000
AR(3)	-	-	-	-	-0.252	0.048	-5.234	0.000
AR(4)	-	-	-	-	-0.087	0.043	-2.016	0.044
MA(1)	-0.686	0.035	-19.432	0.000	0.154	0.037	4.213	0.000
MA(2)	-0.021	0.043	-0.488	0.626	-0.840	0.037	-23.018	0.000
MA(3)	-0.186	0.035	-5.375	0.000	-	-	-	-
Variance Equation								
C	0.000	0.000	5.898	0.000	0.000	0.000	0.878	0.380
ARCH(1)	0.317	0.076	4.180	0.000	0.034	0.016	2.161	0.031
GARCH(1)	0.703	0.043	16.395	0.000	0.934	0.041	22.851	0.000
S.E. of reg.	0.005				0.101			
Sum sq. res.	0.021				9.581			

Source: Authors' estimation.

Table 5 The Ljung-Box Statistics of Standardized Residuals and Squared Standardized Residuals of log Returns and of Illiquidity Measures from GARCH Models and ARCH-LM Test of Order 5 and 10

The Ljung-Box statistics			***ARCH-LM(5)***		***ARCH-LM(10)***	
series	Q(36)	Q^2(36)	F-stat	Obs*R^2	F-stat	Obs*R^2
$R_{M,t}$	57.566 (0.013)	44.320 (0.161)	0.763 (0.576)	3.826 (0.575)	0.593 (0.821)	5.957 (0.819)
$PI_{M,t}$	34.328 (0.548)	18.248 (0.994)	0.900 (0.481)	4.505 (0.479)	0.539 (0.863)	5.423 (0.861)

Notes: $R_{M,t}$ = dlog(BELEX*line*); $PI_{M,t}$ = PI_BELEX*line*. The number in parentheses denotes *p*-value.

Source: Authors' estimation.

Table 6 An Average Value of Daily Illiquidity Measure of BELEX*line* Index for Every Year in Observed Period

average	2005	2006	2007	2008	2009
$PI_{M,t}$	0.552	0.735	0.460	0.590	0.689

Source: Authors' estimation.