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ASYMMETRIC EFFECTS OF TRADE POLICY UNCERTAINTY ON THE STOCK MARKET: EVIDENCE FROM THE MARKOV REGIME SWITCHING MODEL

TİCARET POLİTİKASI BELİRSİZLİĞİNİN HİSSE SENEDİ PİYASASINA ASİMETRİK ETKİLERİ: MARKOV REJİM DEĞİŞİM MODELİNDEN KANITLAR

Ayşegül ŞAHİN*
*Ph.D., Research Assistant, Anadolu University, aysegulsahin@anadolu.edu.tr,

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ABSTRACT

This study examines the S&P 500 index using the Markov Regime Switching model to analyze the effects of trade policy uncertainty on financial markets. Trade policy uncertainty can increase the volatility of financial markets by affecting investor confidence and asset prices through various transmission channels. The study found that the effect of trade policy uncertainty on the stock market index varies depending on the market regime. The findings show that trade policy uncertainty has a negative and significant impact in the stock market uptrend regime (Regime 0). Decreased trade policy uncertainty allows investors to invest more by reducing risk perception. In Regime 1, it is shown that the increases in trade policy uncertainty prevent new stock investments even if there are no serious exits from the stock market. The study's findings reveal that measures to reduce uncertainty in trade policies are critical for financial markets. Policy recommendations such as transparent trade policies, risk management strategies, and investors' portfolio diversification mechanisms are presented in this direction.

Keywords: *Trade policy uncertainty, S&P500, Markov Regime Switching Model*

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ÖZ

Bu çalışma, ticaret politikası belirsizliğinin finansal piyasalar üzerindeki etkilerini analiz etmek amacıyla Markov Rejim Değişim modelini kullanarak S&P 500 endeksi üzerinde bir inceleme yapmaktadır. Ticaret politikası belirsizliği, yatırımcı güvenini ve varlık fiyatlarını çeşitli iletim kanalları aracılığıyla etkileyerek finansal piyasaların oynaklığını artırabilir. Çalışmada, ticaret politikası belirsizliğinin borsa endeksi üzerindeki etkisinin piyasa rejimine bağlı olarak farklılık gösterdiği bulunmuştur. Bulgular, borsa yükseliş rejiminde (Rejim 0) ticaret politikası belirsizliğinin negatif ve anlamlı bir etkisinin olduğunu göstermektedir. Ticaret politikası belirsizliğinde meydana gelen azalma yatırımcıların risk algısını düşürerek daha fazla yatırım yapmalarına imkan tanır. Regime 1'de ise ticaret politikası belirsizliğinde meydana gelen artışların borsadan ciddi çıkışlar yaşanmasa da yeni hisse senedi yatırımlarını engellediğini göstermektedir. Çalışmanın bulguları, ticaret politikalarındaki belirsizliği azaltmaya yönelik önlemlerin finansal piyasalar için kritik bir faktör olduğunu ortaya koymaktadır. Bu doğrultuda, şeffaf ticaret politikaları, risk yönetimi stratejileri ve yatırımcıların portföy çeşitlendirme mekanizmaları gibi politika önerileri sunulmaktadır.

Anahtar Kelimeler: *Ticaret Politikası Belirsizliği, S&P 500, Markov Rejim Değişim Modeli*

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Introduction

Policy uncertainty refers to situations where future government decisions are unpredictable and can increase market volatility, causing businesses and individuals to postpone investment and spending decisions. As long as this uncertainty persists, global economic activity may contract. Policy uncertainty includes uncertainties about government laws, monetary and fiscal policies, tax regulations, or trade policies and can create financial risks at both local and international levels (Pechman, 2001).

It is common that high levels of economic uncertainty affect many areas, from exchange rates to loan interest rates, from economic growth to investments. Therefore, policymakers need to determine how uncertainties have affected the economy and make predictions about their effects in the future.

Trade disputes and, ultimately, trade policy uncertainties affect investments, activities, and employment in the financial sector (Baker et al., 2019). According to Lindé and Pescatori (2019), high trade policy uncertainty reduces global trade, leading to lower output. Especially during the US-China trade war, it has been observed that this dispute does not only harm the US or Chinese stock market but also has a global impact (Huynh and Burggraf, 2020).

Given stock markets' critical role in the financial and economic system, it is important to examine how trade policy uncertainty affects them. Trade policy uncertainty can affect stock markets through different transmission channels. From a microeconomic perspective, trade policy uncertainty, especially from foreign sources, has firm-level effects. Exporting firms face risks in the timing of entering new markets due to uncertain trade policies. Therefore, increasing trade policy uncertainty can negatively affect the market value of exporting firms (Handley and Limao, 2015).

The impact of trade policy uncertainty on financial markets and asset prices occurs through various transmission channels. The first of these mechanisms is the global supply chain, because firms are interconnected in a globalizing world and trade shocks can directly affect business activities (Caldara et al., 2020). Since companies take international trade conditions into account in their investment and valuation decisions, changes in trade policies can directly reflect on the market value of firms (Huang et al., 2019). If a firm's valuation is affected by trade uncertainty, its stock prices will also respond to these changes. In addition, trade policy uncertainty can increase uncertainty in input costs, leading firms to seek new supply chain alternatives (Baker et al., 2019). Second, trade policy uncertainty can be transmitted to financial markets through commodity prices and exchange rates. The commodity price channel shows that the prices of assets such as oil, wheat and gold are closely related to trade policy shocks, and changes in these commodity prices have been found to affect stock market performance (Singhal et al., 2019). Another important channel can affect financial markets through investor confidence and asset allocation (Tiwari et al., 2018). Portfolio rebalancing theory and information transmission hypothesis suggest that investors readjust their portfolios in the face of economic uncertainty and that fund flows can have positive or negative effects on stock market indices (Çepni et al., 2020). Global investors change their asset allocations by focusing on specific markets depending on macroeconomic developments. It can be said that changes in the US trade policies have an impact on both its own stock market and the stock markets of other countries.

There are several key reasons for selecting the S&P 500 index as the financial market indicator in this study. First, the S&P 500 represents the 500 largest publicly traded companies in the United States, encompassing a broad spectrum of sectors, making it a robust proxy not only for domestic U.S. economic dynamics but also for global investor sentiment (Baker et al., 2019). Given the United States' central role in international trade, fluctuations in trade policy are often reflected in the U.S. stock market more rapidly and intensely than in other markets (Caldara et al., 2020). Moreover, the existing literature frequently utilizes the S&P 500 index to examine the impact of trade policy uncertainty on financial markets (He et al., 2021; Huang et al., 2019), indicating its analytical relevance. Thus, to capture the broad and immediate effects of trade policy uncertainty, the S&P 500 is selected as the focal market in this study.

This study aims to contribute to the existing literature on uncertainty by examining the effects of trade policy uncertainty on the stock market. For this purpose, the Markov Regime Switching model, which

can analyze the effects in different regime periods, will be used and it will be determined whether the fluctuations in the US stock market are affected by trade policy uncertainties. The study aims to provide important implications for policymakers and investors by presenting both theoretical and empirical findings.

1. Literature Review

Policy uncertainties play an important role in determining and predicting economic outcomes. The extent to which countries are affected by these uncertainties depends on the strength of the economy and stock market volume (Christou et al., 2017). Existing literature has focused more on the macroeconomic effects and consequences of economic policy uncertainty (Ajmi et al., 2015; Jiang et al., 2019; Adams et al., 2020; Wang and Kong, 2022). An essential contribution to the measurement of policy uncertainty was made by Baker, Bloom, and Davis (2016). The authors developed the Economic Policy Uncertainty Index based on news texts from newspapers and demonstrated that increases in policy uncertainty lead to higher stock market volatility and reduced investment and employment, particularly in sectors with high policy sensitivity, such as infrastructure and finance. This study has garnered significant attention in the literature, as it quantitatively demonstrates the relationship between uncertainty and macroeconomic indicators. Similarly, studies such as Jurado, Ludvigson, and Ng (2015) and Pastor and Veronesi (2012) have also introduced the concept of political risk to the financial economics literature by providing evidence on how uncertainty affects risk premiums and market behavior.

Trade policy uncertainty has become a prominent subtopic in the economic literature, especially with increasing protectionist trends and global trade tensions in recent years (Caldara et al., 2020). Studies on trade policy uncertainty have focused on both the measurement of this uncertainty and the effects of micro and macroeconomic factors on uncertainty (Younis et al., 2024). The re-emergence of protectionist steps has shown that uncertainty can directly affect not only general economic activity but also foreign trade flows and firm behavior. First, Handley and Limao (2017) created an index of trade policy uncertainty. Later, Caldara et al. (2020) created a firm-based trade policy uncertainty index. The increase in news about trade policies and uncertainties causes this index to increase, and this increase provides evidence that investments decrease (Caldara et al., 2020). The literature on trade policy uncertainty has generally focused on the effects of this index on employment, investment, geopolitical risk, energy markets, and exchange rates (Schott et al., 2017; Chen, 2018; Qin et al., 2020; Assaf et al., 2021; Yang et al., 2022; Huynh et al., 2023).

Limão and Maggi (2015) theoretically demonstrated that reducing uncertainty through trade agreements provides an additional benefit to traditional welfare gains. Huang et al. (2018) observed that stocks of US companies trading with China lost value and bond yields decreased during the trade war period. According to Bianconi et al. (2021), sectors that are more exposed to trade policy uncertainty (less dependent on inputs from China) experience more significant fluctuations in stock prices. He et al. (2020) provided evidence that US trade policy uncertainty has a strong long-term effect on the US and Chinese stock markets. Trade disputes between the US and China have negative effects on the Chinese stock market and positive effects on the US stock market. Çepni et al. (2020), in their study investigating the effects of US trade policy uncertainty on bond and stock markets in BRICS countries, stated that the increase in uncertainty negatively affects capital flows to these countries. Similarly, Cebreros et al. (2019) showed that trade policy uncertainty negatively affects foreign direct investments in Mexico.

The effect of trade policy uncertainty on firms' export decisions has also been emphasized in other studies by Handley and Limão. For example, Handley and Limão (2015) analyzed the effects of policy uncertainty on firm behavior in situations where there are high fixed costs of entering export markets. They showed that firms' probability of entering exports decreases in environments where uncertainty is high. Osnago, Piermartini, and Rocha (2015) emphasized in their studies within the World Trade Organization that trade policy uncertainty can act as a trade-restrictive barrier even in the absence of an actual tariff increase. This study highlights that even uncertainties, particularly during the negotiation process, can have a negative impact on firms' trade decisions. Indeed, while

examining China's export boom to the US following its WTO membership in 2001, Crowley et al. (2018) revealed that the elimination of uncertainty was a key factor triggering trade expansion.
Hoque et al. (2022) concluded that the increase in US, Chinese, and Japanese trade policy uncertainty caused an increase in stock market returns in fragile economies (Indonesia, Turkey, Colombia). In particular, US-China trade tensions are beneficial for the stock market performances of these countries. It shows that the stock market of fragile economies can act as a hedge against US, Chinese, and Japanese trade policy uncertainty. Dogah (2021) examined the effect of US and China trade policy uncertainty on the stocks of ASEAN countries (Singapore, Thailand, Malaysia, Philippines, Indonesia). The study results show that China's trade policy uncertainty is more effective than the US. Trade policies are related to how much it is exposed to trade. In other words, the stronger the trade relations with a country, the more it is affected by the uncertainty of that country's trade policy. Similarly, Pierce and Schott (2016) stated that the stronger the trade relations between two countries, the stronger the effect.
Some studies examine the specific effects of trade policy uncertainty on national economies. Steinberg (2019) examined the trade policy uncertainty created by the UK's Brexit decision and demonstrated that Brexit uncertainty resulted in a significant welfare cost, reducing investments in the UK economy. This study is an essential example of how even uncertainty about the future of trade agreements (such as the Brexit process) negatively affects firms' expectations and behaviors.
Unlike other studies, Yunus et al. (2024) examined the impact of trade policy uncertainty on sector-based stocks. In the short term, stock markets of all sectors except China's banking sector are negatively affected by uncertainty. However, in the long term, this negative impact disappears thanks to the government's supportive policies.
The rest of the study is summarized as follows: Section 2 discusses the methodology, Section 3 covers the dataset and preliminary analysis, Section 4 summarizes the empirical findings, and the last section concludes the study.

2. Methodology

In this study, the relationship between trade policy uncertainty and the S&P 500 index is investigated by the Markov Regime Switching method. The Markov regime-switching model was first developed by Quandt (1972) and Goldfeld and Quandt (1973). In the Markov regime model, also known as the Hamilton (1989) model, regime transitions between stagnation and economic expansion are expressed as probabilities. In this model, unlike linear time series, sub-periods of time series with different characteristics are modelled separately (Evci et al., 2016). Hamilton (1989) stated that the economy may have periods of rapid or slow growth and that this process can be explained by the transformation expressed by the Markov process. The first-order Markov chain for the stochastic process in which the way prior probabilities affect the probabilities in a time series is explained is expressed as follows (Bildirici et al., 2010):

$$\mathrm{P}(s_0, s_1, \dots, s_t) = \mathrm{P}(s_0) \prod_{i=1}^{t} \Pr(s_t | s_{t-1}) \, , \forall_t \qquad (1)$$

In Equation 1, $P(s_0)$ indicates the unconditional probability, $P(s_t|s_{t-1})$ indicates the conditional (transition) probability. The transition process of a two-regime model is expressed as follows:

$$\begin{aligned} P_r[s_t = 1 \mid s_{t-1} = 1] &= p \\ P_r[s_t = 0 \mid s_{t-1} = 1] &= 1 - p \\ P_r[s_t = 0 \mid s_{t-1} = 0] &= q \\ P_r[s_t = 1 \mid s_{t-1} = 0] &= 1 - q \end{aligned} \qquad (2)$$

Markov regime-switching models show the relationship between the regime at time *t* and at time *t-1* with the transition probability function. Transition probabilities take values between 0 and 1. The values $s_t = 0$ and $s_t = 1$ in Equation 2 represent unobservable regime transitions. The transition probability matrix for two-state regimes is as follows:

$$P_{ij} = \begin{bmatrix} P_{11} & P_{12} \\ P_{21} & P_{22} \end{bmatrix} \quad (3)$$

where P_{ij} represents the fixed transition probabilities between regimes.

P_{11}: The probability of transition from the first regime to the second regime,

P_{12}: The probability of transition from the first regime to the second regime,

P_{21}: The probability of transition from the second regime to the first regime,

P_{22}: The probability of transition from the second regime to the second regime. When $P_{11} + P_{22} < 1$ the probability of transition from one regime to another is high, and when, $P_{11} + P_{22} > 1$ the probability of transition from one regime to another is low. When Equation 3 is organized through the results in Equation 2, the probability matrix is expressed as follows:

$$P_{ij} = \begin{bmatrix} p & 1-q \\ 1-p & q \end{bmatrix} \quad (4)$$

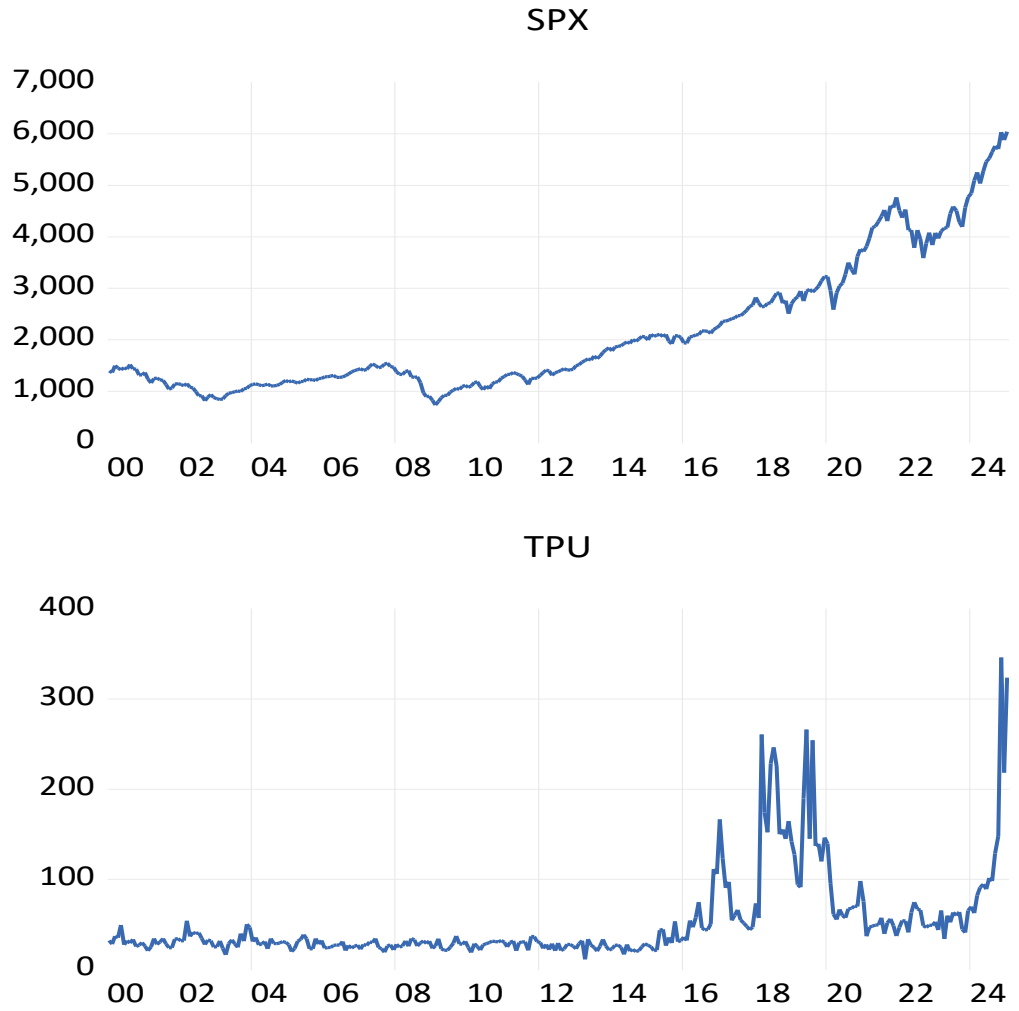
Using fixed transition probabilities, the duration of stay in each regime is calculated with the formulas $1/(1 - P_{11})$ and $1/(1 - P_{22})$.

3. Data and Preliminary Analyses

This study aims to investigate the effects of trade policy uncertainty on the stock market index using monthly data for the period 2000:01-2025:01. For this purpose, the trade policy uncertainty index (TPU) and S&P 500 (SPX) index variables were used. The raw data were obtained from www.policyuncertainty.com and www.investing.com.

Trade policy uncertainty refers to future uncertainties regarding trade-related regulations, tariffs, customs duties, and trade agreements. The index was calculated by Caldara et al. (2020) based on the frequency with which the terms “trade policy” and “uncertainty” appear together in major newspaper news. A high TPU means that firms, investors, and consumers do not clearly forecast how trade policies will be shaped. TPU is an important economic indicator that affects investor sentiment and significantly affects financial markets and trade. During periods when TPU increases, volatility in the markets increases, and there is a flight to safe-haven assets. During periods when TPU decreases, trade and investment increase, and economic growth may accelerate. The S&P 500 is a stock market index that measures the performance of 500 large publicly traded companies in the United States, covering a wide range of sectors, including technology, finance, and energy. Figure 1 shows the time series graphs of the relevant variables.

Figure 1: *The Trend of the Series*



When SPX data is examined, it can be said that it was an index that fluctuated but at a more moderate level until 2013, except for the collapse experienced in the 2008 Global Financial Crisis. Afterward, the expansionary monetary policies of central banks and the economic recovery enabled the S&P 500 to rise steadily for ten years. The S&P 500 fell rapidly due to uncertainties at the beginning of the pandemic, but the index recovered thanks to the incentive packages. In recent years, the strong performance of technology companies and innovations allowed the S&P 500 to reach new peaks. Although trade policy uncertainty fluctuated until approximately 2015, it did not show sudden increases and decreases. The index, which showed its first sudden increase in 2016 with the United Kingdom's decision to leave the European Union, increased trade policy uncertainties in Europe and worldwide. In 2018, mutual tariff increases and trade tensions between the US and China significantly increased global trade policy uncertainty. This situation affected not only these two countries but also global supply chains and other economies. The index has increased by approximately 53% in the last two years due to interest in artificial intelligence technologies, strong performance of large technology companies, and supportive economic policies.

Table 1: *Summary Statistics and Normality Test*

	LSPX	**LTPU**
Mean	7.513583	3.704813
Median	7.307739	3.464137
Maximum	8.706515	5.846193
Minimum	6.606143	2.424725
Std. Dev.	0.529938	0.621164

Skewness	0.565197	1.284644
Kurtosis	2.152800	4.201232
Jarque-Bera	25.02737	100.8876
Probability	0.000004	0.000000
Observations	301	

Summary statistics and normality test results of seasonally adjusted and logarithmic forms of the series are given in Table 1. LSPX has higher mean and median values than LTPU. Skewness values are positive, meaning the series is skewed to the right. Jarque-Bera test statistics show that the series is not normally distributed. There are 301 observations for two variables.

Before proceeding with the analysis, the stationarity levels of the series should be determined. The variables' stationarity levels were determined by the Augmented Dickey-Fuller (ADF) unit root tests developed by Dickey and Fuller (1979), the Phillips and Perron (PP) unit root tests developed by Phillips and Perron (1988), and the structural break unit root test by Lee and Strazicich (2004). In this context, the ADF, PP, and Lee & Strazicich unit root test results of the variables are given in Table 2.

Table 2: *Unit root Test Results*

Variables	**T-stat**	**Prob.**	**T-stat**	**Prob.**
	ADF Test (with constant)		***ADF Test (with constant and trend)***	
LSPX	3.1771	1.0000	0.2367	0.9982
ΔLSPX	-19.1920***	0.0000	-19.8847***	0.0000
LTPU	-1.3142	0.6237	-2.3061	0.4289
ΔLTPU	-26.1391***	0.0000	-26.1886***	0.0000
	PP Test (with constant)		***PP Test (with constant and trend)***	
LSPX	3.0929	1.0000	0.1258	0.9974
ΔLSPX	-19.1546***	0.0000	-19.7990***	0.0000
LTPU	-2.9316**	0.0430	-4.5801***	0.0013
	Lee Strazizich LM Test			
	T-stat	**Critical Value (5%)**	**Break date**	
LSPX	-2.2586	-3.2954	2022:06	
ΔLSPX	-3.9084**	-3.2954	2002:06	
LTPU	-2.3746	-3.2954	2018:06	
ΔLTPU	-13.4476***	-3.2954	2018:04	
*, **, and *** indicates the statistical significance at the 10%, 5% and 1% significance level, respectively.				

Test findings show that the LSPX and LTPU variables are not stationary at the level and contain a unit root. These variables become stationary at the first difference, i.e., integrated of the first degree, and also contain structural breaks in different periods.

4. Empirical Results

Determining that the variables are not stationary at their level values supports using a non-linear econometric model. In addition, it was found that the AIC value in a single-regime model estimate was larger than in a two-regime model and the two-regime structure was found to be more appropriate and this model was preferred in the analyses (Appendix-1). Table 3 shows the results of the Markov regime switching regression used for the study.

Table 3: *Markov Regime Switching Regression Results*

Regime (0)	
Constant	7.06986*** (0.000)
LTPU	-0.22581*** (0.000)
Regime (1)	
Constant	7.42202*** (0.000)
LTPU	0.99688*** (0.001)
Diagnostic Tests	
LR Test (χ^2)	323.41*** (0.000)
AIC	0.0708
Log-likelihood	17.6349
ARCH Test (F)	0.1485(0.4975)
Portmanteau Test (χ^2)	6.4951 (0.1774)
*, **, and *** indicates the statistical significance at the 10%, 5% and 1% significance level, respectively.	

According to the coefficient estimation results of the Markov regime change model, regime periods are divided into periods when the S&P500 increases and periods when it remains more stable. Regime 0 is when the stock market increases become more pronounced, while Regime 1 represents the periods when these increases are not much. In Regime 0, the effect of LTPU on LSPX is negative and significant. It is proven that trade policy uncertainty has effects during periods of increase in the stock market. Decreases in trade policy uncertainty accelerate companies' investment decisions and cause a positive atmosphere in the markets. In particular, trade-sensitive sectors (industry, technology, exporting companies) can perform better. If TPU decreases, investors can take longer-term risks, and a stable increase can be seen in the S&P 500. For example, with the trade agreement between the US and China in 2020, trade policy uncertainty decreased, and the S&P 500 reached high values. Regime 1 is the period when LTPU has positive and significant effects on LSPX. Generally, an increase in TPU is considered a negative signal for the S&P 500. When the period separation of the model is taken into account, it coincides with a period when there are no significant increases in the S&P 500, and it follows a more volatile course. When trade policy uncertainty increases, companies make fewer investments, and the expectation of a contraction in global trade increases. Uncertainties such as trade wars increase risk perception, VIX index increases, and volatility increases in the S&P 500. Although there are no severe outflows in the stock market during this period, it can be said that the increase in uncertainty prevents new investments. When the effects of TPU for the two regimes are compared, it can be said that the effect is stronger in Regime 1. Additionally, the LR (Likelihood Ratio) test was applied to determine whether the model is linear. The LR test statistic of the two-regime model was found to be approximately 324.35. This value rejects the linearity hypothesis even at a 1% significance level. This finding indicates that the data is not linear and that nonlinear models, which allow transitions between regimes, should be preferred. The ARCH and Portmanteau tests in the model show that there are no heteroscedasticity and autocorrelation problems in the model, respectively.

Table 4: *Transition Probabilities Matrix*

	Regime 0, t	*Regime 1, t*
Regime 0, t+1	0.9987	0.0062
Regime 1, t+1	0.0013	0.9938

Table 4 shows the matrices of transition probabilities between regimes for the Markov regime change model. The probability of staying in Regime 0 is 0.9987, and the probability of staying in Regime 1 is 0.9938. These high probability values indicate high permanence in the regimes.

Table 5: *Regime Classifications*

Period	Months	Average Prob.
Regime (0)		
2013(6) - 2025(1)	140	0.995
Average duration	140 months (46.67%)	
Regime (1)		
2002(2) – 2013(5)	160	0.994
Average duration	160 months (53.33%)	

Finally, the duration matrices obtained according to regime classification are given in Table 5. Of the 300-month observation period, 140 months are spent in Regime 0, and 160 months in Regime 1.

5. Conclusion

Trade policy uncertainty (TPU) is a determining factor not only for individual firms but also for stock market performance at the macro level. TPU is transmitted to financial markets through various channels, such as global investor sentiment, portfolio flows, supply chain disruptions, exchange rate fluctuations, and commodity prices. Therefore, minimizing TPU is critical to ensuring financial stability.

This study uses the Markov Regime Switching Model to analyze the effects of trade policy uncertainty (TPU) on the S&P 500 (SPX). The findings show that the effect of TPU on financial markets varies depending on the regimes. In the stock market uptrend regime (Regime 0), TPU is found to have a negative and significant effect. This indicates that the decrease in trade uncertainty can increase investor confidence and cause an increase in the stock market index. In Regime 1, the effect of TPU on the stock market is positive. This indicates that uncertainties can increase short-term capital movements by creating volatility in the market.

Policymakers should pursue steps to reduce trade policy uncertainty, ensure financial market stability, and increase investor confidence. In this context, transparent trade policies, risk management strategies, and central bank interventions are critical to mitigating the impact of uncertainty on financial markets. Governments should make trade policies more transparent and predictable. Policies that create uncertainty, such as sudden tariff changes or cancellation of trade agreements, should be minimized. Investors should diversify their portfolios across sectors and countries to minimize the risks of trade policy uncertainty.

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Appendix-1

Table 1: Determination of the Number of Regimes

Model	**AIC Value**
Single-regime (linear) model	0.9774
Two-regime MRSM	0.0708