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The impact of designated market-makers on liquidity in frontier markets: Evidence from Zagreb and Ljubljana Stock Exchanges*

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Abstract

Many exchanges around the globe have implemented market-making schemes in an attempt to mitigate liquidity risk and enhance trading volume. This research examines the impact of designated market makers on stock liquidity in frontier markets, specifically measured by bid-ask spreads and trading turnover. Using a difference-in-differences analysis, we studied 19 stocks that introduced designated market makers at the Zagreb Stock Exchange and Ljubljana Stock Exchange between May 2010 and January 2022. To the best of our knowledge, this is the first study investigating the impact of market makers in these specific markets and only the second in frontier markets overall. As expected, we find a significant reduction in bid-ask spreads for most stocks following the introduction of market makers. However, unlike findings of studies conducted in more developed markets, our results for turnover are not conclusive, suggesting that market makers alone may not be sufficient to overcome structural impediments to market liquidity in frontier markets, such as lack of free float and the dominance of large investors with long-term investment horizons.

Keywords: *market making, designated market-makers, liquidity provision, frontier markets, market quality*

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1. Introduction

Stock exchanges worldwide rely, irrespective of their specific market designs and characteristics, on market-making to bolster liquidity (Anand et al., 2009; Charitou and Panayides, 2009). Market-makers play a vital role by providing liquidity to other traders through the simultaneous posting of buy and sell orders. Their primary objective is to profit from the bid-ask spread, while steering clear of accumulating a large net position in a stock (Xiong et al., 2015). The widespread adoption and persistence of market making as a function across diverse markets and over time underscore the significant and enduring role that market makers play in facilitating liquidity provision (Benos and Wetherilt, 2012).

Traditionally, exchanges and market-makers establish contractual agreements that outline specific obligations for market-makers in exchange for corresponding benefits. Throughout the remainder of this paper, we will specifically refer to such formal liquidity providers as *designated market makers* (DMMs). The typical obligations assigned to DMMs involve maintaining a presence in the market for a selected portion of the trading day and adhering to maximum spread and minimum quoted size requirements. These obligations in presence, spread, and size ensure that DMMs consistently and continuously provide their services. In return for these obligations, benefits are extended to DMMs, which may include fee rebates, informational advantages, and trading privileges. In certain cases, exchanges may directly compensate DMMs with fees for assuming market-making responsibilities.

With the rise of electronic trading, where participants actively contribute liquidity, traditional market-making appeared to face obsolescence (Skjeltorp and Ødegaard, 2015). The emergence of high-frequency trading, in particular, promised sufficient endogenous liquidity by leveraging increased trading speed and significantly higher trading volumes (Xiong et al., 2015). Contrary to these expectations, DMMs continued to play a crucial role in electronic limit order markets. In the case of large caps, some of the research confirmed that endogenous liquidity providers tended to retract liquidity and curtail their activities during stressed market conditions with the potential to destabilize markets. This structural vulnerability worked in favour of maintaining exchanges' DMM structures (Anand and Venkataraman, 2016).

Moreover, in response to these concerns related to systemic risks, the European Union mandated that algorithmic traders pursuing a market-making strategy enter into a binding agreement with the exchange (European Parliament and Council, 2014). More recent studies on the impact of high-frequency market makers during the COVID-19 crisis present conflicting conclusions with one finding that algorithmic trading was not associated with harmful effects on market quality (Chakrabarty and Pascual, 2023), while another found that market withdrawal was most exacerbated in securities most exposed to high-frequency market makers (Foley et al., 2022). Another interesting evolution in DMM structures is the introduction by DMMs of a fee charged to the issuing firm in the case of small caps (Skjeltorp and Ødegaard, 2015). In some instances, issuers also provide the market maker with an inventory of shares to facilitate market-making activities (Venkataraman and Waisburd, 2007).

Various countries such as France (Venkataraman and Waisburd, 2007), Sweden (Anand et al., 2009), the Netherlands (Menkveld and Wang, 2013), Norway (Skjeltorp and Ødegaard, 2015), and Germany (Theissen and Westheide, 2023) have scrutinized the introductions of DMM. These studies adopt an event study methodology, analyzing market dynamics before and after implementing DMMs. A consensus emerges across these studies, indicating that the most substantial enhancement in liquidity is observed in small-cap, illiquid stocks. This finding is anticipated, given that such stocks exhibit asymmetrical order books, typically lacking offsetting buy and sell orders for large sizes at any given time. In contrast, large-cap, liquid stocks generally experience comparatively lesser benefits from active market making (Weild et al., 2013).

Lack of liquidity in secondary markets can lead to higher investor-required rates of return, and extreme illiquidity might discourage market participation, undermining the positive contribution of capital markets to capital allocation and economic growth. Therefore, the provision of liquidity by market-makers generates positive externalities. In economic theory, when market making is associated with positive externalities, market makers might not be fully compensated for the social benefit of a liquid market. Without some form of policy intervention, the provision of this service may fall below a socially optimal level (Benos and Wetherlit, 2012; Menkveld and Wang, 2013). Bessembinder et al. (2015) posit that DMM contracts, where the issuer pays the market maker for providing liquidity, offer a potential market solution to this market imperfection. By internalizing the cost of market making with issuers, issuer-sponsored DMM contracts enable the inclusion of stocks in market-making schemes where expected trading profits from market-making services may not adequately compensate for a DMM's costs and risks. From the DMM's perspective, the value of the contract is determined by the lump-sum fee received from the issuer, benefits granted by the exchange (if any), trading results, and the perceived value of cross-selling opportunities stemming from the relationship with the issuer (Venkataraman and Waisburd, 2007). From the sponsoring issuer's viewpoint, DMMs create value only if the reduction in the firm's cost of capital offsets the cash outflow in the form of a lump-sum fee. Another source of value creation is viewing market making as an insurance policy for current shareholders against high transaction costs when trading needs arise (Menkveld and Wang, 2013).

This study aims to assess the impact of DMMs on liquidity in frontier markets characterized by thin trading volumes, exemplified by the Zagreb Stock Exchange (ZSE) and the Ljubljana Stock Exchange (LJSE). Generally, frontier markets are countries considered less mature than emerging markets due to factors including demographics, development, politics, or liquidity. Major global index providers classify countries into three categories: developed markets, emerging markets, and frontier markets. In the CEE and SEE regions, most index providers classify the Czech Republic, Hungary, and Poland as emerging markets, while the other countries fall into the frontier markets category. Unlike existing literature that predominantly focuses on specific segments of developed markets specialized in small caps, this paper is centred on two frontier markets that have introduced issuer-sponsored DMM contracts in their top-tier trading segments. This initiative aims to enhance market quality and attract participants to markets significantly constrained by illiquidity. Notably, the study stands out by focusing on markets with a limited number of stocks, and where the available data is less detailed compared to larger markets. The paper introduces an analytical framework for DMM implementation and provides tailored tools for evaluating market quality improvements, particularly suited for frontier markets characterized by a smaller stock population.

This study adds to the limited body of literature that systematically examines the role of DMMs in augmenting liquidity for thinly traded stocks. The scarcity of such studies is attributable, in part, to the infrequency of DMM contract introductions or substantial model changes within stock exchanges. The contribution to the existing literature is twofold: firstly, to our knowledge, only one prior study has delved into the repercussions of DMMs in frontier markets (Čekauskas et al., 2011); secondly, our findings diverge, to some extent to consensus results observed in more developed markets where DMMs have exhibited a substantial positive impact on trading volume. These insights may hold significant implications for policymakers in frontier markets as they formulate and refine their market-making systems.

We employ an event study framework to investigate shifts in market quality for all stocks having introduced a DMM on the ZSE and LJSE between May 2010 and January 2022. These stocks are referred to as MM stocks. The study focuses on two major liquidity indicators: bid-ask spread and turnover. Initially, we identify control stocks – referred to as C-stocks – from the pool of firms that did not introduce a DMM. Subsequently, we evaluate the impact of DMM introductions using a difference-in-differences analytical framework, complemented by paired two-sample t-tests for differences in means for both liquidity indicators.

Building upon the insights garnered from prior research in this domain, we formulate the following research hypotheses:

H1 – The introduction of a DMM will result in narrower observed spreads.

H2 – The introduction of a DMM will lead to an increase in turnover.

Given the inherent illiquidity of the ZSE and the LJSE, stemming from low levels of free float and the predominance of long-term investors, we anticipate that addressing temporal asynchronies in order flow and leveraging network externalities – where existing liquidity begets new liquidity – may not singularly drive a substantial surge in turnover. Aligned with these anticipations, our findings reveal a notable contraction in bid-ask spreads after the introduction of DMMs, although the influence on turnover presents a less pronounced effect.

The remainder of the paper is organized as follows. Section 2 provides an overview of the existing literature and synthesizes previous research. In Section 3, we present the methodology. In Section 4 we introduce the institutional background and present the data. In Section 5 we elaborate on the results and place them in a scientific and practical context. Section 6 concludes.

2. Literature review

Within the extensive body of literature on market making, studies specifically addressing the impact of DMMs on market quality is relatively scarce. This scarcity is primarily attributed to methodological challenges associated with disentangling the effects of DMMs from broader market dynamics. Consequently, the prevailing approach in the literature involves adopting a conceptual framework akin to event studies. In these studies, market quality indicators are systematically compared in the periods before and after the introduction of DMMs. This methodological choice, while effective in capturing specific events, inherently limits the overall number of studies due to the sporadic occurrence of such events.

Despite these challenges, a consensus emerges from existing research indicating that DMMs contribute positively to market quality. In addition, several studies report abnormal positive returns around the introduction of DMMs, implying a favourable market response and potential reductions in the cost of capital. This section provides a comprehensive overview of pertinent studies, laying the groundwork for the development of methodology in the subsequent sections.

In selecting target markets, the predominant focus of most studies centres on thinly traded stocks, as these are perceived to derive the greatest benefits from the activities of DMMs in enhancing liquidity. Sabourin (2006) provides a theoretical underpinning for this approach, arguing that, all else being equal, the expected best prices within a limit order book featuring market makers become more appealing than in a pure limit order book as asset volatility rises. This rationale is further substantiated by the observation that asset volatility tends to decrease with equity capitalization. Consequently, there is a justified inclination to introduce DMMs in lower capitalization stocks rather than larger caps.

An empirical study conducted by Theissen et al. (2013) utilizing a dataset covering 110 German stocks delves into the trading activity of market makers. The study unveils a U-shaped relationship between market makers' participation rates and firm size coupled with trading volume. Specifically, the participation rates of market makers are highest for the smallest firms, decrease with firm size, and then exhibit an upward trend for the largest size quintile. Expectedly, the study identifies that other traders tend to tap into the liquidity provided by market makers, particularly during periods of heightened volatility and substantial informational asymmetries. The study reveals that market makers, on average, do not accrue profits, underscoring the intricate dynamics of their role in various market conditions.

Among the pioneering inquiries into the impact of DMMs on thinly traded stocks is the study by Nimalendran and Petrella (2003), which leveraged trading data from the Italian Stock Exchange. This investigation seized the opportunity presented by the introduction of two distinct regimes for thinly traded stocks to evaluate the influence of DMMs on market quality. The empirical findings, derived from comparing a pure order-driven system to a hybrid order-driven system incorporating a DMM, underscored the superior market quality offered by the latter across various metrics, including bid-ask spread and market depth. Notably, the analysis revealed that the adoption of a hybrid trading system particularly benefited very thinly traded stocks over less inactive ones. In another study, Venkataraman and Waisburd (2007) employed data from the Paris Bourse, focusing on a sample of less liquid securities engaged in call auctions. The research demonstrated that DMMs contribute to enhanced market quality, as indicated by the frequency with which call auctions clear and the reduced variability in both returns and trading volume. Moreover, the investigation documented an increase in market valuation coinciding with the introduction of DMMs. Anand et al. (2009) turned their attention to the Stockholm Stock Exchange between 2002 and 2004, specifically examining the introduction of issuer-sponsored DMMs. Their findings highlighted a substantial improvement in market quality for stocks supported by DMMs, manifested through reduced percentage quoted spreads and enhanced liquidity. The study further revealed that firms characterized by low trading activity, wide spreads, and heightened information asymmetry were more inclined to enter into contracts for liquidity provision. These observations extended to firms contemplating changes to their equity structure in the near term, such as secondary offerings, rights issues, and splits.

Subsequent investigations in diverse stock exchanges further corroborated the positive impact of DMMs on market quality. In an event study focused on 74 small-cap stocks within Euronext Amsterdam, Menkveld and Wang (2013) observed that the introduction of DMMs led to improved liquidity levels, reduced liquidity risk, and abnormal returns. Similarly, Čekauskas et al. (2011) delved into the effects of DMMs on liquidity across three frontier stock markets: Nasdaq OMX Tallinn, Vilnius, and Riga. Utilizing measures such as bid-ask spread, volume, and Amihud's measure of illiquidity, the study revealed that issuer-sponsored DMMs (as in Vilnius and Tallinn) positively influenced liquidity, while DMMs entering into agreements solely with the exchange (as in Riga) did not exhibit the same impact. A comprehensive examination by De Carvalho et al. (2021) involved 55 Brazilian stocks, employing Chow's structural break test to assess the influence of market makers on liquidity proxies. Their findings highlighted significant changes in the average spread, turnover ratio, and trading volume. Finally, analysing differences between the regular and extended trading sessions at the NYSE Arca market, Scharnowski (2024) found that the reduction in the market quality after potentially market-stirring posts in social media can be at least partially the result of the absence of DMMs in the extended trading sessions.

Diverse perspectives on DMMs have been explored in additional studies, shedding light on their impact on market dynamics. Skjeltorp and Ødegaard (2015), in an investigation based on data from the Oslo Stock Exchange, identified a crucial determinant influencing a firm's decision to engage DMMs—the likelihood of issuing capital in the near future. In a more recent study, Bessembinder et al. (2020) underscored that implementing stricter order maintenance requirements and offering higher rebates to DMMs were associated with improved liquidity for thinly traded stocks at the New York Stock Exchange. Examining the competitive landscape among DMMs, research conducted on data from NYSE Euronext Paris by Bellia et al. (2022) revealed that heightened competition led to a substantial decrease in quoted and effective spreads. Similar outcomes were observed in a study by Theissen and Westheide (2023) focusing on Deutsche Börse's Xetra system. Shifting the focus to the effects of market-making in fragmented markets, Clark-Joseph et al. (2017) demonstrated that the removal of voluntary liquidity providers on one exchange left liquidity unchanged. Conversely, removing DMMs resulted in a broad decrease in liquidity across the market. In another study, Clapham et al. (2018) explored the impact of liquidity provider incentives introduced by a market venue in a fragmented market. While these incentives increased liquidity in the specific market, they did not lead to an overall increase in liquidity and turnover. In a study conducted on four Euronext markets (Amsterdam, Brussels, Paris, and Lisbon) Daures-Lescourret and Moinas (2023) showed that in the case of multi-traded stocks trades in one market affects the intensity of competition between market makers in the other venues. A distinct investigation by Ding et al. (2022) scrutinized the voluntary liquidity provision schemes for large caps and liquid stocks in NASDAQ Stockholm. The study revealed that liquidity provision schemes delivered improvements in liquidity, notably in the form of lower spreads. Importantly, no evidence of market liquidity migration from alternative platforms to NASDAQ Stockholm was found. In the context of concerns about the impact of market makers' withdrawal during extreme price movements, Bellia et al. (2023) demonstrated using 37 liquid French stocks that DMMs provide liquidity under isolated selling pressure but consume liquidity when multiple stocks experience stress. An emerging field of research focuses on applying artificial intelligence and machine learning to marketmaking. Hambly et al. (2023) found that reinforcement learning algorithms have been successfully applied in this area, while Lee (2020) highlights the associated systemic risks and advocates for regulatory requirements similar to those for high-frequency traders.

To the best of our knowledge, Čekauskas et al. (2011) is the only internationally available paper dealing with the impact of market makers on stock market liquidity in frontier markets. However, liquidity more generally is a pervasive topic as these markets are by definition struggling with the lack of it. Over the years, several papers have approached the issue of illiquidity in CEE and SEE markets from different angles. Benić and Franić (2008) found that Amihud's illiquidity measure for Croatia, Slovenia, and Serbia, compare very poorly not only to Germany but also to Hungary and Poland. Similarly, using the proportion of days with zero trades as a proxy for illiquidity, Milunovich and Minović (2014) compared market illiquidity across eleven national markets of the Balkans. They found lower levels of illiquidity in EU member countries compared to non-EU markets. Using the Liquidity-adjusted Capital Asset Pricing Model and the price impact measure as a proxy for liquidity, Minović and Živković (2010) found that illiquidity is an important and persistent driver of expected returns in the Serbian market. More recently, Olbryś (2019) explored market tightness as one dimension of market liquidity in seven CEE markets in the context of serious problems with stock illiquidity. Based on daily percentage relative spreads as a proxy of market tightness, the analysis found that the number of zeros in daily volume is very high for many companies (Olbryś, 2019: 558). In a later study, Olbryś (2020) explored the patterns of market-wide commonality in liquidity on six CEE stock exchanges and found no evidence of co-movements in liquidity. Stereńczak et al. (2020) examine the illiquidity premium in frontier markets using a sample of 22 countries from 1991 to 2019 and using six different liquidity measures. The authors found no evidence of a significant illiquidity premium in frontier markets. They explain the insignificance of the illiquidity premium with the low integration of frontier equity markets with the global economy and the limited role of international investors. Finally, within the strain of literature dealing with measures of liquidity in stock markets, some authors are focusing specifically on emerging and frontier markets (Clark, 2011; Marshall et al., 2013).

3. Methodology

This research adopts an event study framework to analyse the impact of the introduction of a DMM on market quality. Building on earlier empirical research across various markets, our expectations align with the anticipated positive influence of market-making on market quality, manifested through a reduction in spreads and an increase in turnover. The event study design is instrumental in mitigating the risk that the observed differences in market quality attributed to the introduction of a DMM may be influenced by unobserved variables.

Another important methodological decision is the selection of proxies for market liquidity. Naik and Reddy (2022), in their comprehensive review of literature from 2009 to 2020, find that a liquid market is generally defined as one in which a large quantity can be traded promptly, with low transaction costs and minimal price impact. Reflecting this definition, the reviewed studies measure stock market liquidity using various indicators that capture its multidimensional nature: depth (volume measure), breadth (price impact measure), immediacy (time measure) and transaction costs (spread and transaction cost measure). Most papers confirm that combining multiple measures or using multidimensional measures is more effective than relying on a single metric. In his analysis of liquidity measures in the context of emerging and frontier market indices, Clark (2011) also highlights that a combination of measures is superior to any single measure used on its own.

As Marshall et al. (2013) noted, the choice of liquidity measure depends on the research purpose. In this study, we use spreads and turnover as liquidity proxies, guided by the practical reasons for introducing DMMs by stock exchanges and issuers, as well as by data availability. Spreads and turnover address two of the four dimensions of liquidity – depth and transaction costs. These measures are particularly relevant to the objectives of stock exchanges and issuers that sponsor market-making schemes that should attract trades and provide low-cost transaction options. Additionally, since DMMs must adhere to a maximum spread, reducing the spread is a clear and pragmatic way to measure their success. Due to data limitations, we could not calculate the price impact of individual trades or implement time measures. However, these liquidity dimensions are less relevant for assessing DMMs' success in achieving their objectives.

Following a methodology similar to Anand et al. (2009), we express the bid-ask spread as a percentage. It is calculated as the difference between the executable best bid and ask orders exposed in the order book at a specific point in time, divided by the mid-price at that same point in time:

$$spread_{s,i} = \frac{ask_{s,i} - bid_{s,i}}{\left(ask_{s,i} + bid_{s,i}\right)/2} \tag{1}$$

where $spread_{s,i}$ is the bid-ask spread for stock s at time i, $ask_{s,i}$ is the ask price for stock s at time i, and $bid_{s,i}$ is the bid price for stock s at time i. In our study, due to availability constraints, spread calculations are based on observations occurring at each full hour during the continuous trading period.

Turnover is expressed in euros and calculated as the product of the number of traded stocks (trading volume) and the trade price. For the purposes of this research, turnover encompasses only transactions that took place within the continuous auction model, excluding reported block and over-the-counter trades.

In line with our expectation that changes in market quality are linked to the introduction of a DMM, we designate the introduction date (ID) as our event date. To account for market wide factors that may influence the bid-ask spread and turnover, we introduce a C-stock for each MM-stock, following the methodology introduced in Huang and Stoll (1996) and later applied in Venkataraman and Waisburd (2007). For each MM-stock, the C-stock is selected from a pool of candidate stocks defined as those without a DMM. Calculations involve utilizing various data sets during the pre-period: average price, average daily turnover, and average market capitalisation. The pre-period for each MM-stock spans the trading days between ID_{-5} and ID_{-34}. A score is assigned to each MM-stock against all the candidate stocks for the respective period:

$$C - score_c = \sum_{j=1}^{3}\left(\frac{a_{j,c} - a_{j,MM}}{\left(a_{j,c} + a_{j,MM}\right)/2}\right)^2 \tag{2}$$

where $a_j \in$ {average price, average daily turnover, average market capitalization} during the pre-period for candidate stocks c and MM-stocks. The C-stock is chosen from the pool of candidate stocks c based on the lowest C-score assigned during the scoring process for the respective MM-stock. A limitation of using average price, trading volume, and market capitalization – particularly when applied to a small number of MM-stocks and a limited pool of candidate stocks, as is the case in frontier markets – is that it may not fully capture the comparability required for accurate difference-in-differences analysis.

Once the control group comprising C-stocks is identified, we assess the influence of introducing a DMM on bid-ask spreads and turnover. Following the methodology outlined by Menkveld and Wang (2013), we initially perform a difference-in-differences analysis, calculated as the post-event minus pre-event differences across MM-stocks and their corresponding C-stocks, as per equation (3):

$$\delta_{DD} = \left(\bar{Y}_{MM,1} - \bar{Y}_{MM,0}\right) - \left(\bar{Y}_{C,1} - \bar{Y}_{C,0}\right) \tag{3}$$

where δ_{DD} is the difference-in-differences, signifying the impact of introducing a DMM on spreads or turnover, and $\bar{Y}$ is the average indicator (spread or turnover) for both MM-stocks and C-stocks over a 1-year period before ID (pre-ID, $\bar{Y}_0$) and a 1-year period after the ID (post-ID, $\bar{Y}_1$). Daily turnover data is available on the ZSE and LJSE websites.

The difference-in-differences approach is a statistical technique suitable for experimental research designs using observational study data. It assesses the effect of an independent variable (the introduction of a DMM) on an outcome (the spread or turnover) by comparing the average change over time in the outcome variable for the MM-stocks group with the average change over time for the C-stocks group.

Moving forward, we employ a regression framework to test spreads and turnover, examining whether firms engaging with a DMM demonstrate superior market quality compared to those without. The regression analysis is formulated as follows:

$$y_i = \beta_0 + \beta_1 * Time_i + \beta_2 * DMM_i + \beta_3 * (Time_i * DMM_i) + \varepsilon_i \qquad (4)$$

where y_i is the observed variable y for the i^{th} observation, $Time_i$ is a dummy variable taking the value 0 or 1 depending on whether the i^{th} measurement corresponds to the pre-ID or post-ID period respectively, and DMM_i is a dummy variable taking the value 0 or 1 depending on whether the i^{th} measurement corresponds to a C-stock or a MM-stock. The null hypothesis (H0) in the regression analysis posits that the introduction of a DMM has no significant influence on spreads or turnover. The significance level used is α = 0.05. Given the number of MM-stocks (19) on the ZSE and LJSE, pairing them with 19 C-stocks in both pre-ID and post-ID periods results in a total of 76 observations in the regression. This small number of observations is a limitation of this approach. A larger number of observations would enhance the precision and reliability of the estimates.

To bolster the robustness and granularity of our observations, we further test the significance of spread and turnover changes at the individual MM-stock level. For this purpose, a two-tailed paired sample t-test with a significance level α = 0.05 is employed, as indicated by the following equation:

$$t = \frac{d}{\sigma/\sqrt{n}} \qquad (5)$$

where d represents the mean difference per paired value, σ is the standard deviation of the differences, and n is the number of observations. The observations encompass spreads from Equation (1) and daily turnover for each MM-stock and C-stock for a one year period before and after the ID. Data at the ID is excluded from the calculation to mitigate potential bias. The null hypothesis (H0) states that there is no significant difference between the means of the data before and after ID. The number of observations is much larger in this analysis compared to the regression in Equation (4), enhancing the robustness of our estimations. The choice of a two-tailed paired sample t-test is well-adapted to the characteristics of analysed data sets, as the data is segmented into two distinctive periods: pre-ID and post-ID.

4. Empirical data and analysis

Data on daily turnover in frontier stock exchanges indicates that the median trading volume is just USD 8 mn per day. This figure represents only 2.6% and 0.6% of the median daily trading volume observed in global emerging markets and developed market exchanges, respectively (Mobilist, 2023). Trading statistics for 2023 reveal that the average daily turnover at the ZSE and LJSE was slightly over EUR 1 mn, which is low even by frontier market standards. As a consequence, illiquidity in frontier markets adversely affects even blue-chip stocks. In contrast to large stock markets in developed economies, market-making strategies in these markets struggle to generate adequate trading volume and profitability. This makes it challenging to attract endogenous liquidity providers. To address this, the ZSE and LJSE permit listed companies to engage DMMs, who assure minimum liquidity against a lump-sum annual fee. The decision to select the investment firm providing DMM services lies with the listed company, with the ZSE and LJSE not directly involved in this selection process.

A joint study investigating the impact of DMMs on market quality at the ZSE and LJSE holds significance for several reasons. Firstly, from a regulatory standpoint, both jurisdictions adhere to the same set of European regulations. Croatia's legislative framework was already aligned with the Union acquis before its accession to the European Union in July 2013. Furthermore, both exchanges utilize the same trading platform, Xetra®T7. Thirdly, from a macro perspective, both economies are relatively small, classifying their markets as part of the MSCI Frontier Market Index due to their size and illiquidity. Lastly, market fragmentation issues are negligible since both exchanges serve as the sole trading venues for the stocks admitted to trading, with an exception for HT whose depositary receipts were traded on the London Stock Exchange until 2014.

The ZSE and LJSE operate as electronic limit order book markets, ensuring transparency and visibility of orders to all participants. Market orders follow automatic execution against the book based on price-time priority rules. Trading hours for continuous trading at the ZSE span from 09:30 to 15:55, with a ten-minute break for an intraday auction at noon. On the other hand, continuous trading at the LJSE occurs from 9:15 to 15:15. While ZSE and LJSE trading rules, along with specific market-making rules, are generally aligned, minor differences persist.

Market makers on both exchanges adhere to minimum affirmative obligations related to presence, spread, and size. While compliance with minimum requirements is mandatory, listed firms retain the flexibility to negotiate narrower spreads or larger quoted sizes with the DMM. Fees paid by issuers to DMMs are a matter of direct negotiation and remain undisclosed to the public. Importantly, the ZSE and LJSE refrain from conferring any informational or trading advantages to DMMs.

At the ZSE, the regulated market comprises three tiers: The Prime Market, the Official Market, and the Regular Market. For issuers seeking admission to the highest segment, the Prime Market, hiring a DMM is obligatory (ZSE, 2021: art. 79, par. 3). DMMs on the ZSE must fulfill presence obligations by posting limit orders during at least 60% of continuous trading hours. Liquidity categorization dictates the maximum allowed spreads between simultaneous bid and ask orders, ranging from 2% to 7%, depending on the stock's daily trading volume. The minimum quote size varies inversely with liquidity, ranging from 4,600 EUR to 1,300 EUR (ZSE, 2023). The ZSE does not provide financial incentives for DMMs. Presently, nine ZSE-listed stocks receive DMM support, with seven on the Prime Market and two on the Regular Market. One stock, SPAN, could not be included in the analysis due to a lack of a pre-period.

The LJSE's regulated market features two tiers: The Prime Market and the Standard Market. Similar to the ZSE, stocks are classified into three liquidity groups based on average daily turnover thresholds. Maximum allowed spreads vary for each group, ranging from 3% to 5%. The minimum required presence is 50% of continuous trading time. DMMs at the LJSE are granted a fee discount, contingent on their trading results and the liquidity group of the stock (LJSE, 2022). Notably, hiring a DMM is not a prerequisite for admission to the highest trading segment (LJSE, 2020). Currently, all seven stocks with DMM support at the LJSE are traded on the Prime Market.

The study focuses on 18 firms that engaged in contracts with DMMs between May 2010 and January 2022 on the ZSE and LJSE. This population comprises 12 stocks from the ZSE and 7 from the LJSE, denoted as MM-stocks. The total number of stocks surpasses the number of firms, as one Croatian firm entered into a market-making contract for both its ordinary and preferred shares. The remaining stocks serve as a pool from which C-stocks are selected based on Equation (2). On the LJSE, with 23 listed stocks, nine trade on the Prime Market. This limited number of stocks poses challenges for C-stock selection. Conversely, the ZSE lists 90 stocks, with six on the Prime Market, providing a more extensive pool for analysis.

The empirical analysis employs four datasets. The first includes DMM contract introduction and termination dates for all MM-stocks. The second comprises daily data on closing prices and trading volume for all ZSE and LJSE stocks for one year before and after the ID. The third dataset includes daily market capitalization data for the same period. The fourth dataset encompasses intraday data for all MM-stocks and C-stocks, featuring the best bid and offer quotes at every full hour during continuous trading hours one year before and after ID. Unfortunately, comprehensive data on bid-offer spreads and transaction breakdowns by investment firms are unavailable, hindering the ability to differentiate DMM transactions from others.

Table 1 presents the MM-stocks along with their corresponding C-stocks, identified in accordance with Equation (2). The pool of potential C-stocks comprises listed stocks lacking a DMM at the ID. Consequently, certain stocks from the MM-stocks list are incorporated into the pool of candidate C-stocks.

Table 1: MM stocks and Control Stocks

Stock Exchange	MM-stock	ID	C-stock	C-score
ZSE	ATGR	28.05.2010	ATPL	0.6955
ZSE	ULPL	28.05.2010	VDKT	1.4757
ZSE	ADPL	17.02.2012	BLJE	0.2917
ZSE	LEDO	30.01.2013	ERNT	2.8885
ZSE	HT	24.07.2013	PBZ	4.7880
ZSE	PODR	09.09.2013	ADRS	0.6592
ZSE	DDJH	31.10.2013	BLJE	0.7730
ZSE	KOEI	16.10.2014	ERNT	0.4601
ZSE	RIVP	01.07.2015	DLKV	2.9034
ZSE	ARNT	06.06.2017	KRAS	0.4235
ZSE	ADRS	01.02.2018	MAIS	0.7625
ZSE	ADRS2	01.02.2018	ATPL	1.5193
LJSE	KRKG	02.01.2019	LKPG	2.6657
LJSE	ZVTG	02.01.2019	LKPG	0.7057
LJSE	PETG	03.01.2019	CICG	1.6447
LJSE	POSR	06.01.2019	LKPG	0.5937
LJSE	CICG	03.01.2021	TLSG	3.9610
LJSE	NLBR	10.01.2021	TLSG	1.9069
LJSE	TLSG	02.01.2022	LKPG	2.0517

Source: Authors’ calculations

The average spreads and daily turnover for the 19 pairs of MM-stocks and their corresponding C-stocks are presented in Table 2 and Table 3, covering the 1-year period before and after the ID.

Table 2: Average spreads

MM-stock	Pre-ID (%)	Post-ID (%)	C-stock	Pre-ID (%)	Post-ID (%)
ATGR	1.467	0.801	ATPL	0.644	0.888
ULPL	1.348	1.506	VDKT	2.938	3.632
ADPL	1.246	1.151	BLJE	1.151	1.370
LEDO	2.458	1.893	ERNT	0.876	0.792
HT	0.294	0.361	PBZ	2.483	2.704
PODR	2.027	1.183	ADRSPA	3.799	2.824
DDJH	1.716	2.529	BLJE	1.430	1.918
KOEI	1.773	1.735	ERNT	0.717	0.833
RIVP	1.085	0.632	DLKV	2.916	2.123
ARNT	2.126	1.090	KRAS	2.601	2.314
ADRS	2.333	1.111	MAIS	2.675	1.704
ADRS2	1.099	0.661	ATPL	1.888	1.983
KRKG	0.521	0.438	LKPG	1.491	1.831
ZVTG	1.139	0.796	LKPG	1.491	1.831
PETG	0.934	0.708	CICG	1.412	1.579
POSR	1.956	1.070	LKPG	1.495	1.813
CICG	1.954	1.435	TLSG	1.126	0.920
NLBR	1.300	1.079	TLSG	1.138	0.909
TLSG	0.890	1.209	LKPG	1.569	1.533

Source: Authors' calculations

Table 3: Average daily turnover

MM-stock	Pre-ID (EUR)	Post-ID (EUR)	C-stock	Pre-ID (EUR)	Post-ID (EUR)
ATGR	45,393	83,951	ATPL	190,817	88,131
ULPL	39,358	26,544	VDKT	13,871	10,459
ADPL	65,458	60,362	BLJE	85,362	40,320
LEDO	34,221	57,729	ERNT	62,700	62,700
HT	261,079	302,469	PBZ	10,578	14,962
PODR	30,249	52,996	ADRS	17,634	22,225
DDJH	25,370	24,049	BLJE	27,468	28,776
KOEI	24,246	18,091	ERNT	94,967	40,591
RIVP	78,322	136,432	DLKV	26,528	12,275
ARNT	20,225	48,309	KRAS	15,998	7,208
ADRS	18,221	19,368	MAIS	6,286	16,755
ADRS2	108,442	77,324	ATPL	50,730	27,124
KRKG	311,046	373,018	LKPG	63,960	30,974
ZVTG	119,665	129,645	LKPG	63,960	30,974
PETG	131,917	93,685	CICG	196,603	63,141
POSR	39,423	43,214	LKPG	63,803	31,098
CICG	67,986	56,421	TLSG	62,737	49,172
NLBR	185,809	200,274	TLSG	62,525	48,423
TLSG	49,426	40,877	LKPG	58,867	45,708

Source: Authors' calculations

These statistics indicate that the spreads fall comfortably within the limits set by the ZSE and LJSE for the specified liquidity groups. This observation suggests that DMMs may be negotiating narrower spread obligations with issuers in comparison to the spreads stipulated by the stock exchanges. Notably, it is intriguing that, for the majority of stocks, spreads were already narrower than the mandated spreads, even during the pre-ID period.

In our research, we explore the impact of a DMM contract on a stock's liquidity, measured through average spread and turnover levels. Employing a difference-in-differences approach as the core methodology, the results derived from equations (3) and (4) are summarized in Table 4 and Table 5.

Table 4: Difference-in-differences calculations

Variable	C-stocks mean		MM-stocks mean		δ_{DD}
	Pre-ID	Post-ID	Pre-ID	Post-ID	
Spread (%)	1.781	1.763	1.456	1.126	-0.313
Turnover (EUR)	61,863	35,317	87,150	97,093	36,489

Source: Authors' calculations

Table 5: Regression results for spreads and turnover

SPREADS	Coeff.	Std. err.	t	P-value	95% conf. int	
MM-stock	-0.00325	0.00228	-1.43	0.158	-0.00780	0.00129
Post-ID	-0.00018	0.00228	-0.08	0.938	-0.00472	0.00436
Interaction term	-0.00313	0.00322	-0.97	0.336	-0.00955	0.00330
Constant	0.01781	0.00161	11.05	0.000	0.01460	0.02102
TURNOVER						
MM-stock	-26,456	22,748	-1.17	0.247	-71,894	18,801
Post-ID	25,287	22,748	1.11	0.270	-20,060	70,635
Interaction term	36,488	22,748	1.55	0.126	-10,118	80,577
Constant	61,862	16,085	3.85	0.000	29,797	93,928

Source: Authors' calculations

The difference-in-differences calculations results from Table 4 reveal a notable 33 basis points reduction in spreads for MM-stocks following the introduction of DMMs, with 31.3 basis points attributable specifically to DMMs. Simultaneously, daily turnover experienced a rise of 9,943 EUR, of which 36,489 EUR can be ascribed to DMMs, considering the sharp decline in turnover for the pool of C-stocks. These outcomes align with our expectations. However, the p-values from the difference-in-differences regression analysis based on Equation (4) indicate that the null hypothesis (H0) cannot be rejected. In other words, we cannot affirm that the introduction of a DMM significantly influenced the spreads or turnover of the stocks.

We further assess the significance of the spread and turnover changes at the individual MM-stock level following the introduction of a DMM. The results of two-tailed paired sample t-tests, conducted with a significance level $\alpha = 0.05$, are presented in Table 6 and Table 7 for the spread and turnover liquidity variables, respectively, for each MM-stock and its corresponding C-stock. The p-value in these tests evaluates whether the change in, for instance, the spread of the MM-stock is statistically different from the change in the spread of the C-stock. Consequently, the null hypothesis (H0) in Table 6 posits that the spread for MM-stocks did not change significantly compared to C-stocks after ID, with the variable analyzed being the difference in spread between the MM-stock and the C-stock. Similarly, the null hypothesis (H0) in Table 7 is that the turnover for MM-stocks did not change significantly compared to C-stocks after ID, with the variable analyzed being the difference in turnover between the MM-stock and the C-stock.

Table 6: Results of two-tailed paired sample t-tests for spreads

Pair	Pre-ID (%)	Post-ID (%)	P-value	No. obs.	Interpretation
ATGR-ATPL	0.823	-0.086	0.000	1,994	rejecting H0
ULPL-VDKT	-1.590	-2.126	0.000	1,990	rejecting H0
ADPL-BLJE	0.0950	-0.590	0.000	1,984	rejecting H0
LEDO-ERNT	1.582	1.101	0.000	2,000	rejecting H0
HT-PBZ	-2.189	-2.343	0.002	2,000	rejecting H0
PODR-ADRS	-1.772	-1.642	0.037	1,992	cannot reject H0
DDJH-BLJE	0.286	0.611	0.000	2,003	rejecting H0
KOEI-ERNT	1.056	0.901	0.000	2,224	rejecting H0
RIVP-DLKV	-1.831	-1.491	0.000	2,219	rejecting H0
ARNT-KRAS	-0.475	-1.224	0.000	2,248	rejecting H0
ADRS-MAIS	-0.342	-0.593	0.000	2,223	rejecting H0
ADRS2-ATPL	-0.790	-1.323	0.000	2,223	rejecting H0
KRKG-LKPG	-0.969	-1.393	0.000	1,694	rejecting H0
ZVTG-LKPG	-0.352	-1.035	0.000	1,694	rejecting H0
PETG-CICG	-0.478	-0.871	0.000	1,714	rejecting H0
POSR-LKPG	0.461	-0.743	0.000	1,708	rejecting H0
CICG-TLSG	0.828	0.515	0.098	1,791	cannot reject H0
NLBR-TLSG	0.162	0.170	0.890	1,796	cannot reject H0
TLSG-LKPG	-0.679	-0.324	0.000	2,000	rejecting H0

Source: Authors' calculations

These statistics reveal a significant decrease in the difference in spread between the MM-stock and its corresponding C-stock in 13 out of 19 paired sample t-tests conducted, accounting for 68.42% of the total population. Notably, the spread significantly increased for three MM-stocks – DDJH, RIVP, and TLSG – compared to the change in spread for their respective C-stocks. In the cases of PODR, CICG, and NLBR, the null hypothesis (H0) could not be rejected. Upon referring to pre-ID and post-ID spreads from Table 2, it is observed that for four out of these six stocks where test results deviate from expectations (PODR, RIVP, CICG, NLBR), the average bid-ask spread post-ID is narrower than the pre-ID spread. These results may signify challenges arising from the limited number of shares in the pool of candidate C-stocks. Nonetheless, these outcomes align with expectations, as the spread obligations of market makers, when properly calibrated, mechanically lead to narrowed spreads.

Table 7: Results of two-tailed paired sample t-tests for turnover

Pair	Pre-ID (EUR)	Post-ID (EUR)	P-value	No. obs.	Interpretation
ATGR-ATPL	-145,424	-4,180	0.000	101	rejecting H0
ULPL-VDKT	25,487	16,086	0.067	101	cannot reject H0
ADPL-BLJE	-19,904	20,042	0.008	243	rejecting H0
LEDO-ERNT	-28,480	-3,379	0.097	274	cannot reject H0
HT-PBZ	250,501	287,506	0.070	248	cannot reject H0
PODR-ADRS	12,616	30,771	0.013	247	rejecting H0
DDJH-BLJE	-2,098	-4,727	0.440	248	cannot reject H0
KOEI-ERNT	-70,721	-22,501	0.000	248	rejecting H0
RIVP-DLKV	51,794	124,157	0.000	129	rejecting H0
ARNT-KRAS	4,226	41,101	0.000	248	rejecting H0
ADRS-MAIS	11,935	2,613	0.086	232	cannot reject H0
ADRS2-ATPL	57,713	50,199	0.637	247	cannot reject H0
KRKG-LKPG	247,086	342,044	0.000	245	rejecting H0
ZVTG-LKPG	55,705	98,671	0.051	245	cannot reject H0
PETG-CICG	-64,687	30,544	0.000	245	rejecting H0
POSR-LKPG	-24,381	12,116	0.000	243	rejecting H0
CICG-TLSG	5,249	7,249	0.795	252	cannot reject H0
NLBR-TLSG	123,283	151,851	0.190	252	cannot reject H0
TLSG-LKPG	-9,441	-4,831	0.546	249	cannot reject H0

Source: Authors' calculations

In the context of the two-tailed paired sample t-tests analyzing the difference in turnover between MM-stocks and their corresponding C-stocks, the null hypothesis (H0) was rejected for 9 out of the 19 pairs, constituting 47.37% of the total population. In all these cases, the t-tests indicated a significant increase in turnover. However, for the remaining 10 MM-stocks, H0 could not be rejected. Notably, turnover for MM-stocks decreased compared to the C-stock in five instances – ULPL, DDJH, ADRS, ADRS2, TLSG – accounting for 26.32% of the total population. These outcomes align with our expectations that the introduction of DMMs would have a less pronounced positive impact on turnover compared to spreads. The relatively weaker influence of market makers on turnover, as opposed to observed bid-ask spreads, can be attributed to the larger dependence of trading volume on exogenous factors, such as market structure. In simple terms, while spread obligations imposed on market makers may automatically narrow or limit observed spreads, the conjunction of spread and size obligations does not necessarily create a corresponding need or motivation for increased trading among market participants. The presence of strategic long-term owners or institutional investors with extended investment horizons, along with a lack of free float, can negatively impact trading volumes despite narrower spreads and the continuous display of bid and ask orders by market makers.

Analyzing the results from both Table 6 and Table 7 reveals a significant positive impact on both spreads and turnover in seven out of 19 MM-stocks (36.84% of the total population), while eight stocks demonstrate a significant improvement in one of the liquidity criteria. Improvement is found predominantly in spread, although two stocks exhibit a significant improvement in turnover without a corresponding significant narrowing of the bid-ask spread. No significant impact in any liquidity criteria is observed in four MM-stocks (21% of the total population). Three of these four stocks are traded on the LJSE, presenting an intriguing finding considering that, unlike the ZSE, the LJSE financially rewards its most active DMMs.

5. Results and discussion

The first hypothesis posited that the DMM introduction would narrow bid-ask spreads. The results of a difference-in-differences calculation support this hypothesis, though the overall regression analysis on the entire group of MM-stocks remains inconclusive. However, individual tests confirmed the significant impact in most stocks where DMMs were introduced. Limitations arise from the small sample of stocks with DMMs and the challenge of selecting appropriate control stocks in frontier markets, influencing the overall regression results. To address this, individual tests were conducted for each stock with a DMM, offering a more nuanced perspective.

Confirming earlier studies by Nimalendran and Petrella (2003), Anand et al. (2009), Menkveld and Wang (2013), Čekauskas et al. (2011), and De Carvalho (2021), our findings align with the consensus that DMM introductions tend to narrow observed spreads in continuous auction models. Distinctively, our study contributes valuable insights by focusing on the empirical effects of DMM introductions in prime trading tiers of exchanges in frontier markets. We note that positive spread effects cannot solely be attributed to exchange-imposed constraints, as observed spreads were already narrower than the maximum spreads allowed in certain instances. The mandated presence of DMMs at 50% and 60% of trading hours, depending on the exchange, also points to the fact that the narrowing of spreads is not the mere result of mechanical adjustment of DMMs to their exchange-mandated obligations. Owing to challenges related to data availability, we were unable to discern and isolate the activity of DMMs from other market participants. Additionally, a comprehensive examination of DMMs' contracts with issuers, and a comparison of their stipulated requirements with those of the ZSE and LJSE, proved unfeasible. The absence of these insights limits a fuller understanding of the factors contributing to the observed narrowing of spreads.

The second hypothesis suggested that introducing a DMM would augment turnover. Although the results of the difference-in-differences calculations attribute an absolute turnover increase to the introduction of DMMs, the regression analysis conducted on the entire population fails to reject the null hypothesis that DMMs do not significantly influence turnover. Moreover, unlike in the case of spreads, a more detailed examination, focusing on individual stock pairs showed a significant causal relationship between the introduction of DMMs and an increase in turnover in less than 50% of stock pairs. This insight suggests that while DMMs effectively address issues of asynchronous order flow and insufficient endogenous liquidity provision, they encounter challenges overcoming structural impediments to market liquidity, such as a lack of free float and the prevalence of long-term investors. Although narrower spreads, coupled with firm limit orders, contribute to reduced trading costs and liquidity risks, they did not alone stimulate a self-reinforcing cycle where heightened trading begets further trading.

These findings related to turnover deviate from empirical research in other markets as documented by Anand et al. (2009), Menkveld and Wang (2013), and De Carvalho et al. (2021) and underscore the divergence in impact on spreads and trading volume. Such disparities are particularly noteworthy for market regulators and stock exchanges in frontier markets aiming to boost trading volumes through the implementation of DMMs. To optimize outcomes, policymakers may consider integrating market-making schemes with complementary tools aimed at fostering broader market participation.

6. Conclusion

This paper investigates the influence of DMMs on stock liquidity at the ZSE and LJSE. The findings align with the first hypothesis, suggesting that the introduction of DMMs effectively reduces bid-ask spreads. However, the results do not convincingly support the second hypothesis, which posits that DMMs contribute to an increase in turnover.

Although the small sample size of the study limits the potential for generalization to all frontier markets, the observed divergence from previous empirical findings from more developed markets, which commonly indicate enhanced spreads and trading volume, underscores the distinctive microstructure dynamics inherent in frontier markets. These markets, often beset by suboptimal liquidity and structural obstacles—such as restricted free float levels and the prevailing influence of strategic, long-term institutional investors—manifest unique challenges. Most importantly, the paper reveals that resolving temporal asynchronies in order flow may not be sufficient to enhance trading volumes. This nuanced understanding contributes valuable insights to the existing literature, predominantly focused on larger, more mature, and more liquid markets, providing a richer contextualization of the implications for market microstructure in the specific context of frontier economies.

The study's limitations stem primarily from two sources: the relatively small stock population on the ZSE and the LJSE, and the narrow scope of available data. This small number of stocks affects not only those supported by DMMs but also the overall number of listed stocks. Although our dual analytical approach, which includes both aggregate and individual levels, mitigates this limitation to some extent by offering valuable insights at a more granular level and laying a foundation for future research, the limited number of stocks reduces the robustness of statistical analysis. Additionally, the use of average price, trading volume and market capitalization creates challenges to the selection of control stocks, potentially introducing unintended biases. Limitations arising from data availability primarily highlight opportunities for future research. Particularly beneficial would be the inclusion of transaction-level data that distinguishes between DMMs and other participants, as well as access to DMMs' contractual obligations with issuers.

The optimal structuring of DMM contracts and its implications for market quality are crucial considerations for stock exchanges and regulatory bodies. While our findings underscore the valuable role of DMMs, in particular in narrowing spreads, certain aspects remain unexplored and provide interesting avenues for future research. Specifically, access to DMM obligations from their contracts with issuers and transaction-level data, along with the ability to distinguish DMMs from other market participants, would enable studies on the market share and activity of DMMs under various conditions and across various market segments. This would also help determine the profitability of the DMM function and assess the effectiveness of DMM contract mechanisms. Also, more detailed data would allow studies of other aspects of liquidity, such as the price impact and other cost aspects of transactions. Finally, alternative incentives for liquidity providers exist, which have not been implemented at the ZSE and LJSE. For example, allocating a diversified portfolio of liquid and illiquid stocks to DMMs can effectively reduce the cost associated with maintaining a presence in less liquid securities. An intriguing alternative involves issuers themselves providing cash and stocks to market makers, thereby mitigating inventory risk. In addition, the interaction between DMMs' spread obligations and the tick size regime applied by exchanges may also be explored. To conclude, given the unconvincing results of the introduction of DMMs on turnover, the key insight for regulators and policymakers is that bolstering liquidity may be most effective through an integrated approach – combining DMMs with other strategic measures that facilitate short-term trading and increase the participation of small investors.

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Utjecaj službenih održavatelja tržišta na likvidnost na graničnim tržištima: primjer Zagrebačke i Ljubljanske burze

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Sažetak

Burze diljem svijeta koriste održavatelje tržišta s ciljem smanjenja rizika likvidnosti i povećanja trgovinskog prometa. Cilj je ovog rada istražiti utjecaj uvođenja službenih održavatelja tržišta na likvidnost na graničnim tržištima, mjerenu rasponom između kupovnih i prodajnih cijena i trgovinskim prometom. U istraživanju koristimo analizu razlika-u-razlikama na 19 dionica koje su uvele službenog održavatelja tržišta na Zagrebačkoj burzi i Ljubljanskoj burzi od svibnja 2010. do siječnja 2022. Prema našem saznanju, ovo je prva studija utjecaja održavatelja tržišta na ovim tržištima te druga graničnim tržištima općenito. Sukladno očekivanjima, kod većine dionica rezultati pokazuju značajno smanjenje raspona između kupovnih i prodajnih cijena nakon uvođenja održavatelja tržišta. Međutim, za razliku od istraživanja provedenih na razvijenijim tržištima, rezultati utjecaja na trgovinski promet su neuvjerljivi te upućuju na to da održavatelji tržišta teško mogu samostalno prevladati strukturalne prepreke većoj likvidnosti na graničnim tržištima, kao što su manjak slobodno raspoloživih dionica ili dominacija velikih investitora s dugim investicijskim horizontom.

Ključne riječi*: održavanje tržišta, službeni održavatelji tržišta, pružanje likvidnosti, granična tržišta, kvaliteta tržišta*

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