

# Changes in the Turnover Ratio and Liquidity in International Equity Markets

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We study trading over 15 years and compare trends internationally. We find European turnover has grown but less than others while turnover ratios have declined. But this decline is exaggerated in standard volume data, which focuses on primary market trading, and is comparable to other countries after adjusting the North American data. Overall, we observe a universal decrease in market turnover ratios accompanied by declining volatility; the European decline is significant, although not as large as that in the U.S. Despite the decrease in turnover ratios, lower market uncertainty and yield spreads potentially mitigate the extent of the observed decline.

**Keywords:** Liquidity, volume, entrepreneurial activity, volatility

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# 1 Introduction

*Europe's equity markets are at a record high but beneath the surface they are in crisis. Trading volumes are sinking, initial public offerings are scarce and some of its biggest companies prefer the appeal of the US.*

Financial Times In charts: Why European stock markets are in crisis.

Nikou Asgari, Alan Smith, Kevin Wilson and Ray Douglas in London,

March 3 2024

Concerns have been raised regarding the possibility that Europe has been experiencing a decline in stock market activity, while other regions, such as North America and Asia, have had the opposite experience. In this paper, we examine trends in international equity market trading activity over the past fifteen years to improve our understanding of what these trends are, whether such trends are characterized by a decreasing turnover ratio in Europe, and what factors could drive the patterns that we observe. We complement the analysis by considering liquidity measures (quoted spreads and depth).

In general, research on trading activity analyzes trading activity as measured by the turnover ratio and volume. The key difference between these two variables is that the turnover ratio (the fraction of outstanding shares changing hands) focuses on (a normalized measure of) the amount traded, whereas volume considers the value of the stocks changing hands. With respect to international comparisons and the study of time trends, the turnover ratio is more appropriate because it is abstracted from price movements. In general, the literature on trading activity focuses primarily on individual markets (Chordia, Huh and Subrahmanyam, 2006; Bogousslavsky and Collin-Dufresne, 2023; Campbell, Grossman and Wang, 1993) or on specific cross-country comparisons (Griffin, Nardari and Stulz, 2006; Chiah and Zhong, 2020; Lesmond, 2005). Our study contributes to the literature by providing a global perspective over the most recent fifteen-year period. Overall, we study liquidity not only via trading activity (the turnover ratio and the USD

value of volume traded) but also in terms of ex ante liquidity (quoted spreads and depth).

We find that that the commonly used data on volume (as provided by Compustat) need to be used with care when making international comparisons, as it can be contaminated by changes in fragmentation. In particular European, and to some extent Australian, aggregate volume data are provided for the primary quoting exchange and, given the growth in trading in the quoting exchanges, the amount of trading in the relevant stocks is underestimated, and the decline in trading activity is exaggerated. Using aggregate country level data we find that Europe has experienced relatively low but positive growth in total turnover, but a significant decline in turnover in primary markets. As a consequence, comparisons using the standard data sources identify a very large difference between European turnover and that of other countries, which exaggerates the true differences in trading activity.

To characterize global equity market movements in greater detail, we use an international sample of stocks. We use membership in the S&P 1200 Global Index to select the instruments in our sample, which covers the period 2009 to 2023. The stocks in this index represent an international and diversified sample of the largest and most frequently traded stocks in the main equity markets across the world.<sup>1</sup>

Our analysis, looks at turnover ratios as a price-free measure of trading activity, in addition to the usual turnover measures. We find a general decline in turnover ratios for the largest traded companies across all countries, and that European primary market turnover ratios have fallen in parallel with those of the rest of the world.

We consider correlates of the turnover ratio and their relationship with the monthly growth rate in the turnover ratio. We find that an often mentioned covariate, initial public offerings (IPOs), is not characterized by the strong positive relationship that is typically presupposed. We consider the total

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<sup>1</sup>The S&P 1200 Global Index represents approximately 70% of the world market cap.

number of IPOs per country as a proxy of entrepreneurial activity and find two things: First, over the 15-year period of our sample, there are large changes in the number of IPOs, with a generally small upward trend for most countries and a strong decline in the past three years. Second, the overall relationship with the turnover ratio is statistically weak with the exception of the U.S. (positive) and Germany (negative), where it is strong (significant at the 0.1% level).

We also reveal that the growth of the turnover ratio is positively related to contemporaneous country-level volatility (Karpoff, 1987) and negatively related to global forward volatility, as measured using the VIX. We find that the relationship between the yield spread and growth of the turnover ratio is negative, which is consistent with the substitution effect between investment classes: investors move from equity to bonds as the return on the latter increases.

Finally, we isolate the time trend that captures a general decline in turnover ratios during our sample across all countries (except Canada). The decline is accompanied by a decline in individual stock volatility which is positively covaries with trading activity, and could be enhancing the decline in trading activity. We reveal that the negative time trend in trading activity is dampened by the time trends in other correlated variables. In particular, over time, we have observed a decrease in risk as measured both by the VIX and the yield spread, which are negative covariates, and could have a dampening effect on the decline in turnover. In terms of entrepreneurial activity as proxied by the total number of IPOs by country and contrary to our expectation, we do not observe a general decline in IPOs but rather large fluctuations with a general positive trend. Overall, the implication is that a continued decrease in individual stock volatility accompanied by an increased in overall market risk could worsen the global decline in trading activity.

We conclude our analysis by looking at the behavior of ex ante liquidity measures, quoted spreads and depth, using intraday data and a narrower,

more recent sample: 2019–2023. Our data indicate a decrease in liquidity over the past few years consistent with the documented decline in the turnover ratio.

This paper contributes to several streams of literature. It is among the few papers to perform a global comparison of liquidity across multiple countries on multiple continents and to do so over a fifteen-year period. Because of limited data availability, the comparisons of spreads and depth are restricted to a shorter, five-year sample. The results are in line with those obtained with respect to the longer sample period.

The analysis builds on the existing theoretical literature on the determinants of variations in volume. This literature can be separated into two approaches. The first approach, rooted in the rational expectations paradigm, explains trading behavior driven by both noninformational factors and the profit motives of privately informed investors. These models typically analyze trading interactions among privately informed traders, uninformed traders, and liquidity or noise traders. Within this framework, investors seek to extract information from trading patterns and market prices, in which context noise trading often complicates this information extraction process (O’Hara, 1997). In contrast to information-based models, the second approach posits that trading is spurred by divergent opinions among investors. Notable contributions include works by Harrison and Kreps (1978), Harris and Raviv (1993), and Kandel and Pearson (1995). In these studies, investors are assumed to possess identical public information but interpret it differently. This divergence in interpretation leads to varying opinions among investors, thereby ultimately driving trading activity in the market.

A key reference for our analysis is Chordia, Huh and Subrahmanyam (2006). This paper provided an insightful analysis of the empirical determinants of trading activity (measured using the unsigned turnover ratio). Using U.S. market data from July 1963 to December 2002, they found support for theories of trading based on certain firm-specific characteristics, such as stock

visibility (proxied by firm size, age, price, and the book-to-market ratio), differences in opinion (proxied by the number of analysts and firm leverage), and uncertainty about fundamental values (proxied by absolute earnings surprises and earnings volatility). Their results show that stocks with higher uncertainty about fundamental values and higher risk show higher trading activity. Moreover, the more extreme the returns (positive or negative), the higher the trading activity. Finally, they argued that the observed long-term increase in trading volume can be attributed to several factors: the expansion of the mutual fund industry, reduced transaction costs and the increase in algorithmic trading. In contrast, we find that trading activity, as measured by the turnover ratio, has been decreasing, which highlights a reversal of the patterns put forth in Chordia, Huh and Subrahmanyam (2006).

Other related papers on similar topics have examined the relationship between volume and volatility. These papers have consistently reported a positive correlation between the trading volume and absolute price changes. Noteworthy contributions include Karpoff (1987), Schwert (1989) and Gallant, Rossi and Tauchen (1992). However, the geographical scope of our study, encompassing various countries and continents, precludes the use of many of the variables used to study volume in the U.S. context, as they are not available for other countries, especially the variables related to differences in opinion and stock visibility. Nevertheless, our results confirm the positive relationship between trading activity and volatility and indicate the opposite relationship with global expected volatility proxied by the VIX index.

## 2 Data

To generate a sample of international equity instruments that reflect international liquidity trends, we use membership of the S&P Global 1200 index as the criterion for inclusion into the sample. The membership information, as well as the portfolio weights, size, and related cross-sectional information,

were provided by S&P Global (the weight and cross-sectional information are inclusive of the period from December 31st, 2008, to 2023).

We use individual stock data variables, and we obtain monthly observations of companies that are members of the S&P Global 1200 index in the top 8 countries (according to the number of companies in the index). The countries included are as follows (from the lowest to highest fraction of companies in the index that are domiciled in said country): Switzerland (CH, 2.18%), Germany (DE, 3.31%), Australia (AU, 3.34%), France (FR, 4.30%), Canada (CA, 4.54%), the United Kingdom (GB, 8.67%), Japan (JP, 13.52%) and the United States (U.S., 41.06%). The sample includes **146,293** stock/month observations.

We obtain the daily price (high, low, and closing) and volume (shares and number of shares outstanding) data from Compustat (North America and Global) for the period 2009–2023. We also obtain monthly aggregates of equity trading by venue type, both at the country and company level, from the Market Share Reporter (MSR) App on the Refinitiv–Eikon platform. The additional intraday information was obtained from LSEG Tick History (formerly TRTH). The intraday information consists of price and bid-ask information sampled every 15 minutes, as well as message-level trade and quote data, from January 2019 to December 2023, which we use to construct daily and monthly observations.<sup>2</sup>

## 2.1 Measuring Trading Activity

Our main variable of analysis is trading activity measured as the turnover ratio. The main variable used is the turnover ratio (TR) by asset/month and its rate of change, where the turnover ratio is computed as the total share volume divided by the number of shares outstanding. We differentiate between volume (the number of shares traded,  $Q$ ) and turnover (the value of

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<sup>2</sup>The sample starts on January 24, 2019, rather than January 1, owing to restrictions in our access to historical LSEG tick history information.

shares traded, price  $\times$  quantity:  $P \times Q$ ) as measures of trading activity. Given that we have a very heterogeneous sample, we focus on turnover measured in USD.

In the process of analyzing the data, we found that the volume of Compustat reports in the Compustat–North America database differed from that in the Compustat–Global database. To illustrate this, we use the trade-by-trade data (LSEG-TRTH) and compute the aggregate volumes for stocks across the different countries, as shown in Table 1. In this table, we include the total volume as reported in Compustat for four random stocks: AMD.OQ (U.S., NASDAQ), 8411.T (Japan), BASFn.DE (Germany), and BNPP.PA (France). The first two lines identify the Compustat data source and the total reported volume. Below this information, we list the disaggregated volume by exchange. If we compute the aggregate volume across exchanges for AMD, the total volume is (essentially) the same as the total volume reported by Compustat–North America. On the other hand, if we consider the data from Compustat–Global, we can see that it reports the volume at the primary exchange only (the first disaggregated exchange for 8411, BASF, and BNPP).

To address the importance of this difference, we use country-level monthly data from the MSR. The data cover total trading in equities by the country of the domicile of the company. This data source separates turnover by venue, and use it to distinguish primary market trading from total trading.<sup>3</sup> We also use it to construct the percentage of primary trading by country (*Prim*) which we will use as a covariate in the stock level analysis below.

On the basis of the MSR data, we construct time series per country for both the total and primary turnover. We display this in Figure 1 to compare the patterns in turnover (value of shares traded) between countries, and

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<sup>3</sup>The data also separates turnover by trade classification. As for the purposes of this paper we are solely interested in the separation by venues (we differentiate the primary market and the rest) we simply aggregate turnover by venue.

we also observe differences between the time evolution of aggregate turnover (solid lines) and turnover in the country’s primary exchange (dot-dash lines).<sup>4</sup> In Panel (a), we display AU and JP as representatives for Oceania/Pacific and Asia, respectively, the U.S. as a representative for North America, and FR as a representative for Europe. Panel (b) includes the other four major equity trading regions: CA and three European countries (CH, DE, GB). The patterns observed in Panel (b) replicate those for the corresponding representative country in Panel (a). We complement the graphical analysis with a simple regression of the log of turnover against a time trend. Table 2 contains the coefficients of the time trend, by country.

In Figure 1 and in terms of the level of overall turnover, we observe the greatest turnover in the U.S., followed by JP, FR, and AU, in that order. On Table 2 we can see that total turnover is increasing for all countries (but GB). However, primary turnover is decreasing for European countries. When comparing the differences between the coefficients of the time trend, we find that these differences are greatest for all four European countries (CH, DE, FR, and GB). Overall European countries have experienced positive growth in turnover in our sample, but to a lesser extent than other countries. However, if one focuses only on turnover on primary markets, the lower growth in European countries turns negative, and the differences with other countries is exaggerated.

Therefore, when we examine the trading activity and liquidity across countries over time using the most traded assets (those in the S&P Global 1200 index), the differences in the distribution of turnover between the primary and the total market imply that we cannot compare the total turnover data provided in Compustat–North America with the turnover data in Compustat–

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<sup>4</sup>As the data are aggregated by country, we cannot separate the primary market for NASDAQ stocks from the primary market for the NYSE. Thus, for the U.S., we define the primary market as the sum of turnover in the NASDAQ and NYSE. This assumption is discussed in detail below.

Global, which has only primary turnover data for the rest of the world. We construct comparable measures of (primary) turnover using the primary turnover data in the MSR database for North American companies. The MSR includes monthly turnover data by venue and trade classification data for individual stocks. We can use these data for our analysis because the data coverage for U.S., CA, and GB companies is high, but we still need to use Compustat–Global, as the coverage in the MSR for company data from other countries is poor. Hence, our analysis combines the relatively good coverage in the MSR for North American companies (82% of company-month observations for the U.S. and 85% for Canada are in both Compustat and the MSR), with complete coverage in Compustat–Global for primary turnover data pertaining to all the companies in the other countries we study.

## 2.2 Sample and Covariates

We use the month-on-month growth in the turnover ratio for the primary market as our price-free measure of trading activity. Descriptive statistics by country are in Table 3. In the table we observe that the distributions are heavy-tailed. Volume, and by extension, the turnover ratio, is known to have a heavy-tailed distribution. In Table 3, we can see this point, both in terms of the skewness and kurtosis of the distributions and in terms of the positive means paired with negative medians.<sup>5</sup> Apart from the striking tails in the Japanese data, we find that the distribution of turnover ratio growth is very similar across countries in terms of the key statistics: mean, standard deviation, quartiles, and interquartile range. As indicated below, despite the tails in the Japanese data, our analysis is robust.

In addition, in Figure 2, we look at turnover ratios (in levels) to visually explore the time trends for our eight countries. Focusing on the representative

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<sup>5</sup>We explored the unusually large kurtosis and skewness for the Japanese stocks. We found that these are due to a small number of very large observations arising during months that display very large changes in the number of shares outstanding and turnover.

countries in Panel (a), we find that there were relatively small differences in the turnover ratio between them at the beginning of the sample (ranging from 0.0045 [45 bps] to approximately 0.0065 [65 bps]), but these differences widened in the 2010s, and then decreased significantly in the period around the COVID (ranging from 20 to 40 bps). In the last year of our sample, i.e., 2013, these differences increased again as ADT grew in JP while the other countries experienced a small decrease. In comparison with the differences in turnover, the turnover ratios have decreased significantly over time. As the turnover ratio is a measure of quantity (percent of shares outstanding traded each day) and turnover (value traded) and includes both quantities and prices, we can conclude that the growth in turnover we described earlier is driven primarily by stock prices. The (normalized) quantity of shares traded (in the primary markets) has decreased everywhere. The decline observed for European countries is not different from those of other countries, and less than that for large U.S. companies.<sup>6</sup>

Beyond these aggregate patterns in turnover and the turnover ratio, we want to explore this point in further depth and examine what has been happening to other known covariates of these variables. We start with the covariates identified in the extant literature, particularly those identified in Chordia, Huh and Subrahmanyam (2006). Given the international nature of our data, we are limited to the subset of those covariates that we can construct for all the countries in our sample. These variables are volatility, positive and negative returns of the country's main stock market index, entrepreneurial activity, and the yield spread. In addition, we include dummies to capture major international events, as well as the countries' consumer confidence indices (*Sentiment*, obtained from the OECD), and, following our earlier discussion, the fraction of turnover traded in the primary market (*Prim*).<sup>7</sup> The descriptive statistics of the continuous covariates are shown

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<sup>6</sup>Especially NYSE stocks, as we will see below.

<sup>7</sup>We thank an anonymous referee for suggesting the use of confidence indices and the

in Table 4.

In the following paragraphs, we discuss the purpose and construction of the variables we use. We start with volatility, which has been established as a key covariate of trading activity in the literature (Karpoff, 1987; Lamoureux and Lastrapes, 1990; Bessembinder and Seguin, 1993). To estimate the effect of volatility, we construct and use two volatility measures. First, we calculate realized volatility as the monthly standard deviation of each national country index (source: World Indices by WRDS). As a measure of general global market volatility, we use the closing value of the VIX. Both variables capture different aspects of volatility: the variable *SD\_Index* measures contemporaneous asset volatility, and the *VIX* variable measures expected forward volatility for the U.S. (and the world's largest stock exchanges) (Karpoff, 1987).

We also incorporate a standard measure for the overall corporate risk of the companies in a given continent, namely, the AAA spread (*YieldSpread*). The logic behind using this variable is that it captures aggregate corporate risk, which affects trading activity, much like volatility does. The argument is as follows: the equity of a company with significant debt is perceived to be riskier by investors than one primarily funded through equity because of the increased likelihood of financial distress and default. In addition, established agency theories propose that in situations where a company has lower equity or is heavily leveraged, managers (specifically equity holders) may opt for riskier and more uncertain ventures (Jensen and Meckling, 1976). We posit that a greater perception of corporate risk is reflected in bond returns, especially in the gap between highly leveraged firms and AAA firms, and this greater corporate risk price could have an impact on overall (equity) trading. The measure we use is the yield spread measured through the difference between high-yield bonds and the risk-free assets in each region (Asia-Pacific, 

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incorporation of the fragmentation measure into the regression.

Europe, North America).<sup>8</sup> This variable could also help explain differences in trading volume across countries. Following the same logic, we include the OECD measure of consumer confidence (*Sentiment*). This should covary with trading activity, as it captures part of the changes in the demand for capital.

We introduced this paper with a quote from the FT that relates the poor relative growth in European turnover to lower entrepreneurial activity (as proxied by the number of IPOs). The academic literature also links trading activity and IPO activity (Ellul and Pagano, 2006; Pham, Kalev and Steen, 2003), which leads us to include it in our analysis. We build our measure using the total number of initial public offerings (IPOs) in each country (source LSE Eikon). In Figure 3, we display the (smoothed) time trends in the log of our variable, where we can see that the proposed correlation may not be as expected, as IPOs have not decreased for most countries. The number of IPOs by country has fluctuated greatly over time, has increased on average, and has experienced a large decline only in the latter part of our sample after a significant post-COVID-19 worldwide increase in number. As indicated below, the relationship between IPOs and trading activity is not simple.

As in Chordia, Huh and Subrahmanyam (2006), we also incorporate stock returns as an explanatory variable, separating positive and negative returns of the country index to capture the asymmetric influence of returns on the turnover ratio. These potentially asymmetric effects are associated with short-selling constraints and the disposition effect (Odean, 1998). The variables used are as follows: (i)  $R^+$ : the daily return of the country stock index if positive and zero otherwise and (ii)  $R^-$ : the daily return of the country stock index if negative and zero otherwise.

The last continuous covariate we incorporate is a market-wide measure of primary trading (*Prim*). As we discussed previously, we observe heterogene-

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<sup>8</sup>Source: FRED High-yield options adjusted spreads.

ity across countries and, over time, in the way trading is distributed across venues. As we are analyzing growth in the turnover ratio in the primary market, we naturally expect that *Prim* will capture some of this variation.

Finally, we incorporate dummy variables (in levels) that capture specific and significant regulatory and economic events that may have influenced trading patterns during the sample period. These events are the implementation of the Markets in Financial Instruments Directive II (MiFID II, from 01–2018 until the end of the sample period—only for the European countries), the COVID-19 pandemic (03–2020 to 12–2020), Brexit (after 01–2021—only for the European countries), the post-COVID-19 inflationary period (03–2021 to 12–2023), and the Russian invasion of the Ukraine (after 02–2022).

By incorporating these variables into our analysis, we aim to provide a more comprehensive understanding of the factors associated with trading volume in global financial markets, while also accounting for the impact of important regulatory and economic events. As a reference to the reader we include a list of all the variables and their definitions in the Appendix, section A.

### 2.3 Methodology

Our objective is to provide a cross-country explanation of the variations in the turnover ratio. To ensure the clarity and comparability of the analysis across different countries, we deseasonalize and standardize the monthly growth rate of the turnover ratio and the monthly values of the explanatory variables (excluding the event dummies). We accomplish this goal by running the following fixed effects panel data regression:

$$Y_{i,t} = \alpha_i + \sum \beta_i \text{Month} + \varepsilon_{i,t} \quad (1)$$

where  $Y_{i,t}$  is one of the endogenous (growth of the turnover ratio) or exogenous variables (VIX, IPO, etc., in levels) and we use the month of January

as the omitted month (and hence captured by the constant). We use the residuals of the regressions and divide them by the standard deviation of the residuals in the sample. This transformation demeanes and deseasonalizes the variables by subtracting the sample means by month of the year (the month dummies in the regression) and standardizes the result by dividing by their standard deviation.<sup>9</sup>

The resulting residuals are the deseasonalized and standardized variables that we use for our analysis of the turnover ratio growth. This rescaling simplifies the interpretation of the coefficient in terms of homogeneous marginal effects of one-standard deviation changes in the variables measured in standardized standard deviations from the deseasonalized mean of the growth in the companies' turnover ratio.

The main specification of the analysis is described by the following equation:

$$\begin{aligned}
 Turn_{i,t} = & \alpha_i + \beta_1 IPO_{i,t} + \beta_2 VIX_{i,t} + \beta_3 SD\_Index_{i,t} + \beta_4 R_{i,t}^+ + \beta_5 R_{i,t}^- \\
 & + \beta_6 YieldSpread_{i,t} + \beta_7 Sentiment + \beta_8 Prim + \beta_9 MiFID2 \\
 & + \beta_{10} COVID + \beta_{11} BREXIT + \beta_{12} Inflation \\
 & + \beta_{13} Ukrania + \sum \gamma_i Month + \varepsilon_{i,t}
 \end{aligned} \tag{2}$$

where  $Turn_{i,t}$  denotes the monthly turnover growth by company. As previously noted, the variables in our regression described by equation 1 are deseasonalized and standardized. We employ a panel data fixed effect model with robust clustered standard errors.<sup>10</sup> The exogenous variables are the standardized residuals of country-level continuous variables plus the event dummies.

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<sup>9</sup>We do not apply this transformation to the returns variables.

<sup>10</sup>We also run quantile (median) regressions for robustness. The results are unchanged.

## 3 Results

### 3.1 Basic Patterns in the Data

Before we present the analysis described in equation (2), we first examine the original data series of the stocks, both in aggregate and by country, as shown in Table 5. When we examine data from the U.S. and Canada, we include the statistics for the main variables in three samples: the primary market variables (MSR) for the subsample that has observations in the MSR dataset (I. Primary, MSR subsample), the whole market variables (Compustat-NA) for the subsample that has observations in the MSR dataset (II. Compustat, MSR subsample), and the whole market variables for the entire sample in the Compustat-NA dataset (III. Compustat, full sample). This approach allows us to compare the primary market with the whole market data for the U.S.<sup>11</sup>

When we compare the different U.S. samples, we can see the difference in coverage in the MSR subsample in the first columns (the number of companies from each country that have entered the index, *compnum*). Comparing the sample (the rows in group II vs those in group III in Table 5), we see that the average number of companies per year is lower and more volatile. This is because the coverage in the MSR improves over the length of our sample. The numbers for the total daily turnover and ADT are comparable. Comparing primary turnover with total turnover (the rows in group I vs those in group II in Table 5), the lower values for the primary turnover reflect the fact that it is a fraction of the total turnover. A comparison of the information for the same sample on the basis of the primary volume in the MSR vs the total volume in Compustat reveals that the average ADT is slightly lower for CA (0.0025 vs 0.0028) and much lower for the U.S. (0.0023 vs 0.0096), whereas the daily turnover displays a similar pattern (58.9 m vs 65 m in CA and 63.5 m and 330 m in the U.S., respectively). We find that

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<sup>11</sup>Compustat-NA measures the total volume in Canada, while the MSR measures the total volume in Canada and the U.S.

this reflects a smaller percentage of primary trading for the U.S. as a whole, which we discussed earlier (70% nonprimary, hence 30%). These differences in the percentage of primary trading for the U.S. (30% earlier vs around 20% on Table 5) are due to the way we define the primary market in the two samples. In Table 5 primary turnover is obtained by averaging over primary trading in each stock, where we differentiate NASDAQ stocks from NYSE stocks. Figure 1 is constructed using aggregate turnover by venue, and there we define primary trading as the sum of turnover in both NASDAQ and the NYSE. Thus, turnover in the primary trading venue in Table 5 has to be smaller relative to the numbers discussed underlying Figure 1. This difference is more noticeable when we consider the time evolution in primary trading. We observe a drop in turnover in the primary market over the sample period (approximately 40%) on Table 5. In comparison the difference between total and primary trading in the Figure we discussed above was approximately constant. To reconcile these two facts, we explored how primary trading data is split between the NASDAQ and NYSE in Figure 4. Although the fraction of trading on both platforms has remained approximately constant, over time, the share of NASDAQ trading has been increasing and that of the NYSE has been decreasing. As NYSE stocks are more prominent in our sample than NASDAQ stocks are, this is reflected in an average decline in primary market trading for our stocks (in Table 5), while the overall share of total trading in both the NASDAQ and NYSE has remained relatively stable (Figure 4).

In Table 6, we present the correlations between the turnover ratio and the correlates of interest, all of which are significantly different from zero. The first covariate is the number of IPOs (*IPO*), which we use as a proxy for entrepreneurial activity and the relative attractiveness of equity financing. This has a positive and significant correlation with the turnover ratio. This is consistent with the positive relationship between entrepreneurial activity and trading activity established in the literature. Furthermore, we reveal

that the correlation between IPOs and both volatility variables is notably negative. This again is consistent with the known reluctance of company management to go public when the market anticipates high volatility and hence risk for the company's share value.

Next, we consider volatility, where we find a strong correlation between our measures of volatility: contemporaneous (*SD\_Index*) and forward-looking (*VIX*) volatility, as well as with the high yield spread, which measures risk in corporate bonds. In terms of the covariance between volatility and ADT, the positive correlations are in line with the results in the literature; see Karpoff (1987) or Gallant, Rossi and Tauchen (1992).

In terms of returns, we find a positive correlation with ADT ( $R^-$  takes negative values) and a stronger correlation for positive values than for negative values. This is consistent with the results in Chordia, Huh and Subrahmanyam (2006), short-selling constraints and the disposition effect.

We postpone a detailed discussion of the relationship between ADT and the remaining two variables, volume dispersion (*primaryPC*) and consumer confidence (*Sentiment*), as they have the opposite sign than expected. We expected that as on average more activity shifts away from the primary exchange, the primary turnover would decrease. As discussed below, the unexpected sign of the correlation coefficient reverts to expectations in the regression analysis.

### **3.2 Multivariate Correlates of the Turnover Ratio**

Given that we are interested in the factors that determine growth in the turnover ratio, we run the main regressions both in aggregate and by country. The regressions correspond to those described in equation (2), where the variable of interest is the deseasonalized and standardized growth of the turnover ratio rate, as described in Section 2.3. The results are shown in

Table 7, where we include the global results and those by country.<sup>12</sup>

We start with IPO activity. The first thing to note is that the sign and significance of the IPO coefficients depend on the country that we study. This finding is consistent with that of Zheng, Ogden and Jen (2005), who reported that the intensity of the relationship between volume and IPOs depends on the characteristics of the IPO. Zheng, Ogden and Jen (2005) also established that there is a positive relation between volume and IPOs. We find this to occur (and be statistically significant) in our sample only for U.S. companies. Conversely, the coefficients for companies in Germany and JP are negative and significant (at the 1% level).

In terms of volatility, we find that the positive correlation with the turnover ratio we found earlier is reflected in the sign of the regression coefficient only for contemporaneous volatility, while the coefficient for forward volatility and risk (VIX) is negative. The positive coefficient for contemporaneous volatility, however, is robustly significant and positive for all countries and is in line with the literature (Anderson and Dyl (2007) and Karpoff (1987) among others). Differences of opinion enhance trading, but market-wide uncertainty reduces it.

In line with this, we find that the coefficients for the yield spread are negative and (for most countries) significant. Higher yield spread signals are associated with higher aggregated risk and increased returns for bonds. As a consequence, the coefficient is consistent with expectations of a lower equity turnover ratio. We posit that this higher risk arises from a greater perception of corporate risk, which is reflected in bond returns, particularly in the gap between highly leveraged firms and AAA firms. Our result stands in contrast with those presented in Chordia, Huh and Subrahmanyam (2006). However, this difference could be due to differences in measures of leverage risk: they

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<sup>12</sup>To test the robustness of the results of the fat tails we found in the previous section, we estimate equation (2) using quantile regression (median), and the results are the same (sign, significance, and, for the most part, also in magnitude).

measured this risk using leverage over assets, while we use the yield spread.

As expected (Chordia, Huh and Subrahmanyam, 2006), negative returns are strongly associated with a lower turnover ratio across countries. On the other hand, we find a wide variation in the coefficients for positive returns and hence an unclear relationship between positive returns and the turnover ratio. Nevertheless, if we consider more extreme returns, as in Chordia, Huh and Subrahmanyam (2006), the results are consistently large and significant. We run the main analysis by interacting the positive and negative return variables with a dummy that takes a value of one if the absolute size of the return is greater than 10%. The estimated coefficients are large and statistically significant. For example, for the whole sample, the coefficients are 2.196 for (large) positive returns and -4.881 for large (negative) returns. The coefficients are significant at the 0.1% level.<sup>13</sup> These results are consistent with the notion of positive feedback trading (Hong and Stein, 1999).

The consumer confidence coefficients are positive and in line with expectations, although they are statistically significant only for Japan and North America (CA and U.S.). Additionally, the coefficients of the market share in the primary market (*Prim*) are in line with expectations for all countries except Japan, where the primary market is essentially the entire market throughout the sample.

With respect to the events that occurred during our sample, we start with the MiFID II coefficient, which is positive and significant for the European markets. One of the aims of MiFID II was to move trading from over-the-counter (OTC) and dark pools to regulated trading platforms. It seems that the effect is reflected in the growth in the turnover ratio in the primary market. We also included a dummy variable for the COVID-19 pandemic period, which is negative in all the cases except for Japan (insignificant)

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<sup>13</sup>As the remaining coefficients in that analysis are essentially the same as those in Table 7, we do not report them here. Nevertheless, all the regression results are available from the authors upon request.

and the U.S. (positive and significant at the 5% level). The positive effect of COVID-19 in the U.S. case is consistent with the common perception of the effect of U.S. policy during the pandemic (the pandemic stimulus checks). This unusual increase in turnover growth is associated with many Americans using their government check to invest in, among other things, equity markets (Chiah and Zhong, 2020). We observe that the post-COVID inflationary period has negative or insignificant coefficients, and again, the U.S. is the exception, with a positive and significant coefficient, while the period from the start of the war in Ukraine has mixed coefficients: positive and significant in the U.S. and Switzerland, negative for CA and JP, and insignificant for the remaining European countries and Australia.<sup>14</sup>

In addition, we include the same analysis using USD denominated primary market turnover (in logs), instead of growth in the turnover ratio, in Table 8. In general, we observe similar results to those for growth in turnover for contemporaneous volatility (positive), bond risk premium (YieldSpread, negative), market share in the primary market (positive), and consumer confidence (positive or not significant). Key differences include the facts that turnover increases with forward volatility (VIX) and that it is robustly positive and significant for the number of IPOs. The coefficients for returns change signs, being primarily positive for positive returns and mixed for negative returns. We associate these differences with the price component in turnover (value of shares traded) that is missing from the turnover ratio measure, which focuses on the number of shares (as a proportion of shares outstanding). High asset valuations are associated with a greater frequency of IPOs and higher returns. After accounting for these differences, the overall results are consistent for both the turnover ratio growth and turnover.

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<sup>14</sup>The results are robust to recent sectoral trends. In particular, we repeat the analysis excluding the information technology sector, and we also repeat it excluding the "magnificent seven" (NVDA, GOOG, AMZN, AAPL, MSFT, FB and TSLA). In both cases, the results are robust in terms of both sign and significance.

To improve our understanding of the time evolution of trading activity and differences across countries, we consider the time trends of the correlates during our sample period (Table 9). We combine the information of the sign of the coefficients with the sign of the time trend in the covariates. In Table 9, we can observe the generalized decline in the market share of primary market trading for all countries, which partially explains the negative growth in ADT across countries, as we discussed above. Note that the positive growth in primary market share for the U.S. in this table refers to the sum of NASDAQ and NYSE trading. While the market share of the sum of both markets increases during our sample, the average market share of the actual primary for our stocks in the sample (dominated by NYSE stocks) declines over the sample period.

We observe that over our sample, entrepreneurial activity increased over the sample period (except for in CH and GB). Thus, as we have found a positive relationship between IPO activity and trading for turnover, the joint effect is positive and hence a common source of higher trading value. However, when we consider ADT, we do not find a positive correlation with IPOs for non-U.S. countries; hence, we do not find evidence that IPOs have helped or hindered the observed decline in ADT growth. For the U.S., the relationship between IPOs and ADT growth is positive and thus possibly dampens the observed decline in ADT growth.

In terms of volatility, both in terms of stock-specific contemporaneous volatility and volatility expectations captured by the VIX index, we observe a uniform decline over the sample period.<sup>15</sup> We found that lower risk expectations correlated with higher ADT; hence, the lower VIX across our sample could have dampened the decline in ADT growth. Only Japan displays a distinct pattern: a positive relationship between the VIX and ADT and a decline in the VIX. Thus, the decline in the VIX is correlated with lower ADT

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<sup>15</sup>As the VIX is the same for all countries (the VIX from the U.S.) the drop in the index is the same.

growth in Japan. In contrast, the opposite correlation between the VIX and turnover would have dampened the observed turnover growth and partially explain the lower turnover in continental Europe. Contemporaneous volatility, however, has the opposite correlation with ADT growth; thus, the decline in stock-level volatility can be viewed as helping the decline in ADT growth across all countries. Lower global uncertainty and lower stock-level activity push trading activity in opposite directions in our sample.

As with the VIX, we find that across countries, corporate risk (AAA yield) has declined across our sample. This lower market-wide risk correlates negatively with trading activity and can be interpreted as a positive force for both ADT growth and turnover in line with the VIX. The net effect is associated with a dampening effect on ADT decline and a positive influence on turnover across the sample.

Finally, consumer sentiment appears to have grown and have had a positive but weak interaction with the turnover ratio. It is significantly important primarily for the U.S. and Japan. It is also significant (and positive) for ADT growth in Canada and for turnover in Great Britain. For the U.S., the average decline in U.S. consumer sentiment in our period could be interpreted to have had a dampening effect on the observed growth in turnover and a force accompanying the decline in U.S. ADT growth. With respect to the other countries, Canada experienced an increase in consumer sentiment and hence relatively higher ADT growth, and Great Britain experienced a decline in sentiment, which combines to entail a dampening of the increase in turnover they experienced.

### **3.3 Liquidity: Intraday Evidence 2019-2023**

Thus far, we have focused on trading activity (as measured by the turnover ratio and volume). We also want to consider other, ex ante, liquidity measures, and we do so for a more recent period. In particular, we have access to data on intraday liquidity measures only from January 2019 to December

2023, and we obtain these for the primary exchanges. We cannot expand our sample to earlier periods because of data limitations. The results are nevertheless consistent with those obtained by reference to the turnover analysis with the longer time interval. On the basis of the intraday measures, we compute daily averages and use the resulting asset/day observations to construct asset/month aggregates. In particular, we compute two liquidity measures: relative quoted spreads ( $QSp$ ) and depth ( $logDepth$ ) as the average of intraday relative quoted spreads and depth sampled every 15 minutes. Similarly, the variable measuring the range of prices,  $HighLow$ , is also computed using intraday data. With this volatility measure ( $HighLow$ ), we can replicate the same methodology used before, namely, a panel regression with monthly observations. In Figure 5 and Figure 6, we can observe the evolution of the quoted spread and the logarithm of depth for Australia, Japan, France, and the United States. Interestingly, we observe a decrease in liquidity, particularly evident in the case of the U.S., which is characterized by a higher cost of transacting. This trend is visible across the examined countries, thus suggesting a broader shift in market dynamics that affects liquidity conditions across different financial markets.

When we examine quoted spreads, we incorporate as controls the appropriate variables from the literature. McInish and Wood (1992) and Madhavan (2000), among others, reported strong relationships between spread and determinants such as volatility, trading activity, frequency of trades, order size, and stock price. The effect of these variables on the quoted spread depends on the importance of the three components of the spread: adverse selection, inventory holding costs, and order processing costs. In this analysis, we also incorporate some of the variables we used the analysis of turnover, de-seasonalize and standardize the endogenous and explanatory variables using equation 1 and use the standardized residuals as the variable in our regressions. The main specification of the regression is a cross-sectional regression equation described by the following equation:

$$\begin{aligned}
Y_{i,t} = & \alpha_{i,t} + \beta_1 IPO_t + \beta_2 LogVol_{i,t} + \beta_3 HighLow_{i,t} + \beta_4 invP \\
& + \beta_5 COVID + \sum \gamma_i Month + \varepsilon_{i,t}
\end{aligned} \tag{3}$$

where our variable of interest is the quoted spread ( $QSp$ ), or depth ( $logDepth$ ). The exogenous variables are entrepreneurial activity ( $IPO$ ), trading activity ( $LogVol$ ), the volatility of the QSp ( $HighLow$ ) and the inverse of the asset price ( $invP$ ).

Table 10 and Table 11 show the results from the analysis. In terms of the main correlates, we find that the coefficient of IPO behaves uniformly across the different countries when the spread is considered. When the coefficient is significant, it is negative. Interestingly, the German and French coefficients are more negative than the rest are. The negative and significant coefficients show that higher IPO activity is correlated with higher liquidity through lower QSp. This is consistent with the explanation we described earlier, namely, that increasing IPOs are usually timed with moments of market optimism, which is also associated with a lower cost of liquidity provision. However, this intuition is inconsistent with the coefficient for Australia or even with the coefficient for Japan, which are not significant. In the case of depth, we see consistent coefficients across European countries and Japan: a greater number of IPOs is associated with lower depth. However, these coefficients are difficult to interpret, as they have the opposite sign than we expected from the correlation between IPOs and liquidity. The remaining coefficients are not significant.

In general, except the U.S., volume ( $LogVol$ ) has a negative effect on QSp since higher volume allows liquidity providers to turn around inventory faster, thereby lowering their potential liquidation costs and reducing their risk (Australia, Switzerland, Germany, France and Japan). The exception is the U.S., where we observe a positive and significant coefficient that drives the global estimation. One hypothesis that could account for the different

behavior for the U.S. is that higher volume could be associated with greater adverse selection. If this is true, then more informed trading would lead to higher liquidity provision costs. This behavior could be associated with higher fragmentation (Tapia, 2017). With respect to Depth, we find that the coefficients are generally not significant, (Espinosa, Tapia and Trombetta, 2008).

With regard to volatility, measured using the average price range over fifteen-minute intervals (HighLow), we find that greater volatility is associated with lower liquidity, higher QSp and lower depth. We expect from the large microstructure literature on the subject (see, for example, Demsetz (1968) Madhavan (2000), Stoll (1978) or Foster and Viswanathan (1993)) that higher volatility will lead to greater uncertainty, higher inventory costs, and higher adverse selection costs, which decrease liquidity. We have also included the inverse of the price, which is typically used to measure the relative tick size. A lower price is more likely to be affected by the minimum tick, which induces a convexity in percentage spreads. We observe this situation at the global level, as well as in the estimation for the U.S. With respect to the greater relative tick size, we observe greater QSp and greater depth.

Finally, for both the U.S. and the global analysis, the coefficient for the period of the COVID-19 pandemic is positive for QSp and negative for depth. These findings imply that liquidity worsened during the COVID-19 pandemic (Chakrabarty and Pascual, 2023).

## 4 Conclusion

On the basis of multiple distinct data sources, as well as a broad set of explanatory variables, we seek to provide a view of the major trends in turnover and liquidity. We focus on primary markets, as this context represents the main measure of turnover available in the primary international volume database (Compustat–Global), and we have centered our analysis

on the evolution of the turnover ratio in primary markets, as a price-free measure of trading activity, over the last fifteen years, exploring potential differences across countries.

We constructing our dataset we gained the first insight revealed by our analysis, namely that publicly available data need to be interpreted with care. When using standard volume series, one needs to be very careful about whether these series measure aggregate volume or volume in the primary market. We studied the importance of this difference by comparing aggregate and primary market turnover at the country-level. We found that there are significant differences both over time and across countries in the two series, which implies that one must be aware of trends in fragmentation when looking at trading activity. This phenomenon is particularly important when comparing the U.S. with Europe, as standard European volume data (Compustat–Global) report only the volume at the primary exchange and ignore the volume in other exchanges that have substantially expanded their market share over our period. For the U.S., the reference dataset (Compustat–North America) reports the aggregate volume across all platforms.

By combining primary market trading activity by stock from the Compustat–Global and the MSR datasets, we construct comparable series of (primary market) trading activity across countries. In terms of the evolution of the fraction of trading in the primary markets (*Prim*), we find a universal decline across markets over our sample period. For the U.S. as a whole, primary trading (as the sum of NASDAQ and NYSE) increases, but in our sample (dominated by NYSE stocks), it declines. Thus, when comparing trading activity for large companies in the U.S. and the EU, we observe that both have experienced lower trading activity, but in the U.S., the lower activity is compensated by price growth, and European stocks have lagged behind in terms of stock market performance.

To improve our understanding of the time evolution of trading activity

and differences across countries, we examine the correlates of the growth of the turnover ratio (ADT) and its evolution. Starting with entrepreneurial activity (measured by the number of IPOs), we find that the positive relationship between IPO activity and trading holds uniform in our sample when looking at turnover. However, when we consider ADT growth, it is positive for the U.S., nonsignificant for the rest of the countries, and reversed for Germany and Japan. For most of the countries (except France and Canada), the number of IPOs has increased; this activity is correlated positively with the overall growth in turnover for Japan, the U.S., and Great Britain and negatively with the decline in turnover in Germany, Switzerland, and Australia.

We also explore patterns in risk measures. We find that we need to distinguish individual stock-level volatility, which is a positive covariate of trading activity, from aggregate uncertainty, both in terms of aggregate volatility expectations (VIX) and corporate risk (AAA yields), both of which are negative covariates with trading activity. As all three of these have experienced a decline over our sample period, we find that the lower stock level volatility can provide a partial explanation for the observed decline in trading activity, which has been dampened by lower aggregate uncertainty.

Finally, we find that consumer sentiment is positively but weakly correlated with trading activity, except for the U.S. and Japanese markets, where it is strongly significant. While in Japan this index has experienced a significant decline during our period, accompanying the decline in Japanese ADT growth, for the U.S. the index has remained stable, and thus a relatively unimportant influence on the observed decline in primary market trading activity.

We conclude our analysis by adding data concerning immediate liquidity across all countries, measured using the quoted spread and depth. Our results confirm that over the past five years, the negative pattern in primary market turnover ratios is also reflected in liquidity.

Overall, we find that Europe's primary stock market decline is smaller than it appears. The negative decline in primary market trading activity in Europe is no worse than that in other countries and better than that in the U.S. In contrast, compared with other countries, European turnover has fared worse during our sample period aided by a stronger decline in primary market stock trading over our sample. This decline has also been accompanied by a decline in stock-level volatility which is a known positive covariate of trading activity. However, we also observe that patterns in accompanying factors such as IPO growth and lower aggregate risk have dampened the decline, and if those patterns change, we may witness a downward trend in stock trading worsening in the future.

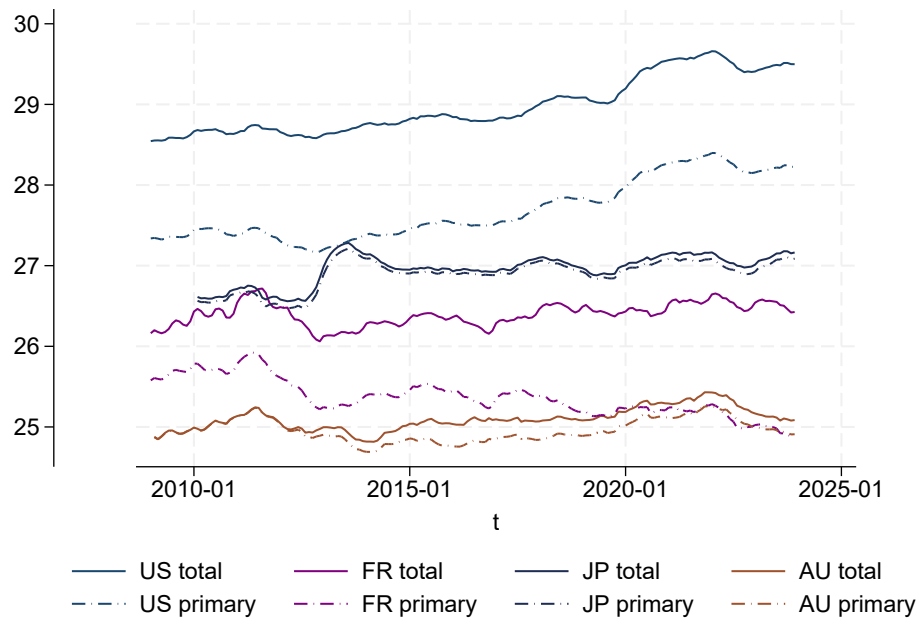
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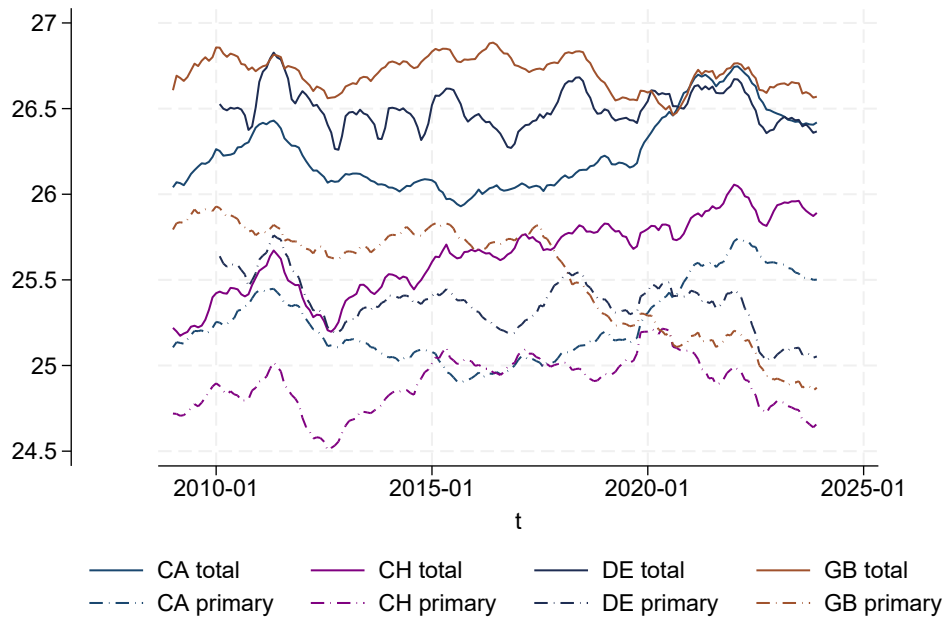
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## A Tables and Figures

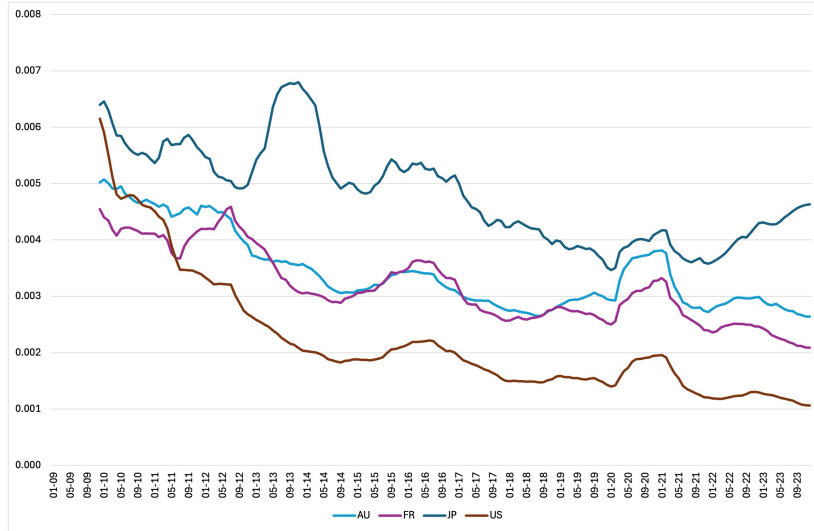


(a) AU, JP, FR, and US.

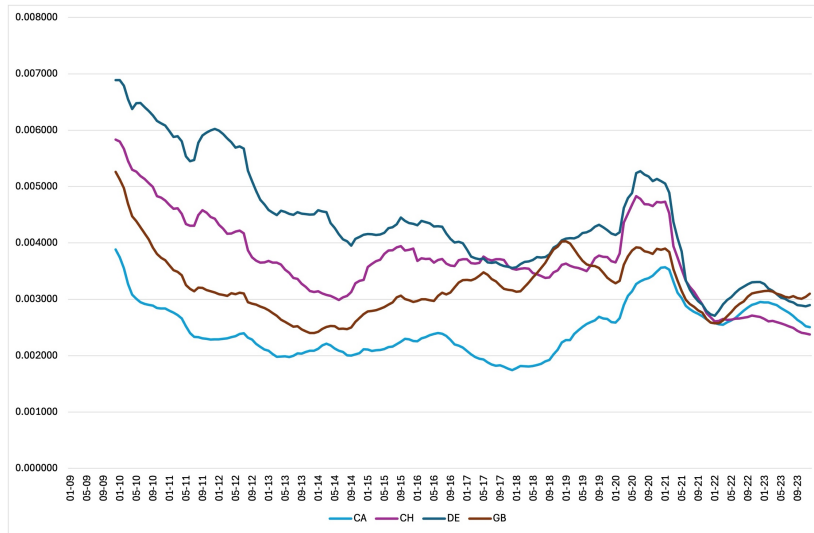


(b) CA, CH, DE, and GB.

Figure 1: Nine month moving average of monthly average of log turnover (in USD) in the primary market and in total. Primary in the US is the sum of NASDAQ and NYSE.

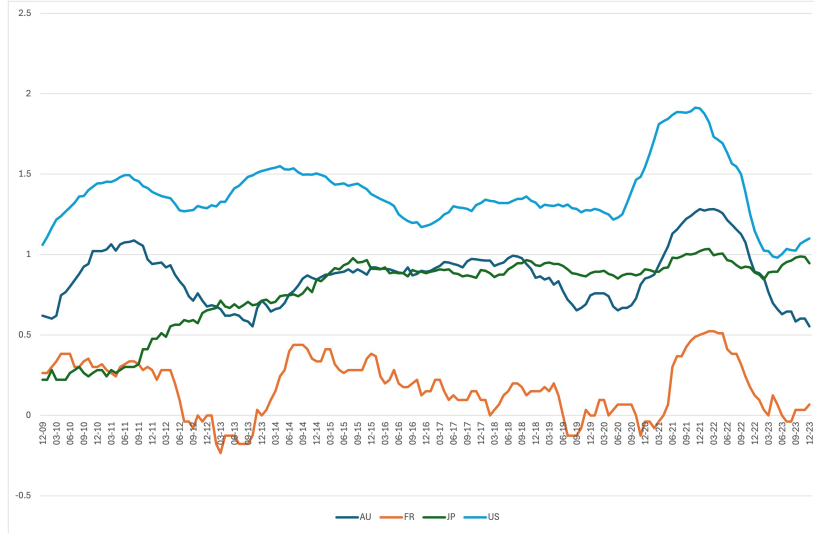


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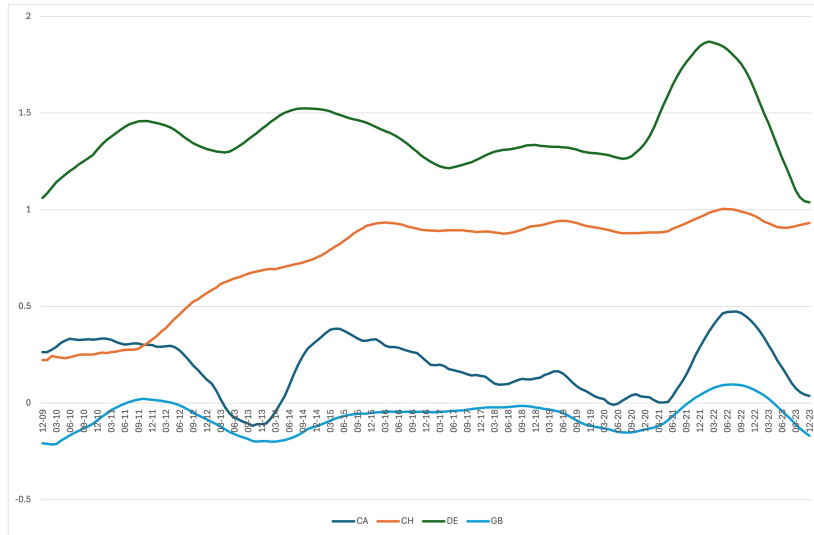


(b) CA, CH, DE, and GB.

Figure 2: Average Daily Turnover ratio for the primary market (in absolute level: 0.01 = 1% of outstanding shares traded, which corresponds to (roughly) a 250% annual turnover ratio)



(a) AU, JP, FR, and US.



(b) CA, CH, DE, and GB.

Figure 3: Log of the twelve month moving average of the total number of IPOs.

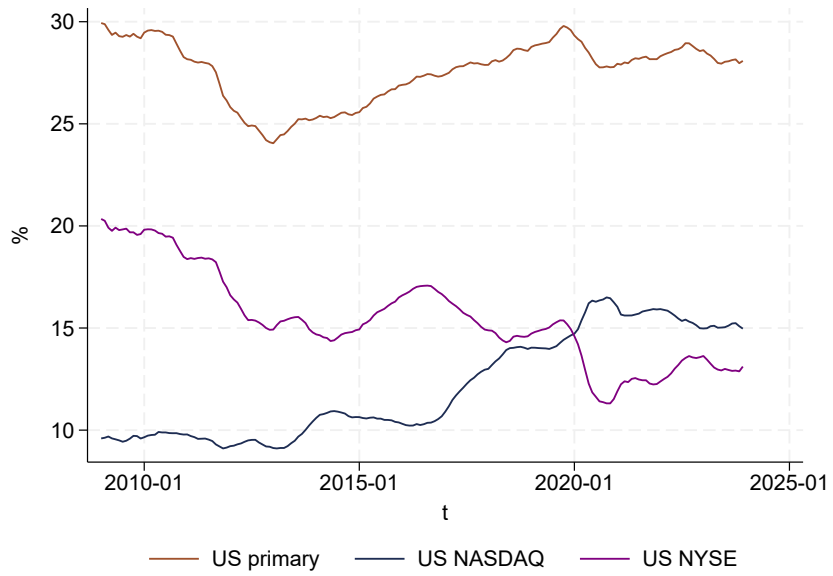
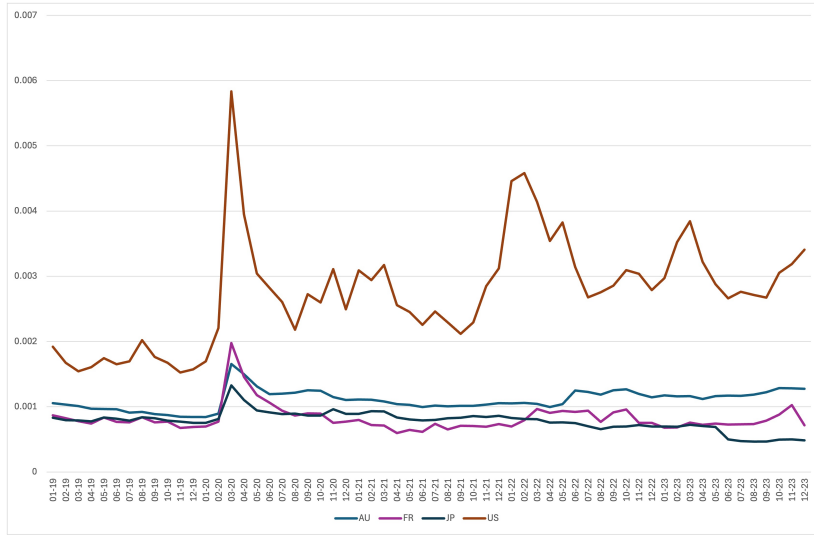
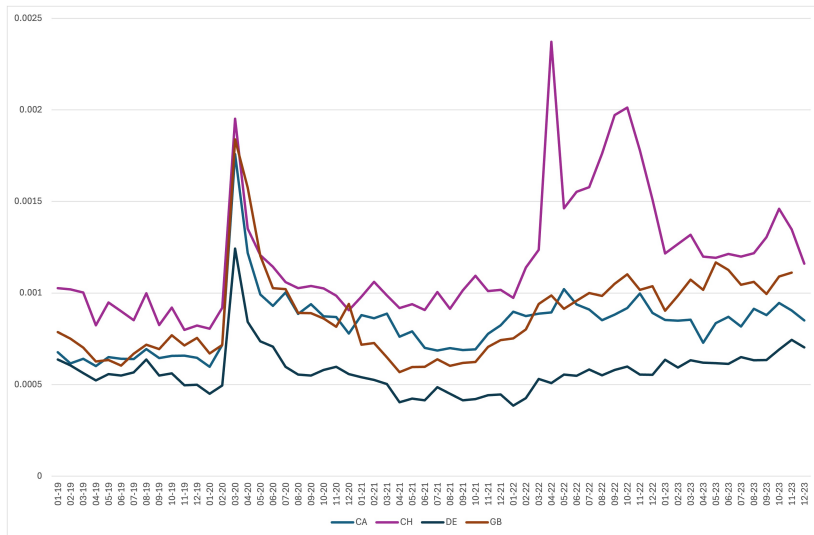


Figure 4: US market share: NASDAQ, NYSE, and the sum of the two (US primary).

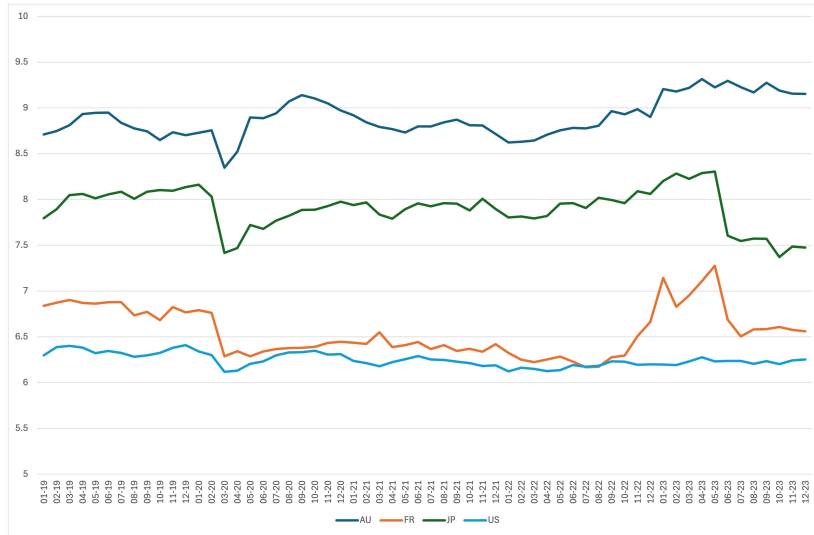


(a) AU, JP, FR, and US.

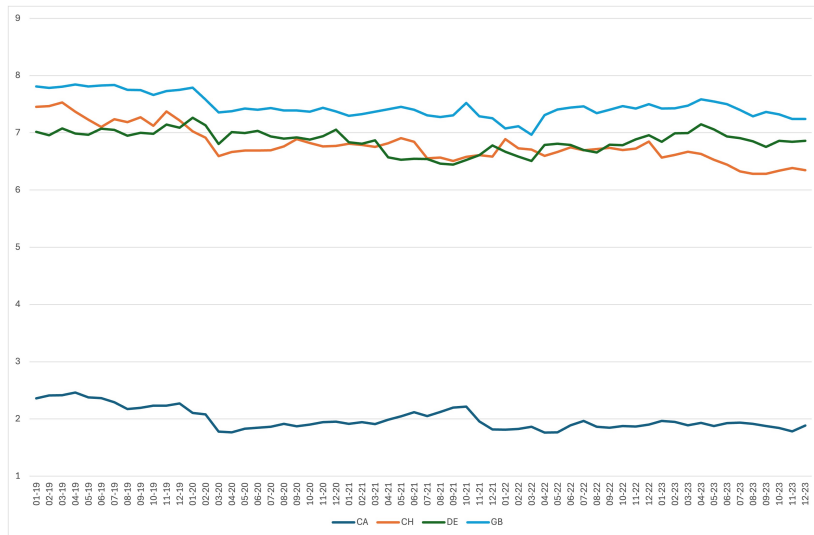


(b) CA, CH, DE, and GB.

Figure 5: Monthly average Quoted Spread (0.01 = 1% of midprice).



(a) AU, JP, FR, and US.



(b) CA, CH, DE, and GB.

Figure 6: Monthly average Log Depth (at the bid and ask)

Table 1: Distribution of Volume Across Exchanges: Compustat North America vs Compustat Global

The table reports volume, both aggregated and disaggregated, reported in different databases, for four instruments in four different countries for August 23rd, 2023.

	Description	Volume	Description	Volume	Description	Volume	Description	Volume
Instrument RIC	AMD.OQ		8411.T		BASFn.DE		BNPP.PA	
Date	23/08/2023		23/08/2023		23/08/2023		23/08/2023	
Database for aggregate volume	Compustat North America		Compustat Global		Compustat Global		Compustat Global	
Reported volume	cshtrd	53,681,000	cshtrd	8,230,100	cshtrd	1,527,219	cshtrd	2,103,839
Database for disaggregated volume	LSEG Tick History		LSEG Tick History		LSEG Tick History		LSEG Tick History	
Volume: primary exchange	NAS	10,009,600	TYO	8,230,100	GER	1,527,219	PAR	2,103,839
Volume: other markets	ADF	31,329,208	JNX	354,500	DXE	495,326	DXE	887,622
	PSE	4,126,824			TQE	53,484	TQE	153,020
	DEX	3,711,583			BTE	3,398	TRQ	1,439
	BAT	1,618,419			MIL	579	BTE	1,051
	MMX	1,158,183			VIE	10	CHI	187
	MID	850,991						
	NYS	556,810						
	IEX	462,458						
	DEA	351,323						
	MPE	204,053						
	BOS	109,086						
	BTY	98,060						
	XPH	88,633						
	CIN	34,947						
	ASE	33,653						

Table 2: This table reports the coefficients of the time trend in log turnover (primary (*PrimTR*) and total turnover (*TotalTR*)) using MSR country level data. The difference between the time trend coefficients is included in column *difference*.

Country	<i>Primary TR</i>		<i>Total TR</i>		Difference
	Time Trend	s.e.	Time Trend	s.e.	
AU	0.058%	0.024%	0.151%	0.022%	0.093%
CA	0.286%	0.028%	0.301%	0.027%	0.015%
CH	0.058%	0.026%	0.389%	0.022%	0.331%
DE	-0.161%	0.024%	0.028%	0.031%	0.189%
FR	-0.357%	0.024%	0.122%	0.028%	0.479%
GB	-0.508%	0.023%	-0.073%	0.019%	0.435%
JP	0.297%	0.024%	0.310%	0.023%	0.013%
US	0.696%	0.023%	0.668%	0.020%	-0.028%

Table 3: Descriptive statistics for growth of the turnover ratio, by country

	Obs	Mean	Stdv	25%	50%	75%	Skewness	Kurtosis
AU	8,439	5.030	37.326	-17.886	-1.132	19.389	2.984	24.712
CA	7,776	6.097	40.753	-19.478	-0.705	21.775	2.970	32.317
CH	4,568	3.612	33.530	-16.874	-1.727	17.067	2.447	18.753
DE	6,688	3.555	31.908	-16.592	-1.769	17.487	2.415	20.049
FR	8,538	3.294	30.928	-16.495	-1.455	17.160	3.048	41.283
GB	16,198	4.429	35.566	-17.724	-1.608	19.001	3.409	42.258
JP	26,705	4.692	45.790	-16.325	-1.235	17.616	15.393	510.998
US	67,381	3.695	34.910	-18.813	-2.300	18.975	3.705	88.970
Total	146,293	4.131	37.292	-17.875	-1.786	18.675	7.544	253.573

Table 4: Descriptive statistics by country: ADT covariates

For each variable we compute the mean, and the standard deviation.

	MonthIPO		SDportret		HighYield AAA		primaryPC		Sentiment	
	Mean	Stdv	Mean	Stdv	Mean	Stdv	Mean	Stdv	Mean	Stdv
AU	7.7	6.1	0.0085	0.0044	2.82	1.04	86.9	7.7	99.9	1.0
CA	12.1	7.2	0.0082	0.0058	5.27	2.22	37.1	2.8	99.9	1.8
CH	0.4	0.7	0.0082	0.0043	5.35	2.99	48.5	9.2	99.8	1.6
DE	1.1	1.4	0.0103	0.0048	5.27	2.80	33.5	6.4	100.5	1.3
FR	1.6	1.9	0.0105	0.0052	5.35	2.99	37.2	10.6	98.9	1.2
GB	5.1	4.3	0.0088	0.0045	5.35	2.99	31.8	8.2	99.2	2.5
JP	6.6	6.3	0.0108	0.0048	2.82	1.04	94.0	1.7	99.2	1.2
US	26.0	20.8	0.0098	0.0062	5.27	2.22	27.6	1.9	99.4	1.5

Table 5: Descriptive statistics by country: Number of Companies, Average Daily Turnover (ADT), Volume in Million, Quoted Spread and Log of the Depth.

For each variable we compute the mean and the standard deviation for the whole sample.

	Compustat-Global: Primary market						TRTH			
	Compnum		ADT		Turnover		QSp(x100)		LogDepth	
	Mean	Stdv	Mean	Stdv	Mean	Stdv	Mean	Stdv	Mean	Stdv
AU	47.35	1.31	0.0035	0.0009	53.81	10.22	0.11	9.21	8.90	2.30
CH	25.76	2.64	0.0037	0.0012	112.97	20.20	0.12	9.41	6.71	1.30
DE	37.36	3.48	0.0044	0.0014	111.39	21.86	0.06	2.64	6.85	0.93
FR	47.82	1.72	0.0032	0.0009	85.64	8.30	0.08	4.23	6.56	1.14
GB	90.89	7.42	0.0033	0.0009	57.14	7.39	0.10	6.98	7.41	1.25
JP	149.49	0.84	0.0049	0.0012	82.33	11.61	0.08	4.70	7.91	1.05
	I. US & Canada: Primary, MSR subsample									
CA	43.58	5.90	0.0025	0.0007	58.86	23.64	0.09	6.87	2.12	1.01
US	377.59	38.25	0.0023	0.0015	63.46	14.53	0.28	38.77	1.65	0.91
	II. US & Canada: Compustat, MSR subsample									
CA	43.58	5.90	0.0028	0.0007	65.08	19.78				
US	377.59	38.25	0.0096	0.0025	330.41	112.63				
	III. US & Canada: Compustat, full sample									
CA	51.52	1.41	0.0030	0.0010	50.60	21.69				
US	459.17	8.02	0.0107	0.0035	269.31	111.46				



Table 7: Turnover ratio growth (Country Estimation)

The table reports the coefficients from the panel data fixed effects of the model described in equation 2. Our variable of interest is the growth in the turnover ratio by country. Columns present different countries. The exogenous variables are: entrepreneurial activity (*IPO*), Volatility measured through the monthly standard deviation of each national Index and the US VIX, positive and negative returns of the Country Index ( $R^+$  and  $R^-$ ), yield spread (HighYield-AAA), consumer confidence (Sentiment), and competition between lit exchanges (Prim). We also include dummies for MiFID II, Brexit, the COVID-19 crisis, the post-COVID high inflation period, and the Ukrainian invasion. The variables are deseasonalized and standardized.

All models include HAC standard errors. One, two and three stars represent statistical significance at the 5%, 1% and 0.1% levels, respectively.

	All	AU	CA	CH	DE	FR	GB	JP	US
<b>IPO</b>	-0.0118***	0.0179	-0.0226	0.00993	-0.0415***	0.00119	-0.00844	-0.0224**	0.0660***
<b>VIX</b>	-0.102***	-0.118***	0.00952	-0.342***	-0.266***	-0.358***	-0.254***	0.0504***	-0.172***
<b>SD_Index</b>	0.197***	0.169***	0.189***	0.356***	0.239***	0.323***	0.280***	0.0805***	0.334***
$R^+$	-1.144***	2.525***	-1.854***	-3.623***	-0.134	-0.148	0.857*	3.400***	-3.036***
$R^-$	-5.097***	-8.460***	-1.777*	-9.641***	-10.76***	-11.92***	-9.124***	-2.986***	-4.472***
<b>YieldSpread</b>	-0.0562***	0.0208	-0.0998***	-0.00548	-0.0781***	-0.0876***	-0.0721***	-0.0583***	-0.0976***
<b>Sentiment</b>	0.0376***	0.0120	0.0367**	0.0439	0.0459*	-0.00175	0.00747	0.0296**	0.100***
<b>Prim</b>	0.00224	0.0301*	0.0642***	0.184***	0.0852***	0.395***	0.141***	-0.000403	0.0300***
<b>MIFID2</b>	0.0322***			0.179***	0.202***	0.552***	0.225***		
<b>COVID</b>	-0.306***	-0.244***	-0.134**	-0.355*	-0.401***	-0.673***	-0.305***	-0.0366	0.0448*
<b>Brexit</b>	0.352***			0.650***	0.686***	0.656***	0.305***		
<b>Inflation</b>	-0.249***	0.0158	-0.0866*	-0.206	-0.295***	-0.431***	0.0518	0.0325	0.0722***
<b>Ukrania</b>	-0.0109	-0.109	-0.108*	0.207**	-0.0297	-0.0109	0.0193	-0.0531**	0.187***
<b>Observations</b>	146,293	8,439	7,776	4,568	6,688	8,538	16,198	26,705	67,381
<b>R-squared</b>	0.052	0.062	0.041	0.127	0.106	0.130	0.063	0.019	0.079
<b>Number of compnum</b>	1,303	84	68	68	68	70	160	203	582

Table 8: LogVol (Country Estimation)

The table reports the coefficients from the panel data fixed effects of the model described in equation 2. Our variable of interest is the log of the primary market volume by country. Columns present different countries. The exogenous variables are: entrepreneurial activity (*IPO*), Volatility measured through the monthly standard deviation of each national Index and the US VIX, positive and negative returns of the Country Index ( $R^+$  and  $R^-$ ), yield spread (HighYield-AAA), consumer confidence (Sentiment), and competition between lit exchanges (Prim). We also include dummies for MiFID II, Brexit, the COVID-19 crisis, the post-COVID high inflation period, and the Ukrainian invasion. The variables are deseasonalized and standardized. All models include HAC standard errors. One, two and three stars represent statistical significance at the 5%, 1% and 0.1% levels, respectively.

	All	AU	CA	CH	DE	FR	GB	JP	US
<b>IPO</b>	0.0167***	0.0165***	0.0186	0.00841***	0.0122***	0.0183***	0.0143***	0.0107***	0.0213***
<b>VIX</b>	0.0490***	0.0219	0.101***	0.0478***	0.0372***	0.0786***	0.0520***	-0.00688	0.0608***
<b>SD_Index</b>	0.0523***	0.0111*	0.0513***	0.00452	0.0132	0.00644*	-0.00980**	0.0408***	0.0979***
$R^+$	0.472***	-0.350**	1.391***	1.340***	0.245***	0.333***	-0.0423	0.0258	0.555***
$R^-$	0.0106	-0.0160	1.114***	-1.092***	-0.116	0.141	0.431**	0.868***	-0.0316
<b>YieldSpread</b>	-0.0240***	-0.0475***	-0.0654***	-0.0416*	-0.0430**	-0.0726***	1.94e-05	0.0168*	-0.0379***
<b>Sentiment</b>	0.0250***	-0.0223	0.0199	0.0243	0.0414*	0.0329*	0.0756***	0.0770***	0.0617***
<b>Prim</b>	0.0324***	0.0960***	0.0205*	0.0862***	0.00643	-0.00157	0.00796	0.0226*	0.0684***
<b>MIFID2</b>	0.0261			-0.0137	0.241**	0.134**	0.205***		
<b>COVID</b>	0.00516	0.120**	-0.00746	0.267***	0.0642	0.0923**	0.158***	-0.0244	0.0217
<b>Brexit</b>	-0.0252	0.0181	0.186**	-0.198**	0.0648	-0.106	-0.280***	0.190***	2.57e-05
<b>Inflation</b>	0.0758***	0.0286	0.0471	-0.0181	-0.00165	0.0128	-0.0317	-0.0941***	0.225***
<b>Ukrania</b>	-0.0225	-0.00572	0.0910	-0.0613	0.0424	-0.0174	0.265***	-0.0339	-0.00417
<b>Observations</b>	146,293	8,439	7,776	4,568	6,688	8,538	16,198	26,705	67,381
<b>R-squared</b>	0.046	0.086	0.374	0.302	0.105	0.056	0.079	0.061	0.141
<b>Number of compnum</b>	1,303	84	68	68	68	70	160	203	582
<b>Observations</b>	146,293	8,439	7,776	4,568	6,688	8,538	16,198	26,705	67,381
<b>R-squared</b>	0.167	0.157	0.227	0.329	0.159	0.212	0.150	0.034	0.344
<b>Number of compnum</b>	1,303	84	68	68	68	70	160	203	582

Table 9: Time trend in turnover and its correlates

The table reports the time trend coefficients from the residuals of the estimation of the model described in equation 1. All models include HAC standard errors. One, two and three stars represent statistical significance at the 5%, 1% and 0.1% levels, respectively.

Time Trend	All	AU	CA	CH	DE	FR	GB	JP	US
<b>ADTprimary</b>	-0.00471***	-0.00507***	0.00273**	-0.00873***	-0.00495***	-0.00500***	-0.000901	-0.00160***	-0.00759***
<b>LogVol_Primary</b>	0.00817***	0.00436***	0.00960***	-0.000252	-0.00838***	-0.0146***	-0.0161***	0.0114***	0.0170***
<b>IPO</b>	0.00362***	0.00265***	-0.00827***	0.00548***	0.00153***	-0.000805***	0.00546***	0.0107***	0.00252***
<b>VIX</b>	-0.01915	—	—	—	—	—	—	—	—
<b>SD_Index</b>	-0.00181***	-0.00179***	-0.00172***	-0.00187*	-0.00250***	-0.00284***	-0.00328***	-0.00357***	-0.000545***
<b>YieldSpread</b>	—	-0.00898***	-0.02538***	-0.03004***	-0.03004***	-0.03004***	-0.03004***	-0.02538***	-0.00898***
<b>Sentiment</b>	-0.00188***	-0.0101***	0.00392***	-0.0148***	-0.00571***	0.00331***	-6.16e-05	-0.00760***	0.000392
<b>Prim</b>	-0.00263***	-0.0122***	-0.00111**	-0.0180***	-0.0137***	-0.0178***	-0.0171***	-0.00323***	0.00496***

Table 10: Quoted spreads (QSp)

The table reports the coefficients from the panel data fixed effects of the model described in equation 3. Our variable of interest is the Quoted Spread by country (QSp). Columns present different countries. The exogenous variables are: entrepreneurial activity (*IPO*), turnover (*LogVol*), price Volatility (*HighLow* measured by the average daily range of the midprice, 15-min High midprice minus 15-min Low midprice, relative to the average of the two  $(H+L)/2$  ), the inverse of the price (*invP*) and, the COVID-19 dummy. The variables are deseasonalized and standardized. All models include HAC standard errors. One, two and three stars represent statistical significance at the 5%, 1% and 0.1% levels, respectively.

	All	AU	CA	CH	DE	FR	GB	JP	US
<i>IPO</i>	-0.0268***	0.0246**	-0.00959	-0.0320	-0.0607***	-0.0308*	-0.150***	-0.0287***	-0.0128*
<i>LogVol</i>	0.205***	-0.153*	0.0833	-0.538***	-0.676***	-0.498***	-0.251*	-0.301***	0.363***
<i>HighLow</i>	0.102***	0.156***	0.439***	0.520***	0.460***	0.488***	0.620***	0.299***	0.0257***
<i>invP</i>	0.0735***	0.463***	-0.0140	0.0391	-0.124*	-0.265**	0.00517	-0.0591	0.0586***
<i>COVID</i>	0.184***	0.0199	-0.115	-0.0908	0.237	0.0162	-0.316***	0.0950**	0.189***
<i>Constant</i>	0.000239	-4.90e-05	0.000116	-0.000608	0.00450	-0.000459	-0.00656	-0.000327	3.72e-05
<i>Observations</i>	39,067	1,792	1,125	316	643	994	2,034	5,701	26,462
<i>R-squared</i>	0.080	0.721	0.545	0.502	0.443	0.537	0.483	0.273	0.053
<i>Number of compnum</i>	926	50	25	25	31	41	67	142	545

Table 11: Depth

The table reports the coefficients from the panel data fixed effects of the model described in equation 3. Our variable of interest is the Depth (*LogDepth*) by country. Columns present different countries. The exogenous variables are: entrepreneurial activity (*IPO*), turnover (*LogVol*), Price Volatility (*HighLow* measured by the average daily range of the midprice, 15-min High midprice minus 15-min Low midprice, relative to the average of the two  $(H+L)/2$ ), the inverse of the price (*invP*) and the COVID-19 dummy. The variables are deseasonalized and standardized. All models include HAC standard errors. One, two and three stars represent statistical significance at the 5%, 1% and 0.1% levels, respectively.

	All	AU	CA	CH	DE	FR	GB	JP	US
<i>IPO</i>	-0.00797*	0.00219	0.0216	-0.0206	-0.113***	-0.0416**	-0.0793***	-0.0390***	0.00271
<i>LogVol</i>	-0.0376	-0.103	-0.0233	0.0139	-0.0472	-0.162	0.279*	0.0550	-0.0597
<i>HighLow</i>	-0.0144**	-0.0415**	-0.148***	-0.110***	-0.148*	-0.148*	-0.0740***	-0.0420*	0.00340
<i>invP</i>	0.302**	0.167**	0.432*	0.219*	0.144*	0.0823	0.157	0.476***	0.310*
<i>COVID</i>	-0.102***	0.0725*	-0.264***	-0.0454	0.174	-0.0176	-0.0508	-0.158***	-0.0975**
<i>Constant</i>	-0.000133	-0.000178	0.000266	-0.000304	0.00331	0.000497	-0.00105	0.000545	-1.92e-05
<i>Observations</i>	39,067	1,792	1,125	316	643	994	2,034	5,701	26,462
<i>R-squared</i>	0.163	0.213	0.256	0.160	0.090	0.087	0.135	0.088	0.241
<i>Number of compnum</i>	926	50	25	25	31	41	67	142	545

# Appendix

## A Variable Definitions

The main variables we use in the analysis are:

- *ADT*: The variable is the daily turnover, total daily share volume (Compustat) divided by the number of shares outstanding.
- *Month ADT*: The variable is the average DT over any given month.
- *Growth in Turnover Ratio*: The variable is the month-on-month growth by month ADT, by asset.
- *LogVol*: The variable is the log of one plus the average daily volume in US Dollars by asset/month.
- *QSp* and *logDepth*: we calculate asset/month averages of the quoted spread in basis points and depth at the bid-ask sampled every fifteen minutes. The quoted spread in basis points is the average of  $[CloseAsk - CloseBid]/CloseMidpoint$  sampled every fifteen minutes. *logDepth* is the log of the  $[CloseQAsk + CloseQBid]$ , where *QAsk* and *QBid* are the number of shares posted at the best ask and best bid, respectively, at the end of the fifteen minutes.
- *Time Trend*: The variable captures the time trend, we use a Month-Year trend.
- *IPO*: we use the number of IPOs for each country/month (source: LSE Eikon).
- *SD\_Index* and *VIX*: in order to estimate the effect of volatility we construct and use two volatility measures. First we calculate the monthly standard deviation of each national Index (source: World Indices by

WRDS). As a measure of general global market volatility, we use the closing value of the *VIX* Index. Both variables try to capture contemporaneous asset volatility (*SD\_Index*) and expected forward volatility for U.S. (*VIX*).

- *HighLow*: The variable is measuring the range of prices. We calculate asset/month averages of  $[HighAsk - LowBid] \times 2 / (HighAsk + LowBid)$  sampled every fifteen minutes.
- $R^+$  ( $R^-$ ): represents the monthly return of the national Index portfolio multiplied by a dummy for when the return is positive (negative) and zero otherwise. (source: World Indices by WRDS)
- *Sentiment*: The variable captures countries' consumer confidence indices (source: OECD).
- *Prim*: The variable captures the fraction of turnover traded in the primary market.
- *COVID*: is a dummy that takes the value 1 between March and December 2020 and zero otherwise.
- *MiFIDII*: is a dummy that takes a value of 1 from January 2018 and zero otherwise.
- *Brexit*: is a dummy that takes a value 1 of from January 2021.
- *Inflation*: is a dummy that takes a value of 1 from March 2021.
- *Ukraine*: is a dummy that takes a value of 1 from February 2022.
- *YieldSpread*: The variable captures the overall corporate risk of the companies in a given country, namely, the AAA spread (*YieldSpread*).

# Online Appendix

## A MSR Definitions

The following is extracted from the Refinitiv documentation, explaining the differences between trade types. The definitions are different for Europe, and the rest of the world. The following is taken verbatim from their help file (with modified formatting):

The Refinitiv Trade Classification (TRTC) is fundamental to Market Share Reporter (MSR) because it normalizes global trade types into a single comparable cross-venue trade classification.

There are two trade classification schemes. One for the Americas, APAC and MEA, and one for Europe.

Table 12: **Americas, APAC and MEA TRTC**

Trade Classification	Definition
Order book - lit	Trades generated by lit orders, executed by electronic open limit order book. This excludes trades executed during an auction period.
Order book - hidden	Trades generated by hidden orders, executed with hidden or transparent orders on electronic open limit order book. This excludes trades executed during an auction period.
Auction	Trades executed during an auction period, operated by electronic open limit order book.
Dark order book	Trades generated by a dark pool of liquidity.
Real-time on - exchange reported	Trades reported under the rules of an exchange, which may be as a result of trading on quotes from market makers; or OTC trades, reported under the rules of a regulated market or ATS/MTF, to which no delay in reporting has been applied.
Delayed on - exchange reported	Trades reported under the rules of an exchange, which may be as a result of trading on quotes from market makers; or OTC trades, reported under the rules of a regulated market or ATS/MTF, to which a delay in reporting has been applied.
Real-time off - exchange OTC	Trades reported off-exchange, to which no delay in reporting has been applied.
Delayed off - exchange OTC	Trades reported off-exchange, to which a delay in reporting has been applied.

Table 13: **Europe TRTC**

Trade Classification	Definition
On-book - lit	Trades generated by lit orders executed on electronic open limit order book, excluding trades executed during an auction period.
On-book - LIS	Large-in-scale order trades executed either in a central limit order book or dark order book, and not marked as RFTP.
Auction	Trades executed during an auction period, operated by electronic open limit order book (for example, open, close, volatility or scheduled auctions). These are used to set the opening pricing level for subsequent periods of continuous trading, or to create the closing price.
Dark RFTP	Trades executed under the mid-point reference price waiver as defined in MiFID II.
Periodic auctions	Trades occurring in marketplaces operating only periodic, frequent or hybrid auctions. Typically, these mechanisms operate alongside continuous trading, and are distinct from the auctions described above.
On-exchange immediate	Trades reported under the rules of an exchange, which may be as a result of trading on quotes from market makers; or OTC trades reported under the rules of a regulated market or ATS/MTF to which no delay in reporting has been applied.
On-exchange non-immediate	Delayed on-exchange trades. These are trades reported under the rules of an exchange, which may be as a result of trading on quotes from market makers; or OTC trades reported under the rules of a regulated market or ATS/MTF to which a delay in reporting has been applied.
On-exchange NTW immediate	Trades executing under the negotiated pre-trade transparency waiver, as defined in MiFID II.
On-exchange NTW non-immediate	Trades identified as deferred negotiated, as defined in MiFID II.
On-exchange LIS deferred	Trades identified as deferred reported large-in-scale, as defined in MiFID II.
On-exchange NPFT/TNCP	On-exchange technical trades flagged as either non-price-forming trades or trades not contributing to price discovery.
OTC immediate	Trades reported through an authorized publication authority that has had no delay in reporting applied.
OTC non-immediate	Trades reported through an authorized publication authority that has had a delay in reporting applied.
OTC LIS deferred	Trades identified as deferred reported large-in-scale, as defined in MiFID II.
OTC NPFT/TNCP	OTC technical trades flagged as either non-price-forming trades or trades not contributing to price discovery.
SI immediate	Systematic internalized trade executions reported immediately.
SI non-immediate	Systematic internalized trade executions reported with deferred publication.
SI LIS deferred	Systematic internalized trade executions reported with LIS deferred publication.
SI NPFT/TNCP	Systematic internalized technical trades flagged as either non-price-forming trades or trades not contributing to price discovery.