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# Market Liquidity and Price Dynamics in Tadawul: A Firm-Day Analysis of Saudi Listed Firms, 2001–2020

**Etelka Éva Katits**[1]
[1]**Department of Finance and Management, University of Pannonia, Zalaegerszeg, Hungary**

**Corresponding author email:** katits.etelka@zek.uni-pannon.hu;

**ABSTRACT:** This study examines trading activity, liquidity, and price behavior in the Saudi Stock Exchange (Tadawul) using a firm-day panel of 600,571 observations for 200 listed companies in 11 sectors from 31 December 2001 to 23 April 2020. The paper follows a descriptive design built on sample profiles, annual and sector comparisons, correlation analysis, one-way analysis of variance, and an ordinary least squares model for the logarithm of traded value. The results show strong market broadening over time, with listed firms increasing from 49 in 2001 to 200 in the 2020 sample. Trading intensity and average traded value peaked in the mid-2000s, especially in 2006, then moderated. Liquidity remained concentrated in a small group of firms and sectors. Traded volume shows the strongest association with traded value, while sector differences in daily returns are statistically significant but economically small. Overall, Tadawul appears to be a larger and more diverse market than at the start of the sample, but one in which liquidity is still unevenly distributed.

**Keywords:** Tadawul; Saudi stock market; liquidity; traded value; sector analysis; firm-day panel.

## I. INTRODUCTION

Understanding how trading activity, liquidity, and prices interact is important for financial research, market design, and portfolio decisions. Tadawul is the largest equity market in Saudi Arabia and one of the most visible exchanges in the Gulf region, making it a useful setting for examining how market depth evolves in an emerging-market context.

The dataset used in this paper provides firm-level trading information over nearly two decades. That span allows the analysis to move beyond event-specific interpretation and document recurring patterns in prices, returns, trading volume, traded value, and transaction counts. These variables jointly capture market participation and liquidity.

This paper contributes an integrated descriptive profile of Tadawul up to 2020. It asks how market size and average trading conditions changed over time, whether sectors differ in liquidity and price behavior, how concentrated traded value is across firms, and which observable variables are most closely associated with traded value.

## II. LITERATURE REVIEW

Studies published during 2010–2019 provide a broad foundation for understanding trading activity, liquidity, and price behavior in Tadawul and related Gulf markets. Global evidence shows that liquidity affects the speed and pattern of asset-price adjustment [1]. At the GCC level, stock returns are not consistently fully random, and nonlinear predictability remains visible in several markets [2]. Oil-price shocks also transmit to GCC equity returns and volatility [3]. More generally, excess global liquidity influences asset prices in emerging markets [4], while MENA stock markets become more strongly linked during periods of financial stress [5].

Saudi-specific and regional studies strengthen this view. In Saudi Arabia, asymmetric GARCH models explain stock-market volatility better than simple symmetric models [6]. International evidence also shows that liquidity often contains a marketwide common component [7], and Saudi weak-form efficiency remains inconclusive even after the institutional transition associated with Tadawul [8]. Similar commonality in liquidity appears across Asian equity markets [9]. For Saudi Arabia, returns exhibit volatility clustering and persistence [10], and stock prices respond to macroeconomic conditions [11]. At the same time, research on emerging markets shows that liquidity measurement depends heavily on the proxy used [12], while analyst recommendations in the MENA region have only partial informational value [13]. Broader GCC evidence continues to reject full weak-form efficiency in several cases [14], and volatility spillovers from Saudi and global markets remain important for neighboring exchanges [15]. Related research on Islamic and conventional equity markets also reports time-varying predictability rather than constant efficiency [16].

Research published in 2016–2017 adds a transmission and risk perspective. Oil and stock-market volatility spillovers remain important when structural breaks are considered [17]. Islamic and conventional equity indexes also display interconnected movements during and after crisis periods [18]. In the wider MENA region, political risk raises financing frictions and the cost of capital [19]. In parallel, work on market-quality measurement shows that not all liquidity proxies capture trading frictions equally well in global research [20]. For Tadawul specifically, information-arrival tests show that the number of trades can be more informative than raw trading volume [21], while Saudi returns still display day-of-the-week and volatility-related autocorrelation [22]. Event-driven responses to stock-market upgrade announcements further suggest that investors in the region react to market-status changes as well as to firm-level news [23].

Studies from 2018–2019 deepen the Saudi and GCC focus. Event-study evidence on quarterly earnings announcements rejects semi-strong efficiency for the Saudi market [24]. Volatility-forecasting results further show that model choice matters for Saudi data [25]. Liquidity commonality in Saudi equities becomes stronger during boom and bust conditions, confirming that marketwide forces shape trading conditions [26]. At the GCC level, dividend announcements affect both prices and trading volume [27]. Islamic-market research also documents volatility spillovers between oil and regional equity indexes [28], while price-volume asymmetry remains relevant in nearby Gulf markets such as Qatar [29]. For Saudi Arabia, market liberalization improved valuation but produced only mixed changes in liquidity and volatility [30]. Intraday evidence from Tadawul also confirms persistent volatility patterns within the trading day [31].

Taken together, the 2010–2019 literature yields four main conclusions. First, Tadawul and related GCC markets are not consistently fully efficient, because returns often display predictability, event sensitivity, or delayed adjustment [2], [8], [14], [16], [22], [24]. Second, volatility is persistent, asymmetric, and influenced by oil and regional transmission channels [3], [6], [10], [15], [17], [25], [28], [31]. Third, liquidity is uneven and shaped by commonality, institutional conditions, and the choice of measurement proxy [1], [7], [9], [12], [20], [26], [30]. Fourth, trading activity carries information, especially when transaction counts, market announcements, and investor responses are analyzed jointly [13], [21], [23], [27], [29].

However, most prior studies examine one mechanism at a time, such as market efficiency, volatility modeling, event reactions, spillovers, or liquidity commonality. Fewer studies provide one integrated description of how prices, trading volume, traded value, firm concentration, and sector structure interact in a long-horizon Tadawul panel [11], [15], [21], [24], [26]. This leaves a clear gap for a descriptive study that combines time variation, sector heterogeneity, firm-level concentration, and the baseline link between trading activity and traded value within a single framework.

**Table 1.** Comparison of studies included in the literature review (2010–2019).

| Study | Context / Sample | Method | Main finding | Link to current paper |
|---|---|---|---|---|
| [1] Belke et al. (2010) | Global asset markets | Panel/time-series liquidity analysis | Liquidity shapes dynamic asset-price adjustment. | Frames liquidity as central to price dynamics. |
| [2] Bley (2011) | GCC equity markets | Predictability and weak-form tests | GCC markets are not fully random. | Supports examining Tadawul price predictability. |

| Study | Context / Sample | Method | Main finding | Link to current paper |
|---|---|---|---|---|
| [3] Arouri et al. (2011) | Oil and GCC stock markets | VAR-GARCH | Oil shocks spill over to GCC returns and volatility. | Links Tadawul to external oil shocks. |
| [4] Brana et al. (2012) | Emerging markets | PVAR | Global excess liquidity affects asset prices. | Connects liquidity conditions to market pricing. |
| [5] Neaime (2012) | Emerging MENA markets | Correlation and volatility analysis | Crisis periods strengthen cross-market linkages. | Places Tadawul in a regional stress environment. |
| [6] Al Freedi et al. (2012) | Saudi stock market | Symmetric and asymmetric GARCH | Asymmetric models fit Saudi volatility better. | Supports volatility asymmetry in Saudi data. |
| [7] Karolyi et al. (2012) | International equity markets | Commonality analysis | Liquidity has a strong common global component. | Motivates marketwide liquidity interpretation. |
| [8] Hokroh (2013) | Saudi market after Tadawul reform | Autocorrelation and runs tests | Weak-form efficiency remains inconclusive. | Provides Saudi post-Tadawul efficiency evidence. |
| [9] Wang (2013) | Asian equity markets | Liquidity commonality models | Liquidity co-moves across markets. | Supports commonality as a useful concept. |
| [10] Kalyanaraman (2014) | Saudi stock market | Univariate GARCH | Returns show clustering and persistent volatility. | Supports volatility persistence in Tadawul. |
| [11] Kalyanaraman & Al Tuwajri (2014) | Saudi Arabia | Macroeconomic regression analysis | Saudi stock prices respond to macroeconomic forces. | Links market prices to broader economic conditions. |
| [12] Kang & Zhang (2014) | Emerging markets | Liquidity-measure comparison | Liquidity results depend on proxy selection. | Supports careful interpretation of liquidity measures. |
| [13] Farooq & Id Ali (2014) | MENA firms | Event-study analysis | Analyst recommendations have only partial value. | Shows information effects vary with institutions. |
| [14] Jamaani & Roca (2015) | Regional Gulf stock markets | Weak-form efficiency tests | Several Gulf markets reject full efficiency. | Reinforces partial predictability in GCC markets. |
| [15] Alotaibi & Mishra (2015) | Saudi, U.S., and GCC markets | Bivariate GARCH spillovers | Regional and global shocks spill over to GCC exchanges. | Places Tadawul in a connected volatility system. |
| [16] Sensoy et al. (2015) | Islamic and conventional equities | Permutation-entropy analysis | Predictability changes over time across markets. | Supports non-constant market efficiency. |
| [17] Ewing & Malik (2016) | Oil and stock markets | Volatility-spillover analysis with breaks | Oil-stock spillovers intensify around structural changes. | Supports regime-sensitive interpretation of volatility. |
| [18] Hoque et al. (2016) | Islamic and conventional indices | Cointegration and decomposition tests | Equity movements remain | Adds a transmission perspective to regional markets. |

| Study | Context / Sample | Method | Main finding | Link to current paper |
|---|---|---|---|---|
| | | | interconnected after crises. | |
| [19] Belkhir et al. (2017) | MENA firms | Cost-of-capital model | Political risk raises the cost of capital. | Shows institutional risk matters for pricing. |
| [20] Fong et al. (2017) | Global equity markets | Liquidity-proxy evaluation | Some liquidity proxies outperform others. | Guides proxy choice in market-liquidity research. |
| [21] Ezzat & Kirkulak-Uludag (2017) | Tadawul sector indices | TGARCH with activity measures | Number of trades is more informative than volume. | Directly links trading activity to information arrival. |
| [22] Chowdhury et al. (2017) | Saudi stock market | Autocorrelation and volatility analysis | Return autocorrelation varies with market conditions. | Supports non-random Saudi return dynamics. |
| [23] Abuzayed & Al-Fayoumi (2017) | Qatar, Dubai, and Abu Dhabi | Event study with multivariate GARCH | Market-upgrade announcements affect returns and volatility. | Shows regional investors respond to market-status news. |
| [24] Syed & Bajwa (2018) | Saudi listed firms | Earnings-announcement event study | Saudi market does not satisfy semi-strong efficiency. | Adds Saudi event-based evidence on information effects. |
| [25] Al Rahahleh & Kao (2018) | Saudi indices | Volatility-forecasting models | Forecast accuracy depends on specification and index. | Supports careful model selection for Saudi volatility. |
| [26] Tissaoui et al. (2018) | Saudi listed stocks | Liquidity-commonality regressions | Liquidity commonality strengthens in boom and bust periods. | Directly supports uneven marketwide liquidity. |
| [27] Felimban et al. (2018) | GCC firms | Dividend-announcement event study | Announcements affect both prices and trading volume. | Supports joint analysis of returns and trading activity. |
| [28] Majdoub et al. (2018) | Islamic equity markets and oil | Spillover analysis | Oil and equity volatility remain connected. | Extends oil-equity transmission evidence. |
| [29] Ahmed (2018) | Qatar stock market | Price-volume modeling | Price-volume relation is asymmetric. | Supports joint treatment of price and activity. |
| [30] Sharif (2019) | Saudi market liberalization | Market-quality comparison | Valuation improved, but liquidity effects were mixed. | Shows market growth does not ensure broad liquidity gains. |
| [31] Shaik & Syed (2019) | Tadawul All Share Index | Intraday volatility modeling | Intraday Saudi volatility is persistent and modelable. | Extends Saudi evidence to intraday dynamics. |

## III. RESEARCH QUESTIONS

Because the study is descriptive rather than causal, it is framed around research questions instead of formal hypotheses:

- RQ1. How did the size of Tadawul and its average trading conditions change from 2001 to 2020?
- RQ2. Do sectors differ in price levels, trading activity, and traded value?
- RQ3. How concentrated is traded value among individual firms?
- RQ4. Which observable variables are most strongly associated with traded value?

## IV. PROPOSED METHOD

### 1. *DATA SOURCE AND SAMPLE*

The proposed method follows a sequential market-data analysis process to examine Tadawul price behavior, trading activity, and liquidity. It begins with the data source and sample, where the study uses Tadawul firm-day observations covering the period 2001–2020. The second stage is data screening, in which the dataset is reviewed for missing values, consistency, and classification accuracy to ensure reliable analysis. The third stage is indicator construction, where the study defines the key measures used in the analysis. These include the price indicators of opening price, high price, low price, closing price, daily change, and daily return; the trading activity indicators of trading volume and number of trades; and the main liquidity indicator, value traded. Daily return is measured as Daily Return (%) = [(Close_t − Close_t−1) / Close_t−1] × 100, while value traded is calculated as Value Traded = Close Price × Volume Traded. The fourth stage is variable transformation, where logarithmic forms are applied to the main trading variables to reduce skewness, specifically ln(1 + Value Traded) and ln(1 + Volume Traded). The fifth stage is descriptive analysis, which uses annual averages and sector averages to identify time trends and sectoral differences in market behavior. The sixth stage is inferential analysis, where the study applies one-way ANOVA to test whether mean returns differ across sectors and estimates an OLS regression model to explain traded value, specified as $\ln(1 + \text{Value Traded}_{i,t}) = \beta 0 + \beta 1 \ln(1 + \text{Volume Traded}_{i,t}) + \beta 2\, \text{Close}_{i,t} + \beta 3\, \text{Daily Return}_{i,t} + \varepsilon_{i,t}$. The final stage is interpretation, where the findings are used to explain Tadawul in terms of price dynamics, liquidity, and trading intensity.

**Table 2.** Sample profile and data completeness.

| Indicator | Value |
|---|---|
| Observations | 600,571 |
| Companies | 200 |
| Sectors | 11 |
| Start date | 2001-12-31 |
| End date | 2020-04-23 |
| Highest missing rate | 1.28% (number of trades) |

Overall, this process provides a clear empirical framework that moves from raw market data to measurable indicators, statistical testing, and economic interpretation.

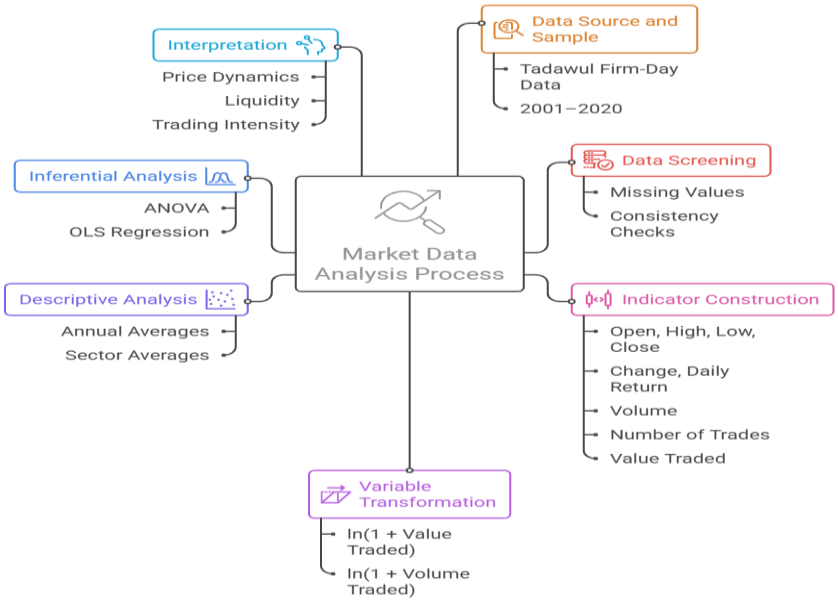


FIGURE 1. Proposed method of the study.

The figure presents the analytical process used in the study, starting from Tadawul firm-day data collection and screening, followed by indicator construction and variable transformation, and ending with descriptive analysis, inferential testing, and interpretation of price dynamics, liquidity, and trading intensity.

## 2. *VARIABLES*

The core price variables are opening, high, low, and closing prices, as well as daily change and daily percentage return. Liquidity and trading activity are proxied by traded volume, traded value, and number of trades. For the regression model, traded volume and traded value are log-transformed.

## 3. *EMPIRICAL STRATEGY AND DIAGNOSTICS*

The workflow has four stages: descriptive summaries, time-series comparisons, cross-sectional comparisons, and inferential tests. The inferential stage applies a one-way ANOVA for sector differences in daily returns and an OLS model in which ln(1 + traded value) is explained by ln(1 + traded volume), closing price, and daily return.

The analysis is intended to describe patterns in the supplied data, not identify causal effects. Economic magnitude is interpreted alongside statistical significance, especially because large samples can produce small p-values for minor effects.

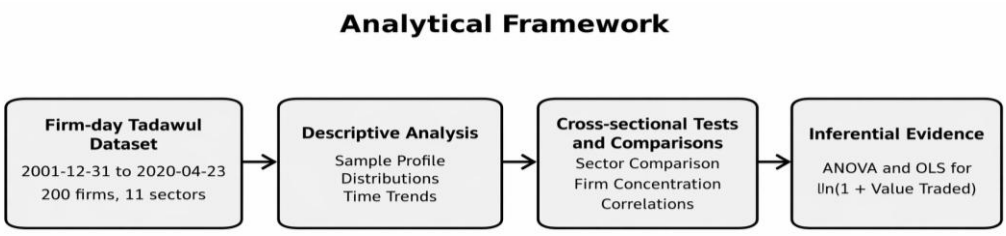


FIGURE 2. Analytical framework.

The study moves from the firm-day dataset to descriptive analysis, cross-sectional tests, and final inferential evidence.

## V. RESULTS

### *1. DISTRIBUTION AND DATA QUALITY*

This subsection summarizes the main descriptive features of the dataset and assesses its overall quality before proceeding to further analysis.

**Table 2.** Selected descriptive statistics.

| Variable | Mean | Median | Max |
|---|---|---|---|
| Close | 40.78 | 26.18 | 6,441.18 |
| Daily return (%) | 0.03 | 0.00 | 1,634.44 |
| Volume traded (mn shares) | 1.67 | 0.43 | 797.67 |
| Value traded (SAR mn) | 49.78 | 12.05 | 15,865.82 |
| Number of trades | 961.86 | 379 | 816,526 |

The distributions are strongly right-skewed. For most variables, the mean exceeds the median, showing that average market conditions are influenced by relatively few high-activity firm-days. Missingness is low, and the dataset is sufficiently complete for descriptive analysis and baseline regression.

### *2. MARKET DEVELOPMENT OVER TIME*

Tadawul broadened steadily over the sample period, but its liquidity profile was not linear. The number of listed firms rose throughout the sample, while average traded value peaked in the mid-2000s and then settled at lower levels.

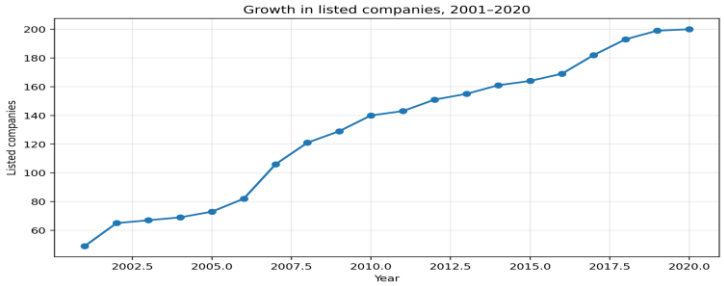


FIGURE 3. Growth in listed companies, 2001–2020.

The number of listed companies increased from 49 in 2001 to 200 in the partial 2020 sample, showing sustained market expansion.

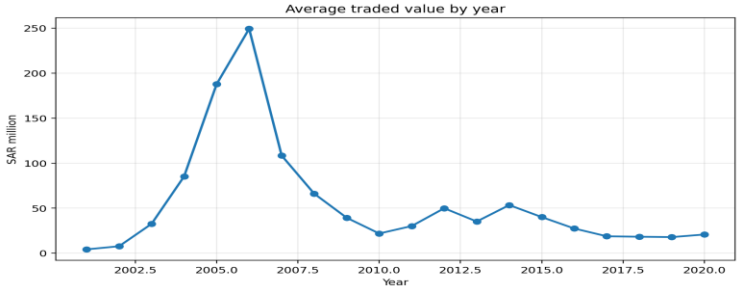


FIGURE 4. Average traded value by year.

Average traded value rose sharply into 2006, then declined and stabilized, indicating that broader market coverage did not produce permanently higher liquidity per observation.

### *3. SECTOR HETEROGENEITY*

Sector differences are economically meaningful. Utilities, communication services, and energy show the highest average traded value, whereas materials and financials contain the largest numbers of firms and observations.

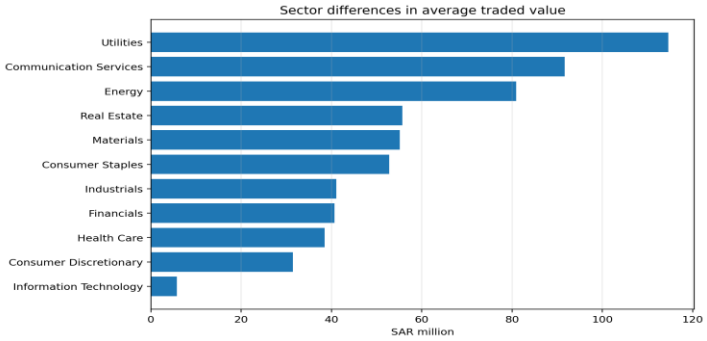


FIGURE 5. Sector differences in average traded value.

Smaller sectors can be more liquid on average than broader sectors, so sector breadth and sector liquidity are not the same.

**Table 3.** Sector comparison.

| Sector | Companies | Avg. volume (mn shares) | Avg. value traded (SAR mn) |
|---|---|---|---|
| Utilities | 2 | 4.78 | 114.62 |
| Communication Services | 6 | 1.81 | 91.64 |
| Energy | 5 | 2.37 | 80.90 |
| Real Estate | 28 | 3.47 | 55.72 |
| Materials | 42 | 1.46 | 55.08 |
| Consumer Staples | 16 | 1.07 | 52.80 |
| Industrials | 20 | 1.28 | 41.02 |
| Financials | 47 | 1.76 | 40.69 |
| Health Care | 8 | 0.97 | 38.43 |
| Consumer Discretionary | 24 | 1.11 | 31.41 |
| Information Technology | 2 | 0.16 | 5.72 |

Sectoral differences in trading activity are substantial. Utilities, Communication Services, and Energy record the highest average traded values, indicating relatively strong liquidity despite having few listed firms. By contrast, sectors such as Information Technology and Health Care exhibit lower average trading activity, while large sectors such as Financials, Materials, and Real Estate combine broader firm representation with moderate-to-high market activity.

## 4. FIRM-LEVEL CONCENTRATION

Liquidity is concentrated in a limited set of firms. Saudi Aramco, SABIC, and Alinma dominate the ranking by average traded value, which shows that market-wide liquidity metrics can be heavily shaped by a small core of names.

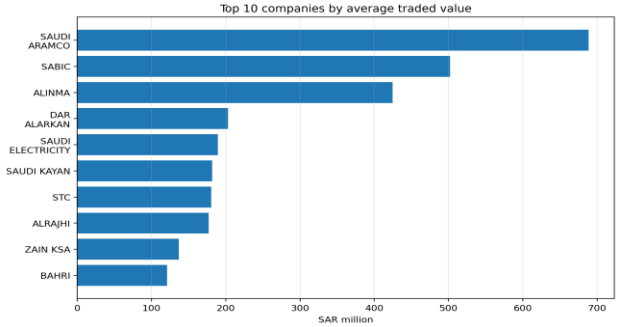


FIGURE 6. Top 10 companies by average traded value.

The leading firms combine either high prices, high turnover, or both, which amplifies their role in total market liquidity.

**Table 4.** Top 10 companies by average traded value.

| Company | Sector | Avg. volume (mn shares) | Avg. value traded (SAR mn) |
|---|---|---|---|
| SAUDI ARAMCO | Energy | 19.76 | 688.67 |
| SABIC | Materials | 5.44 | 501.90 |
| ALINMA | Financials | 36.33 | 424.72 |
| DAR ALARKAN | Real Estate | 20.86 | 202.98 |
| SAUDI ELECTRICITY | Utilities | 8.89 | 189.36 |
| SAUDI KAYAN | Materials | 11.80 | 181.48 |
| STC | Communication Services | 2.24 | 180.18 |
| ALRAJHI | Financials | 3.69 | 177.12 |
| ZAIN KSA | Communication Services | 5.69 | 136.60 |
| BAHRI | Energy | 3.73 | 121.04 |

Trading is concentrated in a few large firms. Saudi Aramco, SABIC, and Alinma record the highest average traded values, showing their strong market presence.

## 5. CORRELATION STRUCTURE AND INFERENTIAL EVIDENCE

The strongest bivariate relationship is between traded volume and traded value (r = 0.681). The number of trades is also positively associated with traded value, while closing prices have a weaker positive relationship.

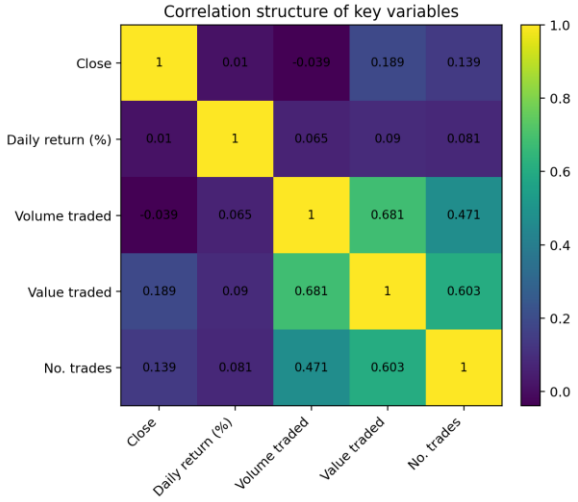


FIGURE 7. Correlation structure of key variables.

Traded value is most closely tied to transaction scale, while return-based relationships are comparatively weak.

**Table 5.** Model summary.

| Model metric | Value |
|---|---|
| ANOVA F-statistic | 2.71 |
| ANOVA p-value | 0.003 |
| Eta squared | 0.000 |
| OLS R-squared | 0.898 |
| OLS observations | 600,571 |

The ANOVA results indicate statistically significant differences across groups, although the effect size is negligible. The OLS model explains a large share of the variation in the data.

**Table 6.** OLS coefficients for ln(value traded).

| Variable | Coefficient | p value |
|---|---|---|
| Constant | 2.54 | 0.000000 |
| ln(volume traded) | 1.04 | 0.000000 |
| Close | 0.005 | 0.000000 |
| Daily return (%) | -0.001 | 0.007894 |

The OLS results show that ln(volume traded) is the dominant predictor of ln(value traded). The coefficient on closing price is positive but much smaller. Daily return is statistically significant, yet its economic effect is minor.

## VI. DISCUSSION

The results present Tadawul as a larger and broader market than at the start of the sample, but not a uniformly liquid one. Listing growth was persistent, while average traded value remained episodic. This implies that market expansion and liquidity deepening did not move one-for-one.

The sector and firm results also point to concentration. Sectors with many firms do not necessarily produce the highest liquidity per firm-day, and a small set of firms accounts for a disproportionate share of traded value. This pattern is consistent with prior work on liquidity commonality, information-driven trading, and regional spillovers in Saudi and GCC markets [26], [21], [15].

The inferential evidence reinforces the descriptive picture. Sector differences in daily returns are statistically detectable, but the effect size is negligible. By contrast, transaction-scale measures explain most of the variation in traded value. For applied work, this means that broad market averages can hide strong asymmetries in where liquidity actually sits.

## VII. CONCLUSION

This paper reorganizes the evidence on Tadawul into a clear descriptive structure and shows three main results. First, the exchange expanded substantially in listed firms between 2001 and 2020. Second, average trading intensity and traded value peaked in the mid-2000s rather than rising steadily with market size. Third, liquidity remained concentrated in a limited set of sectors and firms, with traded volume emerging as the strongest predictor of traded value.

The study contributes a long-horizon firm-day profile of Tadawul and provides a baseline for future work on Saudi market structure. Its main limitations are the partial coverage of 2020 and the absence of richer liquidity measures such as bid-ask spreads or price-impact estimates. Future research can extend the sample beyond 2020, test causal drivers of liquidity, and compare Tadawul more directly with other GCC markets.

### Author Contributions

The author conducted the conceptualization, methodology, data analysis, investigation, writing, review, editing, and final approval of the manuscript.

### Funding

This research received no external funding.

### Data Availability

The dataset will be available from the author upon reasonable request.

### Conflicts of Interest

The author declares no conflict of interest.

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