

Foreign portfolio investment, returns, exchange rate and inflation for Zimbabwe: A Granger Causality and EGARCH approach

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ABSTRACT

This paper analyses the causal relationship between Foreign Portfolio Investment (FPI), Equities Market Volatility, Exchange Rate and Inflation in Zimbabwe using a monthly time series data between October 2018 and November 2021. The granger causality model was used to present the link between the variables, and EGARCH was used to account for volatility and asymmetric effects on the variables. To incorporate innovations and responses into the Granger model, impulse response functions were used. Links between exchange rate and foreign portfolio investments were found. This only suggests that exchange rate volatility will vary when overseas investors purchase and sell financial securities on the Zimbabwe Stock Exchange (ZSE). In contrast, foreign investors sell local financial securities when local stock market returns are negative, leading to a significant outflow of foreign portfolio investment thereby reducing demand for currency. A significant causal relationship was found between the volatility of the exchange rate and stock market returns. It is assumed that stock market returns, and foreign portfolio investments are caused by fluctuating currency rates. The relationship between exchange rate and ZSE returns, and inflation was found based on Granger causality. This implies that stocks are not suitable for long-term investments that compensate investors for their diminished purchasing power. Policy makers should advise the Zimbabwe Stock Exchange to recommend a reduction in capital gains tax and withholding tax and this encourages investors to hold local equities for a long time.

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1. Introduction

International capital flows have increased as a result of the globalization and integration of the financial markets. Return, as defined by Markowitz (1952), is the reward a buyer or seller gets for assuming a specific degree of danger as shown by the mix of securities in an investment portfolio. The assessment of foreign portfolio movements with regard to stock market return arose in the late 1970s, long after the liberalizing the capital account started in the United States of America. As a result, foreign money may enter the Zimbabwe Stock Exchange (ZSE) market more freely. Over time, foreign investors have been able to trade financial goods on domestic equities and credit markets thanks to shifts in worldwide liquidity. Amongst other benefits, foreign portfolio buyers provide stability on the local markets and more importantly on the vital finance for expansion, research and development, and other business operations (Makoni, 2020). As stipulated by Omorokunwa (2018), Foreign Portfolio Investment (FPI) is being identified as a crucial component that complements domestic savings and investment that improves the stock market's liquidity, and reduces the cost of capital. Both domestic and international investors would be exposed to risk due to an unpredictable exchange rate in terms of their investment return in the form of dividends and capital appreciation on their shares listed on the stock market of the host nation. The Zimbabwean stock exchange serves as a vital route for conduit for capital, especially during the hyper-inflationary periods that ended with the US dollar's introduction as a legal tender (Sunde & Sanderson, (2017).

By offering more easily available capital for business growth and advancement, foreign equity participation greatly enhances the capacity of national firms to improve their business processes (SECZIM, 2022; Kanyongo and Gumbo, 2015).

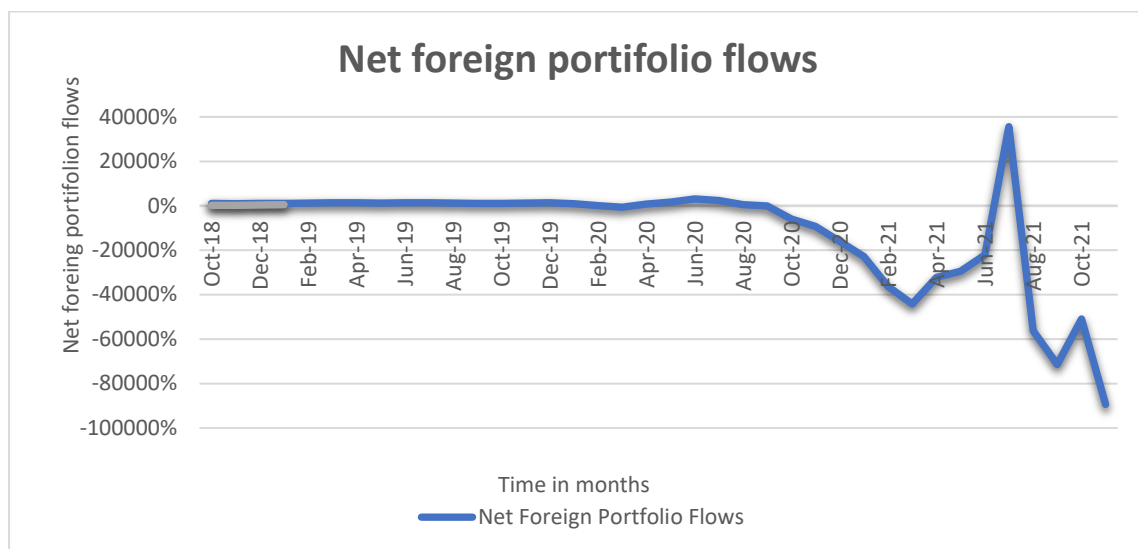
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As a result, capital markets are crucial to the long-term growth of a country's financial market, as demonstrated by Haider et al. (2017). Thus, from October 2018 to November 2021, an ongoing analysis attempts to elucidate the relationship underlying foreign portfolio flows, volatile stock markets, the foreign exchange system, and inflation. The Rhodesia Stock Exchange, formerly known as the Zimbabwe Stock Exchange, reopened for business following Zimbabwe's independence in 1980. Huong et al. (2021) claim that Zimbabwe loosened its financial system in April 1993 to draw in business and abide by global guidelines for the liberalization of its financial accounts. Capital acquisitions by foreign investors rose from zero dollars in April 1993 to eighty-four hundred thousand dollars in December 1996. Huong et al. (2021) state that at that period, foreign investors were allowed to purchase a maximum of twenty-five percent of the total shares that a single business issued. To ensure compliance with change control legislation and the Indigenization and Fiscal Empowerment Policy (IEEP), the Reserve Bank of Zimbabwe boosted foreign ownership of currencies. The percentage of regional stock controlled by foreign investors per transaction rose from ten percent to fifteen percent.

On the other hand, according to the Reserve Bank of Zimbabwe (2016), the overall proportion of foreign ownership of stocks increased from forty per cent to 49 per cent. Following the failure of the "Willing Buyer Willing Seller" transfer of land agreement, the authorities started the Fast Track Land Reform Program to give land to black people. Durham (2000) argued that the statutory capital accounting changes were not implemented smoothly owing to the Fast Track Land Reform Program (FTLRP) of 1998, which was marked by the seizing and repossession of white people's agriculture farms, business and residences. Consequently, from ZIM\$ 434.6 million in 1999 to ZIM\$ 85.66 million in 2000, net foreign equity dropped sharply (Durham, 2000).

Total foreign capital invested decreased by eighty percent in December 2001 in comparison with the corresponding months in 2000 as a response to the economic problems of 2000 and 2001, which included low returns on the ZSE, balance of payment deficit and a shortage of foreign currency (Durham, 2000). According to ZSE (2022) statistical figures, foreign buyers sold local stocks for US\$122.5 million on the local exchange in 2003. Gumus et al. (2013) claim that at the end of 2006, Zimbabwe had the globe's greatest inflationary rate nearly 100 percent which led to a decline in the proportion of shares held by foreign investors, which fell from 2.8 percent in 2005 to 2.31 percent in 2006. The local stock market does not provide information on foreign portfolios in 2007 or 2008. The Zimbabwe Stock Exchange market suspended operating in October 2008 as a result of inflationary pressure. Following the country's adoption of a multi-currency regime monetary posture, the local stock exchange reopened in February 2009. Foreign investment decisions are impacted by the degree of uncertainty in the exchange market, claim Caporale et al. (2017). Changes in the exchange rate therefore have a major and essential effect on foreign portfolio fluctuations and additionally the efficiency and volatility of the stock market as well as on inflation. Fig. 1 depicts foreign portfolio investment on the local bourse stock exchange between October 2018 and December 2021.



Source: Zimbabwe Stock Exchange

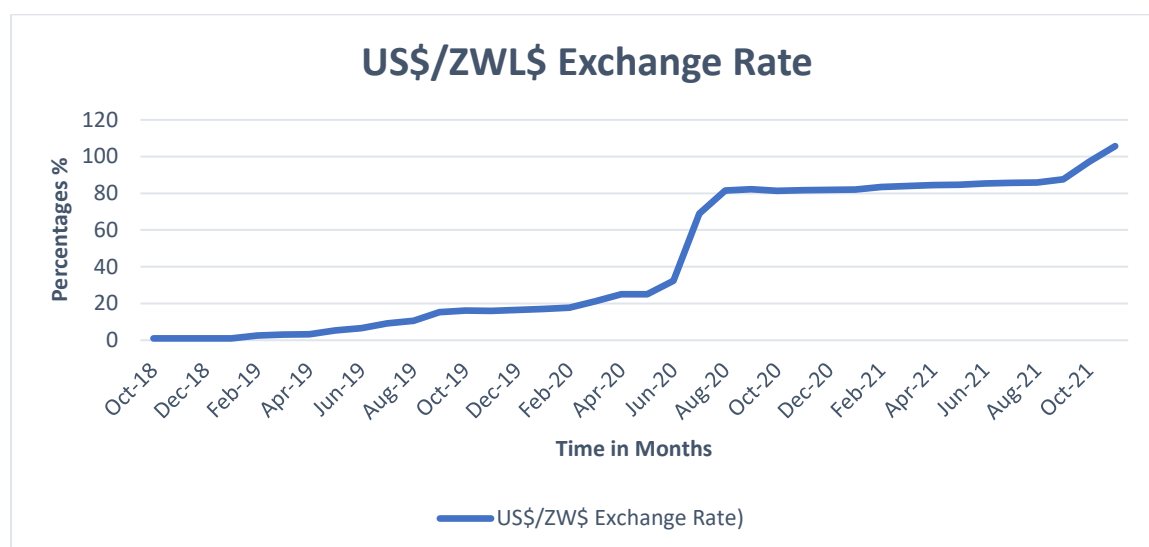
Fig. 1. Net foreign portfolio flows (October 2018 to November 2021)

When the US\$ was declared the trade currency in 2009, foreign investors' confidence in the domestic stock market was restored. Fig.1 shows that net foreign capital outflows in 2018 were almost zero. This resulted from businesses losing trust in the administration run by the ZANU PF. Late in 2019, net investments started to decrease. This may have occurred as a consequence of the final quarter of 2018 high rate of prices (sixty-one percent which reduced company sentiment. According to African Arguments (2019), this was also brought on by the destruction of property and deaths caused by unlawful objections, as well as by contradictions in economic policy surrounding the use of multiple currencies as a medium. The net foreign portfolio flows experienced a notable decline in September 2020. In reference to IMF (2021), the prevalent

rationale for this is the prevalence the worldwide Covid-19 pandemic, which led to a reduction in demand due to lockdown limitations and poor capacity utilization. Currency exchange rates started to fluctuate after the Reserve Bank of Zimbabwe reinstated the local dollar in its Monetary Policy Review Statement from October 2018. The central bank ended the use of multiple currencies and operationalized the use of the Zimbabwean dollar for all local transactions under the Exchange Control Directive RU102/2019 (RBZ, 2018). In accordance with Statutory Instrument 133 of 2019 (MOF 2020) legalized the use of the local currency and the exchange rate regime. Thus, US dollar to ZWL exchange rate was fixed at \$1: ZW 2.5. The ZWL price versus the USD was determined by the market forces of demand and supply as a result of the flexible exchange rate being employed, hence failing to meet Walrasian equilibrium. In order to efficiently allocate scarce US dollars to important economic sectors while allowing for a partly free market determination of the exchange rate, the Reserve Bank of Zimbabwe established the auction-managed rate system in June 2020 (RBZ, 2020). Nevertheless, as Fig. 1 illustrates, the adoption of the auctions exchange rate had no beneficial effect on foreign portfolio investment inflows. The US dollar to Zimbabwean dollars' rate is seen in Fig. 2. Foreign investments are impacted by the degree of uncertainty in the foreign currency market, claim Caporale et al. (2017). Changes in the value of a currency therefore have a major and profound effect on foreign portfolio moves and also the direction and uncertainty of the stock market. Maqsood et al. (2017) state that modeling the relationship between foreign portfolio flows and exchange rate is a crucial subject since it helps us understand how foreign investment flows are impacted by the worth of the local currencies. Moreover, Omorokunwa (2018) proposed that, it is crucial to consider equities market volatility while analyzing foreign equity flows since it reflects the risk profile of the local bourse.

According to Caporale et al. (2017), the level of uncertainty (or lack of trust) in the foreign exchange market represented by Zimbabwe's auction and interbank system moves foreign stock flows. As a result, changes in the exchange rate have a significant impact on foreign portfolio flows, stock market volatility, and performance.

Exchange rate volatility



Source Reserve Bank of Zimbabwe

Fig. 2. The exchange rate volatility (October 2018 to December 2021)

The price fluctuations between US dollars and Zimbabwean dollars since the native currency's September 2018 introduction are displayed in Fig. 2. From October 2018 and May 2020, there was a steady depreciation of the national currency. Due to significant yearly rates of inflation that reached frightening levels of 785.6% in May 2020 as opposed to 75.85% in the previous month (ZIMSTATS, 2020 and RBZ, 2020). Customers seemed simultaneously earning substantial returns while arbitrage firms like Old Mutual fungible shares, which were trading at low prices on the Zimbabwe Stock Exchange and high prices on the Johannesburg Securities Exchange. The Exchange Commission, halted the transaction of all convertible commodities as a result, which led to the suspension of operations on the local stock market.

There was an unexpected decline in the stock market's returns during the middle of 2020 and early 2021. This had been brought on by the COVID-19 worldwide epidemic, the sense that combined and the ensuing devaluation that year, scorched the whole world. Trading on the local exchange were therefore not profitable for investors over that same time period. According to Bhowmik et al. (2020), a stock market serves as a means of supplying money to the economic system and encouraging wise investment. The ZSE has an interesting trading and performance history. Despite Zimbabwe operating under a hyperinflationary environment from 2018 to 2021, the bourse was the best performing exchange in terms of the Index gains as evidenced by the gains on the ZSE main stream index in spite of the fact that there was no real production taking place nor consumption (Mahonye, 2014). Several have linked this to the Fisher effect, and these holds that throughout times of increased inflation, trading engagement increases. This subsequently is translated into excellent results, as shown

by higher so far this year develops on the parameters and the equity exchange's total capitalization by value (Mahonye & Mandishara 2014). One argument put forward is that adoption of the United States dollar (USD) as the reference currency for trading eliminated currency risk, hence, giving ZSE a greater comparative advantage in terms of receiving Foreign Portfolio Investment as compared to other African exchanges. For example, foreign participation increased by 38% (ZSE) from 2009 to 2015 (Mpofu, 2016). ZSE stabilized as real production was now starting to increase and the equities were now backed by real activity and production from the local firms, implying greater output and profit from the local firms.

In retrospect, significant devaluation of the exchange rate has been blamed for the high and constant inflation that has provided cause for great worry since 1980. In light of the foregoing context, the Zimbabwean government has been actively regulating hyperinflation by changing the currency rate; yet, instability persists in Zimbabwe, raising serious concerns. Though Zimbabwe's officials argue that adverse foreign assistance surprises and sanctions from abroad have led to the country's financial collapse since 2000, the private sector's pricing prediction was also the primary source of volatility. As a result, the steady rise in hyperinflation over time has threatened financial security in addition to decreasing the buying capacity of the majority of Zimbabweans.

Investing in the stock market is regarded as one of the safest options when hyperinflation is present. Between 2000 to the present, the nation has seen economic closures due to hyperinflation, exchange rate fluctuations, significant unemployment, and political unrest. It was expected that the collapse of the entire economy would have an impact on the money and financial markets. However, the stock market index kept rising throughout the review period, particularly during the hyperinflationary phase. For investors, the presence of a high inflation period might be troublesome because they anticipate low. Investors purchase more real assets than financial ones during a high inflation period.

The market interconnectedness, the gradual removal of restrictions on capital input, and Zimbabwe's use of various exchange rate mechanisms all contributed to the systematic interdependence of the stock and equity markets. Foreign portfolio investors have been crucial to supplying the necessary funding for investments made through local stock exchanges ever since liberalizing the capital accounts began. Since the end of 2019, net foreign portfolio outflows have fallen as seen in Fig. 1. Because local businesses have a lower amount available for management and reinvestment than they genuinely require, thereby signaling a funding gap. In 2018, the Reserve Bank of Zimbabwe also brought back the local currency.

Nevertheless, as Fig. 2 illustrates, lack of trust (resulting from speculating and arbitrage) during the local currency's reintroduction led to a sharp decline in value as compared to the US dollar (US\$). The marketplace's poorly performance showing can be seen by its annualized rate of return, which varies from an incredibly low to a value that's negative. Although the banking system and national treasury undertook action to maintain the value of the national dollar and create a favorable atmosphere for foreign portfolio flows, but the recent declining trends for both have worried the authorities. In 2018 the Zimbabwean dollar was introduced through the Reserve Bank of Zimbabwe. This move was quickly associated with a decline in confidence in the currency as a result of currency speculation and arbitrage, leading to a sharp decline in its value relative to the US dollar.

Although the national treasury and the banking system have made efforts to hold down the exchange rate of the currency in question and create a favorable atmosphere for foreign portfolio flows, officials have recently become concerned about the deteriorating developments in either. Therefore, the goal of this study is to investigate the nature and origin of the relationship between foreign equity flows, stock market performance, Zimbabwe's currency rate and inflation. To close this gap, the Granger Causality Model will be used in the study. The research uses the EGARCH family model to assess the asymmetrical impacts in financial time series data, the consequences of bad news (regulations inconsistencies and high taxation), good news and leveraging impacts that are commonly encountered in finance historical data.

This is a result of Zimbabwe's currencies experiencing significant depreciation, instability, and volatility as well as hyperinflation. Examining the interplay between markets for stocks, inflation, currency rate fluctuations, and foreign portfolio activities is so crucial. Developing investment strategies, stockbrokers and fund managers will benefit from the research output by being able to better understand the estimated causal relationship among international equity flows, stock market performance, and exchange. The study will benefit the Zimbabwe Stock Exchange, Reserve Bank of Zimbabwe, and Securities Exchange Commission of Zimbabwe (SECZ) in order to boost the entrance of foreign capital onto the country's exchange and stable local currencies. The country's 2030 upper middle-income strategy will be further supported by this by offering policy recommendations that encourage foreign portfolio investment inflows and exchange rate stability, which in turn leads to an among other advantages, an increase in industrial output, employment, earnings, and national welfare.

The investigation's following sections are going to be arranged in the following fashion: Section 2 will give a review of the relevant theoretical and empirical literature. The mechanism that was used to offer diagnostic checks is described in section 3. Using Econometrics Bundle Eviews 10, section 4 will deliver the outcomes, estimating, interpretation processes, summary of the study and policy recommendations.

2. Theoretical literature review

This research employs theoretical models to understand the reasons behind the triple connection among foreign portfolio flows, the stock markets, the exchange rate, and inflation. Theoretical models employed include the Price Pressure Speculation, Base Expanding Hypothesis, Feedback Hypothesis, and Stock Oriented Model.

2.1 Portfolio Diversification theory

According to Goh and Sopian (2017), those who dislike taking risks can lower the possibility of risk of loss by holding properly oppositely associated securities in an identical fund. Markowitz (1952) asserted that the adverse values suffered by any one array constituent will be balanced by additional income gained on additional holdings or investments. As a result, the overall portfolio is complemented. Consumers opt for diversifying their asset holdings through global exchange-traded platforms as a result of this volatility-hedging behavior in order to shield themselves against the risk of loss of money carried on by unorganized risk. Osemene et al. (2018), referenced by Goh and Sopian (2017), showed how factors such as transaction cost affect diversification by purchasing foreign assets and currency rate risk connected to investments in the target nation.

But this theory only considers risk-hedging behavior and excludes the reality that owners desire optimum returns through the use of their own investment. The hypothesis states that the examiner expects to uncover no link of causality (whether it's independently or as the consequence of reinforcement) among foreign equity participation and financial profits.

2.2 Feedback Hypothesis

The fundamental idea of the concept is that investment choices made by foreign investors are based on what is available on market prices at the time, leading to either positive or negative feedback trading (Koskei, 2017). Traders buy stocks when they rise and sell assets whenever they fall, thereby repeating a profitable investing cycle. On the other hand, adverse reaction trade by consumers is exemplified by purchasing stocks at a decrease while releasing them at a rise (Mamvura et al., 2020). These kinds of trading tactics are usually employed by people who have a desire for rapid financial gains from sudden spikes and drops in the value of stocks. The subsequent model was employed by Ramlall (2017) to look for evidence of information dealing:

$$\frac{\text{Net flows}_t}{\text{Market Cap}_{t-1}} = \alpha_0 + \gamma_1 R_{t-p} + \gamma_2 X_t + \varepsilon_t$$

Market Capt-1 shows an industry that is one period behind, whereas NetFlow's show the discrepancy between present international transactions and sales. The framework's capitalization vector, X_t , provides control factors, while R_t represents returns on stock markets, which are obtained by taking the first log differential of the price index. The model's capitalization vector, X_t , represents control variables, while R_t represents the returns of stocks, which are obtained by taking the first log differential of the stock exchange index. If $\gamma_1 > 0$, favorable reaction to exchange is demonstrated. However, if $\gamma_1 < 0$, negative feedback trading is observed. The framework shows the relationship between foreign equity flows and the price of stocks, it ignores the extended impact of the destination country's exchange rate on those flows' exchange rate

2.3 Price pressure hypothesis

In accordance with the findings of Kerl and Walter (2007) and Warther (1995), there is a positive correlation between foreign capital volumes and return on equity. Equities enters and exits the exchanges as a result of buyers seeing the potential for profit from the purchase and sale of financial instruments when the marketplace's demand triangle is not perfectly elastic (Albuquerque et al., 2007). As a result, markets will experience purchasing which will lead to a shortage of interest for equities assets. This will cause stock prices to overreact, climb, and depart above their underlying balance level, providing temporary advantages. Given the significant interest from foreign capitalists, the nation's currency's value increases concurrently. Purchasing momentum gradually fades, like mist, as the economy's adjustment procedure begins.

The return on invested capital will be unfavorable throughout this financial adjustment phase as the prices of stocks mean-revert to their initial equilibrium level (Ogundipe et al., 2019). Resultantly, the short-lived high demand for local currency by foreign investor swiftly disappears and the purchasing power of the country's currency declines. This theory, nonetheless, primarily emphasizes the imbalance between demand and supply within markets and downplays the significance of other types of currency governments, such as Zimbabwe's present regulated fluctuating auctions system. As a result, the research investigation aims to present data that considers Zimbabwe's current finances.

2.4 Empirical literature review

This section presents the empirical literature review. Chihava (2014) investigated the impact of quarterly foreign equity inflows on Zimbabwe's stock exchange performance using a combination of regression analysis and a Granger causality approach using a time series data from 2009 to 2013 and found a strong positive correlation between flows and returns as well as a predicted causal connection among flows and returns. The author's results supported the results for Bhagwati and Meurer, (2016) regarding correlation and favorable reaction trade. Staer (2014) employed a VAR approach and found an

immediate favorable and substantial association between exchange-traded fund flows and return on equity in the USA. While Chihava (2014) and Staer (2014) found nearly identical relationships between flows and comes back, their approaches and conclusions are not the same. Staer (2014) noted the price constraint impact, whereas Chihava (2014) provided proof to support favorable response exchange.

Sapian and Auzairy (2015) investigate the connection between foreign equity flows and Bursa Malaysia stock market performance. The findings show an advantageous causal connection between internal returns on equity and foreign institutions fund transfers. Adebisi and Arikpo's (2015) research looks at the relationship throughout foreign portfolio investments in Nigeria and the state of financial markets during 1984 and 2015. Using the Autoregressive Distributive Lag (ARDL) approach, the researchers show there is no long-term causal relationship between foreign portfolio investment and financial market performances. Additionally, they demonstrate that there's is no direct causative connection between foreign portfolio investments and the profitability or accessibility of the underlying stock marketplace.

Meurer (2016) examined the causal connection amongst FPI and GDP, investments, as well as other economic variables in Brazil, one of the BRICS (Brazil, Russia, India, China, and South Africa) growing market nations, using quarterly statistics for the years 1995 to 2009. He found a strong inverse relationship among the FPI and the real rate of exchange of Brazil. On the scale of the financial infiltration index (FPI), real currencies have a substantial detrimental influence, while financial accessibility has a fairly considerable favorable effect. Mercado and Park (2017) examined the amount of foreign capital flows for a group of countries that included Russia. To look into the connections amongst Malaysia's stock exchange results, fund travels, and unpredictability.

Caporale et al. (2017) conducted a global examination of the relationship between the currency rate and foreign portfolio flows in the Asian developing markets such as Pakistan, Indonesia, South Korea, India, Philippines, Thailand, and Taiwan. For the seven chosen markets, monthly panel data from January 1993 to November 2015 were used. To analyse the gathered data, a hybrid methodology of Markov Regime Switching and Generalized Autoregressive Conditional Heteroscedasticity models was used, building on the work of Engle (1982) and Bollerslev (1986). The study found that there was little exchange rate volatility thereby suggests little currency risk for foreign portfolio flows coming into Asia. In summary, minimal exchange rate risk drew net foreign portfolio investment.

Koskei (2017) examined how foreign asset withdrawals influenced Kenyan investment performance using panel data from 14 publicly listed banking organizations between January 2008 and December 2014. In addition to managing factors such foreign portfolio employee turnover, currency rates, price increases, the value of its shares, and government bill rate, the standard least-squares modelling methodology was used. The analysis's findings show that, within the research's time interval, there was a significant correlation—though not one that is scientifically significant—between return on equity and sales of foreign holdings.

Haider et al. (2017) investigate the impact of stock market performance and inflation on foreign portfolio investment in China using annual time-series statistics from 2007Q1 to 2015Q4. The authors show that investment portfolios made abroad significantly improve the performance of stock markets. Conversely, it is found that expenditures in foreign portfolios have a negative correlation with price increases. They conclude that the market for shares deserves to be monitored and that ought to be limitations over abrupt movements.

A study by Akinmulegun (2018) examined the impact of Nigeria's equity market expansion between 1985 and 2016 on foreign portfolio investments in that country. Its conclusions show how market valuation has a major and detrimental impact on foreign portfolio investments undertaken within the country. Conversely, there is a favorable correlation between the stock market's performance and deposits made in international holdings. Several scholars have examined the relationship between FPI and Indian exchange rates, particularly Kumar (2018). As they found that currency fluctuations possess a extended, unfavorable and significant effects upon these travels, a reduction in the worth of the Indian Rupee will cause a substantial drop in foreign direct investment (FDI) flows to India.

Leveraging the bounds of the ARDL checking a cointegration method, Singhal et al. (2019) aimed to investigate the link of the Mexican index of stocks, the currency exchange rate, the global price of oil, and the worldwide prices of gold. They concluded that although Mexico's markets and its foreign exchange rate did not appear to be related, crude oil played a significant role in the downward trend that the nation's stock markets the index and its currency experienced. In the instance of Nigeria, Okorie et al. (2019) found a shaky beneficial connection amongst stock market returns and foreign exchange rate. After researching the biggest economies in the world, Ferreira et al. (2021) found that while the foreign exchange rate has a substantial impact on the Indian stock market, it has little effect on the exchange rates in European nations.

In European nations, the currency rate is not a significant factor. Mroua and Trabelsi (2020) examined the connection between BRICS indexes of shares and exchange rates for the months of January 2008 through February 2018. Investigators came to an agreement that short- and long-term returns on stocks were significantly impacted by changes in these countries' foreign exchange rates. In a multi-country study, Ogundipe et al. (2019) examined the connection between foreign equity investment within the limits of Nigeria and its exchange rate. The study made use of fortnightly secondary data for time series from January 1996 to December 2016. The exchange-rate instability was also produced using modified autoregressive models' unconditional heteroscedasticity in level (GARCH 1.1).

Makoni (2020) used a wide Sub-Saharan Africa strategy to examine how currency rates and capital openness affect foreign portfolio investment. Annual panel data from 2009 to 2016 were used in the study. Fixed Effects, Generalized Least Squares, and Generalized Methods of Moments were used in the study. The study found that foreign portfolio investment was negatively impacted by exchange rate, capital openness, and inflation throughout the study period. However, the growth of the stock market showed a favorable, significant effect on foreign portfolio flows. These results concurred with those of Rujiravanich (2015), despite the fact that their investigations used different methodologies and focused on different regions and types of data. The findings support the hypothesis provided by the Feedback Trading Hypothesis, which contends that current market performance determines how international investors trade. Ramlall (2017) also offered comparable proof.

3. Research Methodology

This section presents the methodologic proposed to make the study clear. Marovanidze (2014) cautioned against the tendency to adopt models from transitional and developed industries before initially evaluating their applicability and acceptance of evidence in the context of emerging countries. In that regard, this paper makes use of the Generalized Autoregressive Conditional Model (GARCH) and the Previs-Granger Causality. The usage of VARs dates back to the early 1980s, when Sims (1980) and Litterman (1979, 1986) demonstrated that Granger models permit the use of lag values for any system variable as independent explanatory variables, and enhancing the model's capacity for explanation. Granger approaches provide the benefit of accounting for the linear intertemporal interactions between parameters when establishing causality (Gujarat, 2004). To assess the volatility of equities market returns, Generalized Autoregressive Conditional Heteroscedasticity Models are used, building on the work of Bollerslev (1986) and further developments by Zakoian (1994), Shanthi and Thamilselvan (2019). Following a Granger Model used from Gumus et al. (2013), Nwosa and Adeleke (2017), and Chhimwal and Bapat (2020), the data estimation technique follows uses the as following model specification;

$$FPI_{t-w} = \beta_0 + \sum_{t=1}^n \beta_1 FPI_{t-w} + \sum_{t=1}^n \beta_2 ZSE \text{ return}_{t-w} + \sum_{t=1}^n \beta_3 EXR_{t-w} + \varepsilon_t \quad (1)$$

$$ZSE_{t-w} = \beta_0 + \sum_{t=1}^n \beta_1 FPI_{t-w} + \sum_{t=1}^n \beta_2 ZSE \text{ return}_{t-w} + \sum_{t=1}^n \beta_3 EXR_{t-w} + \varepsilon_t \quad (2)$$

$$EXR_{t-w} = \beta_0 + \sum_{t=1}^n \beta_1 FPI_{t-w} + \sum_{t=1}^n \beta_2 ZSE \text{ return}_{t-w} + \sum_{t=1}^n \beta_3 EXR_{t-w} + \varepsilon_t \quad (3)$$

The foreign portfolio investment (FPI), the Zimbabwe Stock Exchange's all share index (ZSE), and the auction exchange rate (EXR). The researcher opts to modify the above model in the manner outlined below to make it match the present inquiry:

$$FPI_{t-w} = \beta + \sum_{t=1}^n \beta_1 FPI_{t-w} + \sum_{t=1}^n \beta_2 ZSE \text{ return}_{t-w} + \sum_{t=1}^n \beta_3 EXR_{t-w} + \sum_{t=1}^n \beta_4 Infl_{t-w} + \varepsilon_t \quad (4)$$

$$ZSE_{t-w} = \beta + \sum_{t=1}^n \beta_1 FPI_{t-w} + \sum_{t=1}^n \beta_2 ZSE \text{ return}_{t-w} + \sum_{t=1}^n \beta_3 EXR_{t-w} + \sum_{t=1}^n \beta_4 Infl_{t-w} + \varepsilon_t \quad (5)$$

$$EXR_{t-w} = \beta + \sum_{t=1}^n \beta_1 FPI_{t-w} + \sum_{t=1}^n \beta_2 ZSE \text{ return}_{t-w} + \sum_{t=1}^n \beta_3 EXR_{t-w} + \sum_{t=1}^n \beta_4 Infl_{t-w} + \varepsilon_t \quad (6)$$

$$Infl_{t-w} = \beta + \sum_{t=1}^n \beta_1 FPI_{t-w} + \sum_{t=1}^n \beta_2 ZSE \text{ return}_{t-w} + \sum_{t=1}^n \beta_3 EXR_{t-w} + \sum_{t=1}^n \beta_4 Infl_{t-w} + \varepsilon_t \quad (7)$$

The above-described model is multivariate, with FPI denoting foreign portfolio investment, ZSE denoting the All-Share Index of the Zimbabwe Stock Exchange, EXR denoting the foreign exchange rate of the Reserve Bank, and Infl denoting hyperinflation. Model restrictions include the parametric coefficients β_0 , β_1 , β_2 , β_3 and β_4 . Extra parameters that affect the equation but are not considered are captured by the erroneous term ε . Wang et al. (2016) claim that the relationship between foreign equity flows, stock market returns, and exchange rate is tempered in the aforementioned model by the stock market's volatility (conditioning factor). The Granger model that is presented looks into the short- and for a long-time impact of the socioeconomic parameters in the analysis. The inclusion of lagging phrases enables the equation to compensate for the impact of negative feedback from every factor that make up the economic situation that the framework is presently analyzing, in accordance with Enders (2015).

3.1 EGARCH Model

To estimate the volatility of the factors under investigation, the study used an approach from the Generalization Conditionally Heteroscedasticity (GARCH) that was put in place by Bollerslev in 1986. GARCH (1.1) is assumed to be the appropriate model. GARCH, nevertheless, is not appropriate in scenarios where foreign portfolio investments, exchange rate, inflation and the return on equity are highly receptive to information, as it assumes symmetrical behavior for financial data over time (Nelson, 1991). Bhowmik and Wang (2020) claim that the EGARCH model should be employed in the research in order to capture the leverage effects that are common in financial time series dataset. According to Nelson (1991), a study might use that framework to explain both negative information and government inconsistency's effects. Additionally, corporations have asymmetries in financial time series (Shanthi & Thamilselvan, 2019; Zakoian, 1994). The investigation's modification of the EGARCH model from Chaudhary et al. (2020) and Jebran and Iqbal (2016) is as follows.

$$W_t = s + \alpha_1 S_{t-z} + \gamma_1 FPI_{t-z} + \varepsilon_t \quad (8)$$

$$Z_t = \theta_1 + \eta_1 z_{t-z} + \lambda_1 \left| \frac{\varepsilon_{t-1}}{z_{t-1}} \right| + \psi_1 \frac{\varepsilon_{t-1}}{z_{t-1}} + \chi_1 FPI_{t-z} \quad (9)$$

The hypotheses of Chaudhary *et al.* (2020) serve as the foundation for Eq. (8) and Eq. (9), which reflect the conditional variance estimation and unconditional average expression of the exponential-GARCH, correspondingly. The two formulas take into account the asymmetric effects of foreign equity investment on return volatility. The positive coefficient of foreign portfolio investment in Eq. (8) indicates an increase in average stock market returns when there is a positive net foreign asset inflow. In the variability Eq. (9), an outcome of 1 denotes the existence of asymmetry implications, but the opposite of this implies that adverse developments will significantly affect returned variability. The positive coefficient of FPI in volatility formula (9) indicates that net foreign equity transactions are increasing the risk of operating on the stocks of Zimbabwe. Nevertheless, the negative component of FPI on the variation in the equation suggests decreased unpredictability when there are strong net foreign portfolio investment movements.

3.2 Data Source

Secondary time series data was utilized to achieve the research's objective. Data on foreign portfolio investment and ZSE returns was collected from ZSE. Data on exchange rate and inflation was collected from the Reserve Bank of Zimbabwe's database. Monthly data stretching from October 2018 to November 2021 was used.

4. Discussion of Results

A logical presentation and analysis of results generated from the Vector Autoregressive model, Exponentially Generalised Autoregressive Conditional Heteroscedasticity (EGARCH) model and VAR-Granger causality will be presented in this section. All necessary pre and post regression estimation tests were conducted in line with Enders (2015) and Diebold (2017) and are presented logically.

4.1 Descriptive Statistics

Table 1 presents the descriptive statistics on foreign portfolio movements, returns on the Zimbabwe Stock Exchange, and the Zimbabwean auction exchange rate for the period from October 2018 to May 2022. With a high standard deviation of 395 and a low mean of -265, the volatility of foreign portfolio investments was highly noteworthy. The volatility of foreign portfolio investments was very high. Foreign portfolio investments assumed larger negative net inflows during the study period, as indicated by a negative skewness of 1.2. This implies that foreign investors who withdrew more money than they invested were the net sellers of local assets on the local exchange. An above-average kurtosis of 3.9 indicates that financial time series are leptokurtic.

The return of a financial portfolio on the Zimbabwe Stock Exchange showed significant volatility, or sensitivity to outside forces, with 29 standard deviations from the mean. The returns on the local stock exchange run a similar gamut, with a minimum return of -17% and a high return of 141%. More positive return values than negative ones are indicated by a positive skewness of 2. As a result, holders of long-term securities get average returns of 15.59%. High peaking and a leptokurtic nature are indicated by a kurtosis of 10.

The data for inflation and the US\$/ZWL\$ auction exchange rate had different skewness and kurtosis than the data for foreign equity flows and returns. The kurtosis values of 1.2 and 2.8 for the currency rate and inflation, respectively, suggest that they are mesokurtic, whereas the stock market and foreign equity investment returns are leptokurtic. However, as the exchange rate's 0.2 skewness and the rising inflation rate's skewness of 1 both shows, the local currency was losing value in comparison to the US dollar. Inflation was between 1.58 and 42%, showing a steady increase in costs, while a US\$/ZWL\$ exchange rate between 1 and 105 indicates that the local currency lost 15840% of its value throughout the study period.

Table 1

Descriptive statistics

	FPI	ZSE_Return	Xrate	Inflation
Mean	-265.975	15.59138	44.4828	13.33684
Median	-76.45	8.052414	25	7.420000
Maximum	356.09	141.535	105.6896	42.10000
Minimum	-1474.41	-17.82579	1	1.580000
Std. Dev.	395.1815	29.58295	37.85278	12.15296
Skewness	-1.202003	2.196275	0.170614	1.009608
Kurtosis	3.942736	9.68231	1.225526	2.828350
Jarque-Bera	101.2506	10.55766	5.169894	6.502267
Probability	0	0.005098	0.0754	0.038730
Observations	38	38	38	38

Unit Root Test

The check for the presence of unit root, Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) test were utilized. This is to make sure that variables are devoid of stationarity weakness that might impede on the result of the analysis. Table 2 and 3 summarizes the ADF and PP and it would be inferred from the result that all the variable were integrated of order one.

4.2 Stationarity (Unit root Test)- ADF

Variable	ADF value	Probability Value	5% Level	Order of Integration	Conclusion
FPI	-1.948009	0.3074	-2.951125	I(0)	Stationary
ZSE	-4.367182	0.0001	-1.950117	I(0)	Stationary
Xrate	0.944062	0.9048	-1.950394	I(0)	Stationary
Infl	-2.203188	0.0283	-1.950117	I(0)	Stationary

Table 3

Philip Peron test

Variable	PP value	Probability Value	5%	Order of integration	Conclusion
FPI	-4.422323	0.0369	-1.95	I(0)	Stationary
ZSE	-4.422323	0.0001	-1.95	I(0)	Stationary
Xrate	-4.475189	0.0000	-1.95	I(0)	Stationary
Infl	-2.054922	0.0397	-1.950117	I(0)	Stationary

The findings of the Unit Root test for foreign equity investment (FPI), stock market return (ZSE return), exchange rate (Xrate) and inflation (Infl) are shown in Tables 2 and 3. Results indicate that at level I (0), all variables are stationary. This implies that all the variables are mean-reverting over time and thus cointegration is not necessary (Insel, 2003; Enders, 2015).

Other diagnostic test

Regarding serial correlation, Greene (2018) and Asteriou and Hall (2007) argue that it is important to ensure that the residuals from the model are randomly distributed over the sample of data being used when conducting Granger Models. In order to check the suitability of the model, we carry out diagnostic tests to check for the possible issues of autocorrelation, heteroskedasticity, misspecification. The results are given in Table 4 below. We are unable to reject the null hypothesis of no serial correlation of LM test, no heteroskedasticity of Harvey-Godfrey test and correctly specified model of Ramsey Reset Test. Therefore, we conclude that the model is correctly specified and is free from serial correlation and heteroskedasticity.

Table 4

Other diagnostic Test

Diagnostic test	P-Value	Critical value	F-Value	Conclusion
Serial LM test	0.444	0.05	0.8774	There is no autocorrelation
Heteroskedasticity	0.0636	0.05	0.8421	the residuals are homoscedastic
Ramsey reset	0.5445	0.05	0.613229	The model is correctly specified

Lag length Criteria

The study uses three distinct information criteria to select the appropriate lag duration for the Vector Autoregressive Model.

Table 5
Lag length Criteria

Lag	AIC	SC	HQ
0	34.19197	34.33075	34.23721
1	31.13415	31.68924	31.3151
2	30.34017	31.31158	30.65682
3	30.39284	31.78057	30.84521
4	29.89221	31.69625	30.48028
5	29.28167	31.50204	30.00545
6	29.16382	31.80051	30.02332
7	28.16045*	31.21345*	29.15565*

NB: * indicate the correct lag length for each information criteria

Prior to estimating the multi-equation system, the proper lag length must be chosen for vector autoregressive analysis. The study chose lag length 7, as chosen by the three information criteria, as the optimal lag length for the Granger model on the basis of the conclusion that the correct lag length is the one with minimum values for most information criterion. Therefore, the lag duration of 7 has the lowest values for every information criterion

Impulse Response Function

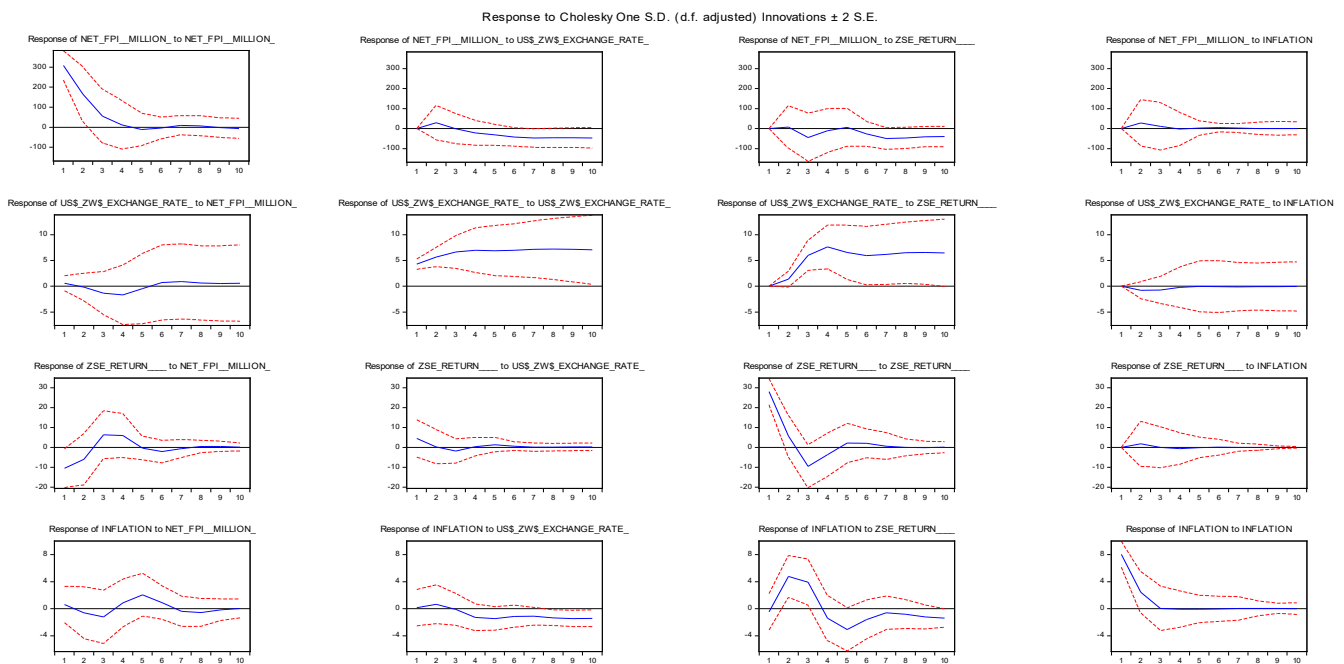


Fig. 4. Impulse response function

Gujarati (2008) states that in order to comprehend the idea of how disturbances to one parameter affect a different factor in the Vector Autoregressive framework, the researcher must employ reactive curves. The results of impulse response functions are displayed in Fig. 4 above. The impulse response function's findings indicate that it takes five months for the foreign portfolio investment, stock market return, and exchange rate to reach equilibrium. Stock market shocks affect exchange rates for four months until long-term equilibrium is attained and the effect is mitigated. Moreover, it takes seven months for the effect of stock market returns on overseas portfolio investments to cancel out and a long-term equilibrium to be attained. Furthermore, the stock market's own shocks, like return volatility or market risk, signal responses to returns that stem from short-run dynamics. When the exchange rate experiences a shock of one standard deviation, the FPI will increase until the third period, at which point it will begin to decline until the conclusion of the period. Long-term equilibrium dynamics can also be seen in responses to exchange rates triggered by external shocks, such as speculative shocks or shocks to consumer confidence. The time it takes for inflation and the exchange rate to stabilize is approximately eight months, indicating that these variables eventually find equilibrium. However, the impulse response functions of foreign equity investment, stock market performance, exchange rates and inflation suggest that the current study is limited to short-term dynamics, with reactions lasting no more than seven months. Regarding this, the initial direction of reactions (positive or negative) is largely determined by the shock source and response variable of the vector autoregressive system.

Returns Volatility Results

The study used the exponentially generalized autoregressive conditional heteroskedasticity model (EGARCH) to get the results of the volatility of stock market returns. Foreign portfolio investment was included in the EGARCH model's conditional variance equation. Using this method, the study can show how foreign portfolio investments affect market return volatility on the local stock exchange. Results for the exponentially generalized autoregressive conditional

heteroskedasticity's mean and conditional variance equation are shown in Table 6 as done by Chaudhary et al. (2017) and Jebran and Iqbal (2016).

Table 6

EGARCH model

Variable	Coefficient	Std. Error	Z-Statistic	Probability Value
C(3)	-1.259736	2.081988	-0.605064	0.5451
C(4)	2.162442	0.884867	2.443804	0.0145
C(5)	-0.231077	0.622083	-0.371458	0.7103
C(6)	0.968910	0.156956	6.173136	0.0000

Table 6 displays the results of the EGARCH variance equation, which was utilized to determine the variability of stock market returns. According to Nelson (1991), Greene (2018), and Mamvura et al. (2020), the framework's estimating effectiveness lies in its ability to consider variance aggregation, asymmetry impacts, and positive and negative information. The conditional variance of the market returns indicated in equation 2 is influenced by the kind of news (C3), the asymmetric impact of volatility (C4), lagged volatility (C5), and the moderating influence of foreign portfolio investment (C6). Table 6 results show a positive volatility constant, supporting the notion that financial markets are fundamentally unstable. The impact of news on volatility is captured by the negative coefficient of C3 (-1.2597), which suggests that negative news makes stock return volatility more volatile. The Efficient Market Hypothesis and the theoretical underpinnings of the EGARCH model are supported by such a relationship (Huong et al., 2021). The positive value of C4 (2.1624) suggests that the asymmetric nature of volatility and the leverage impact (volatility persistence) on the Zimbabwe Stock Exchange do not exist, which runs counter to Jebran and Iqbal's (2016) findings. The autoregressive process (lagged volatility represented by C5) of volatility has a large and positive impact on contemporary instability. It illustrates how volatility in the past can be utilized to forecast volatility in the present. Lastly, a higher net foreign equity investment reduces the erratic nature of returns. It is hypothesised that positive net foreign portfolio investment maintains the local market for shares and reduces the probability of bear returns. According to Chaudhary et al. (2020)

Granger Model Results

Table 7

Granger Causality test

Hypothesis	F-Statistics	Probability Value
ZSE return does not Granger Cause FPI	7.14152	0.6180
FPI does not Granger cause ZSE return	1.47474	0.245
Xrate does not Granger cause FPI	0.77347	0.0006
FPI does not Granger cause Xrate	0.35951	0.9127
Xrate does not Granger cause ZSE return	5.1842	0.6531
ZSE return does not Granger cause Xrate	0.72555	0.0031
INFLATION does not Granger Cause NET_FPI_MILLION	1.16552	0.3572
NET_FPI_MILLION does not Granger Cause INFLATION	1.06659	0.4054
INFLATION does not Granger Cause ZSE_RETURN	0.30380	0.9053
ZSE_RETURN does not Granger Cause INFLATION	4.20499	0.0078
INFLATION does not Granger Cause US\$_ZW\$_EXCHANGE_RATE	0.95212	0.4678
US\$_ZW\$_EXCHANGE_RATE does not Granger Cause INFLATION	2.21326	0.0894

Discussion of results

The goal of Granger causality, according to Wang et al. (2016) and Cagli (2018), is to prevent the under fitting of causality models. The results of this study on causal relationship between the foreign portfolio investment, ZSE returns, exchange rate and inflation in Zimbabwe are shown in Table 7. The study found a statistically significant one-way causal relationship between exchange rate and foreign portfolio investment (FPI) and stock market returns and exchange rate. This only suggests that exchange rate volatility will vary when overseas investors purchase and sell financial securities on the Zimbabwe Stock Exchange. The assumption underlying this link is that foreign investors net purchase local financial securities, increasing the foreign investment, when the local stock market is producing positive returns demand for currency will increase which will then affect stock returns. In contrast, foreign investors net sells local financial securities when local stock market returns are negative, leading to a significant outflow of foreign portfolio investment thereby reducing demand for currency. This demonstrates how international investors behave in a way that is consistent with the Feedback Trading Hypothesis. Between exchange rate and stock market return volatility, a substantial causal link was discovered. The assumption is that fluctuating exchange rates are what cause stock market returns and overseas portfolio investments to be volatile. This only suggests that stock markets operate better and can generate higher profits in an environment with stable exchange rates. However, stock market returns are adversely impacted by excessively variable exchange rates, resulting in low returns. As a result, supporting Base Broadening Hypothesis empirical research. The study also found a causal link between ZSE returns and inflation which suggest that, as investors buy more of shares on the ZSE they put pressure of

demand of currency and as a result of high demand there is an existence of demand-pull inflation. This clearly shows that high demand of stocks in the financial market resulted in high inflation and this supports a study by previous researchers who argued that during high demand of stocks inflation can actually go up. This implies that stocks are not suitable for long-term investments that compensate investors for their diminished purchasing power. Therefore, stocks might not always be a smart investment in the long run, but they might be in the short to medium run. During times of hyperinflation, investors ought to purchase stocks with a short-term perspective rather than a long-term one. Thus, Fama's theory which holds that stock prices don't work as a hedge against inflation—is supported. According to an earlier analysis by Daferighe and Sunday (2012), stocks do not offer a good hedge against inflation. Results showed that net foreign equity inflows and stock market returns are not correlated. It also suggests that foreign investors on the Zimbabwe Stock Exchange do not base their decisions on historical return patterns. Goh and Sopian (2017) support the findings by concluding that there is no correlation between foreign equity investment and stock market return. However, Tuna and Kundakcioglu (2016) established a unilateral causal relationship between foreign equity flows and stock market returns in order to support their findings that good news brings.

Using the Exponentially Generalized Autoregressive Conditional Heteroskedasticity (1.1) technique, the research revealed the unequal effects of stock market performance on stock market volatility. The findings showed that during the study period, there was a negative net outflow of foreign equity investments, which increases volatility and suggested market risk. Furthermore, compared to periods of market stability brought on by positive news, poor news was found to cause periods of extreme volatility (long-lived volatility) (short-lived stability) demonstrating that the market is more negatively impacted by bad news than by good news.

5. Conclusion

The primary research question was to determine the link between foreign portfolio, equity markets and exchange rate volatility in Zimbabwe and also to determine the symmetric and asymmetric effects of stock market return volatility (risk) on exchange rates and foreign portfolio flows. To understand the underlying linkages among these economic factors, the study employed the stock oriented model among others. The research utilized a package of hybrid multi-equation models which are vector autoregressive system to capture feedback relationships, exponentially generalized conditional heteroskedasticity to incorporate asymmetric and volatility effects on stock performance and Granger causality to capture cause and effect dynamics. Impulse response functions and variance decompositions were employed to capture responses and innovations in the VAR system. Results from the examined data revealed presence of short term volatility (implied risk) persistence in the short term, positive link between lagged market returns foreign portfolio investment, inverse link between volatility of market returns and foreign equity flows. On Granger causality, triangular linkages were revealed with unilateral causality emanating from foreign portfolio investment to stock market volatility (implied risk) to foreign portfolio investment volatility. Thus, indicating stock market volatility moderated association between foreign portfolio investment and volatility of foreign portfolio investment. In light of this, the study recommends that in its national promotional materials and logo media outlets, the Federal Reserve Bank of Zimbabwe must facilitate the allocation of foreign exchange for removing investments and dividends being paid to foreign businessmen. The foreign currency release process needs to be expedited in order to give foreign investors the impression that making investments in Zimbabwe is easy and unfettered. In the end, this move will lead to an increase in foreign portfolio investment outflows. The Minister of Treasury should invite those who need to invest in borrowing and securities on the Zimbabwe Stock Exchange to submit an application for an increase in the capital gains tax and tax withheld. This encourages traders to keep local equities for a long time. It also strengthens the market and reduces fluctuations in markets, which draws in small foreign and local financiers to place shares on the stock exchange of Zimbabwe and acquire local firms so for the National Development Strategy's (NDS1) to be fully achieved and for the economy to achieve upper middle -income Status by 2030. In order to accomplish macroeconomic goals and increase actual activity toward improving common stock performance as inflation hedges, Zimbabwe's government, monetary authority, and other regulatory bodies should make use of macroeconomic instruments such as lowering interest and inflation rates. The study concentrated on local level only, this leaves an absence in the research that might be filled by utilizing other factors, like money supply, with annual data from individual research

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