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Changes in the Turnover Ratio and Liquidity in International Equity Markets

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ABSTRACT

We examine global trading activity over 15 years and compare trends across countries. We find that European volume has grown, but less than in other countries, while turnover ratios have declined. However, the decline is exaggerated in standard volume data, which focuses on primary market trading, and becomes comparable after adjusting North American data. Overall, we observe a universal decrease in primary market turnover ratios accompanied by declining stock volatility; the European decline is significant, though smaller than in the United States. This decline has taken place in a context of low forward-looking volatility and yield spreads, which mitigated the decline.

JEL Classification: G14, G18

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 U.S.
> *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 15 years to clarify these trends, determine whether they are characterized by a decreasing turnover ratio in Europe, and identify the factors driving the observed patterns.

In general, trading activity is measured according to the turnover ratio and dollar 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 dollar 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 abstracts from stock price movements and exchange rates. In general, the literature on trading activity focuses primarily on individual markets (Chordia et al. 2006; Bogousslavsky and Collin-Dufresne 2023; Campbell et al. 1993) or on specific cross-country comparisons (Griffin et al. 2006; Chiah and Zhong 2020; Lesmond 2005). Our study contributes to the literature by providing a global perspective over the most recent 15-year period.

We find that the commonly used data on volume (as provided by Compustat) need to be used with care when making international comparisons, as North American volume covers all exchanges, whereas for the remaining countries, only volume on the primary exchange is covered. The first trend that emerges from aggregate country-level data is that volume has increased in the United States both in aggregate and in the primary markets (the sum of the NASDAQ and the NYSE), while Europe has experienced relatively low but positive growth in aggregate dollar volume, but a decline in volume on the primary exchange. As a consequence, a direct comparison of Compustat volume between Europe (with declining primary market volume) and North America (with increasing aggregate volume) exaggerates the true differences in trading activity.

Instead, we focus on trading activity as measured by the turnover ratio. 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 2009–2023. 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.[1] The second trend we find is 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, but to a lesser extent than that in the United States.

To explore this trend, we examine the monthly growth rate in the turnover ratio and how it relates to variables that have been found to correlate with trading activity. For example, we look at initial public offerings (IPOs), an often mentioned covariate of trading activity. We find that periods with high levels of IPOs, despite being associated with high levels of trading activity, are not generally associated with high growth. The overall relationship between IPOs and growth in the turnover ratio is statistically weak except in the United States (US) (positive) and in Germany (DE) and Japan (JP) (negative), where it is strong (significant at the 1% level).

In terms of risk, we discover that the growth of the turnover ratio is positively related to contemporaneous country-level stock 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 when the return on the latter is high.

Finally, we combine the regression results with the time trends in the covariates. The general decline in turnover ratios during our sample across all countries (except Canada) is accompanied by declining stock volatility, which positively covaries with trading activity and may 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, we observe a decrease in risk over time 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, 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 stock volatility accompanied by an increase in overall market risk could exacerbate the global decline in trading activity.

This paper contributes to several streams of literature. It is among the few papers to perform a global comparison of turnover across multiple countries on multiple continents and to do so over a 15-year 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 behaviour driven by both noninformational factors and the profit motives of privately informed investors. These models typically analyse 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, a context in which noisy trading often complicates the 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 et al. (2006). This paper provides an insightful analysis of the empirical determinants of trading activity (measured using the unsigned turnover ratio). Using US market data from July 1963 to December 2002, the authors 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. Our paper extends the scope of the analysis to the growth in the turnover ratio and over a more recent period. We find that uncertainty has the opposite (negative) relationship with growth in trading activity: high levels of forward (VIX) and corporate (yield spreads) risk are associated with lower growth in trading activity.

[1]The S&P 1200 Global Index represents approximately 70% of the world market cap.

Papers on similar topics have examined the relationship between volume and volatility. These papers have consistently reported a positive correlation between trading volume and absolute price changes. Noteworthy contributions include Karpoff (1987), Schwert (1989) and Gallant et al. (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 US context, as they are not available for other countries, especially the variables related to differences in opinion and stock visibility. Nevertheless, our results extend the positive relationship between volatility and trading activity to the growth in trading activity: periods of greater stock volatility are not only periods of high trading activity but also periods during which trading activity grows more rapidly.

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 in 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 31 December 2008 to 31 December 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 eight countries (by 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 (US, 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.[2] Descriptive statistics are included in Table 1.

2.1 | Measuring Trading Activity Across Countries

Our objective is to understand the differences in the evolution of trading activity across countries. We consider two standard measures of trading activity: dollar volume (LogVol) and the turnover ratio by asset/month. LogVol is measured as the log of the dollar value of shares traded in the primary market, and turnover ratio is computed as the total share volume divided by the number of shares outstanding. The advantage of LogVol is that it helps compare our results with those in the literature, as well as with nonacademic commentaries. The turnover ratio has the advantage of being a price-free standardized measure of trading activity suitable for comparisons both across countries and over time. We compute our main measure of the turnover ratio, the average daily turnover ratio (ADT), as the daily quantity of shares traded (in the primary markets), normalized by the number of shares outstanding (source: Compustat stock-level monthly data).

Our data set is constructed by combining stock-level primary market volume data from two sources: Compustat–Global and MSR. We combine volume data from two different sources because Compustat–North America and Compustat–Global measure volume in different ways: Compustat–North America provides volume data across all markets, whereas Compustat–Global measures volume solely on the primary exchange.[3]

TABLE 1 | Descriptive statistics by country: Number of Companies, Average Daily Turnover (ADT), Volume in Million, Quoted Spread and Log of the Depth.

	Compnum		ADT		Turnover	
	Mean	**Stdv**	**Mean**	**Stdv**	**Mean**	**Stdv**
Compustat-Global: Primary market						
AU	47.35	1.31	0.0035	0.0009	53.81	10.22
CH	25.76	2.64	0.0037	0.0012	112.97	20.20
DE	37.36	3.48	0.0044	0.0014	111.39	21.86
FR	47.82	1.72	0.0032	0.0009	85.64	8.30
GB	90.89	7.42	0.0033	0.0009	57.14	7.39
JP	149.49	0.84	0.0049	0.0012	82.33	11.61
US and Canada: Primary, MSR sample						
CA	43.58	5.90	0.0025	0.0007	58.86	23.64
US	377.59	38.25	0.0023	0.0015	63.46	14.53

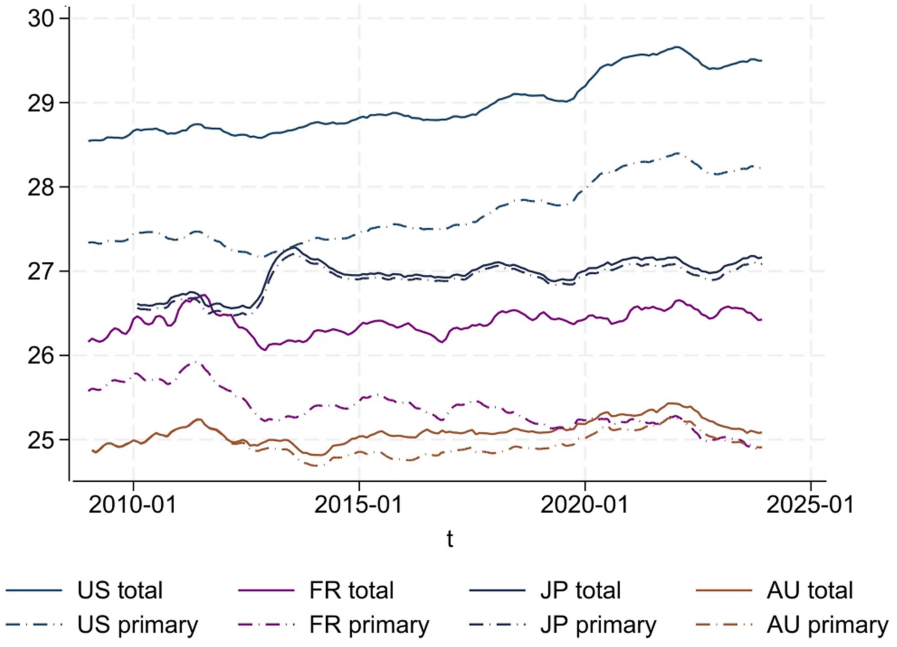
[2]The MSR app in Refinitiv has been replaced by EMSR. This functionality provides recent daily and monthly information, as well as historical quarterly information since 2008. The monthly data are only available for the last 2 years; thus, the sample we have constructed is no longer publicly available.

[3]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 the Supporting Information Appendix, Table B.2. In this table, we include the total volume as reported in Compustat for four random stocks: AMD.OQ (US, NASDAQ), 8411.T (JP), BASFn.DE (Germany), and BNPP.PA (FR). 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).

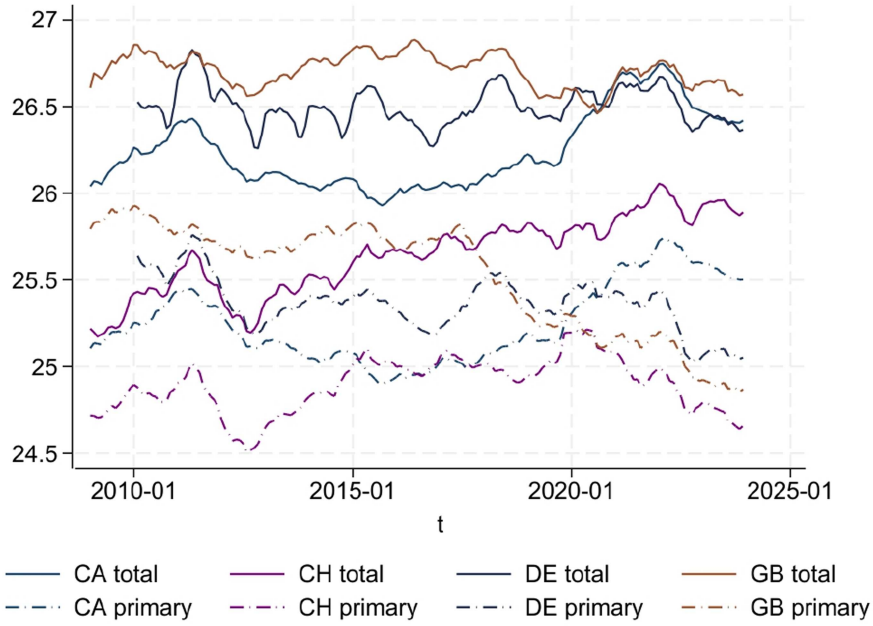
MSR provides volume data separated by trading venue, both by country and by stock. However, we found a significant amount of missing data for countries other than CA, the US, and GB. Therefore, we choose to combine stock-level Compustat-Global primary market data with stock-level MSR volume data for primary markets in the United States and CA.[4]

2.2 | International Trends in Trading Activity

We focus on the time evolution of trading activity by country over the past 15 years. Figure 1 shows the aggregate dollar volume by country (MSR), both primary and total, and Figure 2 shows the average stock-level ADT by country, using only the stocks in our sample. To complement the figures, we include



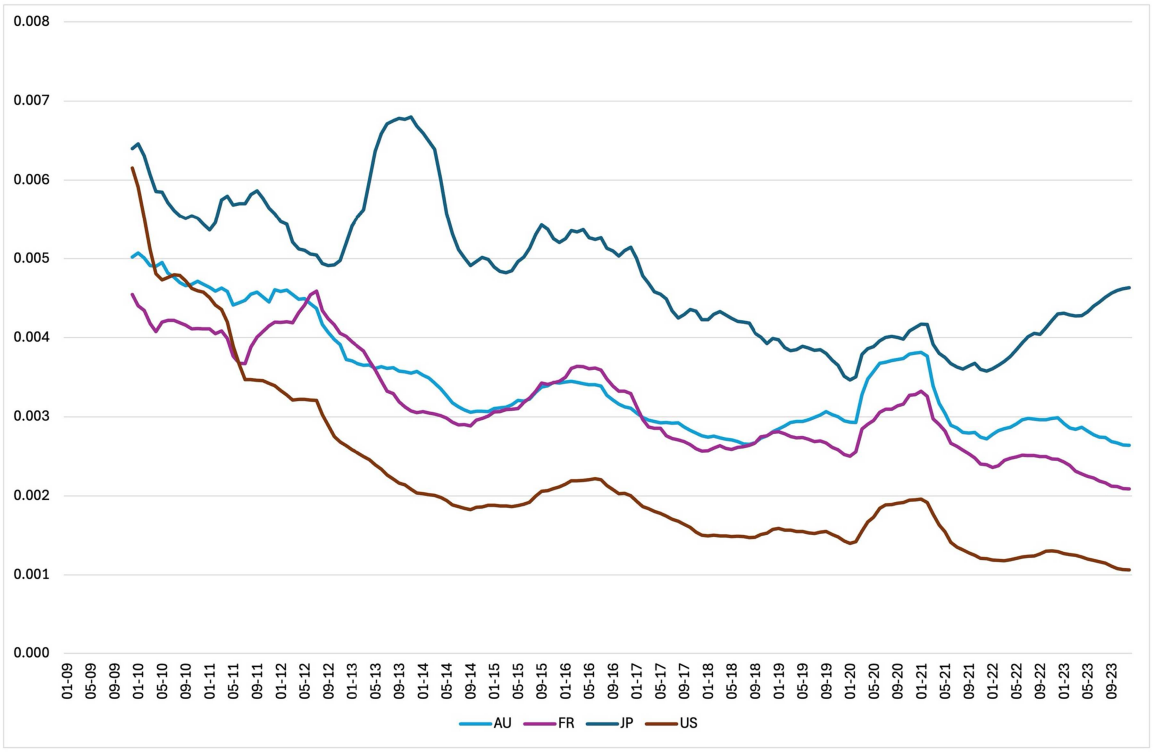
(a) AU, JP, FR, and US.



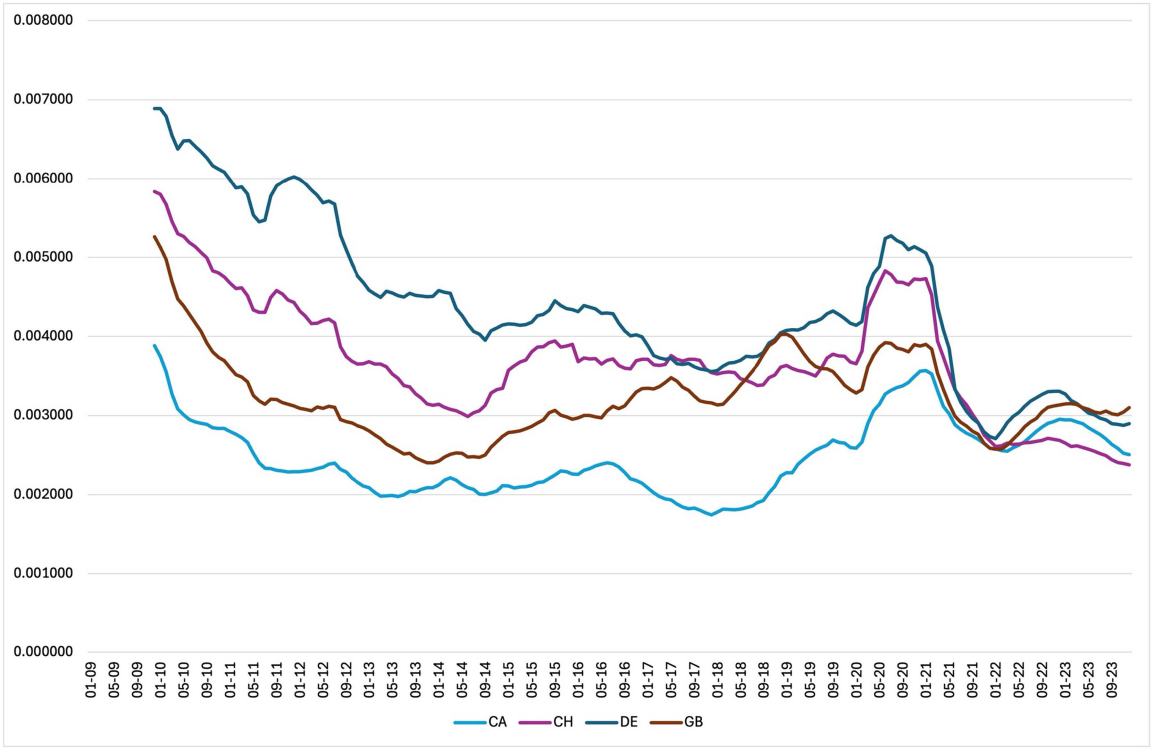
(b) CA, CH, DE, and GB.

FIGURE 1 | Nine-month moving average of the monthly average LogVol (in USD) in the primary market and in total. Primary in the United States is the sum of the NASDAQ and the NYSE. (a) AU, JP, FR, and US. (b) CA, CH, DE, and GB.

[4]MSR separates turnover by venue and uses it to distinguish primary market trading from total trading. The data also separate turnover by trade classification. For the purposes of this paper, we are solely interested in the separation by venue (we differentiate the primary market and the rest), and we simply aggregate turnover by venue.



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



(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.

estimated time trend coefficients for stock-level OLS regressions on LogVol and ADT in Table 2.

As shown in Figure 1, aggregate dollar volume increases across countries. However, dollar volume in the primary markets (the dotted-dashed lines) does not evolve in the same way. We find that despite the increase in aggregate volume, primary volume in European countries decreases across our sample (i.e., for DE, FR, and GB, the time trend for CH is nonsignificant). This observation is confirmed by the estimated trend coefficients in Table 2.

In addition, Figure 2 illustrates turnover ratios to reveal the time trends for our eight countries. We find that in contrast to the dollar volume, the ADT has decreased everywhere. The decline observed for European countries does not differ from that of other countries and is less than that for large US companies. To confirm the visual analysis, we consider the estimated trend coefficients in Table 2, where we confirm the similarity between the coefficients of DE and FR with that of AU. The coefficient for US is more negative. Interestingly, the time trend coefficient for CA is positive.

TABLE 2 | Time trend in USD volume and turnover ratio.

TimeTrend	LogVol	ADT
All	0.00817***	−0.00471***
AU	0.00436***	−0.00507***
CA	0.00960***	0.00273**
CH	−0.000252	−0.00873***
DE	−0.00838***	−0.00495***
FR	−0.0146***	−0.00500***
GB	−0.0161***	−0.000901
JP	0.0114***	−0.00160***
US	0.0170***	−0.00759***

Note: The table reports the time trend coefficients from the residuals of the estimation of the model described in Equation (1) for USD volume (in logs) and the ADT (Average Daily Turnover Ratio) in the primary market. All models include HAC standard errors. *, **, *** represent statistical significance at the 5%, 1% and 0.1% levels, respectively.

2.3 | Methodology

As part of our objective is to provide a cross-country explanation of trends in trading activity, we examine how different known correlates of volume are related to changes in the turnover ratio.

As our main specification, we run a panel data analysis of the stock level changes in ADT ($Turn_{i,t}$) against the following variables: the number of IPOs ($IPO_{i,t}$), the United States VIX ($VIX_{i,t}$), the volatility of the country's main equity index ($SD\_Index_{i,t}$), the return of the main index (separated into a positive $R^{+}_{i,t}$ and a negative component $R^{-}_{i,t}$), the yield spread ($YieldSpread_{i,t}$), the country's consumer sentiment index (*Sentiment*), and the fraction of an asset's total volume traded in the primary market (*Prim*).[5] We also include time dummies for the following events: the introduction of MiFID II (*MiFID2*), the 2020 pandemic (*COVID*), Brexit (*BREXIT*), the postpandemic inflationary period (*Inflation*), and the start of open hostilities in Ukraine (*Ukrania*). As a reference, we include a list of all the variables and their definitions in the Appendix, Section A. Descriptive statistics for $Turn_{i,t}$ by country are in Table 3. The descriptive statistics of the continuous covariates are shown in Table 4.

To maintain comparability with the literature, we repeat the analysis using LogVol instead of $Turn_{i,t}$. Table 5 includes the pairwise correlations between the variables of interest.

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 continuous explanatory variables (excluding the event dummies). The deseasonalization is performed by running the following fixed effects panel data regression for each continuous variable by country:

$$Y_{i,t} = \alpha_i + \sum \beta_i \, Month + \varepsilon_{i,t}, \tag{1}$$

where $Y_{i,t}$ is the endogenous (growth of the turnover ratio) or exogenous variable (VIX, IPO, etc., in levels).[6,7] Standardization

TABLE 3 | Descriptive statistics for growth in the turnover ratio, by country.

	Obs	Mean	Stdv	25%	50%	75%	Skewness	Kurtosis
AU	8439	5.030	37.326	−17.886	−1.132	19.389	2.984	24.712
CA	7776	6.097	40.753	−19.478	−0.705	21.775	2.970	32.317
CH	4568	3.612	33.530	−16.874	−1.727	17.067	2.447	18.753
DE	6688	3.555	31.908	−16.592	−1.769	17.487	2.415	20.049
FR	8538	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

[5]We thank an anonymous referee for suggesting the use of confidence indices and the incorporation of the fragmentation measure into the regression.
[6]We do not apply this transformation to the returns variables.
[7]We use the month of January as the omitted month (and hence captured by the constant).

TABLE 4 | Descriptive statistics by country: ADT covariates.

	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

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

TABLE 5 | Spearman correlations.

	Turn	**LogVol**	**MonthIPO**	**VIX**	**SD_Index**	R^+	R^-	**YieldSpread**	**primaryPC**	**Sentiment**
Turn	1									
p-value	.									
LogVol	0.002	1								
p-value	0.407	.								
MonthIPO	−0.019	0.420	1							
p-value	0.000	0.000	.							
VIX	0.062	0.009	−0.078	1						
p-value	0.000	0.001	0.000	.						
SD_Index	0.109	0.012	−0.167	0.683	1					
p-value	0.000	0.000	0.000	0.000	.					
R^+	−0.130	0.037	0.040	−0.234	−0.249	1				
p-value	0.000	0.000	0.000	0.000	0.000	.				
R^-	−0.159	0.016	0.079	−0.450	−0.429	0.820	1			
p-value	0.000	0.000	0.000	0.000	0.000	0.000	.			
YieldSpread	−0.006	0.176	0.089	0.410	0.299	−0.031	−0.130	1		
p-value	0.019	0.000	0.000	0.000	0.000	0.000	0.000	.		
primaryPC	0.018	−0.387	−0.488	0.049	0.159	−0.053	−0.071	−0.451	1	
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.	
Sentiment	0.017	0.007	0.057	−0.452	−0.343	−0.043	0.097	−0.271	0.024	1
p-value	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.

Note: The table reports Spearman's correlation of the variables included and their *p* values. We include the original (un-deseasonalized and un-standardized) variables.

is performed by dividing the residuals of the regressions by their (in-sample) standard deviation.

Thus, the main specification is described by the following equation:

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

We employ a panel data fixed effect model with robust clustered standard errors.

Our choice of covariates is based on those identified in the extant literature, primarily in Chordia et al. (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.

The dummy variables (in levels) capture specific and significant regulatory and economic events that may have influenced trading patterns during the sample period. In the following paragraphs, we discuss the purpose and construction of the other (continuous) 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 stock volatility as the monthly standard deviation of each country's stock market index (source: World Indices by WRDS). As a measure of general global market forward volatility, we use the closing value of the VIX for all the countries. Both variables capture different aspects of volatility: the variable *SD_Index* measures contemporaneous asset volatility, and *VIX* measures expected forward volatility for the United States (and the world's largest stock exchanges) (Karpoff 1987).

We also incorporate a standard measure for the overall corporate risk of companies on 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 substantial 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, Europe, North America).[8] 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 stock investments.

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 et al. 2003), so we include it in our analysis. We build our measure using the total number of initial public offerings (IPOs) in each country (source: LSE Eikon).

As in Chordia et al. (2006), we 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; (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 heterogeneity across countries and, over time, in the way trading is distributed across venues. As we are analysing growth in the turnover ratio in the primary market, we naturally expect that *Prim* will capture some of this variation.

3 | Results

3.1 | Correlates of Turnover Ratio Growth

We run the analysis of the changes in the turnover ratio both in aggregate and by country, following the specification in equation (2). The results are shown in Table 6, where we include the global results and those by country.

We also run the same analysis using LogVol as the left-hand-side variable to serve as a point of comparison with the literature. The results of this analysis are shown in Table 7.

Our first correlate of interest is IPO activity. The IPO coefficients for LogVol in Table 7 are positive, and their magnitude depends on the country under analysis. This finding is consistent with that of Zheng et al. (2005), who reported a positive relationship between volume and IPOs. They also found that the intensity of the relationship between volume and IPOs depends on the characteristics of the IPO. In terms of IPOs and changes in ADT, we also find significant variation across countries in terms of both signs and magnitudes. The coefficient is positive and significant only for the United States, whereas the coefficients for companies in DE and JP are negative and significant (at the 1% level).

In terms of volatility, the literature (Anderson and Dyl 2007; Karpoff 1987, among others) predicts positive and significant coefficients. In Table 7, we find that only GB has a negative and significant coefficient. If we examine the coefficients for changes in ADT, we find the same positive and significant effect across all countries: higher stock market volatility (*SD_Index*) is associated with greater growth in trading activity. Conversely, if we consider forward volatility and risk (VIX), the effect is positive and significant for levels (LogVol) but negative for ADT growth, except in JP. Differences of opinion enhance trading, but market-wide uncertainty, as captured by the VIX, reduces the growth in ADT.

In line with these findings, we find that the coefficients for the yield spread are negative and (for most countries) significant both for LogVol and for changes in ADT. 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 lower volume and a decrease in the growth rate of ADT. We posit that this greater degree of 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 findings of significant and negative coefficients stand in contrast with those presented in Chordia et al. (2006). However, this difference could be due to differences in measures of leverage risk: they measured this risk

[8]Source: FRED High-yield options adjusted spreads.

TABLE 6 | Turnover ratio growth (Country Estimation).

	All	AU	CA	CH	DE	FR	GB	JP	US
IPO	−0.0118***	0.0179	−0.0226	0.00993	−0.0415***	0.00119	−0.00844	−0.0224**	0.0660***
VIX	−0.102***	−0.118***	0.00952	−0.342***	−0.266***	−0.358***	−0.254***	0.0504***	−0.172***
SD_Index	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***
YieldSpread	−0.0562***	0.0208	−0.0998***	−0.00548	−0.0781***	−0.0876***	−0.0721***	−0.0583***	−0.0976***
Sentiment	0.0376***	0.0120	0.0367**	0.0439	0.0459*	−0.00175	0.00747	0.0296**	0.100***
Prim	0.00224	0.0301*	0.0642***	0.184***	0.0852***	0.395***	0.141***	−0.0004	0.0300***
MIFID2	0.0322***			0.179***	0.202***	0.552***	0.225***		
COVID	−0.306***	−0.244***	−0.134**	−0.355*	−0.401***	−0.673***	−0.305***	−0.0366	0.0448*
Brexit	0.352***			0.650***	0.686***	0.656***	0.305***		
Inflation	−0.249***	0.0158	−0.0866*	−0.206	−0.295***	−0.431***	0.0518	0.0325	0.0722***
Ukrania	−0.0109	−0.109	−0.108*	0.207**	−0.0297	−0.0109	0.0193	−0.0531**	0.187***
Observations	146,293	8439	7776	4568	6688	8538	16,198	26,705	67,381
R^2	0.052	0.062	0.041	0.127	0.106	0.130	0.063	0.019	0.079
Companies	1,303	84	68	68	68	70	160	203	582

Note: 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 (*SD_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 Ukranian invasion. The variables are deseasonalized and standardized. All models include HAC standard errors. *, **, *** represent statistical significance at the 5%, 1% and 0.1% levels, respectively.

TABLE 7 | LogVol (Country Estimation).

	All	AU	CA	CH	DE	FR	GB	JP	US
IPO	0.0167***	0.0165***	0.0186	0.00841***	0.0122***	0.0183***	0.0143***	0.0107***	0.0213***
VIX	0.0490***	0.0219	0.101***	0.0478***	0.0372***	0.0786***	0.0520***	−0.00688	0.0608***
SD_Index	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
YieldSpread	−0.0240***	−0.0475***	−0.0654***	−0.0416*	−0.0430**	−0.0726***	1.94e-05	0.0168*	−0.0379***
Sentiment	0.0250***	−0.0223	0.0199	0.0243	0.0414*	0.0329*	0.0756***	0.0770***	0.0617***
Prim	0.0324***	0.0960***	0.0205*	0.0862***	0.00643	−0.00157	0.00796	0.0226*	0.0684***
MIFID2	0.0261			−0.0137	0.241**	0.134**	0.205***		
COVID	0.00516	0.120**	−0.00746	0.267***	0.0642	0.0923**	0.158***	−0.0244	0.0217
Brexit	−0.0252	0.0181	0.186**	−0.198**	0.0648	−0.106	−0.280***	0.190***	2.57e-05
Inflation	0.0758***	0.0286	0.0471	−0.0181	−0.00165	0.0128	−0.0317	−0.0941***	0.225***
Ukrania	−0.0225	−0.00572	0.0910	−0.0613	0.0424	−0.0174	0.265***	−0.0339	−0.00417
Observations	146,293	8439	7776	4568	6688	8538	16,198	26,705	67,381
R^2	0.046	0.086	0.374	0.302	0.105	0.056	0.079	0.061	0.141
Companies	1,303	84	68	68	68	70	160	203	582

Note: 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 (*SD_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. *, **, *** represent statistical significance at the 5%, 1% and 0.1% levels, respectively.

using company-level leverage over assets, while we use the yield spread for an entire economic area.

We find that negative returns are strongly associated with lower ADT growth 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 growth in ADT. Nevertheless, if we consider more extreme returns, as in Chordia et al. (2006), the results are consistently large and significant.[9]

The consumer confidence coefficients for LogVol are positive and in line with expectations. The effect is similar for growth in ADT, although they are statistically significant only for DE, JP and North America (CA and US). Additionally, the coefficients of the market share in the primary market (*Prim*) are in line with expectations for all countries except JP, where the primary market is essentially the entire market throughout the sample, and this coefficient is not significant.

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. The coefficient of this dummy is positive and significant for both the turnover ratio growth and the dollar volume regressions for DE, FR, and GB. On the other hand, as discussed above, the overall fraction of trading in primary markets declines across our sample, particularly in European countries. Thus, the MIFiD regulation can be interpreted as having a dampening effect on the general decline in primary trading.

We also include a dummy variable for the COVID-19 pandemic period, which is negative in all the cases except for JP (nonsignificant) and the US (positive and significant at the 5% level). The positive effect of COVID-19 in the United States is consistent with the common perception of the effect of US 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 nonsignificant coefficients, and again, US is the exception, with a positive and significant coefficient. The period from the start of the war in Ukraine has mixed coefficients: positive and significant in US and CH, negative for CA and JP, and nonsignificant for the remaining European countries and AU.

3.2 | Time Trends in Correlates and the Decline in Trading Activity

We have identified the relationship between correlates of trading activity and the growth in trading activity. For example, we now know that low levels of market volatility are associated with lower market activity growth. However, this result does not itself help us understand the evolution of trading activity in the last 15 years, as we do not know what has happened to market volatility over these last 15 years. To complete the analysis, we regress the correlates of trading activity against a time trend. These coefficients are included in Table 8.

In Table 8, we find that market volatility (*SD_Index*) decreases over our sample period for all the countries. This lower volatility is associated, through the positive coefficients in Table 6, with lower growth in ADT. Thus, our analysis suggests that the decrease in volatility over our sample accelerated the decline in trading activity. This decline is greatest for European countries (DE, FR, GB) and JP and least so for US, reinforcing the pattern of declining trading activity in Europe.

The counterfactual is that in a context of increasing volatility, the decline in trading activity would have been weaker. The yield spread also has a negative time trend (Table 8), but the coefficients in Table 6 are negative (when significant). In this case, the effect is the opposite of the previous effect (*SD_Index*). Our economic region-wide measures of the yield spread reveal a

TABLE 8 | Time trend in turnover and its correlates.

TimeTrend	IPO	VIX	SD_Index	YieldSpread	Sentiment	Prim
All	0.00362***	−0.01915	−0.00181***	—	−0.00188***	−0.00263***
AU	0.00265***	—	−0.00179***	−0.00898***	−0.0101***	−0.0122***
CA	−0.00827***	—	−0.00172***	−0.02538***	0.00392***	−0.00111**
CH	0.00548***	—	−0.00187*	−0.03004***	−0.0148***	−0.0180***
DE	0.00153***	—	−0.00250***	−0.03004***	−0.00571***	−0.0137***
FR	−0.000805***	—	−0.00284***	−0.03004***	0.00331***	−0.0178***
GB	0.00546***	—	−0.00328***	−0.03004***	−6.16E-05	−0.0171***
JP	0.0107***	—	−0.00357***	−0.00898***	−0.00760***	−0.00323***
US	0.00252***	—	−0.000545***	−0.02538***	0.000392	0.00496***

Note: 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. *, **, *** represent statistical significance at the 5%, 1% and 0.1% levels, respectively.

[9]We run the main analysis by interacting the positive and negative return variables with a dummy that takes a value of 1 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. As the remaining coefficients in that analysis are essentially the same as those in Table 6, we do not report them here. Nevertheless, all the regression results are available from the authors upon request.

greater decline in the EU than in North America, with the Asia-Pacific region experiencing the smallest decline. We can interpret the trend in the yield spread as a positive force dampening the decline in ADT, with a similar net effect for DE, CA, and US, but a significantly greater effect for FR.

Trends in the other covariates (sentiment and IPOs) are mixed or nonsignificant (VIX). For example, we find a positive time trend in U.S. IPOs, which, together with a positive coefficient with ADT growth, suggests that IPOs have been a dampening force on the decline in U.S. ADT. In contrast, for DE, a positive time trend in IPOs combined with a negative coefficient with ADT growth suggests that higher IPO activity accelerates the decline in trading activity in DE.

3.3 | Robustness

Volume, and by extension, the turnover ratio, is known to have a heavy-tailed distribution. In Table 3, we can see this in terms of both the skewness and kurtosis of the distributions.[10] 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. To test the robustness of the results to the presence of fat tails (see Table 3), we also estimate Equation (2) using quantile regression (median). The results are the same for all countries (in sign, significance, and, for the most part, magnitude), including JP.[11]

We also test the robustness of our analysis 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.[12]

4 | Conclusion

We have studied the main trends in trading activity across countries using multiple distinct data sources and a broad set of explanatory variables. We have focused on primary markets to construct comparable trading activity measures. We have centred our analysis on the evolution of the turnover ratio in primary markets, as a price-free measure of trading activity, over the past 15 years, exploring potential differences across countries.

We find a universal increase in dollar volume traded, accompanied by a decline in ADT across markets over our sample period. To better understand these trends, we examine the correlates associated with the growth of ADT. We find that entrepreneurial activity has a heterogeneous relationship with ADT growth, with some countries having a significant positive relationship (US) and others having a significant negative relationship (DE, JP).

We also explore patterns in risk measures. We find that we need to distinguish individual country-level volatility, which in general is a positive covariate of growth in ADT, from aggregate uncertainty, both in terms of aggregate volatility expectations (VIX) and corporate risk (AAA yields), both of which are negative covariates with the growth in ADT. As the evolution over time of these three correlates has been negative 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.

Overall, we find that commentaries that use dollar volume data to argue that Europe's stock markets are in decline may be based on a comparison of noncomparable data. When using a common measure of trading activity, ADT, on primary markets, we find that for large stocks, if anything, the opposite is true.

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Conflicts of Interest

The authors declare no conflicts of interest. The views and opinions in this paper in no way represent the views of the funding institutions.

Data Availability Statement

The data that support the findings of this study are available from LSEG Refinitiv and DataScope, S&P Global Market Intelligence. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the author(s) with the permission of LSEG Refinitiv and DataScope, S&P Global Market Intelligence.

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[10]We explored the unusually large kurtosis and skewness for the Japanese stocks. We found that these effects 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.
[11]The results are available upon request.
[12]The results are available upon request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.
Supporting File: eufm70086-sup-0001-PLATO_onlineAppendix.pdf.

Appendix A

Variable Definitions

The main variables we use in the analysis are as follows:

- *ADT*: This variable is the daily turnover, the total daily share volume (Compustat) divided by the number of shares outstanding.
- *Month ADT:* This variable is the average DT over any given month.
- *Turn:* This variable is the month-on-month growth by month ADT, by asset.
- *LogVol:* This variable is the log of one plus the average daily volume in U.S. dollars by asset/month.
- *Time Trend:* This variable captures the time trend; we use a monthÃƒÂ£Â¡year trend.
- *IPO:* We use the number of IPOs for each country/month (source: LSE Eikon).
- *SD_Index* and *VIX:* 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*. Both variables are intended to capture contemporaneous asset volatility (*SD_Index*) and expected forward volatility for the U.S. (*VIX*).
- R^+ (R^-): This variable 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).
- *YieldSpread:* This variable captures the overall corporate risk of the companies in a given country, namely, the AAA spread (*YieldSpread*).
- *Sentiment:* This variable captures countries' consumer confidence indices (source: OECD).
- *Prim:* This variable captures the fraction of turnover traded in the primary market.
- *COVID:* This is a dummy that takes a value of 1 between March and December 2020 and zero otherwise.
- *MiFID II:* This is a dummy that takes a value of 1 from January 2018 and zero otherwise.
- *Brexit:* This is a dummy that takes a value of 1 from January 2021.
- *Inflation:* This is a dummy that takes a value of 1 from March 2021.
- *Ukraine:* This is a dummy that takes a value of 1 from February 2022.