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Inflation Threshold Effects on Stock Prices: Evidence from the Plantation Sector in Malaysia

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Abstract

This study aims to examine the threshold effect of inflation on stock prices in the Malaysian plantation sector. This study used earnings per share (EPS) and return on equity (ROE) as proxies for microeconomic variables, and inflation (INF which proxies for the consumer price index) as a proxy for macroeconomic variables. A panel dataset covering 32 listed companies in the plantation sector from 2008Q3 to 2023Q3 is used. The results of threshold analysis show that inflation has a nonlinear effect, with a threshold value of 4.6128%. This implies that when inflation crosses this value, it significantly alters the outcome of stock prices. Inflation consistently has a negative effect on stock prices across both regimes, although the impact slightly decreases under higher inflation. Higher inflation will increase the detrimental effects of ROE and reverses the significance effect of EPS and DTE to insignificant, while enhancing the positive contributions of revenue and operating cash flow.

Keywords: Stock prices, Inflation, Threshold analysis

1. Introduction

Inflation, often measured by the consumer price index (CPI), is a critical determinant of stock prices because of its influence on production costs and profit margins (Al-Dwiry et al., 2022; Silfia & Zuhroh, 2022; Wong & Pinjaman, 2022; Raza et al., 2021; Widyastuti & Susilo,

2020; Ogunsakin & Awe, 2020). In the Malaysian plantation sector, this relationship is particularly significant because the sector is highly sensitive to economic variables, including inflation and commodity price fluctuations, given its dependence on exports. Malaysia, as one of the world's largest producers and exporters of palm oil and rubber, plays a pivotal role in global trade patterns and contributes substantially to the country's GDP, export earnings, and rural employment (Ibrahim, 2022; Malaysian Palm Oil Council, 2021b).

Price fluctuations in these commodities directly affect income levels, government revenues, investment decisions, and consumer costs, highlighting their importance to Malaysia's economic stability (Malaysian Palm Oil Council, 2021a). However, the impact of inflation on stock prices is not always consistent, with some studies suggesting nonlinear relationships or threshold effects (Asab & Al-Tarawneh, 2019; Dionísio et al., 2004). Threshold effects occur when the influence of an independent variable, such as inflation, on a dependent variable, such as stock prices, changes upon reaching a specific threshold level (Hansen 2000).

Figure 1 shows the quarterly trend movement of stock prices alongside inflation (CPI as a proxy). While inflation demonstrates a steady upward trend, stock prices fluctuate significantly. In general, before 2015Q1 (110.50), both variables moved positively together, but after this period, the relationship became negative, suggesting a threshold effect. Understanding these effects is essential for accurately predicting market behavior and making informed investment decisions. Large shifts in inflation can have a disproportionately large effect on stock prices, underscoring the importance of examining this nonlinear relationship.

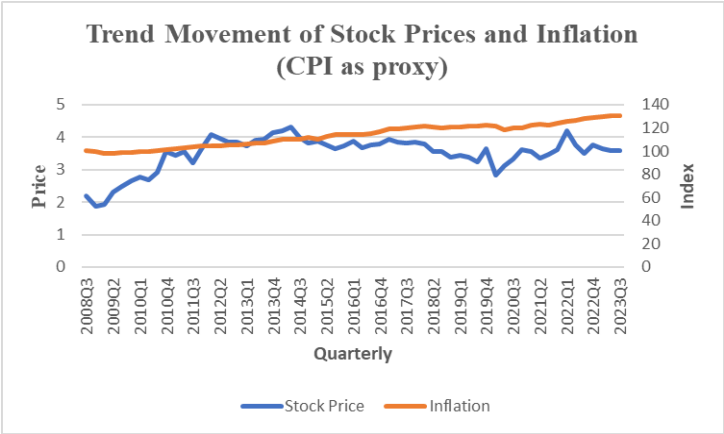

Figure 1. Trend Movement of Stock Prices and Inflation (CPI as proxy)

This study aims to examine the threshold effects of inflation on stock prices in the Malaysian plantation sector. These findings are expected to contribute to both theoretical and practical knowledge. Theoretically, it will extend the understanding of stock price determinants by emphasizing the significance of threshold effects. Practically, the results will enable investors to make better-informed decisions, support policymakers in maintaining market stability, and assist researchers in constructing robust economic models. Furthermore, the methodology used in this study can be applied to other industries and sectors, enhancing its broader

relevance.

2. Literature Review

Previous studies have examined the determinants of stock markets in various countries and sectors, including Financial Services, and Consumer Products and Services. It highlights the importance of macroeconomic variables, specifically inflation in the stock market by using analysis method such as ordinary least squares, ARDL, VECEM, VAR, Johansen cointegration, fixed effect, common effect model, and generalized method of moment. However, the findings reveal that the impact of inflation on the stock market varies across different contexts and methodologies. A summary of the literature review may be found in Appendix A.

According to Al-Dwiry et al. (2022), Silfia and Zuhroh (2022), Wong and Pinjaman (2022), and Olorunleke (2014), INF positively impacts stock prices. This finding indicates that companies follow anticipated inflation conditions, moreover, changes in the price level do not affect a company's financial performance because of the ability to maintain maximum profit with minimum cost (Wong & Pinjaman, 2021). In contrast, Raza et al. (2021), Ogunsakin and Awe (2020), Widyastuti and Susilo (2020), Hasan and Sharif (2019), Joshi and Giri (2015), and Mutuku and Ng'eny (2014) reported a negative relationship. This suggests that the companies followed unanticipated inflation conditions (Wong & Pinjaman, 2021). According to Joshi and Giri (2015), inflation reduces the value of money and thus reduces the purchasing power of people, which has a negative effect on savings and investment activities in the stock exchange.

As mentioned earlier, the inconsistent results may be due to the linearity assumption (Asab & Al-Tarawneh, 2019). Research by Bui and Nguyen (2023), and Asab and Al-Tarawneh (2019) has explored the threshold effect of inflation on stock markets. The result indicates that inflation has a nonlinear effect. Specifically, inflation has a positive effect on the stock market before it reaches a certain threshold level. However, it becomes negative above the threshold level. This finding is consistent with that of Kusumatrisna et al. (2022), despite their focus on economic growth. Therefore, the threshold effect of inflation might not be ignored.

This study is grounded in signaling theory (1973), which consists of 4 components: sender, signal, signal environment, and receiver. In this context, sender refers to listed companies in the plantation sector. A signal is presented in an annual report, which communicates the company's financial condition and serves as the main communication channel between internal and external stakeholders (Rajandran, 2021; Sun et al., 2020). The macroeconomic variable of inflation acts as the signal environment. Inflation can be classified as the signal transmission medium between the signal and the receiver (stock price), which influences how the receiver perceives and interprets the signal (Shou et al., 2020; Wei et al., 2017).

In this study, threshold analysis is applied to better understand how inflation, as the signal environment, impacts the transmission and interpretation of the signal. The threshold effect suggests that inflation does not have a uniform impact across all levels but instead influences stock prices in a nonlinear manner. In other words, the relationship between inflation and

stock price may change when inflation reaches a certain threshold, affecting how the receiver (stock price) responds to signals from the sender (company's annual report). This approach helps to examine how stock prices react differently at various inflation levels, providing a more nuanced understanding of the impact of inflation as a signal environment on the interpretation of corporate signals.

Hence, this theoretical framework not only connects the components of signaling theory but also integrates threshold analysis to deepen our understanding of how stock prices are influenced by both the signal (annual report) and the signal environment (inflation), particularly under varying inflation conditions.

In past studies, the majority focused on country-level analysis, whereas few studies focused on the sectoral context, specifically the plantation sector. Furthermore, there is still limited research examining the threshold effect of inflation on the stock market. Hence, this study aims to fill the existing gap by examining the threshold effect of inflation on stock prices specifically in the context of the plantation sector in Malaysia. Instead of focusing on the linear effect of inflation, this study applies threshold analysis to provide a more comprehensive understanding of how stock prices react at different levels of inflation.

3. Data and Methodology

3.1 Data

This study employs quantitative research to examine the threshold effect of inflation on stock prices in the plantation sector in Malaysia. Stock prices (SP, closing prices) are the dependent variables of the study. Earnings per share (EPS) and return on equity (ROE) are proxies for microeconomic variables, whereas inflation (INF which proxies for the consumer price index) is a proxy for macroeconomic variables. In addition, control variables are also included, which are revenue (RV), net profit (NP), operating cash flow (OCF), and debt to equity (DTE). All the data are obtained from Bloomberg. This study focuses on 32 listed companies with available data on the plantation sector in the main market of Bursa Malaysia. This study covers the period from 2008Q3-2023Q3, with 1952 observations.

3.2 Model Specification

The primary challenge in applying macroeconomic variables in panel regression analysis lies in the limited variation within the panel dataset, particularly at the firm-specific level. This occurs because macroeconomic variables typically have the same value across all companies within a given country. This lack of variability reduces their effectiveness in detecting meaningful effects on the dependent variable. To address this, the threshold regression model focuses on inflation as the sole macroeconomic variable in the analysis.

This study adopts the threshold estimation methodology proposed by Hansen (2000), which offers significant advantages in capturing nonlinear relationships in economic data. Unlike the traditional model, which assumes a constant relationship between variables. The threshold model allows for identifying points where this relationship changes, resulting in a more detailed view of the data. This adaptability supports the complicated data structure while

improving the model fit and forecast accuracy.

Furthermore, the threshold model is able to handle structural breaks and regime changes explicitly, which are common in economic and financial series. It improves diagnostic capabilities by identifying several behavioral patterns to reveal hidden patterns and asymmetric effects. This is particularly beneficial for policy formulation and strategic decision-making as it provides the specific information needed for effective management.

Hence, threshold analysis is designed to capture how the relationship between variables changes abruptly or nonlinearly once a certain threshold is crossed. Typically, the threshold model commonly encompasses two or more regimes. In this study, a two-regime approach is employed. The threshold variable of inflation is divided into two regimes on the basis of the single threshold sample splitting model. Each regime represents a different functional relationship between the variables of interest. Therefore, this approach allows for the identification and analysis of threshold effects that occur below or above the specified threshold level (Soo et al., 2023).

Equation (1) is the basic panel model of the linear function.

$$lnSP_{it} = \beta_0 + \beta_1 lnEPS_{it} + \beta_2 lnROE_{it} + \beta_3 lnNP_{it} + \beta_4 lnOCS_{it} + \beta_5 lnDTE_{it} + \beta_6 lnINF_{it} + \varepsilon_{it} \quad (1)$$

To capture the nonlinearity or threshold effect of inflation, equation (1) must be rewritten as shown in equation (2). The following threshold model is used to examine the nonlinear or threshold effects between inflation and stock prices.

$$lnSP_{it} = [\beta_0 + \beta_1 lnEPS_{it} + \beta_2 lnROE_{it} + \beta_3 lnNP_{it} + \beta_4 lnOCS_{it} + \beta_5 lnDTE_{it} + \beta_6 lnINF_{it}]\delta(lnINF_{it} \leq \gamma) + [\beta_0 + \beta_1 lnEPS_{it} + \beta_2 lnROE_{it} + \beta_3 lnNP_{it} + \beta_4 lnOCS_{it} + \beta_5 lnDTE_{it} + \beta_6 lnINF_{it}]\delta(lnINF_{it} > \gamma) + \varepsilon_{it} \quad (2)$$

4. Results and Discussion

4.1 Descriptive Statistics

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
lnSP	1952	0.5046	1.2177	-2.5257	3.2696
lnEPS	1952	-2.9199	1.7718	-9.2103	1.1237
lnROE	1952	1.7981	1.2533	-6.0323	7.5153
lnRV	1952	11.0694	2.0690	-0.6931	15.7965
lnNP	1952	10.6875	3.1315	0.0000	26.1975
lnOCF	1952	11.0447	3.3131	0.6931	24.6315
lnDTE	1952	1.7373	2.6525	-9.2103	5.4081
lnINF	1952	4.7287	0.0860	4.5856	4.8727

Table 1 provides insights into the characteristics and variability within the Malaysian plantation sector. The mean value of the stock price (lnSP) is 0.5046, indicating that the average value is slightly above zero. The standard deviation is 1.2177, suggesting a moderate level of variability in stock prices. The minimum value is -2.5257, whereas the maximum value is 3.2696, indicating a wide range of stock prices in the dataset. This range implies that

stock prices are highly volatile, which could be attributed to various market conditions affecting different companies in the plantation sector.

The mean value of earning per share (lnEPS) is -2.9199 with a standard deviation of 1.7718. The negative mean value suggests low profitability or even losses for many companies. The minimum is -9.2103 and the maximum is 1.1237, indicating substantial variation in earnings among the companies in the dataset. The wide range reflects differences in financial performance, with some companies facing major profitability problems.

The mean value of return on equity (lnROE) is 1.7981 with a standard deviation of 1.2533. The mean suggests a positive condition of overall profitability. The minimum value of -6.0323 and the maximum value of 7.5153 indicate a wide variation in ROE among the companies. This demonstrates different levels of efficiency in generating profits from shareholder equity.

Inflation (lnINF) has a mean of 4.7287 and a standard deviation of 0.0860. The mean indicates a relatively stable inflation condition. The range between the minimum value of 4.5856 and the maximum value of 4.8727 is tight, indicating that the inflation condition remained constant with limited variance during the observed period.

4.2 Coefficient of Correlation Test

Table 2. Coefficient of Correlation Result

	lnEPS	lnROE	lnRV	lnNP	lnOCF	lnDTE	lnINF
lnEPS	1.0000						
lnROE	0.1466	1.0000					
lnRV	0.0359	0.4309	1.0000				
lnNP	0.7243	0.2212	0.1337	1.0000			
lnOCF	0.1111	0.1356	0.2094	0.2231	1.0000		
lnDTE	-0.0513	0.2040	0.3903	0.1513	0.1544	1.0000	
lnINF	0.1385	-0.0893	0.1050	0.1918	0.0689	0.1043	1.0000

According to the criterion that a correlation coefficient greater than 0.80 indicates the presence of multicollinearity (Shrestha, 2020), the results in Table 2 demonstrate no evidence of multicollinearity between the variables. This indicates that while some variables, such as earnings per share (EPS) and net profit (NP), are moderately correlated due to their intrinsic financial relationship, the correlations are not strong enough to pose multicollinearity problems. Therefore, the variables in the model can independently contribute to explaining the variations in stock prices without significant distortion in the estimates caused by multicollinearity. This ensures the reliability and robustness of the regression results.

4.3 Threshold Estimator

Table 3. Threshold Estimator Results for Inflation

Threshold Estimator	**INF**
Threshold Value	4.6128
Fstat	507.60
Prob	*(0.0000)****

Note: The value inside the parentheses refers to the p-value of the variable, where *, **, and *** refer to significance at the 10%, 5%, and 1% levels, respectively.

Table 3 shows a summary of the threshold estimators for inflation. The threshold value is known as the point at which inflation will alter the outcome. The threshold value of INF is 4.6128 in natural logarithm form, and the initial number is 100.7659 (e^4.6128). This implies that when INF crosses this value, it significantly alters the outcome of stock prices, as the p-value is significant at the 1% level. In other words, INF has a threshold effect.

4.4 Threshold Regression

For Regime 1, where the INF is less than 4.6128, several variables exhibit different relationships with stock prices. EPS, RV, OCF, and DTE positively impact stock price, whereas ROE, NP, and INF negatively impact stock price. Throughout the p-values, only ROE and OCF have an insignificant effect, whereas the other variables have a significant effect across different significance levels.

For Regime 2, where INF is greater than 4.6128, DTE exhibits inverse relationships compared with the results in Regime 1. In this regime, DTE negatively impacts stock prices. Additionally, the significance of EPS, NP, and DTE becomes insignificant, whereas the opposite is true for ROE and OCF.

Table 4. Threshold Regression Results for the Plantation Sector

Threshold Value	Threshold INF = 4.6128	
Variables	Regime 1<TINF	Regime 2>TINF
lnEPS	0.0292	0.0036
	*(0.070)**	*(0.608)*
lnROE	-0.0029	-0.0424
	(0.882)	*(0.000)****
lnRV	0.0521	0.0739
	*(0.000)****	*(0.000)****
lnNP	-0.0271	-0.0061
	*(0.015)***	*(0.124)*
lnOCF	0.0079	0.0054
	(0.178)	*(0.026)***
lnDTE	0.0208	-0.0085
	*(0.016)***	*(0.144)*
lnINF	-1.6023	-1.5669
	*(0.000)****	*(0.000)****
Constant	7.2828	
	*(0.000)****	
Observations	1952	
R^2	0.1880	

Note: The value inside the parentheses refers to the p-value of the variable, where *, **, and *** refer to significance at the 10%, 5%, and 1% levels, respectively.

On the basis of these results, the following important conclusions can be drawn for the focused variables of EPS, ROE, and INF:

1. lnEPS remains positive in both regimes; however, its significance shifts from significant to insignificant. This finding indicates that the impact of the EPS depends on inflation levels. As inflation continues to rise and across the threshold value of 100.7659, the EPS may no longer serve as a reliable indicator for decision-making.

2. The changes in lnROE from insignificantly negative (-0.0030) in Regime 1 to highly significant negative (-0.0424) in Regime 2, with differences of 0.0394. This finding indicates that the impact of ROE becomes increasingly detrimental as inflation increases. This notable change highlights that the influence of profitability measures such as ROE on stock prices is highly sensitive to inflation levels.

3. lnINF remains negative and highly significant in both regimes, with a slight increase in its absolute coefficient value from -1.6023 in Regime 1 to -1.5669 in Regime 2. This finding indicates that inflation continues to have a strong negative effect on stock prices, although this effect slightly diminishes at higher levels. This negative relationship indicates that, regardless of the inflationary environment, increases in inflation tend to drive stock prices down, confirming the threshold effect noted in the introduction.

Surprisingly, after crossing the threshold level, the impact of INF remains consistent. This result contrasts with the findings of Bui and Nguyen (2023), Kusumatrisna et al. (2022), and Asab and Al-Tarawneh (2019). Their studies reported a shift in the effect of inflation from a positive impact at lower inflation levels to a negative impact at higher inflation levels. However, the consistent negative relationship between inflation and stock prices in this study aligns with the findings of Raza et al. (2021), Widyastuti and Susilo (2020), Ogunsakin and Awe (2020), Hasan and Sharif (2019), Joshi and Giri (2015), and Mutuku and Ng'eny (2014).

These studies highlight that higher inflation reduces purchasing power and increases production costs, leading to reduced corporate profitability and declining stock prices. This suggests that companies in the plantation sector respond to unanticipated inflationary conditions. Conversely, studies by Al-Dwiry et al. (2022), Silfia and Zuhroh (2022), Wong and Pinjaman (2022), and Olorunleke (2015) reported a positive relationship between inflation and stock prices, highlighting the variety of findings across different sectors and contexts.

When the sectors are examined individually, the Commercial Banks (Al-Dwiry et al., 2022), Food and Beverage (Silfia and Zuhroh, 2022), and Travel, Leisure, and Hospitality sectors (Wong and Pinjaman, 2022) exhibit positive relationships with inflation. In contrast, the Textile sector (Raza et al., 2021) has a negative relationship, suggesting that it is more vulnerable to inflationary pressures.

5. Conclusion and Recommendations

This study examined the threshold effect of inflation on stock prices in the Malaysian plantation sector over the period 2008Q3-2023Q3. This result confirmed that inflation has a threshold effect on stock prices. The shift from Regime 1 to Regime 2 highlights the complexity and dynamics of the impact of inflation on stock prices. Higher inflation reverses the insignificant negative effect of ROE in Regime 1 to a highly significant negative impact in Regime 2, indicating that higher inflation levels worsen the detrimental effects of ROE on stock prices. Similarly, the positive contributions of OCF and DTE observed in Regime 1 diminish under higher inflation, with OCF becoming significant and DTE turning negative but insignificant in Regime 2. Conversely, the positive impact of RV strengthens as inflation increases, suggesting that revenue becomes a more critical driver of stock prices in high-inflation conditions. EPS remains positive but shifts from significant in Regime 1 to insignificant in Regime 2, indicating that its influence on stock prices depends on inflation levels. Unlike previous findings, INF consistently has a significant negative effect on stock prices in both regimes, with a slight reduction in its effect under higher inflation levels, emphasizing its strong adverse impact on stock prices.

Several policy and investment recommendations may be drawn for both lower and higher levels of inflation. For investors, diversifying portfolios on the basis of inflation regimes is crucial. During periods of low inflation, where the CPI is less than 100.7659,

- Investors may prioritize higher values of EPS, RV, and DTE. For beginner investors in the stock market, using these indicators to screen potential investment opportunities can be effective, as they are likely to drive stock prices up in the future. It is also important to evaluate these indicators each quarter once the audited reports are available to determine whether to continue investing or to exit.
- However, investors should carefully assess profit and loss statements to identify any one-time events or cost issues, as NP can negatively impact stock prices. It is essential to understand whether a decline in NP is due to temporary factors or ongoing issues.

During periods of higher inflation, where the CPI exceeds 100.7659, these same criteria may no longer be as effective. In such cases, investors should focus more on lower ROE values and higher values for RV and OCF, rather than relying on EPS, NP, and DTE.

For policymakers, policymakers may aim to maintain inflation within a stable range to avoid crossing the threshold level. During periods of low inflation,

1. **Encouraging a Low Interest Rate**: By maintaining low interest rates, policymakers may encourage businesses to invest in expansion, research and development, and technological innovations. Low inflation generally accompanies a stable economy, allowing companies to focus on long-term growth.
2. **Promote Access to Credit**: In periods of low inflation, businesses may be more inclined to take on debt to finance growth. Policymakers may ensure that financial institutions provide affordable access to credit and venture capital to foster growth in

both large and small companies.

During periods of higher inflation, policymakers may tighten monetary policy. When inflation is high, central banks may raise interest rates to control inflation. While this might increase borrowing costs, it can also help stabilize the economy by reducing inflationary pressures, ultimately ensuring that businesses are not trapped in rising expenses.

In summary, by recognizing the threshold effect of inflation on stock prices, investors and policymakers may take proactive steps to reduce risk and prevent adverse conditions. Investors may adjust strategies on the basis of inflation conditions, whereas policymakers may implement policies to maintain economic stability and promote industry growth. These approaches may potentially to improve the flexibility and performance of plantation investments under changing inflationary conditions. For future research, a similar research topic could be extended to other sectors over longer periods to gain a better understanding. Additionally, other macroeconomic variables such as the exchange rate and sentiment variables, could also be examined as potential threshold variables.

Authors contributions

The PhD students Wong Vui Ken and Dr. Saizal were responsible for the study design and revision. Wong Vui Ken was responsible for data collection. The PhD student Wong Vui Ken drafted the manuscript, and Dr. Saizal revised it. All the authors read and approved the final manuscript. This paragraph, also explains any special agreements concerning authorship, such as if the authors contributed equally to the study.

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The data that support the findings of this study are available on request from the

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Data sharing statement

No additional data are available.

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Appendix A

Table 1. Past Studies and Summaries

No	Author	Year	Periods/ Frequency	Number of Firms/ Observations	Sector/Industry	Market/Country	Model/Dependent	Result
1	Bui and Nguyen	2023	2008-2020	8 Countries	Emerging & Developing Economies	Asia	Threshold-GMM/Stock Market Capitalization to GDP	INF (non-linear), Threshold = 1.9%, BTL (+) & ATL (-)
2	Al-Dwiry, Al-Eitan, & Amira	2022	2010-2021	13 NoF/143 Obs.	Commercial Banks	Amman Stock Exchange	Fixed Effect/Market Price per Share	EPS (+), GDP (+), INF (+)
3	Silfia & Zuhroh	2022	2016-2020	10 NoF/50 Obs.	Food and Beverage	Indonesia Stock Exchange	CEM/Stock Price	ER (-), INF (+), IR (+), ROE (+), DTE (+), EPS (-)
4	Wong and Pinjaman	2022	2013-2019	23 NoF/161 Obs.	Travel, Leisure, and Hospitality	Bursa Malaysia	GMM/Stock Price	EPS (+), ROE (+), INF (+), ER (-)
5	Kusumatrisna, Sugema, & Pasaribu	2022	1994-2019	26 Provinces	-	Indonesia	Threshold FE/Economic Growth	INF (non-linear), Threshold = 9.59%, BTL (+) & ATL (-)
6	Raza, Hassan Gillani, Ahmad, Qureshi, & Khan	2021	2009-2017	62 NoF/588 Obs.	Textile	Pakistan	Fixed Effect/Share Price	EPS (+), GDP (+), INF (-)
7	Widyastuti & Susilo	2020	2015-2018	17 NoF/68 Obs.	-	Indonesia Stock Exchange	Pooled OLS/Stock Price	ROE (+), EPS (+), ER (+), INF (-)
8	Ogunsakin and Awe	2020	1985-2018	-	-	Nigeria	ARDL/Stock Index	INF (-), ER (-)
9	Asab and Al-Tarawneh	2019	1980-2018	-	-	Aman Stock Market	Threshold Model by CLS, 2SLS/Stock Market Capitalization to GDP	INF (non-linear), Threshold = 1.6%, BTL (+) & ATL (-)
10	Hasan and Sharif	2019	Jan2013-Oct2018	-	-	Dhaka Stock Exchange, Bangladesh	Johansen Cointegration/Stock Index	INF (-), ER (+)
11	Joshi and Giri	2015	Apr2004-Jul2015	-	-	India	ARDL & VECM/Stock Price	INF (-), ER (+)
12	Olorunleke	2014	1986-2012	28 Obs.	-	Nigeria	OLS/Stock Market Return	INF (+)
13	Mutuku and Ng'eny	2014	Quarterly, 1997-2010	-	-	Kenya	VAR & VECM/Stock Pirce	INF (-), ER (+)