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Stock Returns and State-Dependent Effects of Changes in Exchange Rate and Money Supply from Central Banks

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Authors' contributions

This work was carried out in collaboration between all authors. Aurthors SE E and OJB conceptualized the research study, reviewed the literature, and wrote the first draft of the manuscript. Author DU restructured the research methodology, formulated the relevant models, performed enhanced data estimation, provided the discussion of results, and also wrote the conclusion. All authors read and approved the final manuscript.

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ABSTRACT

This study investigates the state-dependent effects of exchange rate movements and money supply shocks on stock market returns using daily stock returns, exchange rate, and variations in money supply data obtained from the databank.worldbank.org website from 1990 to 2022. The stock markets of ten emerging and developed countries were used in the study. The Markov-Switching regression methodology was utilized for this study. The results suggest that for the developed stock markets, in Regime 1, a positive shock to the money supply stimulated a significant rise in the stock returns while in Regime 2, a positive shock to the money supply induced a drop in returns. This suggests that for the developed stock markets, the effect of money supply shock on returns is state-dependent. In the developing stock markets, the coefficient for exchange rate was negative and

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significant in Regime 1, while it was insignificant in Regime 2. Therefore, the effect of exchange rate on returns is state-dependent in developing countries. Also, the coefficient for volatility in the exchange rate was negative and sizable in both regimes, indicating that the returns effect of volatility is not state-dependent. Basically, each day the exchange rate appreciates, stock returns rises in the developed stock markets while a devaluation policy executed in developing countries stimulated some decline in returns of emerging markets. In both regimes, a rise in money supply shock had positive and significant returns. The effect of money supply on stock returns is not state-dependent. Consequently, developing countries need flexible approaches to managing the variations in the exchange rates and money in circulation. While policymakers in developed markets may need to focus more on reducing volatility rather than adjusting exchange rates to influence stockpiling, those of emerging countries could benefit more from policies that stabilize exchange rates.

Keywords: Money supply; exchange rate volatility; stock returns; state-dependence effects; Markov-switching regression.

JEL Classification: D29, F34, E60.

1. INTRODUCTION

Shocks measured as volatility in the stock market are thought to be influenced by changes in monetary policy factors such as interest rates, money supply, and exchange rates. According to [1], financial markets are crucial to the transmission of monetary policy, hence, monetary policy has a major role to play in influencing stock market return. The larger the exchange rate volatility, the bigger the risk connected with the country and the less appealing it is to foreign investors. Ceteris paribus, a decline in the money supply is frequently accompanied by an increase in interest rates. According to [2], higher discount rates result in lesser future cash flows and, thus, lower stock prices.

In the context of well-developed markets, a lot of research has been done on stock market returns in relation to exchange rate volatility and money supply [3-15]. The majority of this literature concludes that central banks' monetary policy decisions have an impact on the volatility and returns of stock markets. Technically and fundamentally, developing markets vary from developed markets [16]. Higher volatility has been linked to lower stock returns, which reflects the market's low appetite for such circumstances [17]. Financial markets that fluctuate frequently indicate a lack of investors' confidence. Hence, businesses cut back on their investment spending and are wary about hiring new employees. Similarly to this, instability of economic policy implementation only attracts lesser and lesser foreign investment [18]. Identifying the link between monetary policy shocks, exchange rate volatility, and stock market prices is highly imperative to portfolio investors.

Besides, macroeconomics is currently engaged in a heated dispute about the nature of the connection between monetary variables and asset price fluctuations [19]. For that reason, it becomes pertinent to empirically unravel the connections between changes in currency rates, money stock, and stock returns. According to [19]'s theory, monetary officials' actions should result in changes in financial asset prices and returns that, if all goes according to plan, will influence economic behavior. Knowing how state-dependent effects of exchange rate volatility and monetary policy shocks on stock market prices also necessitate unveiling how both policy variables influence asset prices in the financial market and by extension returns of businesses. As a result, our task is to evaluate the state-dependent effects of exchange rate and money supply shocks on stock returns in both emerging and advanced stock markets. Therefore, the paper answers the question, do stock markets in industrialized and developing nations exhibit state-dependent responses to changes in exchange rates and variations in money supply? We, therefore, hypothesized that the stock price effect of changes in monetary policy and exchange rate volatility is not state-dependent.

The significance of the study derives from the following facts. Investors' knowledge of stock market returns with changes in money stock rates and exchange rate policy of the central banks are less vulnerable to market losses and

risk. There is a dearth of empirical findings especially when it comes to the state-dependence effect of monetary and exchange policies on stock market performance in different countries. This study attempts to bring empirical insights to fill this gap in the literature. Likewise, the scope of the stock returns state-dependent effect of changes in money stock and exchange rate policy is highly desirable by financial market regulators to stabilize the financial market. Finding the variables that influence the risks associated with the return of a stock is essential to stock marketers. This is because it forms a factor in the investors' decision-making in the equities market. This goes a long way to avert a crash in the investment portfolio. In addition, this research aims to close the knowledge gap as it relates to comparative evidence on monetary and exchange rate policies between developing and developed countries. The rest of the study comprised chapter two concerned with the review of relevant literature, theoretical review, empirical review, and the gap in the literature. Section 3 is concerned with methodology which consists of a theoretical framework, study design, data source, and specification of model and techniques of analysis. In section 4, the presentation, analysis of data, and policy implications and dealt with. Section 5 is a conclusion to the research.

2. LITERATURE REVIEW

The stock market, also known as the equity market or share market, is characterized by the aggressive buying and selling of stocks, which stand for the ownership of claims on businesses. According to the flow-oriented paradigm [20], exchange rates and stock returns are positively correlated. This concept is predicated on the notion that the current account or trade balance of a nation determines the exchange rate. This model assumes that fluctuations in foreign currency rates can have an impact on trade balances and global competitiveness. The phenomenon can be explained by the fact that domestic enterprises will become more competitive as a result of having cheaper exports in global trade as a result of the local currency's depreciation. Increased exports will boost domestic company wealth by boosting domestic stock prices of domestic companies. In this regard, the exchange rate will be a cause of the stock returns.

According to the stock model of [21], [22], and [23], the supply and demand for financial assets affect the exchange rate. This model is further divided into two categories: the monetary model and the portfolio balance model. According to the portfolio balance model, exchange rates and stock prices are related causally. This model assumes that investors hold both domestic and overseas assets, including both local and foreign currencies. Investors are forced to sell their foreign assets when the value of domestic assets rises. Investors' increased wealth as a result of rising domestic asset values drives them to seek out additional domestic assets, which raises interest rates. The value of the currency will rise as a result. Nevertheless, the monetary theory upholds that there is little to no correlation between currency rates and stock prices. The exchange rate is regarded as the asset's price in this approach. Exchange rates are based on future predicted exchange rates, just as asset values are based on expected future prices. Therefore, every factor that modifies the current exchange rate predicted future value will also do so. Changes in exchange rates might be influenced by other sources than changes in stock prices. There may therefore not be a correlation between stock prices and exchange rates under such circumstances.

Also, the balance of payments (BoP) theory upholds that the value of the nation's currency increases when the country's BoP is favorable [24], and [25]. The external value declines as a result of an unfavorable balance of payments. The study by [26] and provides first-hand data on the consequences of exchange rate volatility on India's cross-border trade with the United States, Germany, Japan, and China at the commodity level. The findings demonstrate that nominal exchange rate volatility significantly dampens India's export rates to the US, Germany, and China as well as import rates from the US and China over the long term. Using the DCC models and quantile regressions, [27] derived time-varying associations regarding the effects of volatility on the U.S. stock.

The empirical survey of the relevant literature on the return effects of exchange rate changes has been mixed. The research by [28] implemented the GARCH modeling technique and found a spillover effect from volatility in the Euro and the Australian dollar to the volatility of S & P 500. In addition, they reported that the volatility in Euro, Canadian dollar, and Australian dollar, had a significant effect on stock return. Another recent research that implemented the ECM, GARCH, and ARDL estimation methods, [29] was able to

establish a positive long-term and short-run nexus between exchange rate movement and stock returns. In the short-term analysis, the stock returns were found to be negatively correlated with the exchange rate. Similar results and findings were reported based on the ARDL estimation of quarterly data by [30]. In particular, [30] found a negative association between stock returns and exchange rates. The result obtained by [31] established that variations in the exchange rate asymmetrically impacted the stock returns of sectors. Hence, the authors reported that it will empirically misleading to rely upon one particular model to analyze returns of different sectors in the economy. It has also been established by [32] that the exchange rate of the dollar had a negative impact on the stock index of the Palestine stock market.

Regarding the returns effects of money supply, during the 2008 global financial crisis, [33] reported that a rise in money supply had no considerable influence on the US stock market, but during the COVID-19 manifestations, changes in money supply positively impacted stock returns. The study by [34] found a direct association between money supply stock returns while [35] also reported a positive effect of the changes in money on Indian stock market capitalization and stock market index. On the contrary, [36] established that money growth lowers stock returns. A nonlinear impact of substantial positive effect of monetary policy on stock exchange returns in Nigeria was established [37]. In the research by [38], money supply was found to significantly influence the valuation of the S&P 500 index. Specifically, when money in circulation rose by $1 billion, S&P 500 increased by 0.14 percent.

3. METHODOLOGY

The nature of this work is empirical and descriptive. This study employed the Markov-Switching regression estimation methods to examine the relationship between stock returns, variations in money supply, and changes in the exchange rates of ten emerging and developed stock markets. The variables in the study included exchange rate (EXCRATE), its volatility captured as LOG(SIGMA) in the Markov-Switching regression estimations, money supply shock (MONSHOCK), and stock returns (STOCKRETNS), for which daily observations were collected for 10 industrialized and emerging markets. Due to the recent stock market's erratic behavior, the use of daily series becomes essential. Besides, the Markov-Switching model methodology allows for changes in the relationship between variables over time. The simple Markov switching model could be specified as:

$$STOCKRETNS = \begin{cases} \phi_1 + \phi_2 STOCTRETNS_{t-1} + \mu_t, & S_t = 0 \\ \phi_1 + \alpha + \phi_2 STOCTRETNS_{t-1} + \mu_t, & S_t = 1 \end{cases}$$

where $|\phi_2| < 1$ and μ are i.i.d. random variables with zero mean, S_t is the regime factor. When $S_t = 0$ the mean is given as $\phi_1 / (1-\phi_2)$. When St switched to 1, the mean becomes $(\phi_1 + \alpha)/(1-\phi_2)$. Since S_t follows a first-order Markov chain, the transition matrix was given by:

$$Prob = \begin{bmatrix} \mathrm{P}(s_t = 0 | s_{t-1} = 0) & \mathrm{P}(s_t = 1 | s_{t-1} = 0) \\ \mathrm{P}(s_t = 0 | s_{t-1} = 1) & \mathrm{P}(s_t = 1 | s_{t-1} = 1) \end{bmatrix} = \begin{bmatrix} \mathrm{P}_{00} & \mathrm{P}_{01} \\ \mathrm{P}_{10} & \mathrm{P}_{11} \end{bmatrix}$$

where *Pij* represents transition probabilities of *St* = *j* given that $S_{t-1} = i$. Noticeably, the transition probabilities satisfy $P_{10} + P_{11} = 1$. The empirical specification is such that for emerging stock markets,

$$Regime1: STOCKRETNS = \delta_1 + \delta_2 EXCRATE + \delta_3 MOSHOCK + \upsilon_1$$
$$Regime2: STOCKRETNS = \delta_4 + \delta_5 EXCRATE + \delta_6 MOSHOCK + \upsilon_2$$

where $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5, \delta_6$ are the parameters to be estimated, υ_1 and υ_2 are the error terms for regime 1 and regime 2, respectively. The regime probabilities were modeled using a logistic function:

P(Regime 1) = 1 / (1 + exp(-γ_1 - γ_2 STOCKRETNSlag))

where γ_1 and γ_2 are the regime probability parameters, and STOCKRETNSlag is the lagged value of STOCKRETNS. For developed stock markets, the following specifications hold:

$$Regime1: STOCKRETNS = \phi_1 + \phi_2 EXCRATE + \phi_3 MOSHOCK + \in_1$$
$$Regime2: STOCKRETNS = \phi_4 + \phi_5 EXCRATE + \phi_6 MOSHOCK + \in_2$$

where $\phi_1, \phi_2, \phi_3, \phi_4, \phi_5, \phi_6$ are the parameters to be estimated, $\in_1$ and $\in_2$ are the error terms for regime 1 and regime 2, respectively. Using the logistic function, the regime probabilities were modeled as:

P(Regime 1) = 1 / (1 + exp(-γ_1 - γ_2 STOCKRETNSlag))

where γ_1 and γ_2 are the regime probability parameters, and STOCKRETNSlag is the lagged value of STOCKRETNS. The variables used in the study are stock returns (STOCKRETNS), variations in money supply (MONSHOCK) by the central banks calculated as the variations in the totality of credit, loans, and savings, and exchange rate volatility (EXCRATE) of the ten developing countries and developed countries spanning through all years. The sample size for this study is a period of 1990 to 2022 for each of the ten emerging and developed markets. Data on all variables were sourced from the official website of the World Bank, namely, https://databank.world.org/source/world-development-indicators#.

4. RESULTS AND DISCUSSION

4.1 Emerging Markets Analysis

The presence or otherwise of stationarity was tested for and the results reported in Table 1 show the results of the stationary test. After first differenced in Table 1, stock market returns, exchange rate, and variation in money supply were found stationary over the period from 1990 - 2022. This means that stock market return, exchange rate, and lending rate are *I*(1).

The regression output in Table 2 shows the results of a Markov-Switching regression for two different regimes. The regimes were interpreted as two different states of the economy. For the emerging markets whose results are presented in Table 2, the high points of the estimates are as interpreted hereunder.

Regime 1: For the EXCRATE, the z-statistic is -4.565048, indicating a significant negative relationship between EXCRATE and Regime 1. The probability (Prob.) associated with this z-statistic is reported as 0.0000, suggesting a highly significant connection. Concerning MONSHOCK, the z-statistic is 9.598730, but the associated probability is 0.0000, which is above the conventional significance level of 0.05. Therefore, there is sufficient evidence to conclude that a significant association between the money supply shock and the stock returns exists in Regime 1. The volatility measure, LOG(SIGMA) has a significant z-statistic which is 42.60170, indicating a highly significant relationship between the volatility (measured by LOG(SIGMA)) and the dependent variable in Regime 1. The associated probability is reported as 0.0000, further confirming the significance.

Regime 2: For the EXCRATE variable, the z-statistic is 1.088118, and the associated probability is 0.5408. This indicates that the variable EXCRATE does have an insignificant positive link with STOCKRETNS in Regime 2. Regarding money supply shock, MONSHOCK, the z-statistic is 2.959222, and the associated probability is 0.0031, indicating a significant association between MONSHOCK and STOCKRETNS in Regime 2. The LOG(SIGMA) measure of volatility has 63.09133 z-statistic, and the associated probability is 0.0000. This suggests a highly significant relationship between volatility (measured by LOG(SIGMA)) and the dependent variable in Regime 2.

Common: The lagged values of STOCKRETNS (AR(1), AR(2), AR(3), and AR(4)) indicate that only AR(1) and AR(2) had significant values in both regimes. The z-statistic of AR(1) is 33.64041, and the associated probability is 0.0000, indicating a highly significant relationship between the one-period lagged value of the

Table 1. Unit Root Test Results at Difference based on Levin, Lin & Chu

Variable	Test Statistic	P – value	Critical value
STOCKRETNS	-27.90844	0.0001	1%, 5%, 10%
EXCRATE	-141.443	0.0001	1%, 5%, 10%
MONSHOCK	-200.69377	0.0039	1%, 5%, 10%

STOCKRETNS (AR(1)) and the current value in both regimes. The z-statistic of AR(2) is 30.593594, and the associated probability is 0.0000, indicating a significant link between the two-period lagged value of STOCKRETNS (AR(2)) and the current value in both regimes. The z-statistic of AR (3) is 1.005241, and the associated probability is 0.4959, indicating that the third lag of STOCKRETNS (AR(3)) may not have a significant relation with the current value in both regimes. The z-statistic of AR(4) is -0.432077, and the associated probability is 0.9638, suggesting that the fourth lag of STOCKRETNS (AR(4)) does not have a significant link with the current value in both regimes.

Transition Matrix Parameters: The probability of staying in Regime 1 given by P11-C is significant. This can be seen from the z-statistic of 4.970559, and the associated 0.0000 probability indicating a highly significant probability of staying in Regime 1. This suggests that once in Regime 1, the probability of remaining in that regime is high. The probability of moving from Regime 1 to 2 given by P21-C is also significant. Hence, the z-statistic of -10.292588, and the associated zero probability which is indicative of a highly significant probability of transitioning from Regime 1 to Regime 2. This suggests that there is a significant likelihood of moving from Regime 1 to Regime 2.

In sum, the Markov-Switching regression analysis for developing countries shows that the coefficient for EXCRATE is negative and significant in Regime 1, while it is insignificant and positive in Regime 2. By implication, whenever there was a positive shock to the exchange rate (devaluation policy) in developing countries, stock returns fall. The coefficient for LOG(SIGMA) is negative and significant in both regimes, indicating that volatility reduced STOCKRETNS in both regimes. The transition matrix parameters suggest that the probability of moving from Regime 1 to Regime 2 is relatively high compared to the probability of staying in Regime 1. In effect, there exist two distinct regimes (Regime 1 and Regime 2) with different relationships between the variables and the dependent variable. In Regime 1, the variable EXCRATE and the volatility (LOG(SIGMA)) are highly significant, and so does the variable MONSHOCK. In Regime 2, the variable MONSHOCK and the volatility (LOG(SIGMA)) are both statistically significant, while the variable EXCRATE is not significant. In both regimes, namely, 1 and 2, money supply shock had positive and significant coefficients, implying that a percentage rise in the variations in money supply results in an increase in stock returns in the economy. In regime 2, the result is the same. Hence, the effect of money supply on stock returns is not state-dependent whereas that of exchange rate changes is state-dependent. The lagged values of the dependent variable have varying levels of significance across different lags (AR(1) and AR(2) are significant). Additionally, there is a significant probability of transitioning from Regime 1 to Regime 2.

4.2 Developed Stock Markets Analysis

Table 3 shows that all variables, namely, stock returns, exchange rate, and money supply are stationary after the first difference. In other words, stock market return, exchange rate, and returns, exchange rate, and variations in money stock are both integrated of order one *I*(1).

For the developed markets, the high points of the Markov-Switching regression estimates reported in Table 4 are as follows:

Regime 1: The variable EXCRATE had a positive z-statistic of 0.652858, and the associated probability is 0.5138, indicating an absence of a significant positive link between EXCRATE and STOCKRETNS in Regime 1. The variable MONSHOCK had a z-statistic of 0.023563, and the associated probability is 0.9812, suggesting no significant relationship between MONSHOCK and stock returns in Regime 1. The volatility measured by LOG(SIGMA), had a highly significant relationship with STOCKRETNS in Regime 1, as indicated by the high z-statistic of 233.5123 and the associated probability of 0.0000.

Table 2. Results of markov-switching regression models for emerging markets

	Model 1			Model 2			Model 3	
Variable	**z-Statistic**	**Prob.**	**Variable**	**z-Statistic**	**Prob.**	**Variable**	**z-Statistic**	**Prob.**
	Regime 1			**Regime 1**			**Regime 1**	
EXCRATE	-4.565023	0.0000	MONSHOCK	9.594567	0.0000	EXCRATE	-30.091058	0.0074
LOG(SIGMA)	-42.60230	0.0000	LOG(SIGMA)	-25.73054	0.0000	MONSHOCK	11.702383	0.0000
						LOG(SIGMA)	-26.28236	0.0000
	Regime 2			**Regime 2**			**Regime 2**	
EXCRATE	1.088118	0.5408	MONSHOCK	2.959222	0.0031	EXCRATE	0.02147	0.5720
LOG(SIGMA)	-26.37633	0.0000	LOG(SIGMA)	-63.09133	0.0000	MONSHOCK	20.798597	0.0005
						LOG(SIGMA)	-43.36019	0.0000
	Common			**Common**			**Common**	
AR(1)	33.64041	0.0000	AR(1)	18.62001	0.0000	AR(1)	94.32619	0.0000
AR(2)	30.50894	0.0000	AR(2)	47.953874	0.0000	AR(2)	30.10989	0.0000
AR(3)	1.008041	0.4959	AR(3)	0.475304	0.6671	AR(3)	1.523437	0.1678
AR(4)	-0.437577	0.9638	AR(4)	-0.467560	0.7879	AR(4)	-0.255090	0.4560
Transition Matrix Parameters			**Transition Matrix Parameters**			**Transition Matrix Parameters**		
P11-C	4.9703535	0.0000	P11-C	9.1005678	0.0000	P11-C	9.267800	0.0000
P21-C	-10.293456	0.0000	P21-C	-4.309863	0.0000	P21-C	-4.433542	0.0000

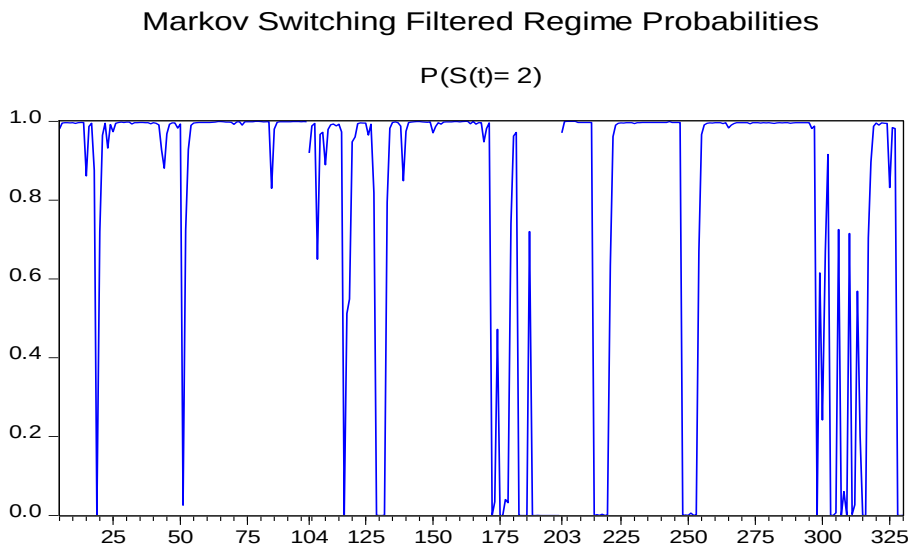

Fig. 1. Regime probabilities for emerging markets for MONSTOCK STOCKRETNS

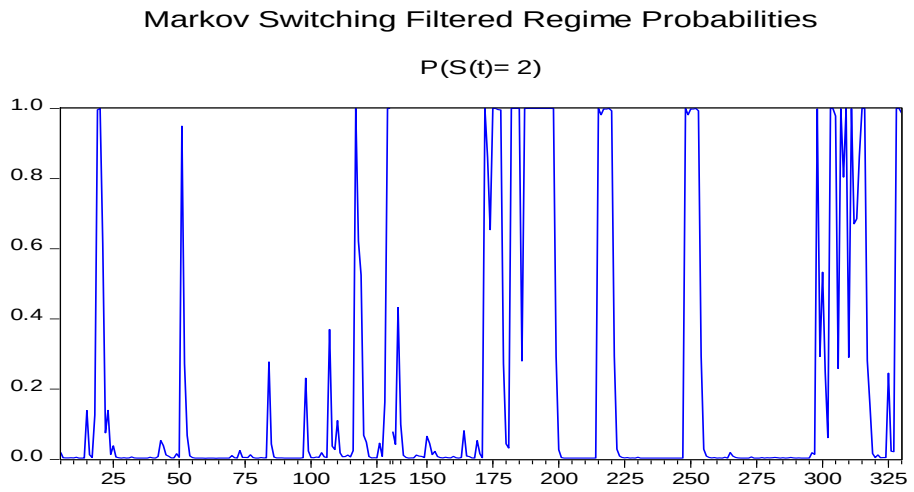

Fig. 2. Regime probabilities for emerging markets with EXCVOL, MONSHOCK, STOCKRETNS

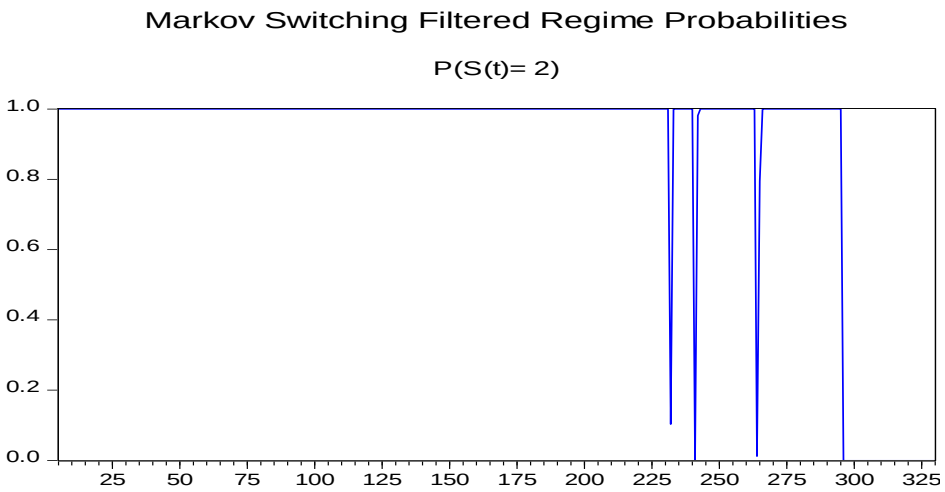

Fig. 3. Regime probabilities for developed stock markets with EXCRATE, MONSHOCK, STOCKRETNS

Table 3. Unit root test results at difference based on Levin, Lin & Chu

Variable	Test Statistic	P – value	Critical value
STOCKRETNS	-17.85500	0.0001	1%, 5%, 10%
EXCRATE	-234.03081	0.0001	1%, 5%, 10%
MONSHOCK	-192.37593	0.0088	1%, 5%, 10%

Regime 2: The variable EXCRATE had a positive z-statistic of 90.168857, and the associated probability is 0.0000 suggesting that EXCRATE does have a significant positive association with STOCKRETNS in Regime 2. In effect, exchange rate appreciation stimulates stock returns in the developed stock markets. This could be pointing to the fact that these set of countries hardly devalue their exchange rate. The variable MONSHOCK had a z-statistic of 2.285076, and the associated probability is 0.0223, indicating a significant association between MONSHOCK and STOCKRETNS in Regime 2. The volatility measured by LOG(SIGMA), had a highly sizable impact on stock returns in Regime 2, as indicated by the high z-statistic of 75.51423 and the associated probability of 0.0000.

Common: The lagged values of stock returns (AR(1), AR(2), AR(3), and AR(4)) have varying levels of significance in both regimes. In Regime 1, only AR(1) had a highly sizable impact on the current value of returns, as indicated by the positive z-statistic of 97.46751 and the associated probability of 0.0000. In Regime 2, AR(1) is highly significant, AR(2) is not significant, and AR(3) and AR(4) have marginal significance. This could be suggesting that exchange rate volatility is not common in developed countries.

Transition Matrix Parameters: The probability of staying in Regime 1 is highly significant, as indicated by the z-statistic of 6.084509 and the associated probability of 0.0000. The probability of transitioning from Regime 1 to Regime 2 is highly significant, with a z-statistic of -8.511888 and an associated probability of 0.0000. In sum, the Markov Switching (M-S) regression analysis for developed countries reveals the following:

In Regime 1, the volatility (LOG(SIGMA)) has a highly significant negative relationship with STOCKRETNS, while the variables EXCRATE and MONSHOCK do not show significant relationships. In Regime 2, both MONSHOCK and the volatility (LOG(SIGMA)) have significant negative relationships with stock returns. The coefficient of the exchange rate variable, EXCRATE is negative and also highly significant in Regime 2. By implication in the developed stock markets, the exchange rate (devaluation) results in a drop in returns for model 1 and model 2 respectively. In Regime 1, a positive shock to the money supply stimulated a significant rise in the stock returns while in Regime 2, a positive variation to the money supply induced a drop in returns. This suggests that for the developed stock markets, the effect of variation in money supply on returns is state-dependent. The lagged values of the STOCKRETNS have varying levels of significance across different lags, with AR(1) consistently showing a highly significant association. The transition matrix parameters indicate a significant probability of transitioning from Regime 1 to Regime 2 and a significant probability of remaining in Regime 1.

Overall, the Markov-switching regressions suggest that the relationship between EXCRATE and STOCKRETNS is state-dependent, meaning that the effect of EXCRATE on STOCKRETNS varies depending on the state of the economy. In particular, the effect of EXCRATE is positive in both Regimes for developed countries while it is negative for developing countries. However, the impact is significant only in Regime 2. By implication, whenever, the exchange rate appreciates, stock returns rise in the developed stock markets while a devaluation policy executed in developing countries stimulated some decline in returns of emerging markets accordingly. Also, the Markov-switching regressions show that the coefficient for EXCRATE is insignificant in Regime 1, indicating that EXCRATE does not have a significant effect on STOCKRETNS in that regime but sizably impacted returns in Regime 2. The effect of volatility on STOCKRETNS is negative in both regimes for emerging markets, indicating that volatility had an adverse effect on STOCKRETNS in Regime 1 and Regime 2. The transition matrix parameters suggest that the probability of staying in regime 1 is relatively high compared to the probability of moving to regime 2. Largely, the results of the Markov-switching regression suggest that the relationship between EXCRATE and STOCKRETNS is not state-dependent for the developed countries. Conversely, the effect of EXCRATE on

Table 4. Results of switch regression models for developed stock markets

	Model 1			Model 2			Model 3	
Variable	**z-Statistic**	**Prob.**	**Variable**	**z-Statistic**	**Prob.**	**Variable**	**z-Statistic**	**Prob.**
	Regime 1			**Regime 1**			**Regime 1**	
EXCRATE	0.6766888	0.5768	MONSHOCK	0.0260945	0.9680	EXCRATE	0.098760	0.6255
LOG(SIGMA)	-233.97812	0.0000	LOG(SIGMA)	-216.50978	0.0000	MONSHOCK	5.623450	0.0000
						LOG(SIGMA)	-215.4654	0.0000
	Regime 2			**Regime 2**			**Regime 2**	
EXCRATE	90.168857	0.0000	MONSHOCK	-2.978756	0.0241	EXCRATE	16.805407	0.0000
LOG(SIGMA)	-75.51423	0.0000	LOG(SIGMA)	-119.1872	0.0000	MONSHOCK	-2.388929	0.0166
						LOG(SIGMA)	-71.21240	0.0000
	Common			**Common**			**Common**	
AR(1)	97.46394	0.00000	AR(1)	12.77675	0.0000	AR(1)	9.571006	0.0000
AR(2)	0.383395	0.64660	AR(2)	1.373043	0.1697	AR(2)	0.653452	0.5674
AR(3)	0.157660	0.87975	AR(3)	1.872823	0.0611	AR(3)	1.5997973	0.1322
AR(4)	0.9897834	0.46500	AR(4)	-1.616770	0.1059	AR(4)	-1.198564	0.2356
Transition Matrix Parameters			**Transition Matrix Parameters**			**Transition Matrix Parameters**		
P11-C	6.084509	0.0000	P11-C	3.117205	0.0018	P11-C	3.117205	0.0018
P21-C	-8.511888	0.0000	P21-C	-5.702246	0.0000	P21-C	-5.702246	0.0000

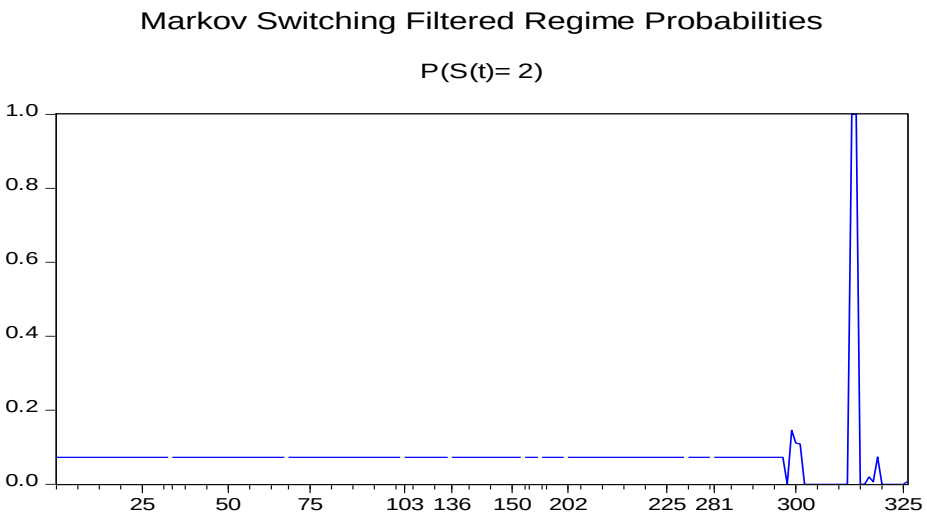

Fig. 4. Regime probabilities for developed stock markets for MONSHOCK, STOCKRETNS, EXCRATE

STOCKRETNS does vary depending on the state of the economy for the developing countries with emerging markets. Moreover, the effect of volatility on STOCKRETNS is negative in both regimes for developing countries but is stronger in Regime 1 for developed markets. The results also suggest that developing countries may benefit more from policies that stabilize exchange rates than developed countries.

5. CONCLUSION

This study made an empirical attempt to evaluate the state-dependent effects of exchange rate, exchange rate volatility, and monetary policy shock on stock returns in developed and emerging stock markets using the Markov-Switching regression methodology. According to the M_S analysis, for the developed stock markets, In Regime 1, a positive shock to the money supply stimulated a significant rise in the stock returns while in Regime 2, a positive shock to the money supply induced a drop in returns. This suggests that for the developed stock markets, the effect of money supply shock on returns is state-dependent. The study also established that the effect of the exchange rate on stock returns does not rely on the state of the economy in developed countries. Besides, the relationship between the volatility in the exchange rate and stock returns is significant and negative. Volatility, on the other hand, had a large impact on stock returns in both regimes, with a greater impact in Regime 1 than in Regime 2. In the developing stock markets, the coefficient for exchange rate was negative and significant in Regime 1, while it was insignificant in Regime 2. This goes to show that whenever there was a positive shock to the exchange rate in developing countries with emerging stock markets, stock returns fall while it rises insignificantly in Regime 2. Therefore, the effect of the exchange rate on stock returns is state-dependent in emerging stock markets. Also, the coefficient for volatility in the exchange rate was negative and significant in both regimes, indicating that volatility harmed returns in both regimes. In both regimes, a positive shock to the money supply shock had a positive and significant impact on stock returns in the economy. Consequently, the effect of money supply on stock returns is not state-dependent in developing nations. The transition matrix values indicated that the likelihood of remaining in Regime 1 was higher than the probability of transitioning to Regime 2. The study contributes to the understanding of the relationship between macroeconomic indicators and stock returns in both developing and developed markets. According to the findings, exchange rate, money stock, and volatility all have a considerable impact on market returns in both emerging and advanced markets but the effect of the exchange rate is state-dependent accordingly for the emerging markets economies. Relatively, the effect of money supply shock on returns is state-dependent in developed countries. The findings show that policymakers and investors should pay attention to the behavior of macroeconomic variables such as exchange rates, money supply, and variation in the exchange rate. Policymakers need to consider the state of the economy when

designing policies related to exchange rates and the supply of money. In particular, policymakers in developing countries may want to encourage exchange rate stability and reduce volatility to increase stockpiling, while policymakers in developed markets may need to focus more on reducing volatility rather than adjusting exchange rates to influence stockpiling.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

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