Uluslararası İktisadi ve İdari İncelemeler Dergisi
International Journal of Economic and Administrative Studies
https://dergipark.org.tr/tr/pub/ulikidince

UİİİD-IJEAS, 2024 (45) ISSN 1307-9832

THE EFFECT OF MACRO-ECONOMIC INDICATORS ON STOCK PRICES: HETEROGENEOUS PANEL DATA ANALYSIS

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Absract

This study investigates the effects of countries' main macroeconomic indicators on stock prices. Although many studies have been conducted on the effects of macroeconomic indicators on stock prices, the results of these studies do not overlap with each other. For this reason, a heterogeneous panel data model was created to determine the effect of the main macroeconomic indicators, which exchange rates, interest rates, inflation, and economic growth in 27 countries, on stock prices over the 22-year period between 2000 and 2021 and was analyzed with the help of the Extended Average Group Estimator (AMG). Although the results of the analysis differ in units, they show that economic growth has a positive and significant effect on stock prices across the entire panel. Other variables had no significant effect on the entire panel. The fact that the analysis results differ on the basis of all panels and units reveals the importance of country-specific factors.

Keywords: *Stock Prices, Macro Economic Indicators, Heterogeneous Panel Data Analysis*
JEL Classification: *G12, E44, C10*

MAKRO-EKONOMİK GÖSTERGELERİN HİSSE SENEDİ FİYATLARI ÜZERİNDEKİ ETKİSİ: HETEROJEN PANEL VERİ ANALİZİ

Öz

Bu çalışma, ülkelerin temel makroekonomik göstergelerinin hisse senedi fiyatları üzerindeki etkilerini incelemektedir. Makroekonomik göstergelerin hisse senedi fiyatları üzerindeki etkileri üzerine birçok çalışma yapılmış olmasına rağmen, bu çalışmaların sonuçları birbiriyle örtüşmemektedir. Bu nedenle, 27 ülkedeki temel makroekonomik göstergeler olan döviz kurları, faiz oranları, enflasyon ve ekonomik büyümenin, 2000-2021 yılları arasındaki 22 yıllık dönemde, hisse senedi fiyatları üzerindeki etkisini belirlemek amacıyla heterojen panel veri modeli oluşturulmuş ve Genişletilmiş Ortalama Grup Tahmincisi (AMG) yardımı ile analiz edilmiştir. Analiz sonuçları, birim bazında farklılık gösterse de, panelin tamamı ekonomik büyümenin hisse senedi fiyatları üzerinde pozitif ve anlamlı bir etkiye sahip olduğunu göstermektedir. Diğer değişkenlerin panelin tamamı üzerinde anlamlı bir etkisi yoktur. Analiz sonuçlarının tüm panel ve birimler bazında farklılık göstermesi ülkeye özgü faktörlerin önemini ortaya koymaktadır.

Anahtar Kelimeler: *Hisse Senedi Fiyatları, Makroekonomik Göstergeler, Heterojen Panel Veri Analizi*
JEL Sınıflandırması: *G12, E44, C10*

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Araştırma Makalesi

Makalenin Geliş Tarihi (Recieved Date): 20.07.2024
Yayına Kabul Tarihi (Acceptance Date): 06.09.2024

Kalaycıoğlu, Z. (2024). The Effect of Macro-Economic Indicators on Stock Prices: Heterogeneous Panel Data Analysis. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*, 45, 199-212. https://doi.org/10.18092/ulikidince.1518324

1. Introduction

Although each of the main macroeconomic indicators may appear to be different economic elements, they can be argued to represent parts of a whole. Many economic factors directly or indirectly interact with each other, such as interest rates, exchange rates, current account deficits, public expenditures, money supply, growth, and savings rates, housing and energy markets, oil and gold prices, and the industrial production index. This interaction will play an active role in stock prices and return expectations, while creating a network of expectations and forecasts regarding the direction of future macroeconomic conditions, along with current economic performance. As a matter of fact, the interaction between stock price movements and economic factors that may cause cyclical fluctuations in the general economy and the interaction between these factors and stock price movements, have been discussed many times in academic studies. The general view in these studies is that changes in the main macroeconomic indicators may directly or indirectly change the general economic conjuncture positively or negatively and that stock prices and returns will be indirectly affected by these changes.

The first indicator that comes to mind when we call the relationship between main macroeconomic indicators is the relationship between inflation, exchange rates and interest rates. Fisher (1930) stated that the expected nominal interest rate and expected inflation interact with each other in the same direction. According to this interaction expressed as “Fisher Hypothesis”, the expected long-term nominal interest rate consists of the sum of the real interest rate and the expected inflation rate. A one-unit increase in the inflation rate causes a one-unit increase in the nominal interest rate, while the real interest rate is constant. However, in periods of economic fluctuations, contrary to expectations, if inflation reaches very high rates, the need for liquidity will increase. While increasing liquidity needs cause an increase in loan demands, the increase in loan demands will cause a contraction in the loan supply. This prevents the real interest rate from remaining constant and may even cause it to fall to a negative value. The decrease in the real interest rate will pave the way for the loss of value of savers as a result of inflation. With the deterioration of liquidity supply-demand balances will also increase the nominal interest rate. This inflation and interest rate imbalance will also disrupt exchange rate stability. As a matter of fact, a cycle will occur between these three macroeconomic indicators. In this cycle, economic factors such as goods and capital movements, purchasing power, economic growth, investment and consumption expenditures, saving power, money supply policies, public expenditures, import-export balances and the power to access foreign finance will be directly or indirectly involved in this cycle. Therefore, the definition of inflation as the result of a persistent general price increase in goods and services, which reduces the purchasing power of money and increases costs because to an imbalance between supply and demand, represents the smallest share in this economic cycle.

The impact of this economic cycle created by the interaction between the main macroeconomic indicators and stock prices has been the subject of numerous economic and financial studies. Each price step begins with an IPO and then changes with supply-demand balances, providing access to a large pool of countries’ stock price indices by analyzing past price movements and making future predictions. These indices provide access to information about the price and return performance of stocks, show the market performance of stock prices according to certain criteria, and serve as indicators of the economic situation of countries. As a matter of fact, while changes in stock prices direct investors’ expectations regarding the financial performance of firms, the economic conditions of the countries affect the financial performance of firms and therefore stock prices. For this reason, the relationship between many factors that indicate countries' economic situations and stock price index price changes has been the subject of many academic studies. However, although it is foreseen that there is a general relationship between price changes in the stock price index and the main macroeconomic indicators, no consensus exists on the existence and direction of these relationships. Studies on the relationship between stock price index price changes and main macroeconomic indicators are ongoing.

The primary purpose of this study is to examine how macroeconomic indicators influence stock prices. For this purpose, the general views in the literature on the effects of the main macroeconomic indicators, such as inflation, interest rates, exchange rates, and economic growth, on stock prices are presented. Then, the hypotheses, methodology, and findings of the study are interpreted, and recommendations for future studies are presented.

2. Literature Review

When the relevant literature is examined, it is seen that the studies focus on *"the effect of the increase in the inflation rate on the stock prices in the short and long term and the ability of the stock returns to protect the investors from inflation."* Fisher (1930), who signed one of the pioneering studies examining the relationship between inflation, interest rates, and asset returns, predicted a positive long-term relationship between expected inflation, nominal interest rates, and stock returns. In periods of high inflation, persistent increases in general prices narrow saving volume and lead to a decrease in purchasing power. In the face of this situation, Fisher (1930), who considered stocks as a hedge against inflation and thus preserved the purchasing power of money, stated that stock returns can protect investors from the effects of inflation by moving together with the inflation rate and the nominal interest rate, which he expressed as equal to the inflation rate. This prediction has been supported in many studies, such as Gibson (1970), Anari and Kolari (2001), Sönmez and Noyan (2022), Topcu (2023), Özdemir et al. (2023), Bozkurt and Kaderli (2024), and Coşkuner and Özer (2024). On the other hand, Fama (1975) stated that there is a relationship between current interest rates and past inflation rates with the "proxy hypothesis" and that the real interest rate is fixed in the short term, but this is not the case in the long term. According to Fama (1975), Fisher's (1930) theory can only maintain its effectiveness in an efficient market if all forecasts and information about past data and future inflation are used correctly. It has been seen in many studies that expected inflation and actual inflation figures differ; the real interest rate cannot remain constant over the long run; accordingly, the direction of asset returns contradicts these findings. According to Fama (1975), stock returns are not expected to increase in periods when inflation rises, economic movements are restricted, and growth stagnates or shrinks. Therefore, it is normal for stock prices to decline during periods of inflation. Therefore, a negative relationship between inflation and stock returns is inevitable. Studies by Cohn and Lessard (1981), Balduzzi (1995), Sathyanarayana and Gargesa (2018), and Ikeobi (2024) support this prediction. Hardouvelis (1987), Tiwari et al. (2020), Varlık (2023), and Kadim and Al-Bakri (2024) stated that the expected real interest rate increases with inflation, which reduces stock prices in the short term and does not provide protection against inflation in the long term. Carmichael and Stebbing (1983) stated that inflation does not have any effect on the nominal interest rate in the short or long run and therefore affects asset returns. In contrast, after taxes, inflation, and real interest rates have the opposite relationship.

In general, interest rate changes are expected to cause asset price changes. A decrease in interest rates can increase investment and spending by reducing borrowing costs. In terms of firms, changes in interest rates affect both the discount rate and the direction of expected future cash flows. As a matter of fact, it has been stated by Pearce and Roley (1983), Hardouvelis (1987), and Yener (2023) that when the interest rate increases, the discount rate increases and decreases stock prices. This hypothesis is also supported in Amarasinghe's (2015) study, which found that interest rates cause stock price changes and significantly affect stock returns. According to Bae (1990), sensitivity to current interest rate changes and expected or unexpected interest rate changes depends on the index on which stocks are traded and whether the firms are depositors or not. Although sensitivity varies, expected or unexpected interest rate changes negatively affect stock prices. According to Smithers (2009), stock prices are affected by interest rate changes, but this effect is short term, and it cannot be said that there is an interaction between them over the long term. In this short-term interaction, stock prices may return to them should-beta values or move far away from their expected value to disrupt stock market balances. The direction and degree of this interaction are shaped according to the

efficiency of the stock market. Alam and Uddin (2009), on the other hand, cannot deny that the opposite interaction between interest rates and stock prices cannot be denied, but the direction of this interaction may change or not at all depending on the country's level of development. According to Assefa et al. (2017), the opposite interaction between interest rates and stock prices may be true in developed countries, but it may be partially felt in developing countries. Because the main determinant of stock prices in these countries is the "World Market Portfolio,". According to Karagöz (2024), the interaction between interest rates and stock returns varies according to structural differences among sectors. As a matter of fact, in sectors based on production and capital inputs, stock returns are more sensitive to changes in interest rates, and this sensitivity is negative. In sectors with relatively low capital, interest rate changes positively affect stock returns. Ünal (2024) stated that stock returns increased significantly after interest rate cuts. According to Kazak (2023), Temel and Güneş (2024) the direction of stock returns changes when interest rates increase and decrease. However, stock returns are much more sensitive to interest rate cuts.

The most general research question is to what extent GDP, considered the leading indicator of cyclical performance in the general economy and the main measure of economic growth, affects short- and long-run stock price movements. It can be seen that the main distinction in academic studies is the difference between the interaction in developing and developed countries. Another emphasis is that slow but steady rather than rapid economic growth will play a more effective role in stock prices and returns. According to Fama (1981), a strong, direct relationship between rising stock prices and economic growth is inevitable. This view is supported by Igoni et al. (2020), Algarini (2020), Setiawan (2020), Özkul and Kasım (2021), Li et al. (2022), Perdana and Setyadharma (2022), and Keswani (2024). Barro (1990) mentioned that an increase in stock prices creates a wealth effect that can also pave the way for investments. Increased investments will improve economic performance and GDP growth. According to Ritter (2005), there is a negative correlation between economic growth, stock price increases, and stock returns. He predicts that small or large proportional increases in GDP will benefit consumers rather than capitalists. Although increasing GDP per capita offers consumers a higher standard of living and higher real wages; shareholders are not facing higher dividends. Therefore, it is not possible to discuss a highly correlated relationship between GDP, the pioneer of economic growth, and predictions about the past and future states of stock prices and stock returns. Moradi et al. (2021), Toni and Simorangkir (2022), Fadila and Rachmawati (2024), the negative relationship between GDP growth and stock returns is inevitable. According to Ritter (2005), these are just theories. Rather than examining the relationship between GDP, stock prices and returns; He stated that it would be more appropriate to make predictions by looking at the growth of dividends per share in reaction to increasing GDP.

Another economic indicator that interacts with stock prices is exchange rate movements. Although many studies have been conducted on the interaction between exchange rates and stock prices, no consensus has been reached on the direction of the interaction between them. According to Jorion (1990), the interaction between the exchange rate and stock price movements changes according to the development status of each country. In fact, developing countries are known to be more vulnerable to exchange rate movements. Ajayi et al. (1996) and Güler and Haykır (2023) stated that the relationship between exchange rates and stock prices, as well as countries' level of development, differs in the long term and the short term. Although an increase in stock prices will have a positive effect on the exchange rate in the short term, an increase in the exchange rate will lead to depreciation in the local currency and will have a negative impact on stock prices in the short and long term. Because depreciation of a local currency brings inflation along with it. Therefore, the two-way interaction between the exchange rate and stock prices will have different short- and long-term interactions depending on the development level of the countries. According to Wong (2022), there will, of course, be an interaction between the exchange rate and stock prices in the short or long term, but the

direction of this interaction should be differentiated according to developing or developed countries. Exchange rate increases can either increase or decrease stock prices. The evaluation of other economic factors affecting this increase or decrease will give the most reasonable opinion.

Yüzbaşıoğlu (2024) emphasised that while the exchange rate is fixed, developing countries with similar economies have similar effects on stock prices. However, he stated that although developing countries have similar economies during periods when the exchange rate is volatile, stock prices vary at different levels. Therefore, the effect of the exchange rate on stock prices creates different levels of influence, including global factors and the economic conditions of countries. Güngör and Polat (2020) stated that the most important macro-economic factor affecting stock returns is the exchange rate. As the exchange rate increases, returns decrease along with stock prices. Akyol (2021) reported that an increase in the exchange rate increases stock prices over the long run. Stock prices are extremely sensitive to exchange rates, but this sensitivity is not felt in the short term. According to Franck and Young (1972), Suriani et al. (2015), Karaçayır (2024), exchange rates are not related to stock prices.

3. Development of Theory Hypothesis

When the relevant literature is examined, it can be seen that the relationship between the main macroeconomic indicators and stock prices and returns may vary according to many factors, such as the time period used, the statistical method used, the stability of the main macroeconomic indicators in the countries analysed, monetary policies, and the level of development of the countries. Although no consensus exists on the impact of macroeconomic indicators on stock prices, the main view is that all these indicators interact with each other and have a direct or indirect impact on stock prices. For this reason, studies on this subject have attracted the attention of researchers, and empirical studies have been conducted with comparisons between countries, distinctions between developed and developing countries, and different statistical methods. Considering the predictable prediction potential for stock prices of the main macroeconomic indicators, more research is needed.

The aim of this study is to reveal the relationship between changes in the stock prices of the countries and the main macroeconomic indicators and to reveal the explanatory power of this relationship. Although the hypotheses discussed in this context have different perspectives, they are also the mainstay of this study. However, unlike other studies, this study does not predict that macroeconomic indicators directly interact with stock prices. The main macroeconomic indicators interact with each other, and the results of each cause the other macroeconomic indicator. Changes in stock prices increase or decrease because of this interaction among macroeconomic indicators. When the linear relationship between inflation, interest rate, and exchange rate is examined, *"Is the rise in the exchange rate and interest rate a result of inflation, or is the rise in the interest rate and exchange rate the cause of inflation?*" is one of the leading debates. These three indicators, accepted as the basic building blocks of the general economic conjuncture, enter non-linear cycles based on many factors. In fact, outside intervention in the interest rate or exchange rate changes the direction of this cycle when inflation rises. Many macroeconomic indicators will also be affected by this change in direction. Therefore, the conditions under which an increase or decrease in stock prices will be affected by which macroeconomic indicator will differ according to the world economy parameters and applied monetary policies, the economic conditions, socioeconomic conditions, and political conditions of the countries, and this difference will only be a result of this cycle.

In this context, the first hypothesis of this study can be expressed as follows:

H_1: "The stock prices of countries are not in direct interaction with inflation, interest rates, and exchange rates, which are the main macroeconomic indicators."

It is evident that there is no consensus in the studies on the interaction between stock prices and GDP. Along with the short or long-term course of increases or decreases in main macroeconomic indicators, the investment-savings understanding of countries also paves the way for these differences of opinion. It can be stated that stable increases in GDP, which is considered the basic measure of economic growth, increase the per capita national income, so that savings and investment preferences can also expand. Therefore, increases in GDP are expected to have a positive effect on stock prices. The second and final hypothesis of the study can be expressed as follows:

H_2: "As the GDP of the countries increases, the stock prices will also increase."

4. Research Methodology

In line with the purpose of this study, inflation, exchange rate, interest rate, and economic growth, which are among the main macroeconomic indicators that have been the subject of many academic studies, are included in the analysis as independent variables, whereas the stock price index is included as the dependent variable. The panel dataset was created using data from 27 countries (Australia, Brazil, Canada, Chile, China, Colombia, Czech Republic, Denmark, Euro Area, Hungary, Iceland, India, Indonesia, Israel, Japan, Korea, Latvia, Mexico, New Zealand, Norway, Poland, Russia, South Africa, Sweden, Switzerland, Türkiye, and the United Kingdom) for the period 2000–2021. In the analysis, the Extended Average Group Estimator (AMG), a heterogeneous panel data model derived from Eberhardt and Teal (2010) and Eberhardt and Bond (2009), was used. The Stata/MP 14.0 package was used for the analysis. In addition, the Gengenbach, Urbain, and Westerlund (GUB-2016) test, a panel cointegration test, was applied to test the existence of a long-run relationship after examining the current period relationships between variables, and it was understood that there was no cointegration relationship.

There are similar studies on the subject in the literature: Ibrahim (2002), Sindhu et al. (2014), Tripathi and Kumar (2015), Khan et al., (2017), Abed and Zardoub (2019), Humple and McMillan (2020), Hashmi and Chang (2023), Kengatharan and Suganya (2021), Ali (2021), Javangwe and Takawira (2022), Sanusi and Kapingura (2022), Dao et al. (2022), Neifar (2022), Waiker and Chavhan (2022).

4.1. Sample and Data

In this study, all statistical data regarding the variables were obtained from the OECD-Data base. Information about these variables and variables is presented in Table 1.

Table 1: **The Variables of the Study**

Name of Variables	Symbol	Data Source	Definition of Variables
Stock Prices	SPrice	OECD-Data Warehouse	The price indices were calculated by taking the monthly arithmetic averages of the daily closing prices of the stocks.
Consumer Price Index-Inflation	CPI	OECD-Data Warehouse	The CPI, which is used to measure inflation, reflects price changes that occur in a group of goods or services over a certain period.
Gross Domestic Product	GDP	OECD-Data Warehouse	The GDP is an important indicator of economic growth and is expressed as the added value created by the goods and services produced during a certain period.
Exchange Rates	ExcRate	OECD-Data Warehouse	Indicates the national currency per US dollar.
Interest Rates	IntRate	OECD-Data Warehouse	Indicates the overnight interbank rate.

4.2. The Empirical Models

SPrice was determined as the dependent variable in the panel data model created in this study. In panel data analysis, "I" is the unit size, "t" is the time dimension, and "Ɛ" is the error

term. "β" represents the explanatory variables. In this context, the statistical model established to explain the interaction between the main macroeconomic indicators and stock prices is expressed as follows:

$$SPrice_{it} = \beta_{0i} + \beta_{1i}CPI_{it} + \beta_{2i}GDP_{it} + \beta_{3i}ExcRate_{it} + \beta_{4i}IntRate_{it} + \varepsilon_{it} \quad (1)$$

After determining the panel dataset heterogeneity, a heterogeneous panel data model was established. The cross-section dependency was determined, the first differences in the variables were taken to ensure their stationarity, and then the model was reconstructed. The heterogeneous panel data model, which considers cross-sectional dependence, can be expressed as follows:

$$\Delta SPrice_{it} = \beta_{0i} + \beta_{1i}\Delta CPI_{it} + \beta_{2i}\Delta GDP_{it} + \beta_{3i}\Delta ExcRate_{it} + \beta_{4i}\Delta IntRate_{it} + \varepsilon_{it} \quad (2)$$

4.3. Findings of Research

The main macroeconomic indicators of the 27 countries and summary statistical information about stock prices are presented in Table 2. The difference in the number of observations of the variables indicates that the sample comprises an unbalanced panel data set.

Table 2: **Descriptive Statistics**

Variables	Obs	Mean	Std. Dev.	Min	Max
SPrice	594	0.87	0.509	0.082	6.165
ExcRate	594	0.355	0.456	0.0	2.001
GDP	584	0.031	0.034	-0.143	0.142
CPI	593	0.038	0.048	-0.014	0.549
IntRate	592	0.048	0.09	-0.02	1.832

The fact that the range of stock price values varies between 8.2% and 616.5% across time series sections reveals large price differences between countries. It can be said that these differences are generally mentioned in other variables. While the average value of Excrate, which represents the national currency per 1 US dollar, is 35.5%, the value range is between 200%; the GDP, which is an indicator of economic growth, is 3.1% on average, with a value between -14.3% and 14.2%; the CPI, which is used as an indicator of inflation, has an average value of 3.8%, varying between -1.4% and 54.9%; and the IntRate, which represents the interest rate, is 4.8% on average and varies between -2% and 183.2%.

The correlation coefficients between the variables are presented in Table 3. Whether the coefficient is positive or negative indicates the same or opposite relationship between variables. Although SPrice has a negative relationship with CPI and IntRate variables; there is a positive relationship with ExcRate and GDP. It is not desirable that the correlation coefficient between variables to be high, and it is preferred that the coefficient is close to 0, that is, there is no strong relationship between them.

Table 3: **Correlation Analysis Results**

Variables	SPrice	ExcRate	GDP	CPI	IntRate
SPrice	1.00				
ExcRate	0.05	1.00			
GDP	0.01	-0.13	1.00		
CPI	-0.13	-0.06	0.12	1.00	
IntRate	-0.15	-0.00	0.13	0.58	1.00

In the case of cross-sectional dependence, the variables are related to each other, and a positive or negative situation that may occur in any of the countries may have similar effects on other countries. According to the Pesaran CD test results, there was a cross-sectional dependence. The results are shown in Table 4.

Table 4: **Pesaran (2004) CD Test- Cross-Section Dependency**

Variables	CD-Test	P-Value	Corr	Abs(Corr)
SPrice	62.54***	0.00	0.712	0.725
CPI	24.45***	0.00	0.278	0.349
GDP	45.07***	0.00	0.518	0.527
ExcRate	35.15***	0.00	0.40	0.519
IntRate	52.91***	0.00	0.604	0.609

Notes: ***There is a correlation between units at the 1% significance level.

After detecting the cross-sectional dependence of the panel data, second-generation panel unit root tests were used to test for stationarity. Im, Pesaran, and Shin (IPS), Horizontal Section Expanded Im, Pesaran, and Shin (CIPS), and Horizontal Section Extended Dickey Fuller (CADF) tests were used to determine stationarity. The purpose of using more than one test is to compare test results and select the most appropriate method. The unit root test results are presented in Table 5.

Table 5: **Unit Root Test Results**

Variables	IPS		CIPS		CADF	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend	Intercept	Intercept and Trend
SPrice	**5.23**	**-0.66**	**-0.66**	**3.80**	**-1.34**	**-1.24**
	(1.00)	**(0.25)**	**(0.25)**	**(1.00)**	**(0.93)**	**(1.00)**
CPI	-7.36***	-5.25***	-5.96***	-4.07***	**-0.12**	**1.21**
	(0.00)	(0.00)	(0.00)	(0.00)	**(0.45)**	**(0.89)**
GDP	-6.91***	-5.49***	**-0.55**	**1.47**	**2.67**	**6.46**
	(0.00)	(0.00)	**(0.29)**	**(0.93)**	**(0.996)**	**(1.00)**
ExcRate	-0.91	-1.74*	**-0.244**	-3.58***	**-1.46**	**-2.140**
	(0.18)	(0.04)	**(0.40)**	(0.00)	**(0.94)**	**(0.83)**
IntRate	-3.16***	-6.52***	-4.60***	-3.72***	**2.18**	**5.55**
	(0.00)	(0.00)	(0.00)	(0.00)	**(0.96)**	**(1.00)**
ΔSPrice	-10.33***	-7.91***	-3.34***	-1.88*	-2.38***	-2.65*
	(0.00)	(0.00)	(0.00)	(0.03)	(0.00)	(0.03)
ΔCPI	-17.77***	-14.92***	-13.51***	-11.47***	-3.06***	-3.87***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ΔGDP	-15.66***	-12.39***	-7.84***	-5.06***	-7.84***	-5.06***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ΔExcRate	-10.74***	-9.68***	-7.38***	-9.68***	-3.14***	-2.98***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ΔIntRate	-14.89***	-11.87***	-10.85***	-8.57***	-4.49***	-8.57***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Notes: Optimal delay lengths were determined according to the AIC criterion. *** p<0.01, **p<0.05, * p<0.01.

According to the IPS test results, the SPrice and ExcRate variables are not stationary. According to the CIPS results, Sprice, GDP, and ExcRate variables are not stationary. According to the CADF test results, all variables, including the dependent variable, are not stationary; According to all tests, these variables become stationary when the first difference is made. The first differences in which all variables are stationary were considered because the stationary states of variables vary in different tests.

The second step in selecting an appropriate model for analysis is to determine whether the constant and slope parameters are homogeneous or heterogeneous. For this reason, the Swamy S test was applied. It can be seen that the parameters are heterogeneous according to the Chi2 test result and probability value.

After determining the cross-sectional dependence and heterogeneity, the Extended Mean Group Estimator (AMG) was applied, which considers both parameters in the selection of the appropriate model. The estimation results are shown in Table 7.

Table 6: **Swamy Homogeneity Test Results (AMG Model)**

Swamy Test	Chi2	P-Value
Swamy S	370.48***	0.00

Notes: ***Represents heterogeneity at the 1% significance level.

Table 7: **Extended Mean Group Estimator (AMG) Findings**

Variables	Coef.	Std. Err.	z	p
Δ ExcRate	-49.66	106.78	-0.47	0.64
ΔGDP	1.02	0.19	5.14***	0.00
ΔCPI	-0.25	0.52	-0.49	0.63
Δ IntRate	-1.40	0.98	-1.41	0.16
Cons	-0.06	0.00	-8.89***	0.00

Notes: Δ: Indicates the primary difference of the variable. *** p<0.01, **p<0.05, * p<0.01.

When the estimation results are examined within the framework of the entire panel, we can conclude that the probability value of the Wald test is significant as a whole. According to the estimation results, GDP alone can explain SPrice at the 1% level. According to the results, a one-unit change in GDP increased 1.02 units in SPrice during the period studied. In this context, *"H_2: As the GDP of countries increases, stock prices will increase."* hypothesis was accepted. This finding; it supports Fama's (1981) view that the existence of a strong and direct relationship between rising stock prices and economic growth is inevitable. Other variables have no significant effect on SPrice. For this reason, *"H_1: The stock prices of countries are not in direct interaction with inflation, interest rate and exchange rate, which are main macroeconomic indicators."* hypothesis was accepted. However, when analyzed in units, differences were observed in the estimation results. Only the Czech Republic, the Euro Area, Hungary, Latvia, Poland, Sweden, and Türkiye have a significant and positive effect of GDP on SPrice. Although not significant in the overall model, when analyzed in units, the ExcRate variable has significant explanatory power for SPrice in Iceland, Japan, the Czech Republic, and South Africa. In particular, a unit increase in ExcRate; while it caused an increase of 349.94 units in Iceland and 12.16 units in the Czech Republic; one-unit decrease in ExcRate; it is seen that it caused a decrease of 49.43 units in Japan and a decrease of -4.36 units in South Africa. In Iceland and Japan, the large difference between the increase and decrease created by the ExcRete variable on SPice is remarkable. The fact that both countries are in the category of developed countries and that both countries are members of the OECD cannot prevent the difference in the analysis results. In this case, country-specific factors play a role. The explanatory power of the CPI over SPrice is only significant in Norway. It can be stated that a one-unit increase in CPI increases SPrice by 2.47 units. In Iceland, a one-unit increase in IntRate increased 14.36 units on SPrice. Variables do not have a significant effect on SPrice in Australia, Brazil, Canada, Chile, China, Colombia, Denmark, India, Indonesia, Israel, Korea, Mexico, New Zealand, Russia, Switzerland, and the United Kingdom.

Table 8: **AMG Forecast Results by Units**

	Δ ExcRate			ΔGDP			ΔCPI			Δ IntRate		
Countries	**Coef.**	**z**	**p**	**Coef.**	**z**	**p**	**Coef.**	**z**	**p**	**Coef.**	**z**	**p**
Whole Panel	-49.66	-0.47	0.64	1.02	5.14***	0.00	-0.25	-0.49	0.62	-1.40	1.41	0.16
Australia	-0.11	-0.62	0.54	-0.87	-0.97	0.33	0.16	0.16	0.87	-1.02	-0.71	0.48
Brazil	0.20	0.27	0.79	1.70	1.31	0.19	0.60	0.45	0.66	-1.15	-1.17	0.24
Canada	-0.07	-0.24	0.81	0.79	1.19	0.24	0.99	0.49	0.62	-2.44	-1.83	0.07
Chile	449.81	1.25	0.21	0.75	0.94	0.35	0.49	0.17	0.86	-3.76	-1.04	0.30
China	7.26	0.74	0.46	4.40	1.21	0.23	1.06	0.55	0.58	-20.72	-1.11	0.27
Colombia	1150.6	1.34	0.18	-0.13	-0.17	0.87	-1.05	-0.26	0.80	-2.85	-0.83	0.40
Czech Republic	12.16	2.30*	0.02	2.11	3.32***	0.00	-1.84	-1.52	0.13	-1.09	-0.44	0.66
Denmark	-1.86	-1.06	0.29	0.60	0.73	0.47	1.94	0.72	0.47	-3.56	-1.37	0.17
Euro Area	-0.19	-1.28	0.20	0.96	2.26*	0.02	-1.69	-1.28	0.20	2.17	1.12	0.26

Table 8 (Devamı): **AMG Forecast Results by Units**

	Δ ExcRate			**ΔGDP**			**ΔCPI**			**Δ IntRate**		
Countries	**Coef.**	**z**	**p**	**Coef.**	**z**	**p**	**Coef.**	**z**	**p**	**Coef.**	**z**	**p**
Hungary	-25.99	-0.36	0.72	2.13	3.31***	0.00	1.59	1.15	0.25	-2.26	-1.56	0.12
Iceland	349.94	3.15***	0.00	0.36	0.10	0.92	-12.35	-1.42	0.16	14.36	2.32*	0.02
India	-29.94	-1.77	0.07	-0.01	-0.02	0.98	0.48	0.48	0.63	-1.04	-0.50	0.62
Indonesia	-2414.76	-0.56	0.57	1.94	1.54	0.12	0.24	0.24	0.81	-0.82	-0.47	0.64
Israel	-2.53	-1.80	0.07	0.70	1.24	0.22	1.54	1.20	0.23	-3.48	-1.88	0.06
Japan	-49.43	-2.07*	0.04	0.12	0.17	0.86	-0.01	-0.01	0.99	-1.60	-0.09	0.93
Korea	-766.30	-1.49	0.14	1.35	1.59	0.11	2.46	1.48	0.14	3.24	0.62	0.54
Latvia	0.13	0.27	0.79	1.48	2.27*	0.02	0.34	0.23	0.82	0.33	0.13	0.90
Mexico	-5.53	-1.44	0.15	0.67	1.38	0.17	1.27	0.73	0.46	-1.72	-1.53	0.13
New Zealand	-0.07	-0.21	0.84	-0.26	-0.28	0.78	-1.68	-1.05	0.29	-1.90	-0.99	0.32
Norway	0.18	0.14	0.89	1.76	1.90	0.06	2.47	2.20*	0.03	-0.06	-0.05	0.96
Poland	0.03	0.05	0.96	1.92	3.46***	0.00	-0.97	-0.64	0.52	-0.07	-0.06	0.96
Russia	-7.47	-0.99	0.32	1.02	1.76	0.08	-0.11	-0.18	0.86	-0.76	-1.79	0.07
South Africa	-4.36	-2.46*	0.01	1.33	1.23	0.22	0.28	0.27	0.79	-2.55	-1.88	0.06
Sweden	-1.75	-1.68	0.09	1.03	2.70***	0.00	-1.53	-1.53	0.13	-2.44	-1.92	0.06
Switzerland	-0.33	-1.35	0.18	0.26	0.35	0.73	-1.47	-0.73	0.46	-1.08	-0.64	0.52
Türkiye	-0.17	-0.48	0.63	0.90	2.28	0.02*	0.23	0.61	0.54	0.01	0.05	0.96
United Kingdom	-0.31	-1.96	0.05	0.36	1.15	0.25	-0.27	-0.14	0.89	-1.25	-0.66	0.51

Notes: *** p<0.01, **p<0.05, * p<0.01.

The current period relationship between the AMG estimation results and variables was revealed, and the existence of long-term relationships was tested. For this purpose, the cross-sectional dependence and homogeneity assumption were tested in the entire model. It was observed that there was cross-sectional dependency in the entire model, and the parameters had a heterogeneous structure. In this context, the Gengenbach, Urbain, and Westerlund (2016) co-integration test, a second-generation co-integration test that considers heterogeneity and cross-section dependency, was applied. According to the test results, there was no co-integration relationship between the variables. The co-integration test results are presented in Table 9.

Table 9: **Cointegration Prediction Results**

Cross-section Dependency and Homogeneity Tests	**Statistics**	**P-Value**
Pesaran and Yamagato (2008)	14.19***	0.00
Δ_{adj} (Pesaran and Yamagato, 2008)	16.71***	0.00
Pesaran (2015)	-3.26***	0.00
Δ_{adj}(Pesaran, 2015)	-3.84***	0.00
Cointegration Prediction Test	**T-bar**	**P-Value**
Gengenbach, Urbain and Westerlund (2016)	9.50	>0.1

Notes: *** p<0.01, **p<0.05, * p<0.01.

5. Conclusion

Although the relationship between main macroeconomic indicators and stock prices has been the subject of many academic studies, no consensus exists on the relationship between these indicators and stock prices. This study aims to contribute to the literature by revealing the relationship between changes in the stock prices of countries and the main macroeconomic indicators, as well as the explanatory power of this relationship. Many factors can be counted among the main reasons for the lack of consensus on the subject.

The results of the analysis show that *"Fama's (1981) conclusion is that there is a strong and direct relationship between increasing stock prices and economic growth."* confirmed his opinion. According to the results, stock prices increase as GDP rises. This view is supported by Igoni et al. (2020), Algarini (2020), Setiawan (2020), Özkul and Kasım (2021), Li et al. (2022), Perdana and Setyadharma (2022), and Keswani (2024).

The differences in the analysis results for all panels and units coincide with the differences in the results of the relevant literature. As a matter of fact, while GDP has significant explanatory power on the basis of the whole panel, it is meaningful only in 7 out of 27 countries when evaluated on the basis of units, which can be considered an indication that more comprehensive evaluations are needed. As a matter of fact, when the relevant literature is examined; it is seen that these effects may change in the short and long term, and the results may differ according to the distinction between developing and developing countries. The rate of economic growth and the rate of change in this growth, stability in general economic cyclical performance, and resistance to an increase or decrease in the general level of prices emphasize the effectiveness of these effects.

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