The Disparate Risk and Efficiency Implications of Information Dissemination*

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Abstract

We examine the impact of NYSE stock ticker subscriptions on systematic risk and price efficiency. An increase in the number of ticker subscriptions is associated with lower systematic risk, and consequently a lower equity premium. This finding is consistent with stock tickers disseminating firm-specific information. However, consistent with Eyster, Rabin, and Vayanos (2013), an increase in the number of ticker subscriptions increases the predictability of firm-level returns. Intuitively, the firm-level price information disseminated by stock tickers decreases the cross-correlation between firm-level returns while increasing the autocorrelation in firm-level returns.

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1 Introduction

Stock tickers broadcast the market price of individual stocks and highlights the respective change in these prices from closing prices on the previous trading day. According to Mulherin, Netter, and Overdahl (1991), the invention of the stock ticker enabled the widespread dissemination of market prices. However, these authors argue that the dissemination of price information required more than technological innovations such as the telegraph or telephone.[1] Instead, Mulherin, Netter, and Overdahl (1991) conclude that establishing property rights for market prices is essential for creating a financial market.

The archives of the New York Stock Exchange (NYSE) contain the number of NYSE stock ticker subscribers in the United States as well as within each individual state. Our sample period begins in 1927 and ends in 1988 due to the introduction of Bloomberg terminals and internet trading accounts. Bogan (2008) describes the development of internet resources for trading, with DLJ Direct having pioneered online investing in 1988. A year later in 1989, the Consumer News and Business Channel (CNBC) was launched.[2] However, during our sample period, stock tickers were the only available means to disseminate intraday price information to a large number of investors. More recently, investors are able to receive current market prices from a multitude of different electronic sources. However, rather than undermining the importance of our study, this fragmentation reinforces that stock ticker subscriptions provide an ideal proxy for studying the economic implications of information dissemination.

Unlike proxies for information diffusion such as media coverage (Tetlock, 2011), institutional ownership or analyst coverage (Hong, Lim, and Stein, 2000) that are positively related to firm size, and are often non-existent for small firms, our sample of ticker subscriptions directly measures the dissemination of price information regarding all listed NYSE firms. Thus, the number of subscriptions is well suited for examining systematic risk. To our knowledge, the impact of information technology on the equity premium has not previously been studied. Although Jain (2005) reports that the introduction of electronic trading improves market liquidity, this country-level study does not examine systematic risk. In contrast, we find that NYSE ticker subscriptions impact systematic risk as well as liquidity.

[1]A projection system for displaying ticker information onto a screen was introduced in 1923, while a wall-mounted electronic display became available in 1963.

[2]CNBC acquired its main competitor, the Financial News Network, in 1991.

An increase in the number of stock tickers is associated with greater trading volume and lower bid-ask spreads. These findings are consistent with stock tickers disseminating public information that increases liquidity without exacerbating asymmetric information.[3] We control for volume and spreads in our empirical tests to account for the indirect influence of stock tickers on liquidity.

Variation in the number of stock tickers is not sensitive to population growth, economic growth, or stock returns. The first result indicates that a larger population, which allows for a larger number of market participants and therefore improved risk-sharing, is not responsible for the impact of stock tickers on the equity premium. Instead, this insensitivity leads us to examine the systematic risk implications of ticker subscriptions.

To examine whether stock tickers affect systematic risk, we compute the average pairwise correlation between stock returns in Pollet and Wilson (2010). While innovations in aggregate risk are difficult to observe due to the Roll critique, these authors argue that individual stock returns have a common sensitivity to these innovations. The average R-squared from the market model provides an alternative proxy for systematic risk. We report that an increase in the number of NYSE stock tickers is associated with lower systematic risk, after controlling for liquidity. Moreover, an increase in the number of tickers is associated with a lower equity premium due to this reduction in systematic risk. These results are consistent with stock tickers broadcasting firm-level information that reduces the cross-correlation between individual stock returns.

An increase in the number of stock tickers, whose purpose is to disseminate firm-specific information, is also associated with higher idiosyncratic volatility.[4] This increased idiosyncratic volatility may limit arbitrage activity (Zhang, 2006) and therefore reduce price efficiency. Moreover, the impact of broadcasting market prices can directly alter price efficiency. In the model of Eyster, Rabin, and Vayanos (2013), stock prices are too sensitive to public information because investors fail to fully extract the private information in stock prices. Hong and Stein (1999) also assume the existence of newswatchers whose failure to fully extract the information contained in market prices leads to mispricings.

[3]Conversely, higher trading volume is associated with an increase in the number of stock tickers. This finding is consistent with higher trading commissions financing additional stock ticker subscriptions by brokerages.

[4]Similarly, in a later sample period, Antweiler and Frank (2004) report that internet message boards covering the stock market increase return volatility.

We find that an increase in the number of ticker subscriptions increases the time series predictability of firm-level returns. Intuitively, investors who monitor stock tickers simultaneously receive identical stock prices that induce correlated uninformed trades in individual stocks. Thus, by attracting less sophisticated retail investors to brokerage offices, stock tickers coordinate uninformed trading at the level of individual firms and decrease price efficiency in the manner predicted by Eyster, Rabin, and Vayanos (2013). In support of this intuition, Brav, Brandt, Graham, and Kumar (2010) report that idiosyncratic volatility increases with the influence of retail investors.

Our empirical results highlight a tradeoff between systematic risk, hence returns, and price efficiency that is exacerbated by the dissemination of firm-specific information. From a time series perspective, individual stock prices deviate from fundamentals due to correlated noise trading that is stimulated by stock tickers. Indeed, an increase in the number of ticker subscriptions increases trading volume while lowering spreads. Conversely, from a cross-sectional perspective, the uninformed trades stimulated by stock tickers lower the aggregate cross-correlation between firm-level returns, which reduces systematic risk and returns as a consequence.

The tradeoff we report between price efficiency and systematic risk is indirectly addressed by Hou, Peng, and Xiong (2013)'s argument that a low R-squared does not signify price efficiency. However, their study does not examine information dissemination or directly examine systematic risk. Instead, these authors critique using R-squared as a proxy for price efficiency (Morck, Yeung, and Yu, 2000).

2 Data

We examine NYSE stock ticker subscriptions from 1927 to 1988 at both the national and state level. Figure 1 displays the time series variation in these subscriptions at the national level during the sample period.[5]

[5] Although 16 years have missing ticker data, a later robustness test estimates these missing values by conditioning on the number of brokerage offices with NYSE subscriptions. Only 1984 is missing both ticker and office subscriptions. The robustness test confirms that our results are insensitive to whether ticker estimates are included in our sample. We report our main results without ticker estimates, implying a maximum of 59 annual ticker subscription changes are available during the 60 year period from 1927 until 1988. Subtracting

Panel A of Table 1 contains summary statistics for annual variation in the number of NYSE ticker subscribers, the average pairwise correlation between firm-level returns, the average R-squared and idiosyncratic return volatility (IVOL) from the market model, and the equity premium. The equity premium is the buy-hold return of the NYSE minus the daily one-month Treasury Bill return posted in Kenneth French's data library based on the number of trading days each month. The average pairwise return correlation, R-squared, and idiosyncratic return volatility are value-weighted by the respective market capitalization of each firm at the beginning of each year. Value-weighting is consistent with risk being defined relative to diversified portfolios involving market-based portfolio weights.

Furthermore, Panel A summarizes average weekly return autocorrelations and variance ratios at the national level. Variance ratios involve a comparison of weekly return volatilities with monthly return volatilities in each year. Deviations between these ratios and one are computed. The absolute value of these deviations as well as the weekly return autocorrelations assess price efficiency. Consistent with the return anomalies literature, the return autocorrelations and variance ratios are equal-weighted across firms each year.

Trading volume and the bid ask spread are also summarized in Panel A of Table 1, with both variables obtained from CRSP. At the national level, we use the total trading volume of all NYSE stocks, while the average bid-ask spread is equal-weighted. Population and gross domestic product (GDP) data are obtained from the Census and Bureau of Economic Analysis, respectively.

State-level variables involving returns are computed and summarized in Panel B of Table 2 based on the headquarter location of firms. State-level trading volume and the average bid-ask spread are also computed using the headquarter location of firms. However, state-level volume is computed per firm and averaged across firms to mitigate fluctuations induced by variation in the number of firms headquartered in an individual state. Population data is available from 1927 for individual states while data on their gross state product (GSP) is available from 1963.

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the 16 years with missing ticker data yields 43 annual observations that typically appear in Panel A of our tables.

3 Tickers and Liquidity

This section studies the determinants of stock ticker variation. We find that trading volume is the main determinant and consequence of variation in stock ticker subscriptions.

3.1 Determinants of Ticker Variation

Although the number of tickers trends upward during our sample period, this trend coincides with considerable time series variation. The following regression examines the determinants of this variation by conditioning on population growth, economic growth, and volume growth as well as NYSE index returns and the average bid-ask spread each year

$$\begin{aligned} \Delta \mathrm{NT}_t &= \beta_0 + \beta_1 \,\mathrm{Volatility}_t + \beta_2 \,\Delta\, \mathrm{Volume}_t + \beta_3 \,\Delta\, \mathrm{GDP}_t + \beta_4 \,\Delta\, \mathrm{Population}_t \\ &\quad + \beta_5 \,\mathrm{Return}_t + \beta_6 \,\Delta\, \mathrm{Volume}_{t-1} + \beta_7 \,\mathrm{Spread}_t + \beta_8 \,\mathrm{Trend}_t + \epsilon_t \,, \end{aligned} \tag{1}$$

where NT_t denotes the number of ticker subscriptions in year t and $\Delta\mathrm{NT}_t$ is defined as $\ln\left(\frac{\mathrm{NT}_t}{\mathrm{NT}_{t-1}}\right)$. Population, GDP, and volume growth are also defined as log growth rates. Trend represents a linear time variable that equals 1 in 1927, and increases by 1 in each subsequent year.

Market volatility is included in equation (1) to account for the possibility that investors demand more information in periods of greater uncertainty. The inclusion of population growth accounts for the possibility that an increasing population may improve the market's risk-bearing capacity and lower the equity premium through greater investor participation. The inclusion of GDP growth determines whether stock ticker subscriptions increase during recessions, when expected returns are higher. Similarly, annual NYSE returns control for investor demand for information.

According to Panel A of Table 2, only volume and the time trend have significant coefficients. Thus, variation in the number of tickers over time is not attributable to population growth, economic growth, or NYSE market returns. As a consequence, the ability of stock tickers to explain the equity premium is not due to improved risk sharing arising from a larger population. In addition, as ticker subscriptions are not counter-cyclical, an increase in the number of ticker subscriptions does not reflect greater investor attention (Andrei and Hasler, 2015). Stock market performance also does not influence the number of stock tickers.

In contrast, ticker subscription growth has a positive contemporaneous and lagged relation with growth in trading volume. For example, in the full time series regression, the β_2 coefficient for contemporaneous volume growth equals 0.1715 (t-statistic of 3.46). The positive β_8 coefficient of 0.0031 (t-statistic of 2.69) in the full specification captures the upward trend in ticker subscriptions.

The panel regression using state-year observations assumes that investors residing in the same state as a firm's headquarters are its marginal investor (Korniotis and Kumar, 2013). This assumption enables return-based variables to be computed at the state-level, where states are indexed by i, along with trading volume and bid-ask spreads. States are required to have at least five NYSE-listed firms to be included in the panel.

$$\begin{aligned}\Delta \text{NT}_{t,i} &= \beta_1 \, \text{Volatility}_{t,i} + \beta_2 \, \Delta \, \text{Volume}_{t,i} + \beta_3 \, \Delta \, \text{GDP}_{t,i} + \beta_4 \, \Delta \, \text{Population}_{t,i} \\ &\quad + \beta_5 \, \text{Return}_{t,i} + \beta_6 \, \Delta \, \text{Volume}_{t-1,i} + \beta_7 \, \text{Spread}_{t,i} + \beta_8 \, \text{Trend}_t + \epsilon_t \, . \qquad (2)\end{aligned}$$

Fixed effects for each state are included, with standard errors clustered by state. In unreported robustness tests, including the total trading volume on the NYSE and the bid-ask spread of averaged over all NYSE stocks, as in equation (1) instead of their state-level equivalents, does not alter our conclusions. Specifically, only market volatility and the time trend exert any influence on ticker dynamics.

The state-level panel regression results in Panel B of Table 2 are consistent with the national results. Indeed, ticker subscriptions appear more exogenous as even volume cannot explain their variation at the state-level. However, compared to the national results, the sample size is smaller since economic growth at the state level is not available until 1963.

Co-movement in ticker subscription growth across states also addresses the endogeneity of these subscriptions as well as the role of information production. This co-movement is defined as the average pairwise correlation in subscription growth across states. In unreported results, compared with the co-movement of 0.780 across state-level returns (0.521 across state-level GSP growth), the co-movement of 0.353 for ticker variation across states is low. The higher return co-movement suggests that it is unlikely ticker subscriptions reflect information production since its co-movement is less systematic than return co-movement.[6]

[6]Although firms headquartered in the same state may have correlated fundamentals, Korniotis and Kumar (2013) report that correlated fundamentals cannot explain the correlation between investor-level trades and

3.2 Impact of Tickers on Liquidity

To study the liquidity implications of stock tickers, we examine whether the number of NYSE ticker subscribers impacts trading volume and bid-ask spreads using the following regressions

$$\begin{aligned}\Delta\,\text{Volume}_t &= \beta_0 + \beta_1\,\Delta\,\text{NT}_t + \beta_2\,\Delta\text{Volume}_{t-1} + \beta_3\,\text{Return}_t + \beta_4\,\text{Trend}_t \\ &\quad + \beta_5\,\text{Spread}_t + \beta_6\,\text{Volatility}_t + \epsilon_t\,, \end{aligned} \tag{3}$$

$$\begin{aligned}\text{Spread}_t &= \beta_0 + \beta_1\,\Delta\,\text{NT}_t + \beta_2\,\Delta\,\text{Volume}_t + \beta_3\,\text{Return}_t + \beta_4\,\text{Trend}_t \\ &\quad + \beta_5\,\text{Volatility}_t + \beta_6\,\text{Spread}_{t-1} + \epsilon_t\,, \end{aligned} \tag{4}$$

The positive β_1 coefficient of 0.8454 (t-statistic of 2.71) from equation (3) reported in Panel A of Table 3 indicates that stock tickers stimulate trading volume. Higher stock returns also correspond with greater trading volume as β_3 is positive, 0.6760 (t-statistic of 4.76), while wider spreads decrease volume as β_5 is negative, -3.7256 (t-statistic of -2.45). The positive correlation between volume and volatility is also detected by the positive β_6 coefficient.

The negative β_1 coefficient of -0.0557 (t-statistic of -2.26) from the full specification in equation (4) indicates that an increase in the number of ticker subscriptions decreases the average bid-ask spread. This result is consistent with tickers transmitting public, not private, information.

The results in Panel B of Table 3 from the following panel regressions with state fixed effects and standard errors clustered by state

$$\begin{aligned}\Delta\,\text{Volume}_{t,i} &= \beta_1\,\Delta\,\text{NT}_{t,i} + \beta_2\,\Delta\text{Volume}_{t-1,i} + \beta_3\,\text{Return}_{t,i} + \beta_4\,\text{Trend}_t \\ &\quad + \beta_5\,\text{Spread}_{t,i} + \beta_6\,\text{Volatility}_{t,i} + \epsilon_{t,i}\,, \end{aligned} \tag{5}$$

$$\begin{aligned}\text{Spread}_{t,i} &= \beta_1\,\Delta\,\text{NT}_{t,i} + \beta_2\,\text{Volume}_{t,i} + \beta_3\,\text{Return}_{t,i} + \beta_4\,\text{Trend}_t \\ &\quad + \beta_5\,\Delta\text{Volatility}_{t,i} + \beta_6\,\text{Spread}_{t-1,i} + \epsilon_{t,i}\,, \end{aligned} \tag{6}$$

confirm our earlier conclusions based on national data. In particular, the β_1 coefficient is positive in equation (5) and negative in equation (6). Moreover, higher trading volume narrows the bid-ask spreads since β_2 is negative, -0.0164 (t-statistic of -9.48). This finding is consistent

firm-level returns for investors and firms within the same state, respectively.

with the trading volume stimulated by stock tickers being uninformed. As stock tickers have a direct impact on spreads and an indirect impact on spreads through volume, we control for trading volume and spreads in our subsequent empirical tests.

Intuitively, a loop appears to link trading volume with the number of stock tickers as both exert a positive influence on one another. However, volume dynamics are far more complex given their dependence on bid-ask spreads and returns. While a brokerage's decision to subscribe to an NYSE ticker may represent a form of advertising that is funded by commissions based on trading volume, our results shed light on the systematic risk and price efficiency implications of such advertising. Nonetheless, the dynamics of ticker subscriptions are not driven by economic growth or demographics. Instead, the upward trend in these subscriptions parallels the adoption of information technology across other aspects of modern life.

4 Systematic Risk and the Equity Premium

This section examines whether variation in the number of stock tickers affects systematic risk and the equity premium. Specifically, we determine whether the dissemination of public firm-specific information impacts systematic risk and the premium for bearing this risk.

4.1 Systematic Risk

Motivated by Pollet and Wilson (2010), we first estimate the following regression whose dependent variable is the average pairwise correlation among individual stock returns

$$\begin{aligned}\text{Correlation}_t &= \alpha_0 + \alpha_1\,\Delta\text{NT}_t + \alpha_2\,\Delta\text{Volume}_t + \alpha_3\,\text{Spread}_t + \alpha_4\,\text{Return}_t \\ &\quad + \alpha_5\,\text{Volatility}_t + \alpha_6\,\text{Trend}_t + \epsilon_t\,. \end{aligned} \tag{7}$$

Besides the average return correlation, we measure systematic risk using the average R-squared from the market model

$$\begin{aligned}\text{R-squared}_t &= \alpha_0 + \alpha_1\,\Delta\text{NT}_t + \alpha_2\,\Delta\text{Volume}_t + \alpha_3\,\text{Spread}_t + \alpha_4\,\text{Return}_t \\ &\quad + \alpha_5\,\text{Volatility}_t + \alpha_6\,\text{Trend}_t + \epsilon_t\,. \end{aligned} \tag{8}$$

Recall that the average return correlation and average R-squared are both computed as value-weighted annual quantities using the log market capitalization of each firm listed on the

NYSE.[7] The inclusion of volume and spread control for the impact of liquidity on systematic risk while the NYSE market return accounts for the higher correlation between returns during periods of poor market performance (Ang and Chen, 2002).

Panel A of Table 4 reports negative α_1 coefficients of -0.1584 (t-statistic of -2.15) and -0.2473 (t-statistic of -4.58) from equation (7) and equation (8), respectively, in the full specifications. These negative coefficients indicate that a greater number of NYSE ticker subscriptions reduces systematic risk, after controlling for liquidity and market volatility.

We then estimate the impact of stock ticker subscriptions on systematic risk using panel regressions involving state-level observations in lieu of national observations

$$\begin{aligned}\text{Correlation}_{t,i} &= \alpha_1\,\Delta\text{NT}_{t,i} + \alpha_2\,\Delta\text{Volume}_{t,i} + \alpha_3\,\text{Spread}_{t,i} + \alpha_4\,\text{Return}_{t,i} \\ &\quad + \alpha_5\,\text{Volatility}_{t,i} + \alpha_6\,\text{Trend}_t + \epsilon_{t,i}\,, \end{aligned} \tag{9}$$

$$\begin{aligned}\text{R-squared}_{t,i} &= \alpha_1\,\Delta\text{NT}_{t,i} + \alpha_2\,\Delta\text{Volume}_{t,i} + \alpha_3\,\text{Spread}_{t,i} + \alpha_4\,\text{Return}_{t,i} \\ &\quad + \alpha_5\,\text{Volatility}_{t,i} + \alpha_6\,\text{Trend}_t + \epsilon_{t,i}\,. \end{aligned} \tag{10}$$

As with prior specification, state fixed effects are included with standard errors clustered by state.

Panel B of Table 4 continues to report negative α_1 coefficients of -0.0135 (t-statistic of -2.01) when the dependent variable is the average pairwise correlation, and -0.0261 (t-statistic of -2.56) when the dependent variable is R-squared in the full panel regression specifications. This evidence confirms that systematic risk is reduced by the dissemination of firm-specific information via stock tickers.

4.2 Idiosyncratic Volatility

By disseminating firm-specific information, an increase in the number of stock tickers may increase idiosyncratic return volatility (IVOL). IVOL is defined as the standard deviation of firm-level residuals from the market model, with these standard deviations then value-weighted across firms each year.

[7] Estimation error in R-squared does not affect the standard error of the α coefficients since this estimation error is captured by the residuals in equation (8). Furthermore, errors in the firm-level R-squared estimates would need to be systematic to bias the dependent variable in this equation.

The impact of stock tickers on idiosyncratic volatility is then examined at the national level using the following time series regression

$$\begin{aligned} \text{IVOL}_t &= \alpha_0 + \alpha_1\,\Delta\text{NT}_t + \alpha_2\,\Delta\text{Volume}_t + \alpha_3\,\text{Spread}_t \\ &\quad + \alpha_4\,\text{Return}_t + \alpha_5\,\text{Trend}_t + \epsilon_t\,. \end{aligned} \tag{11}$$

The market return volatility is omitted from this specification given its dependence on idiosyncratic volatility.

The results in Panel A of Table 4 confirm that an increase in the number of tickers corresponds with higher idiosyncratic return volatility after controlling for liquidity.[8] Specifically, the α_1 coefficient from equation (11) equals 0.0112 (t-statistic of 2.93). This positive coefficient indicates that an increase in the number of stock tickers is associated with higher average idiosyncratic return volatility. Thus, uninformed trades stimulated by stock tickers increase idiosyncratic volatility while lowering systematic risk.

Similar results in Panel B of Table 4 are reported from a panel regression involving state-year observations

$$\begin{aligned} \text{IVOL}_{t,i} &= \alpha_1\,\Delta\text{NT}_{t,i} + \alpha_2\,\Delta\text{Volume}_{t,i} + \alpha_3\,\text{Spread}_{t,i} \\ &\quad + \alpha_4\,\text{Return}_{t,i} + \alpha_5\,\text{Trend}_t + \epsilon_{t,i}\,, \end{aligned} \tag{12}$$

with state fixed effects and standard errors clustered by state. In particular, the α_1 coefficient in equation (12) is positive in the full specification, equaling 0.0013 (t-statistic of 1.98). Thus, an increase in the number of ticker subscriptions corresponds to higher idiosyncratic return volatility.

The respective ticker-induced impacts of systematic risk and idiosyncratic volatility on the equity premium are the subject of our next analysis.

4.3 Equity Premium

As systematic risk provides a channel through which the number of stock tickers can affect the equity premium, we implement an instrumental variables procedure whose first stage involves

[8] Using analyst coverage and institutional ownership as proxies for information diffusion, Ang, Hodrick, Xing, and Zhang (2009) conclude that information diffusion is not responsible for the inverse cross-sectional relation between idiosyncratic volatility and subsequent returns. In contrast, we examine the time series of aggregate idiosyncratic volatility since stock tickers disseminate information on all listed NYSE firms.

the following regression

$$\text{Correlation}_t = \gamma_0 + \gamma_1 \, \Delta\text{NT}_t + \epsilon_t \, . \tag{13}$$

The fitted correlations from this first stage, denoted $\hat{\text{FCR}}_t = \hat{\gamma}_0 + \hat{\gamma}_1 \, \Delta\text{NT}_t$, are then independent variables in the second stage. A similar first stage procedure is estimated for idiosyncratic volatility

$$\text{IVOL}_t = \gamma_0 + \gamma_1 \, \Delta\text{NT}_t + \epsilon_t \, , \tag{14}$$

to produce fitted idiosyncratic volatilities, $\hat{\text{FIVOL}}_t = \hat{\gamma}_0 + \hat{\gamma}_1 \, \Delta\text{NT}_t$. The fitted values from the first stage are then utilized in the second stage

$$\begin{aligned} \text{Premium}_{t+1} = \; & \alpha_0 + \alpha_1 \, \Delta\text{NT}_t + \alpha_2 \, \Delta\text{Volume}_{t+1} + \alpha_3 \, \text{Spread}_{t+1} + \alpha_4 \, \text{Premium}_t \\ & + \alpha_5 \, \text{Correlation}_t + \alpha_6 \, \hat{\text{FCR}}_t + \alpha_7 \, \hat{\text{FIVOL}}_{t+1} + \alpha_8 \, \text{Trend}_t + \epsilon_{t+1} \, , \end{aligned} \tag{15}$$

to determine whether the equity premium is sensitive to the number of stock ticker subscriptions through the systematic risk channel.

According to Panel A of Table 5, after controlling for liquidity, the negative α_1 coefficient from equation (15) indicates that an increase in the number of NYSE ticker subscriptions lowers the equity premium by reducing systematic risk. When the fitted correlations from the first stage in equation (13) are included in lieu of ticker subscriptions, the α_6 coefficient is positive, 3.0576 (t-statistic of 2.48). This finding indicates that ticker subscriptions lower the equity premium through the systematic risk channel. In contrast, idiosyncratic volatility attributable to the number of NYSE ticker subscriptions exerts an insignificant impact since the α_7 coefficient is insignificant. Replacing the average pairwise correlation with the average R-squared produces nearly identical results, which are unreported for brevity.

For emphasis, the number of stock ticker subscriptions does not necessarily proxy for stock market participation. Although an increase in the number of stock tickers may reflect an expanding investor class, improved risk-sharing would lower the equity premium without a corresponding reduction in systematic risk. However, the number of stock ticker subscriptions is not explained by population growth. Moreover, if a larger population broadens the investor base of firms, the equity premium required to bear systematic risk decreases, the amount of systematic risk does not decrease.

5 Return Predictability

Our next analysis examines the relation between price efficiency and the dissemination of public firm-specific information. As proxies for price efficiency, we examine weekly return autocorrelations as well as variance ratio tests based on weekly and monthly returns. These proxies are equal-weighted across NYSE firms each year. In contrast to Griffin, Kelly, and Nardari (2010)'s study of emerging versus developed markets, cross-sectional differences in information production are less salient across US states. Consequently, state-level variation across the market efficiency proxies in our study can be linked more closely with variation in ticker subscriptions.

Price efficiency does not necessarily improve with the greater dissemination of public firm-specific information regarding market prices. According to Eyster, Rabin, and Vayanos (2013), investors induce return continuation by failing to extract private information from observed market prices.

The absolute return autocorrelation is the dependent variable in the following regression

$$\begin{aligned} |\text{Autocorrelation}|_t &= \alpha_0 + \alpha_1\,\Delta\text{NT}_t + \alpha_2\,\Delta\text{Volume}_t + \alpha_3\,\text{Spread}_t \\ &\quad + \alpha_4\,\text{IVOL}_t + \alpha_5\,\text{Return}_t + \alpha_6\,\text{Trend}_t + \epsilon_t\,. \end{aligned} \tag{16}$$

The positive α_1 coefficient in Panel A of Table 6 signifies that more NYSE ticker subscriptions increases the predictability of individual firm-level returns, after controlling for liquidity and the general downward trend in return predictability. This evidence is consistent with public information being responsible for return predictability, as in the theoretical model of Eyster, Rabin, and Vayanos (2013).

In addition to using the absolute value of weekly return autocorrelations as a proxy for market efficiency, we also examine variance ratios (Boehmer and Kelley, 2009). Specifically, we examine the absolute deviations $|1 - \text{VR}(1,4)|$ where VR(1,4) is defined as

$$\text{VR}(1,4) = \frac{\frac{1}{4} \times \sigma_M^2}{\sigma_W^2}\,. \tag{17}$$

The variance of weekly returns within a year is denoted σ_W^2 while the variance of monthly returns is σ_M^2. Under the null hypothesis that returns follow a random walk, VR(1,4) equals 1. Therefore, we replace the dependent variable in equation (16) with the absolute value of deviations between VR(1,4) and 1. The positive α_1 coefficient of 0.1115 (t-statistic of 2.22) in Panel A of Table 6 indicates that an increase in the number of stock tickers reduces price efficiency as deviations between the variance ratios and 1 become larger. Besides a downward trend in these deviations, which is consistent with a gradual improvement in price efficiency over time, wider spreads are associated with lower price efficiency.

As with our analysis of systematic risk and the equity premium, we extend our time series regression involving national data to a panel regression

$$\begin{aligned} |\text{Autocorrelation}|_{t,i} &= \alpha_1\,\Delta\text{NT}_{t,i} + \alpha_2\,\Delta\text{Volume}_{t,i} + \alpha_3\,\text{Spread}_{t,i} \\ &\quad + \alpha_4\,\text{IVOL}_{t,i} + \alpha_5\,\text{Return}_{t,i} + \alpha_6\,\text{Trend}_t + \epsilon_{t,i}\,, \end{aligned} \tag{18}$$

involving state-level data and obtain similar empirical results. The results in Panel B of Table 6 provide additional evidence that price efficiency decreases with ticker subscriptions as the α_1 coefficient is positive in every specification.

The disparate impact of ticker subscriptions on systematic risk and price efficiency support Hou, Peng, and Xiong (2013)'s critique of R-squared as a measure of price efficiency.[9] These authors argue that a low R-squared does not indicate price efficiency if trades are uninformed.

5.1 Robustness Tests

We conduce three robustness test using state-year panel regressions to confirm the economic implications of stock ticker subscriptions on systematic risk and price efficiency.

Our first robustness test utilizes an enhanced sample that estimates missing ticker subscriptions at the state-level using the number of brokerage offices with ticker subscriptions. The number of tickers divided by the number of offices is stable at the state level, and increasing with population density. The results in Panel A of Table 7 reinforce our earlier conclusions regarding the ability of ticker subscriptions to lower systematic risk while also lowering price efficiency.

In addition to studying the level of systematic risk, idiosyncratic return volatility, and the equity premium, our second robustness test examines changes in these variables. The change

[9] We find a negative correlation between R-squared and daily return autocorrelation at the firm-level. Return autocorrelation offers a time series perspective on return predictability while Hou, Peng, and Xiong (2013) implement price momentum strategies that provide a cross-sectional perspective on price efficiency. Lewellen (2002) emphasizes that return predictability at the firm-level does not imply price momentum.

in the autocorrelation is not examined as there is little serial correlation in this proxy for price efficiency. The results in Table 7 are similar to the state-level results based on levels. Panel B focuses on the pairwise correlation while our next analysis focuses on R-squared measures since only the later are available at the firm-level for use in Fama-MacBeth regressions.

Using firm-level R-squared, idiosyncratic volatility, equity returns, and return autocorrelations, our third robustness test conducts Fama-MacBeth regressions. The results in Panel C of Table 7 confirm that a greater number of ticker subscribers is associated with higher return autocorrelation but lower systematic risk at the firm level.

6 Conclusion

We examine the impact of NYSE stock tickers, which disseminate public firm-specific information, on systematic risk and the equity premium as well as price efficiency. An increase in the number of stock tickers is associated a lower average pairwise correlation between individual NYSE stock returns, hence lower systematic risk, and consequently a lower equity premium. However, an increase in the number of stock tickers increases the predictability of firm-level stock returns. Therefore, despite reducing the price efficiency of individual stocks, the dissemination of firm-specific information by stock tickers lowers the cross-correlation between individual stock returns.

Our results highlight two disparate implications of uninformed trading initiated by the increased availability of market prices. At the level of individual firms, stock tickers facilitate correlated trading by uninformed investors that induces return predictability. At the aggregate level, stock tickers broadcast firm-level information that weakens the return correlation between firms, and consequently lowers systematic risk.

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Table 1: Summary Statistics

This table reports summary statistics (mean, median, standard deviation) for the main variables in our study. The average pairwise correlation and the average R-squared from the market model along with the average idiosyncratic volatility (IVOL) are value-weighted using the market capitalization of individual firms. The average autocorrelation of daily returns is equal-weighted before the absolute value is applied. Panel A reports summary statistics at the national level. Panel B reports summary statistics at the state level, with return-based variables, trading volume, and spread determined by the state in which each firm is headquartered, for states containing at least 5 NYSE firms. **What units apply to Spread?**

Panel A: National-level summary statistics

	N	Mean	Median	Std. Dev.
ΔTickers	43	0.0218	0.0324	0.1432
Pairwise Correlation	43	0.1992	0.1810	0.0852
R-squared	43	0.3202	0.2988	0.1255
IVOL	43	0.0140	0.0131	0.0046
Equity Premium	43	0.0250	0.0697	0.2058
|Weekly Autocorrelation|	43	0.1285	0.1264	0.0150
ΔVolume	43	0.0534	0.0755	0.2834
Spread	43	0.0389	0.0223	0.0384

Panel B: State-level summary statistics

	N	Mean	Median	Std. Dev.
ΔTickers	1,297	0.0476	0.0308	0.2269
Pairwise Correlation	1,297	0.1786	0.1629	0.0878
R-squared	1,297	0.2566	0.2233	0.1527
IVOL	1,297	0.0156	0.0141	0.0073
State Equity Premium	1,297	0.0299	0.0604	0.2386
|Weekly Autocorrelation|	1,297	0.1264	0.1221	0.0336
ΔVolume	1,297	0.0156	0.0141	0.0073
Spread	1,297	0.0337	0.0215	0.0365

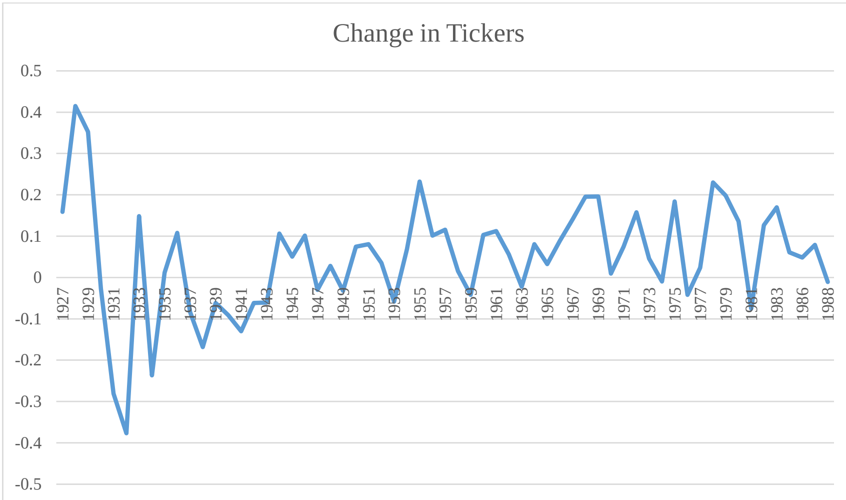

Figure 1 This figure illustrates the variation in the number of NYSE ticker subscriptions at the national level from 1927 until 1988.

Table 2: Determinants of Ticker Subscriptions

This table reports on the determinants of variation in stock tickers at both the national and state level. t-statistics in parentheses are reported below each coefficient, with the asterisks ***, **, and * denoting significance at the 1%, 5%, and 10% significance levels, respectively.

Panel A: National-level determinants

	ΔTickers	ΔTickers	ΔTickers	ΔTickers
Volatility	-3.7042	-5.2741*	-4.2354	-1.9059
	(-1.06)	(-1.88)	(-1.54)	(-0.45)
ΔVolume	0.2585***	0.1474***	0.1850***	0.1715***
	(4.29)	(3.73)	(4.23)	(3.46)
ΔGDP	—	-0.0644	-0.0393	-0.0643
		(-0.32)	(-0.21)	(-0.35)
ΔPopulation	—	-0.1954	-0.1242	-0.4381
		(-0.12)	(-0.11)	(-0.39)
Return	—	0.0640	0.0438	0.0547
		(0.68)	(0.48)	(0.57)
Lag ΔVolume	—	—	0.0793**	0.0685*
			(2.32)	(1.75)
Spread	—	—	—	-0.4533
				(-0.83)
Time Trend	0.0021*	0.0036***	0.0031***	0.0031**
	(1.70)	(3.15)	(2.76)	(2.69)
Constant	-0.0128	-0.0482	-0.0501	-0.0492
	(-0.27)	(-0.84)	(-1.00)	(-1.00)
Observations	43	41	41	41
R-squared	0.5102	0.6569	0.6788	0.6808

Panel B: State-level determinants

	ΔTickers	ΔTickers	ΔTickers
Volatility	-5.0778***	-2.6655	-15.7932
	(-3.70)	(-0.41)	(-1.52)
ΔVolume	0.1389***	0.0549	0.0405
	(8.19)	(1.24)	(0.81)
ΔGSP	—	-0.1161	-0.1175
		(-0.28)	(-0.26)
ΔState Population	—	1.4945	1.3154
		(1.07)	(0.93)
Return	—	—	-0.0448
			(-0.50)
Lag ΔVolume	—	—	-0.0449
			(-0.87)
Spread	—	—	7.6488
			(1.49)
Time Trend	0.0018***	0.0041	0.0048
	(3.57)	(1.57)	(1.62)
State Fixed Effects	Yes	Yes	Yes
Observations	1,297	492	492
R-squared	0.1163	0.0131	0.0188

Table 3: Impact of Ticker Subscriptions on Liquidity

This table reports on the results from equation (3) and equation (4) regarding the impact of ticker variation on liquidity, where liquidity is measured by trading volume and the average bid-ask spread. t-statistics in parentheses are reported below each coefficient, with the asterisks ***, **, and * denoting significance at the 1%, 5%, and 10% significance levels, respectively.

Panel A: National-level liquidity determinants

	ΔVolume	ΔVolume	Spread	Spread
ΔTickers	1.0558***	0.8454**	-0.0515**	-0.0557**
	(3.14)	(2.71)	(-2.48)	(-2.26)
ΔVolume	—	—	0.0103	-0.0087
			(0.71)	(-0.69)
Lag ΔVolume	-0.2933**	-0.3290***	—	—
	(-2.31)	(-2.77)		
Return	0.5462***	0.6760***	-0.0511**	0.0063
	(3.39)	(4.76)	(-2.69)	(0.36)
Time Trend	-0.0004	0.0014	-0.0001	0.0002
	(-0.24)	(0.87)	(-0.35)	(0.80)
Spread	-0.5289	-3.7256**	—	—
	(-0.62)	(-2.45)		
Volatility	—	24.3799***	—	3.7165**
		(3.13)		(2.46)
Lag Spread	—	—	0.7302***	0.3159**
			(4.18)	(2.10)
Constant	0.0422	-0.1193	0.0165**	-0.0124
	(0.51)	(-1.38)	(2.03)	(-0.78)
Observations	43	43	43	43
R-squared	0.6403	0.6881	0.7743	0.8492

Panel B: State-level liquidity determinants

	ΔVolume	ΔVolume	Spread	Spread
ΔTickers	0.2157***	0.1628***	-0.0183***	-0.0194***
	(5.60)	(4.30)	(-6.85)	(-8.15)
ΔVolume	—	—	-0.0143***	-0.0164***
			(-7.40)	(-9.48)
Lag ΔVolume	-0.2139***	-0.2169***	—	—
	(-9.51)	(-9.93)		
Return	0.9603***	1.0773***	-0.0277***	0.0015
	(22.04)	(24.33)	(-7.76)	(0.41)
Time Trend	0.0008	0.0029***	-0.0001**	0.0001***
	(1.24)	(4.39)	(-2.27)	(3.28)
Spread	-0.8865***	-3.1269***	—	—
	(-3.17)	(-8.44)		
Market Volatility	—	22.9828***	—	2.8272***
		(8.86)		(18.12)
Lag Spread	—	—	0.7299***	0.4890***
			(39.47)	(23.10)
State Fixed Effects	Yes	Yes	Yes	Yes
Observations	1,297	1,297	1,297	1,297
R-squared	0.3911	0.4271	0.6865	0.7517

Table 4: Systematic Risk and Idiosyncratic Volatility

This table reports on the relation between the number of NYSE stock tickers, systematic risk, and idiosyncratic return volatility (IVOL). Systematic risk is measured using the average pairwise correlation between individual stock returns and the average R-squared from the market model. Both averages are value-weighted using the market capitalization of firms. Panel A reports the results from equation (7) and equation (8) involving time series data at the national level. Panel B reports the results from comparable panel regressions involving state-year observations for states with at least 5 firms listed on the NYSE. t-statistics in parentheses are reported below each coefficient, with the asterisks ***, **, and * denoting significance at the 1%, 5%, and 10% significance levels, respectively.

Panel A: National-level systematic risk and idiosyncratic volatility

	Correlation	Correlation	R-squared	R-squared	IVOL	IVOL
ΔTickers	-0.1600**	-0.1584**	-0.2531***	-0.2473***	0.0112**	0.0112***
	(-2.18)	(-2.15)	(-4.78)	(-4.58)	(2.11)	(2.93)
ΔVolume	-0.0233	-0.0190	-0.0200	-0.0038	-0.0007	0.0023*
	(-0.95)	(-0.62)	(-0.85)	(-0.12)	(-0.61)	(1.93)
Spread	-2.4097***	-2.3809***	-1.7268***	-1.6193***	0.1229***	0.1206***
	(-6.49)	(-6.62)	(-5.85)	(-5.64)	(9.53)	(9.08)
NYSE Return	—	-0.0096	—	-0.0359	—	-0.0067***
		(-0.25)		(-1.07)		(-3.31)
Market Volatility	19.6173***	19.3682***	23.1471***	22.2164***	—	—
	(7.11)	(7.54)	(10.83)	(10.77)		
Time Trend	-0.0012***	-0.0013***	-0.0014***	-0.0014***	-0.0000	-0.0000
	(-2.99)	(-2.93)	(-3.05)	(-3.19)	(-0.25)	(-0.18)
Constant	0.1420***	0.1441***	0.2077***	0.2155***	0.0093***	0.0096***
	(7.62)	(7.40)	(11.13)	(11.66)	(7.07)	(8.27)
Observations	43	43	43	43	43	43
R-squared	0.8087	0.8089	0.9204	0.9220	0.8028	0.8559

Panel B: State-level systematic risk and idiosyncratic volatility

	Correlation	Correlation	R-squared	R-squared	IVOL	IVOL
ΔTickers	-0.0185***	-0.0135**	-0.0304***	-0.0261**	0.0010	0.0013**
	(-2.74)	(-2.01)	(-2.98)	(-2.56)	(1.47)	(1.98)
ΔVolume	-0.0107***	0.0069	-0.0187***	-0.0040	0.0015***	0.0031***
	(-2.63)	(1.44)	(-3.06)	(-0.55)	(3.88)	(6.87)
Spread	-1.4522***	-1.3648***	-1.5214***	-1.4484***	0.1382***	0.1357***
	(-22.43)	(-20.98)	(-15.62)	(-14.62)	(30.79)	(30.64)
NYSE Return	—	-0.0618***	—	-0.0516***	—	-0.0056***
		(-6.57)		(-3.60)		(-6.72)
Market Volatility	14.7963***	13.6529***	20.7838***	19.8297***	—	—
	(33.32)	(29.04)	(31.10)	(27.70)		
Time Trend	-0.0016***	-0.0016***	-0.0025***	-0.0025***	-0.0000	0.0000
	(-13.62)	(-14.01)	(-14.00)	(-14.15)	(-0.34)	(0.54)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,297	1,297	1,297	1,297	1,297	1,297
R-squared	0.6462	0.6581	0.6661	0.6696	0.5030	0.5203

Table 5: Tickers and the Equity Premium

This table reports on the relation between the number of NYSE stock ticker subscriptions and the equity premium. Panel A reports the results involving time series data at the national level. Panel B reports the results from a comparable panel regression involving state-year observations for states with at least 5 firms listed on the NYSE. Fitted values are those attributable to stock tickers. *t*-statistics in parentheses are reported below each coefficient, with the asterisks ***, **, and * denoting significance at the 1%, 5%, and 10% significance levels, respectively.

Panel A: National-level equity premium

	Equity Premium	Equity Premium	Equity Premium
Lag ΔTickers	-0.3946**	—	—
	(-2.03)		
ΔVolume	0.4414***	0.3303**	0.2406
	(3.29)	(2.35)	(1.58)
Spread	-1.1195	-1.9162	-1.5069
	(-0.89)	(-1.58)	(-1.16)
Lag Equity Premium	0.1524	-0.0102	-0.0093
	(0.70)	(-0.05)	(-0.04)
Lag Correlation	0.9744*	—	—
	(1.95)		
Lag Fitted Correlation	—	3.0576**	3.7023**
		(2.48)	(2.29)
Fitted IVOL	—	—	24.2850
			(0.68)
Time Trend	0.0024	0.0028	0.0046
	(0.83)	(0.93)	(1.36)
Constant	-0.2198	-0.3470*	-0.7003
	(-1.09)	(-1.73)	(-1.57)
Observations	43	43	39
R-squared	0.4345	0.3712	0.4100

Panel B: State-level equity premium

	Equity Premium	Equity Premium	Equity Premium
Lag ΔTickers	-0.1029***	—	—
	(-3.92)		
ΔVolume	0.3530***	0.3214***	0.3117***
	(20.30)	(18.79)	(17.38)
Spread	-0.8137***	-1.0500***	-0.7531***
	(-3.88)	(-4.98)	(-3.47)
Lag Equity Premium	0.0937***	0.0383	0.0393
	(3.39)	(1.42)	(1.38)
Lag Correlation	0.6243***	—	—
	(6.99)		
Lag Fitted Correlation	—	5.4911***	4.7029***
		(4.12)	(3.44)
Fitted IVOL	—	—	3.3038
			(0.12)
Time Trend	0.0013**	0.0081***	0.0082***
	(2.45)	(3.63)	(3.56)
State Fixed Effects	Yes	Yes	Yes
Observations	1,310	1,310	1,179
R-squared	0.3100	0.2833	0.2964

Table 6: Tickers and Return Predictability

This table reports on the relation between the number of tickers and return predictability. Return predictability is measure using the equal-weighted average of weekly return autocorrelations in absolute value and variance ratio tests that compare weekly with monthly return volatility. Deviations in the variance ratios from one in absolute value are equal-weighted across firms to compute annual estimates of price efficiency. *t*-statistics in parentheses are reported below each coefficient, with the asterisks ***, **, and * denoting significance at the 1%, 5%, and 10% significance levels, respectively.

Panel A : National-level return predictability

	Autocorrelation	Autocorrelation	Variance Ratios	Variance Ratios
ΔTickers	0.0401*	0.0464*	0.1308**	0.1115**
	(1.96)	(1.93)	(2.40)	(2.22)
ΔVolume	-0.0079	-0.0039	-0.0043	-0.0163
	(-0.95)	(-0.47)	(-0.18)	(-0.54)
Spread	-0.0730	-0.0180	1.1413***	0.9738***
	(-0.43)	(-0.10)	(3.72)	(2.98)
IVOL	1.1856	0.6891	-1.8219	-0.3096
	(0.82)	(0.46)	(-0.73)	(-0.11)
Return		-0.0110		0.0335
		(-0.91)		(0.83)
Time Trend	-0.0005***	-0.0005***	-0.0008***	-0.0009***
	(-2.86)	(-2.88)	(-2.94)	(-2.91)
Constant	0.1288***	0.1337***	0.3201***	0.3053***
	(11.07)	(10.24)	(12.29)	(10.95)
Observations	43	43	43	43
R-squared	0.3922	0.4015	0.6469	0.6562

Panel B : State-level return predictability

	Autocorrelation	Autocorrelation	Variance Ratios	Variance Ratios
ΔTickers	0.0129***	0.0133***	0.0403***	0.0385***
	(3.63)	(3.61)	(3.80)	(3.55)
ΔVolume	-0.0035	-0.0015	0.0304***	0.0224**
	(-1.21)	(-0.43)	(3.09)	(2.40)
Spread	0.0610*	0.0633*	0.9190***	0.9103***
	(1.83)	(1.92)	(6.22)	(5.98)
IVOL	0.0013	-0.0507	-0.3113	-0.1088
	(0.01)	(-0.25)	(-0.19)	(-0.06)
Return		-0.0077		0.0301
		(-1.24)		(1.57)
Time Trend	-0.0004***	-0.0003***	-0.0009***	-0.0009***
	(-4.78)	(-4.51)	(-4.88)	(-5.49)
State Fixed Effects	Yes	Yes	Yes	Yes
Observations	1,297	1,297	1,297	1,297
R-squared	0.0388	0.0400	0.1439	0.1462

Table 7: Robustness Tests

This table reports the results for three robustness tests involving state-level panel regressions as well as Fama-MacBeth regressions. Panel A examines an enhanced sample where missing ticker data is estimated using the subscriptions of brokerage offices. In Panel B, we re-examine the results involving the pairwise correlation, idiosyncratic return volatility, and the equity premium using their respective changes over consecutive years instead of their levels (absolute average weekly return autocorrelation is not serially correlated over consecutive years). In Panel C, we report the results from Fama-MacBeth regressions involving R-squared measures, idiosyncratic returns volatilities, equity premiums, and weekly autocorrelations at the firm-level. *t*-statistics in parentheses are reported below each coefficient, with the asterisks ***, **, and * denoting significance at the 1%, 5%, and 10% significance levels, respectively.

Panel A: Extrapolated tickers

	Correlation	R-squared	IVOL	Equity Premium	Equity Premium	Autocorrelation
ΔTickers	-0.0127**	-0.0309***	0.0015***			0.0131***
	(-2.28)	(-3.41)	(2.90)			(3.37)
Lag ΔTickers				-0.0693***		
				(-2.96)		
ΔVolume	0.0068*	-0.0143**	0.0028***	0.3683***	0.3292***	-0.0068***
	(1.85)	(-2.39)	(8.09)	(25.91)	(23.58)	(-2.64)
Spread	-1.5098***	-1.6664***	0.1441***	-1.0478***	-1.1140***	0.0814**
	(-27.30)	(-18.57)	(38.26)	(-5.75)	(-5.97)	(2.17)
Return	-0.0439***	-0.0130	-0.0066***			-0.0020
	(-6.15)	(-1.12)	(-10.61)			(-0.42)
IVOL						-0.0751
						(-0.43)
Volatility	15.7436***	22.3726***				
	(46.16)	(40.41)				
Lag Equity Premium				0.0989***	0.0414*	
				(4.57)	(1.94)	
Lag Correlation				0.6481***		
				(9.62)		
Lag Fitted Correlation					6.0488***	
					(3.18)	
Time Trend	-0.0012***	-0.0019***	0.0001***	0.0003	0.0066***	-0.0002***
	(-17.38)	(-16.08)	(7.50)	(1.01)	(2.82)	(-4.77)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,916	1,916	1,916	1,875	1,875	1,916
R-squared	0.6618	0.6194	0.4993	0.3204	0.2860	0.0356

Panel B: Change in variables

	ΔCorrelation	ΔIVOL	ΔState Equity Premium	ΔState Equity Premium
ΔTickers	-0.0095**	0.0011**		
	(-2.32)	(2.39)		
Lag ΔTickers			-0.3423***	
			(-7.27)	
ΔVolume	0.0177***	0.0027***	0.3780***	0.3074***
	(3.65)	(9.89)	(11.45)	(9.20)
ΔSpread	-1.1432***	0.1411***	1.6497***	1.2853***
	(-7.11)	(18.87)	(4.04)	(3.12)
ΔReturn	-0.0701***	-0.0028***		
	(-13.89)	(-6.71)		
ΔIVOL	-2.8184***			
	(-3.19)			
ΔVolatility	17.8690***			
	(26.37)			
Lag ΔCorrelation			1.1687***	
			(13.99)	
Lag Fitted ΔCorrelation				31.5382***
				(5.68)
State Fixed Effects	Yes	Yes	Yes	Yes
Observations	1,297	1,297	1,294	1,310
R-squared	0.7547	0.4638	0.2566	0.1592

Panel C: Fama-MacBeth regressions

	R-squared	IVOL	Equity Premium	Equity Premium	Autocorrelation
ΔTickers	-0.0309***	0.0013**			0.0106**
	(-3.32)	(2.45)			(2.05)
Lag ΔTickers			-0.1670***		
			(-4.28)		
ΔVolume	0.0034	0.0013***	0.1552***	0.1442***	-0.0290***
	(1.20)	(4.62)	(11.05)	(7.23)	(-3.66)
Spread	-0.4895	0.5090***	-2.2847*	-2.5337***	0.1160
	(-1.20)	(8.51)	(-1.94)	(-3.46)	(0.34)
Return	-0.0671***	-0.0001			0.0279
	(-8.28)	(-0.08)			(1.23)
IVOL					-0.4110
					(-0.46)
Volatility	13.6161***	0.5624***			
	(12.68)	(10.71)			
Lag Equity Premium			0.0970***	0.0649***	
			(4.02)	(2.68)	
Lag R-squared			-0.0932		
			(-0.49)		
Lag Fitted R-squared				4.9250***	
				(3.92)	
Observations	37,362	37,365	38,139	38,146	37,362
R-squared	0.1834	0.6805	0.1545	0.1528	0.0080