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THE IMPACT OF VIX RISK APPETITE INDEX ON THE DYNAMICS OF TIME-VARYING MARKET EFFICIENCY IN BORSA ISTANBUL

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Mehmet Kuzu
Bayburt University, Vocational School of Social Sciences, Finance, Banking and Insurance Department, Bayburt, Turkiye.
mehmetkuzu86@gmail.com , ORCID:0000-0001-5354-4368

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ABSTRACT

Purpose – The purpose of this research is to investigate the time-varying efficient market structure of the Borsa Istanbul (BIST-100) index at a daily frequency from 1988 to 2024, as well as to examine the impact that the risk appetite index (VIX) has on this structure.
Methodology – A vector autoregression (VAR) model and a time-varying variance ratio test are used in this research project to evaluate the effectiveness of the market and its time-varying dynamic development.
Findings – According to the findings, market efficiency changes over time due to domestic and global political issues. This suggests that market efficiency is not static but rather dynamic. The market had a low level of efficiency between the years 1988 and 1995, then moved to a semi-efficient form between 1995 and 2002, and then reached a strong form between 2002 and 2010, despite undergoing fluctuations. Worldwide crises caused these fluctuations. For the period spanning from 2010 to 2020, the most significant degree of efficiency and the most efficient flow of information is shown. On the other hand, following 2020, market efficiency exhibited a complicated pattern, alternating between semi-efficient and strong forms.
Conclusion – Risk appetite shocks favorably impact short-term market efficiency but adversely impact market efficiency over the long term. In this context, information asymmetry and irrational investment conduct seem to contribute to a gradual decline in market efficiency. The research contributes to the existing form of knowledge by providing a methodological framework that can be used to analyze the development of dynamic market efficiency. Furthermore, the results shed light on the need for policymakers to pursue structural changes based on behavioral finance to maintain market efficiency.

Keywords: Efficient Market Hypothesis, Time-Varying Variance Ratio, Risk Appetite, Borsa Istanbul, Market Shocks.
JEL Codes: F37, G02, G32

1. INTRODUCTION

Two essential societal paradigms, based on the ideals of freedom and equality, have significantly influenced the development of the modern political economy. In Western nations founded on liberty, a fundamental behavioral human archetype has been required to shape economic theories and institutions. Consequently, the rational individual, expected to make logical economic choices influenced by the Aristotelian rationalism of Ancient Greece, was chosen as the archetype.

Hypotheses concerning economic and financial markets (money and capital) were created based on the assumption of rational human conduct. The optimal market structure is considered a totally competitive marketplace, which is presumed to minimize costs and optimize returns by allowing unrestricted entry and exit from the market (Markowitz, 1952; Sharpe, 1964; Lintner, 1965; Mossin, 1966). However, observing inconsistencies in establishing perfect competitive conditions in economic and financial markets throughout the 1950s resulted in the birth of finance as a separate discipline from economics (Mossin, 1966). Moreover, observations and theoretical models of financial markets have relied on an investor profile presumed to make rational judgments (Fama, 1965). In this context, modern portfolio theory, the capital asset pricing model, and the efficient markets hypothesis were respectively developed under the assumption of rational decision-making by financial actors and perfectly competitive market conditions (Markowitz, 1952; Sharpe, 1964; Lintner, 1965; Mossin, 1966).

According to the Efficient Market Hypothesis (EMH), financial markets are structured to quickly and completely include all available information into pricing, therefore reducing the probability of investors obtaining anomalous returns (Fama, 1965). Fama classified the hypothesis in his first study by looking at financial market efficiency in three basic types: weak, semi-strong, and strong (Fama, 1970). This theory holds that stock prices follow a random walk, hence making future prices impossible to forecast only from past data (Samuelson, 1965).

Figure 1. Efficient Market Types

Source. Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. Journal of Finance, 25(2), 383-417.

Nevertheless, the validity of this concept has been a subject of extensive discourse within the academic literature on finance for the last five decades. The extant literature has progressively incorporated critiques of the Efficient Market Hypothesis (EMH), claiming its occasional invalidity and the potential for market structure to evolve over time. Grossman and Stiglitz (1980) contended that a perfectly efficient market structure is unfeasible. They asserted that one of the core assumptions of perfect competition, specifically that the costs of acquiring financial information are negligible, is invalid. Shiller (1981) asserted that the significant volatility in market prices cannot be ascribed to dividend policy and payments that may change.

Several studies in the literature have suggested that market efficiency may vary over time, resulting in the emergence of anomalies at specific periods. Lo and MacKinlay (1988) provided empirical evidence demonstrating that stock prices do not adhere to a completely random walk. Basu (1977) posited that firms with low price/earnings ratios outperform the market as a whole, underscoring the notion that distinct stocks may exert disparate impacts on developing an efficient market structure. Moreover, he proposed that the efficient market structure may undergo dynamic alterations over time.

This paper analyzes the dynamic time-varying efficient market structure of the BIST-100 index on Borsa Istanbul from 1988 to 2024. The objective is to examine the impact of risk appetite on the variation in market efficiency, utilizing fundamental methodologies from existing research. This method has examined the evolution of the efficient market structure over time and its impact on investor behavior. The study has used the time-varying variance ratio test to identify the time-varying efficient market framework. The impact of risk appetite on the efficient market structure is examined using impulse-response functions developed from the VAR (Vector Auto Regressive) technique. Risk appetite phenomena are used to test the time-varying Efficient Market Hypothesis, which is driven by its assumptions and goals. The efficient market hypothesis says that financial markets should concentrate on average returns rather than remarkable profits to be predictable.

The precise evaluation of average returns relies on optimal risk assessment. Considering the prevailing trends in financial markets, characterized by diminished trading hours and substantial surges in trade volume, analyzing the time-varying Efficient Market Hypothesis in conjunction with varying risk appetite is likely to enrich the current literature, both theoretically and practically substantially.

2. LITERATURE REVIEW

The Efficient Market Hypothesis (EMH) holds that market prices fairly reflect all the readily available information. Investors cannot so routinely generate returns above average without incurring more risk. Initially proposed by Fama (1965), this hypothesis has evolved into a fundamental theoretical framework in financial economics and has been extensively examined

by academics covering the spectrum of market conditions. In his 1991 paper, Malkiel underlined the need for behavioral finance as a field of anomalies and objections related to effective markets. According to him, market abnormalities originate from cognitive distortions and herd mentality. According to his argument, one might be unable to assume the Efficient Market Hypothesis is legitimate. Theoretically, the Efficient Market Hypothesis has been categorized into weak, semi-strong, and strong variants, so many studies have been done in the corpus of current knowledge. Beechey, Gruen, and Vickery (2000), who underline that the theory relies on logical behavior and the quick circulation of financial information, capture this category. Conversely, the Efficient Market Hypothesis could potentially link to various facets of diverse financial markets. When Pesaran (2005) investigated the Efficient Market Hypothesis in commodities markets, he discovered events wherein actual data deviated from theoretical forecasts. Geopolitical factors explained the differences. Lo (2005), on the other hand, contended that the Efficient Market Hypothesis fits behavioral finance ideas. Later, Lo (2007) presented a more dynamic substitute for the Efficient Market Hypothesis: The Behavioral Market Hypothesis (BMH). Lo achieved these results by incorporating behavioral finance and employing advanced econometric models to scrutinize market anomalies, thereby easing the rigorous assumptions of the Efficient Market Hypothesis. According to research done by Pesaran in 2010, macroeconomic shocks have an effect on how predictable the market is. This conclusion is in line with the ideas behind the efficient market hypothesis (EMH). Sensoy (2013) researched efficiency dynamics in Middle Eastern and North African domestic markets for six years. The research concentrated on identifying the time-varying degrees of efficiency in various marketplaces. In their 2012 study of the effectiveness of derivatives markets, Sheikh and Noreen say that regulatory frameworks and market dynamics affect market efficiency. Sensoy et al. (2015) also offer a new way to measure market efficiency that is based on how inefficient the European Union (EU) stock markets change over time. Ensoy et al. (2015), on the other hand, show interesting results from a permutation entropy study of how predictability changes in Islamic and traditional capital markets. Although they underline the existence of delays in integrating new information into pricing, Vashishtha and Hooda (2015) claim that Indian stock markets show semi-efficiency. Alexandra Gabriela (2015) claims that achieving strong-form efficiency in markets marked by high volatility is somewhat difficult. Time series modeling, regression analysis, and event investigations are the main tools of EMH research. These are the most commonly applied techniques. Furthermore, the field of research on the Efficient Market Hypothesis has grown to include asset types other than equity-based ones like bonds, derivatives, and commodities. This research indicates that the specific market structure under consideration might affect the degree of market efficiency. Well-known markets like the United States and Europe often exhibit modest to poor efficiency trends. On the other hand, structural limitations, poor rules, market mix, investor behavior, and outside pressure characterize developing markets. Each of these components contributes to producing a weak-form efficiency situation. The Efficient Market Hypothesis (EMH) is still a fundamental idea for understanding market dynamics despite considerable literature criticism. The increasing evidence of market anomalies and departures from market efficiency underlines the need for a more thorough investigation of these occurrences. In the future, researchers should look into how market structure affects investor behavior, make methods better, and use ideas from behavioral finance to test the Efficient Market Hypothesis (EMH), which would add to their current approach. This work studies efficient market structure in a dynamic rather than a static form.

Still a fundamental concept in financial economics, the Efficient Market Hypothesis (EMH) is under continual research via empirical analysis. New studies released after 2020 have contributed to the debate by looking at market efficiency in different contexts, including the role of behavioral finance, the impact of global crises, and the limitations of standard efficiency models, all inside the framework of this literature review that summarizes the findings of current studies to help to grasp the evolution of market efficiency in the modern financial environment. Emphasizing that market efficiency is not fixed but dynamic, Gu (2023) probes the dynamic relationship between EMH and behavioral finance. This study introduces the Adaptive Market Hypothesis (AMH) to align evolving investor behavior with traditional EMH. Furthermore, Woo et al. (2020) look into strange things that happen in the stock market and discover that different types of assets have different levels of efficiency, which limits how widely EMH can be used.

Li et al. (2021), specifically in reaction to financial shocks, investigate how market efficiency varies with economic circumstances. Their results imply that markets show brief inefficiencies during unstable times before returning to equilibrium.. Gu (2023) notes disparities in pricing adjustments as the study looks at market responses to events connected to pandemics.

Developed markets showed a faster return to efficiency than emerging markets, which show ongoing volatility. Chen et al. (2021) conducted a similar study in which they found that information dissemination was crucial in restoring efficiency; markets changed as investors were more transparent about economic consequences. By analyzing how the pandemic long-term influenced financial markets, Wang et al. (2022) extend this research. Their studies verify that investor attitudes and outside uncertainty influence dynamically shifting efficiency. These results confirm that market efficiency is context-dependent rather than absolute. Zhang and Li (2022) highlight the methodological hurdles in EMH research, noting variations in econometric models and data selection. Their investigations use better theoretical knowledge of behavioral finance to provide a better sampling of actual market behavior. Liu et al. (2023) also investigate how algorithmic trading affects market efficiency, contending that while high-frequency trading could improve price discovery, it might also lead to transient

inefficiencies. Recent studies reveal that EMH offers a basic framework but does not thoroughly understand the dynamics of the financial markets. Psychological factors, outside shocks, and technical developments affect the various degrees of market efficiency. The forthcoming research should emphasize enhancing EMH models to integrate algorithmic and behavioral trading points of view.

3. PURPOSE, IMPORTANCE AND METHOD OF THE RESEARCH

This research seeks to assess the impact of risk appetite on establishing a time-varying efficient market structure in Borsa Istanbul from 1988 to 2024. The study will be conducted in two stages. In the first phase of the inquiry, the time-varying efficient market structure will be identified daily during the specified observation period. This will be accomplished by categorizing it as strongly efficient, semi-efficient, or weakly efficient.

In the subsequent phase, the impact of the VIX risk appetite index on the efficient market structure will be quantified. The study's most significant outcome is assessing the dynamic, time-dependent, efficient market structure. Analyses of efficient market structures in financial markets are generally performed statically over a defined observation period. This research dynamically employs the "variance ratio" test using a "rolling window" technique to assess the efficient market structure. An "impulse-response" research is used to assess the impact of risk appetite on forming an effective market structure. An analytical examination of the used research methodologies is vital in this context.

The time-varying variance ratio test assesses time-varying market efficiency, with the variance ratio adjusted through a temporally determined sliding window. The rationale behind the sliding windows equations is founded on the identical methodological framework employed in the time-varying Granger causality test and the identification of time-varying price bubbles utilizing right-sided equations (Shi et al., 2020). Formula One signifies a time-dependent variance ratio (Andrew & MacKinlay, 1988; Charles & Darne, 2009).

$$R(k) = k \cdot \frac{\text{Var}(X_t - X_{t-1})}{\text{Var}(X_t - X_{t-k})} \quad (1)$$

Xt: Logarithmic price or return at time t.
k: Delay length (default k=2)
Var: Variance of the relevant differences.

The Z-Statistic is used to determine whether VR is significantly different from 1:

$$Z = \frac{VR(k) - 1}{\sqrt{\text{Var}\left(VR(k)\right)}} \quad (2)$$

Here:

$$Var\left(VR(k)\right) = \frac{2(2k-1)(k-1)}{3kN} \quad (3)$$

N: The number of observations within the window.

According to the equations obtained, it is essential whether the VR variable is less than 1 to determine whether the market structure is effective in the relevant observation:

Weak Efficiency (Random Walking): | VR − 1| < ϵ, where ϵ is a small tolerance (e.g., ϵ = 0.05). (4)

Average Rotation (Semi-Effective): VR < 1 (5)

Trend Formation (Strong Active): VR > 1 (6)

The model measuring the time-varying efficient market structure proposed by Andrew and MacKinlay (1988) will be used (See Equation 7).

$$VR = \frac{\sigma_q^2}{\sigma_1^2 \cdot q} \quad (7)$$

The formula assesses the efficient market structure at a given time. Utilizing the formula, we can provide a more detailed explanation.

$1. \sigma q2 \sigma_q^2 \sigma q2: Multi\ yields\ variance$

$$\sigma_q^2 = \text{Var}\left(\sum_{i=0}^{q-1} r_{t+i}\right)$$

$q - calculated\ by\ q\ period$

$2.\sigma_1^2: Single\ Period\ variance$:

$\sigma_1^2 = \text{Var}(r_t)$

$daily\ yields\ varaiance.$

$3.q: Combined\ time\ interval$:

$q = 5\ days.$

$4.Varianci\ Ratio\ Test$

$$VR = \frac{\sigma_q^2}{\sigma_1^2 \cdot q}$$

This formula tests whether the variance scales directly proportionally with time over q periods.5. Random Walk Hypotesis:

Assuming that markets align with the random walk hypothesis, the VR value is predicted to approximate 1.

$$VR \approx 1$$

The analysis of risk appetite shocks on the efficient market structure will occur in the second part of the study, using impulse-response functions derived from VAR equations as the secondary method (Sims, 1980; Hamilton, 1994).

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_p Y_{t-p} + \epsilon_t \; n \quad (8)$$

Y_t: Dependent variable at time t,
$A_1, A_2, \ldots, A_p$: Coefficients of the model,
$Y_{t-1}, Y_{t-2}, \ldots, Y_{t-p}$: Values of the dependent variable in past periods,
ϵ_t: Error term (random error).

$$\text{IRF(h)} = \frac{\partial Y_{t+h}}{\partial \epsilon_t} \quad (9)$$

IRF(h): Impulse-Response Function for h period,
∂Y_{t+h}: derivative of the variable at time t + h,
$\partial \epsilon_t$: derivative of the shock at time t.

4. DATASET

Data comes from two factors in the research. The time-varying efficient market structure is assessed using Borsa Istanbul's BIST. The research employs two distinct variables that compose the data set. The daily time series of the BIST-100 index closing prices for Borsa Istanbul from 03/01/1988 to 15/11/2024 is used to assess the time-varying efficient market structure. The VIX risk appetite-fear and volatility index is used daily from March 1, 1990, to November 15, 2024, to assess the structural effects of risk appetite on the time-varying efficient market framework. From 1988 to 1990, an impulse-response study was conducted on January 3, 1990, with no VIX index.

Bist-100 index closing prices from 03/01/1988 to 15/11/2024. From March 1, 1990, to November 15, 2024, the VIX risk appetite-fear and volatility index is used daily to assess risk appetite's structural effects on the time-varying efficient market framework. Without a VIX index from 1988 to 1990, an impulse-response study was performed on 03.01.1990.

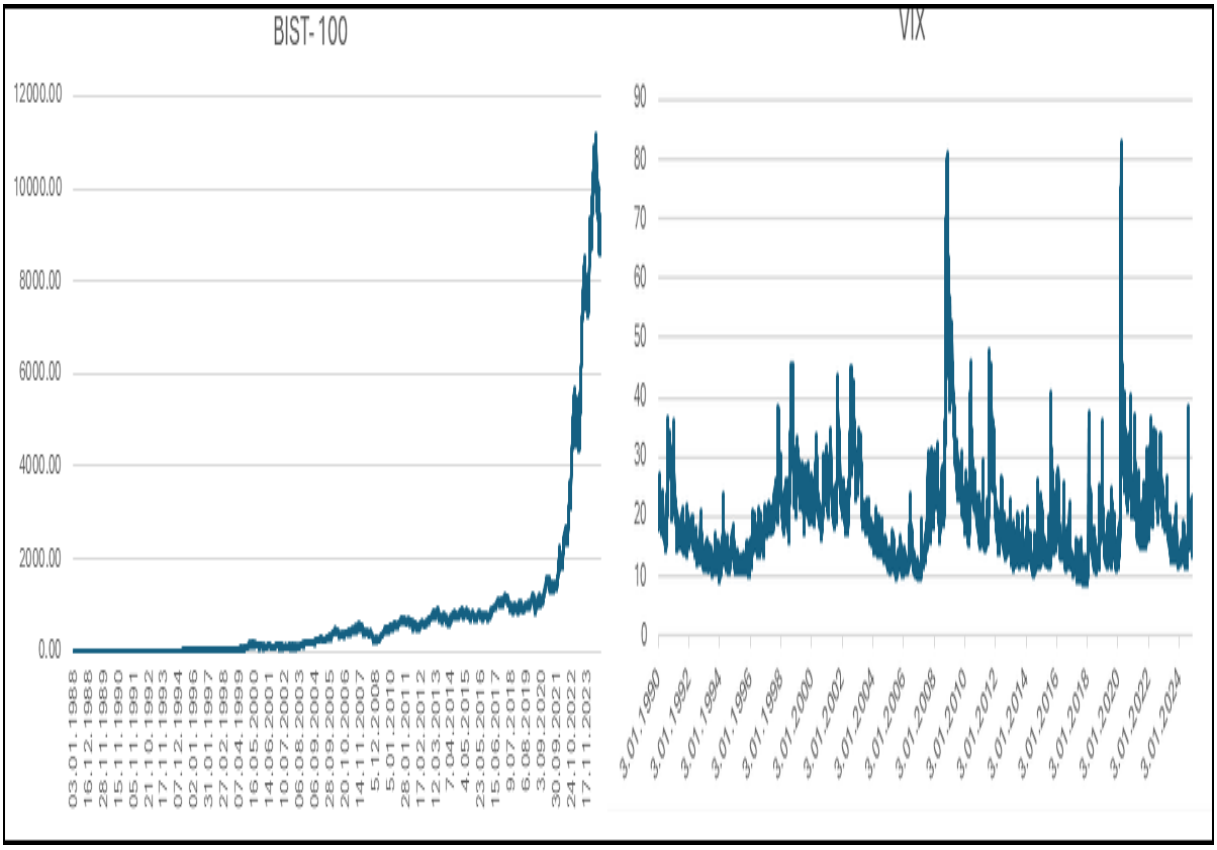
Bist-100 exhibits high variability and extreme non-normality due to significant skewness and kurtosis, likely influenced by outliers or dramatic market shifts: Rolling Variance Ratio, the most stable variable with minimal skewness and kurtosis closer to normal.VIX shows signs of extreme market volatility, reflected in its high skewness and kurtosis (See Table 1).

Table 1: Data Set and Descriptive Statistics

VARIABLES	BIST_100	VIX	ROLLING VARIANCE RATIO
FREQUENCY	Daily	Daily	Daily
PERIOD	03.01.1988-15.11.2024	3.01.1990-15.11.2024	03.01.1988-15.11.2024
SOURCE	investing.com	investing.com	Calculated by the Author
MEAN	9451954.00	1951505.00	2012107.00
MEDİAN	4319000.00	1769000.00	2030000.00
MAXİMUM	11172.75	8269000.00	3400000.00
MİNİMUM	0.23	9140000.00	0.24

STD. DEV.	1888179.00	7873927.00	0.48
SKEWNESS	3560529.00	2206062.00	-0.16
KURTOSİS	1558735.00	1168591.00	2755660.00
JARQUE-BERA	70283.38	31894.35	5395034.00
PROBABİLİTY	0.00	0.00	0.00
SUM	7623001	16227.64	157388.9

Figure 2: Variables

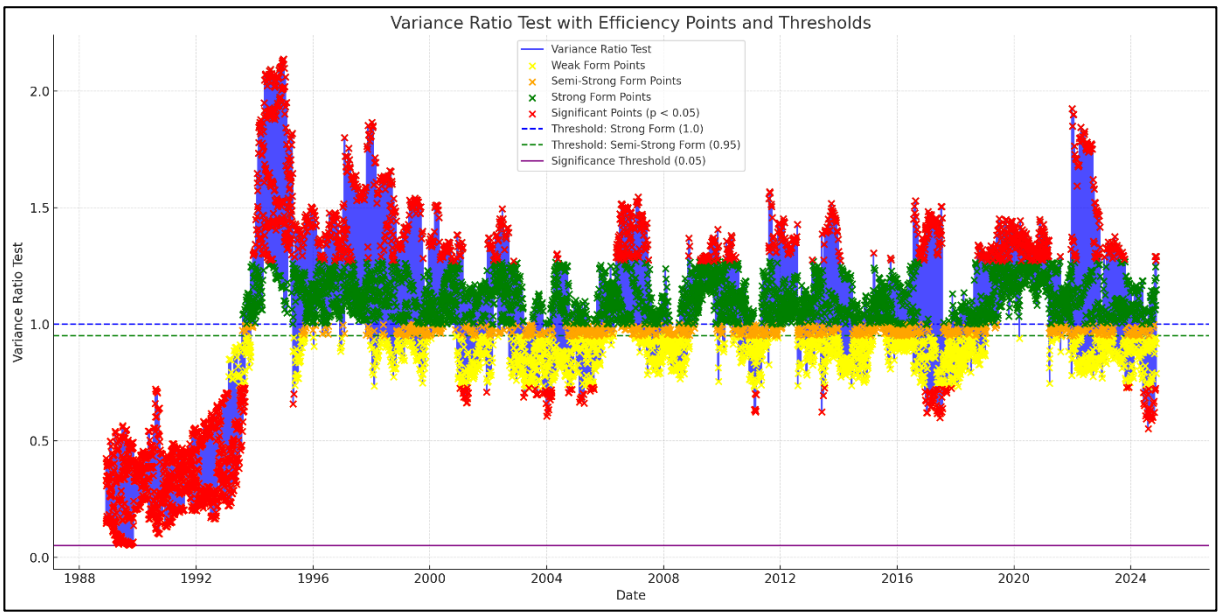


Source: investing.com database

5. FINDINGS OF THE RESEARCH

The established methodological framework utilizes the variance ratio test to evaluate the time-varying efficiency of the market structure. Additionally, the Z-statistic indicates the periods during which the variance ratio test is statistically significant. The computations were executed in Excel, and the results were transposed to a graph. This graph depicts the periods during which Borsa Istanbul showed weak, semi-strong, and strong efficiency. The cutoff or threshold value for the variance test is 1. Values exceeding 1 signify market efficiency; values ranging from 0.95 to 1 denote a semi-efficient form, while values below 1 represent a weak form. The significance level for the probability value is 0.05 (See Figure 3).

Figure 3: Time-Varying Effective Market Structure Analysis Heat Map Results



The efficiency form and significance findings should be analyzed about the relevant periods. The interval from 1995 to 1998 is typically marked by diminished market efficiency. Nonetheless, the outcomes are generally statistically significant at the 0.05 threshold. The results from this era suggest that historical prices inadequately represent market prices, potentially enabling investors to achieve excessive returns via fundamental and technical analysis.

From 1995 to 2002, Borsa Istanbul underwent a notable transformation in market efficiency, progressing from a weak to a semi-efficient state. The significance of the findings increased concurrently. The previous result indicates that publicly available information has begun to be incorporated into prices. Nevertheless, it implies that information-acquisition methods could produce significant benefits, encompassing basic research, technical analysis, and insider trading.

Between 2002 and 2010, although there was a broad transition to the strong form, the market had a variable structure, intermittently oscillating between the semi-efficient and weak forms. It can be argued that the 2008 global financial crisis precipitated this unpredictable structure. Moreover, the results are mostly significant. On the other hand, throughout this time span it become more difficult to get excess returns.

Over the decade from 2010 to 2020, the market showed a statistically significant movement towards the triple efficient model. Diminished market efficiency from the Federal Reserve's gradual cut of its bond-buying program in 2013 and growing financial instability in emerging market nations complicated the creation of excess anomalous returns.

From 2020 until the present, Borsa Istanbul's market efficiency has shown a several-sided structure. During this period, frequent shifts among strong, semi-strong, and weak forms of efficiency have been noted, with the semi-strong type being the most dominant. The importance levels have been less pronounced compared to other periods. These observations yield the subsequent conclusions as follows:

From 1988 to 1995, the era was marked by inefficiency in form and an unstable market structure.

A semi-efficient form marked the interval from 1995 to 2002, resulting in the attainment of market equilibrium.

The interval from 2002 to 2010 was the emergence of strong-form efficiency and a partially chaotic market structure.

The decade from 2010 to 2020 was defined by the subsequent characteristics: The era marked by the highest prevalence of information efficiency was defined by strong form efficiency.

The timeframe from 2020 until the present is a unique era. The structure is intricate, demonstrating shifts between semi-efficient and strong-form efficiency.

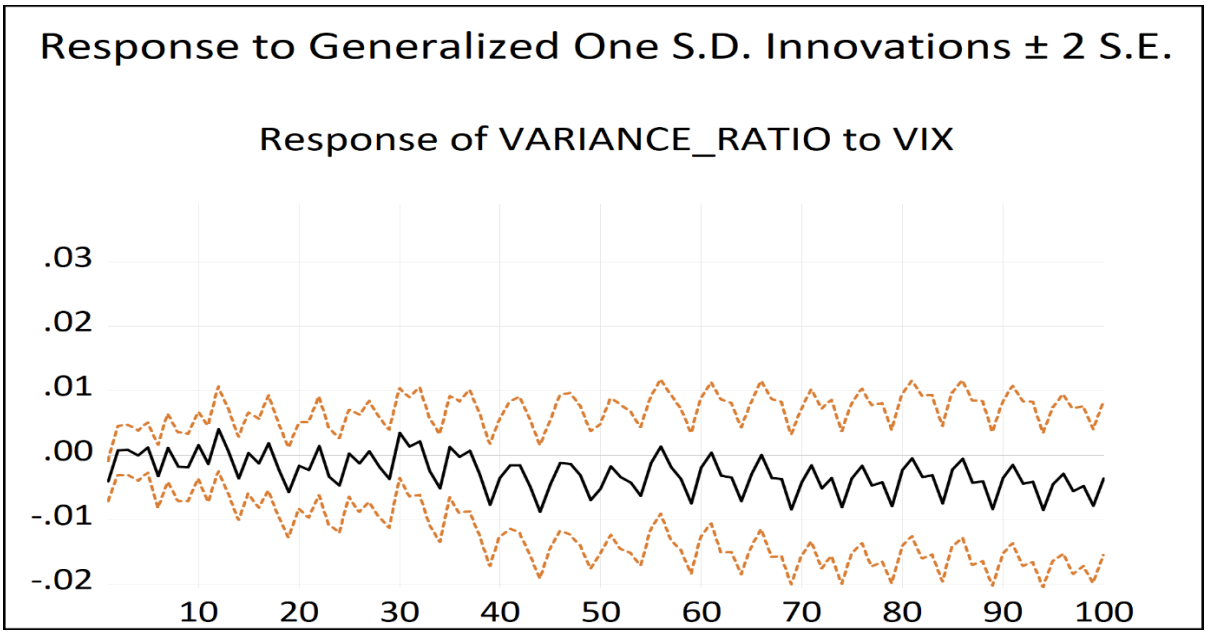
This section analyzes the structural impacts of risk appetite on establishing an efficient market structure. A vector autoregression (VAR) model was developed to analyze the relationship between the time-varying variance ratio test and the Chicago Board Options Exchange (CBOE) Volatility Index (VIX) from 1990 to 2024. The model structure was examined up to the 55th lag to fulfill the assumptions associated with the VAR model. The analysis using Eviews 12 reveals that the model remains stable at lag 50, exhibiting no autocorrelation or variance problems (See Table 2). Considering that the dataset

comprises daily observations, the lag length is justifiable, with lag 55 equating to roughly lag two at the monthly frequency. Given the existing theoretical framework, it is prudent to dismiss the premise of normality. Lütkepohl (2005) asserts that the assumption of normality in VAR models is not essential for the efficiency of estimators and the precision of confidence intervals, provided that the model parameters are consistently estimated using the least squares approach. Departures from the normality of error terms generally exert a negligible impact on the outcomes of the impulse-response analysis. According to Stock and Watson (2001), for high sample sizes, the accuracy of parameter estimations and derivative analyses (e.g., impulse-response functions) is preserved even in the absence of the normalcy requirement for error terms impulse-response functions) is preserved even in the absence of the normalcy requirement for error terms.

Table 2: İmpluse-Response Test Results

TEST	VALUE	RESULT
AR Test	0,99-0,79	Model is stabil
Oto-Correlation	0,2683	No oto-correlation at 0,05
Heteroscedasticity	0,2277	No Heteroscedasticity at 0,05

Figure 4: Impulse- Response Resutulr (VIX Shocks for Variance Rate)



The findings of the impulse-response study demonstrate that the market efficiency structure's positive reactions to risk appetite shocks persistently oscillate between days 2 and 66. In contrast, the reactions persist in declining after day 66. The days demonstrating affirmative reactions are days 2, 3, 5, 7, 10, 12, 13, 15, 17, 22, 25, 27, 30, 31, 32, 35, 37, 56, 61, and 66. The findings suggest that the risk pricing by investors in Borsa Istanbul is not rational nor consistent, exhibiting knowledge asymmetry. This illogical pricing disrupts the efficient market framework and aligns the stock market more closely with a weakly efficient model. This outcome typically corresponds with the results of efficient market analysis for other emerging market economies.

6. CONCLUSION AND IMPLICATIONS

This research analyzes the dynamic, efficient market framework of the Borsa Istanbul (BIST-100) index from 1988 to 2024. Furthermore, it examines the impact of structural shocks on market efficiency, as represented by the risk appetite index (VIX). This study utilizes the time-varying variance ratio test and impulse-response functions developed from the vector autoregression (VAR) model.

The study's findings indicate the existence of varied weak, semi-strong, and strong-form efficient market systems in Borsa Istanbul over different times. Between 1988 and 1995, the weak form of market efficiency increased the probability of investors obtaining excess profits by exploiting past price variations. Following 1980, economic liberalization initiatives began, driven by the ascendance of right-wing ideology, a novel public administration approach, and the advent of supply-side economics, resulting in the deregulation of financial markets.

With the 1994 economic crisis, the depreciation of the Turkish lira, rising inflation, and limited access to financial information, the market remained superficial and volatile due to weak regulation, lack of strict financial laws, and diminished investor confidence.

The 1994 economic crisis, the declining value of the Turkish lira, rising inflation, and limited access to financial information all made the market shallow and unstable because of weak regulation, a lack of strict financial laws, and a lack of trust from investors. Borsa Istanbul changed from an inefficient market to a semi-efficient market between 1995 and 2002. This was due to more publicly available information being used to set index prices. The 1999 Marmara Earthquake and the 2001 Turkish Banking Crisis caused the efficient market system to be unstable at times during this time.

From 2002 to 2007, the capital finance account, bolstered by strong economic development and increased short-term portfolio inflows, was essential in the market's evolution towards a resilient state. From 2002 to 2010, although the market approached a robust form, the systematic and systemic risks stemming from global financial changes led the stock market to revert to a semi-efficient and weak form structure at some intervals. The crisis led to the formation of a volatile structure. The economic reforms implemented under Türkiye's relative political stability enhanced market efficiency; external shocks, such as the 2008 Global Financial Crisis, adversely impacted the market's efficiency framework. The period from 2010 to 2020 was characterized by the following attributes: The period characterized by the greatest prevalence of information efficiency was defined by significant form efficiency. The period from 2020 until the present is a distinctive term. The structure is complex, illustrating transitions between semi-strong and strong-form efficiency.

REFERENCES

Andrew, W. R., & MacKinlay, A. C. (1988). Variance ratio test of random walk hypothesis. Econometrica, 56(6), 1251–1273.

Beechey, M., Gruen, D., & Vickery, J. (2000). The efficient market hypothesis: A survey (RBA Research Discussion Paper No. 2000-01). Reserve Bank of Australia.

Charles, A., & Darné, O. (2009). Variance ratio tests of random walk: An overview. Journal of Economic Surveys, 23(3), 503–527.

Chen, H., Zhang, Y., & Lin, J. (2021). The role of information dissemination in market efficiency during economic crises. Journal of Financial Studies, 45(3), 112–130. https://doi.org/10.1016/j.jfs.2021.09.008

Fama, E. F. (1965). The behavior of stock market prices. Journal of Business, 38(1), 34–105.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. Journal of Finance, 25(2), 383–417.

Grossman, S. J., & Stiglitz, J. E. (1980). On the impossibility of informationally efficient markets. American Economic Review, 70(3), 393–408.

Gu, G. (2023). The Dynamic Interplay of Market Forces and Human Psychology in the Efficient Market Hypothesis. Advances in Economics, Management and Political Sciences, 31, 1498. https://doi.org/10.54254/2754-1169/31/20231498

Gu, Y. (2023). Efficient market hypothesis during COVID-19 Pandemic: an analysis of market reactions. Advances in Economics, Management and Political Sciences, 26, 588. https://doi.org/10.54254/2754-1169/26/20230588

Hamilton, J. D. (1994*). Time series analysis*. Princeton University Press.

Investing.com. (2024, November 15).https://tr.investing.com/

Jensen, M. C. (1978). Some anomalous evidence regarding market efficiency. Journal of Financial Economics, 6(2–3), 95–101.

Li, Z., Li, R., & Xiao, B. (2021). A Literature Review on the Evidence and Limitations of the Adaptive Market Hypothesis. Proceedings of the 2021 3rd International Conference on Economics and Management Science, 468. https://doi.org/10.2991/assehr.k.211209.468

Liu, C., Sun, H., & Zhou, X. (2023). Algorithmic trading and market efficiency: a double-edged sword? Quantitative Finance Journal, 20(1), 33–51. https://doi.org/10.1080/qfj.2023.0071

Lo, A. W. (2007). Efficient market hypothesis. In L. Blume & S. Durlauf (Eds.), The New Palgrave: A Dictionary of Economics (2nd ed.). Palgrave Macmillan.

Lo, A. W., & MacKinlay, C. (1988). Stock market prices do not follow random walks: Evidence from a simple specification test. Review of Financial Studies, 1(1), 41–66.

Lütkepohl, H. (2005). *New introduction to multiple time series analysis*. Springer

Malkiel, B. G. (1991). The efficient market hypothesis and behavioral finance. Journal of Economic Perspectives, 17(1), 59–82.

Malkiel, B. G. (2003). The efficient market hypothesis and its critics. Journal of Economic Perspectives, 17(1), 59–82.

Markowitz, H. (1952). Portfolio selection. The Journal of Finance, 7(1), 77–91. https://doi.org/10.2307/2975974

Mossin, J. (1966). Equilibrium in a capital asset market. Econometrica, 34(4), 768–783.

Pesaran, M. H. (2010). Predictability of asset returns. The Review of Financial Studies, 23(1), 33–56.

Samuelson, P. A. (1965). Proof that correctly anticipated prices fluctuate randomly. Industrial Management Review, 6(2), 41–49.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. The Journal of Finance, 19(3), 425–442.

Sheikh, M. J., & Noreen, U. (2012). The validity of the efficient market hypothesis: Evidence from derivative markets. Journal of Business and Financial Affairs, 1(2), 45–60.

Shiller, R. J. (1981). Do stock prices move too much to be justified by subsequent changes in dividends? American Economic Review, 71(3), 421–436.

Sims, C. A. (1980). Macroeconomics and reality. Econometrica, 48(1), 1–48.

Stock, J. H., & Watson, M. W. (2001). Vector autoregressions. Journal of Economic Perspectives, 15(4), 101–115. https://doi.org/10.1257/jep.15.4.101

Wang, T., Yu, S., & He, F. (2022). Long-Term Effects of COVID-19 on Market Efficiency: A Sectoral Analysis. Economic Analysis Review, 57(2), 89-104. https://doi.org/10.1080/ear.2022.0034

Woo, K.-Y., Mai, C., McAleer, M., & Wong, W.-K. (2020). Review on efficiency and anomalies in stock markets. Economies, 8(1), 1–51. https://doi.org/10.3390/economies8010001

Ying, Q., Yousaf, T., & Ain, Q. (2019). An empirical study on the efficiency of bond markets under regulatory changes. Journal of Financial Regulation and Compliance, 27(3), 304–318.

Zhang, Q., & Li, D. (2022). Methodological challenges in market efficiency research: a critical review. Finance and Economics Review, 39(4), 65–82. https://doi.org/10.1016/fer.2022.08.005