The Dynamics of Foreign Portfolio Investment, Equities Market Volatility and Exchange Rate in Zimbabwe

Pasca Mushaike (Pascamushaike@gmail.com)
University of Zimbabwe
Elisha Mavodyo
University of Zimbabwe

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Abstract

In recent years, the amount of foreign equity investment inflows in Zimbabwe has decreased against the backdrop of an unstable and rapidly appreciating local currency. The aim of the study was to reveal the nexus among foreign portfolio investment, stock market performance and exchange rate in Zimbabwe from October 2018 to April 2022. The research utilized a package of hybrid multi-equation models including, vector autoregressive system to capture feedback relationships, EGARCH 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 revealed presence of short-lived volatility (implied risk) persistence, positive link between lagged market returns and foreign portfolio investment, inverse link between volatility of market returns and net 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, it may be concluded that stock market volatility attenuated the relationship between foreign portfolio investment volatility and that relationship. Consequently, the study's empirical results has various policy ramifications. The investment community is recommended to buy assets at deep discounts and keep them for long-term wealth maximization in order to capitalize on the ZSE's transient volatility. In terms of policy recommendations, the Ministry of Finance is urged to reduce the withholding tax and capital gains tax on long-term stock and debt investors on the Zimbabwe Stock Exchange.

1. Introduction

Capital account reforms across the globe have necessitated the free flow of capital as a factor of production beyond national boundaries (King and Wadhwani, 2019 and Sati *et al.,* 2017). Resultantly, the world has witnessed unification of national financial markets and economies into one integrated trading market (Sati *et al., 2017*). International capital flow reforms have, over time, enabled foreign investors to participate on local equities and debt markets through buying and selling of financial products. Among other things, foreign portfolio investors provide liquidity on the local markets and most importantly the much needed capital to finance research and development, expansion and other corporate operations. Thus, capital markets play an enormously crucial role towards national and global economic growth and development (SECZIM, 2022). However, foreign equity investment inflows as recorded on the Zimbabwe Stock Exchange has been following a downward trend (Reserve Bank of Zimbabwe, 2022). Hence, the current research seeks to unveil the link among foreign portfolio flows, stock market volatility and the contemporary Reserve Bank of Zimbabwe managed exchange rate regime from 2009 June to 2021 December.

In Zimbabwe, the stock market is a vital investment channel for both international and local investors especially in the aftermath of the hyper-inflation phase which ended by the adoption of the US$ as legal tender (Sunde and Sanderson, 2012; Musimwa and Kaseke, 2016; SECZIM, 2022;) opined. Through increasing the amount of affordable capital available for domestic firms to improve their operations, foreign equity investment plays a significant role towards economic growth and development (Kganyago and Gumbo, 2015 and SECZIM, 2022). Thus Haider *et al.* (2017) put forward that the presence of stock markets in the financial system of a country is imperative for its growth. Modelling the nexus among foreign portfolio flows and exchange rates is a crucial subject as it helps to understand the impact of the value of local currency on the flow of foreign investment (Maqsood *et al.,* 2017). However, Omorokunwa (2018) argued that it is of significant importance to incorporate equity market volatility whenever analysing foreign equity flows. This is so because volatility of returns on the local securities market reflects risk profile of the local bourse.

1.1 Foreign Equity Investment Dynamics

Caporale *et al.* (2017) opined that foreign equity flows are moved by the extent of uncertainty (and or lack of confidence) in foreign currency market (which is represented by the auction and interbank system in Zimbabwe). Thus, exchange rate becomes a vital and fundamental economic factor whose variations affects foreign portfolio flows, stock market performance and volatility. Figure 1 illustrates foreign equity flows on the local bourse (Zimbabwe Stock Exchange).

Denoted on Figure 1 are actual net foreign portfolio flows and the linear trend of net foreign portfolio flows. In 2018, foreign equity investment net flows were close to zero. However, in late 2019 net portfolio flows started to fall. This could have been a result of diminishing business confidence due to high inflation (61%) in the last quarter of 2018 as mentioned by RBZ, 2019), loss of human life and damage to property during unlawful demonstrations, macroeconomic policy inconsistency on use of multicurrency for medium of exchange purpose etcetera (African Arguments, 2019). A sharp decline in net foreign portfolio flows was realised in September 2020. With respect to IMF (2021), conventional explanation for such is the presence of the global Covid-19 pandemic which resulted in subdued demand due to lockdown restrictions and low-capacity utilisation.

The stock market is an imperative part of financial system sector on the local economy in Zimbabwe (ZSE, 2022). This is so because the bourse provide affordable financial capital to firms for research and development, daily operations and for expansion (growth) among others. More precisely, foreign portfolio investors have been playing a pivotal role towards supplying the much needed capital for investment through local stock market. However, net foreign portfolio inflows have been following a downward trend since the end of 2019 as depicted on figure 1.1. As a result, the amount of funds available for local firms to utilise in their operations and investment activities becomes less relative to their needs, thus creating a funding gap. Concurrently, in 2018 the Reserve bank of Zimbabwe reintroduced the local currency which was swiftly linked to loss of confidence (due to currency speculation and arbitrage) in the currency which resulted in rapid depreciation in value against the US dollar (Ministry of Finance and Economic Development, 2020). Despite measures by the central bank and the national treasury to stabilise the value of the local currency and create a colourful environment for foreign portfolio flows, the downward trends for both have been a contemporary worrisome issue for the authorities. Modelling the nexus among foreign portfolio flows, stock market performance and exchange rates is a crucial subject as it helps shed light on an understanding of the impact of the value of local currency on the flow of foreign investment (Maqsood *et al.,* 2017). Thus, the present study seeks to examine the nature and cause of the nexus among foreign equity flows, stock market performance and exchange rate in Zimbabwe.

The relations among foreign equity flows, stock market performance and exchange rate has gone through rigorous research in developed and transitional economies such as USA, India, Singapore, China and Brazil among others. However, the relationship has not been well established in developing economies. Consequently, prior researches conducted in developed and transitional economies by scholars such as Gumus *et al.* (2013), Waqas *et al.* (2015), Babalos *et al.* (2016), Caporale (2017) and Huong *et al.,* (2021) among others, cannot be sufficient to inform global policy formulation without fully incorporating study output from developing nations such as Zimbabwe. The current study fills this gap in the literature by conducting an analysis of the dynamics between foreign portfolio investment, stock market performance, and exchange rate in Zimbabwe, a topic that has not been fully explored in the literature.

Prior studies on ZSE have looked at; trade automation and market development (Musimwa and Kaseke, 2016), stock exchange market performance and interest rates (Kganyago and Gumbo, 2015). Njanike *et al.* (2009) looked at determinants of stock market performance. Whilst Tsaurai and Odhiambo (2012) examined the role of the stock market towards national development. However, due to the unstable nature of and highly depreciating characteristic of the local currency in Zimbabwe, it is crucial to examine its effects on foreign portfolio flows and stock market performance. The research output will also aid stockbrokers and fund managers to improve their decisions through incorporating the estimated dynamic linkages among international equity flows, stock market performance and exchange rate when formulating investment strategies. This will further support the country's 2030 middle income agenda through providing policy suggestions which promote foreign portfolio investment inflows and exchange rate stability which in turn leads to an improvement in industrial output, employment, incomes and national welfare among other benefits.

2. Related Literature

As opined by Gokmenoglu (2021) and Wong (2017), the nexus among foreign equity investment, stock market returns and exchange rate is an imperative subject which largely affect business operations, economic policy formulation (exchange rate, monetary and fiscal policy), implementation and capital accumulation at both firm and national level. Given such conventional logic, we examine theoretical foundations which guides the link among foreign equity flows, stock market returns and exchange rate in Zimbabwe. Secondly, we present an analysis of empirical literature. To understand the roots of the triple association among foreign portfolio flows, stock market performance and exchange rate, the study employs the stock-oriented model by Branson (1983) and Frankel (1983). The model is based on the premise that the exchange rate of a country's currency is anchored among other factors on the demand of local financial assets (equity securities and bonds) by foreign investors. When the demand of local financial assets rise (or falls), the performance of the local bourse (as measured by stock returns) increases (or plummets) thus attracting or discouraging investors to participate on the local capital markets. Consequently, the value of the local currency either moves north or south in value relative to foreign currencies due to the rise (fall) in the demand of the local currency for trading financial assets.

The model proposes a positive link between stock market performance and exchange rate. The relationship being moderated by investment (foreign and local) and demand for local currency. However, while the model employs a multi-faceted approach to explain the link among stock market performance, foreign equity flows and exchange rate, it fails to conventionally account (explain) for the source of demand for financial securities. Thus, implying that the demand for such assets is exogenously determined. The model further ignores the imperative role of volatility of stock market returns in affecting investor sentiments and moving exchange rate. Hence, it also fails to capture the asymmetric effects of good news (business enhancing policies) and bad news (such as policy inconsistency) on the trilemma relationship being currently analysed. Therefore, the contemporary research shall close that gap through utilising generalised autoregressive conditional heteroskedasticity models to capture symmetric and asymmetric effects of volatility on exchange rate and foreign equity flows. Moreover, this model focuses mainly on market mechanism (demand and supply) and underestimates the effect of other important factors that determines foreign equity flows such as the market regulation, liquidity of assets on the market, inflation and transaction costs among others. It further undermines the role of various modes of exchange rate regimes such as the current managed floating auction mechanism in Zimbabwe. Hence, the study seeks to provide evidence based on the *status quo* of economic climate in Zimbabwe

2.1 Empirical Literature Review

Empirical work by Nyang oro (2013) on foreign equity flows-stock market performance link in Kenya employed multi-factor pricing model (extended arbitrage pricing theory) and predictive causality methodology. The researcher used monthly time series data from April 1996 to December 2011. Causality results indicated unidirectional relationship from standardised net purchases to market returns. Furthermore, these findings are similar to an early study by Warther (1995) and they lend support to Base Broadening Hypothesis as expected flows move market returns (Clark and Berko, 1997). Although Warther (1995) and Nyang'oro (2013) agreed on the general positive relationship between flows and returns, Warther (1995) dispute the presence of any lead or lag link between variables under investigation. On the other hand, Albuquerque et al. (200) documented evidence for return chasing behaviour in the US.

A study documented by Goh and Sapian (2017) employed ADF test, impulse response functions and VAR-Granger Causality approach to examine relations among stock market returns, fund flows and volatility. The study improves methodology from Umultu *et al.* (2013) to analyse daily data from October 2009 to December 2015. Findings reviewed negative correlation between market returns and net equity flows whilst market volatility show positive correlation with net equity flows. Causality test unveil unidirectional causal relationship from market returns to net equity flows relative to bi-directional causality established by Thiripalraju and Acharya (2013). Output from impulse response functions demonstrate that shocks in net equity flows are followed by short run and weak variations in market volatility and returns. However, vis-à-vis responses were substantial. Akin to such findings is study by Tuna and Kundakcioglu (2016). Even though findings on impulse response functions from both studies are similar, on Granger causality test Tuna and Kundakcioglu (2016) establish that Istanbul (Turkey) stock market returns Granger-cause foreign equity flows.

Partially identical to findings by Koskei (2017) are results by Oh and Parwada (2007) which showed negative but significant association between net equity inflows and market returns in Korea. Mamvura *et al.* (2020) used causality approach, GARCH (1.1) and Panel VAR models to scrutinize foreign equity

investment and stock market performance among SADC countries. Absence of significant causal connection from capital market performance to foreign portfolio investment within SADC countries. However, contrary to the evidence by Loncan and Caldeira (2015) which established that international portfolio investment cause stock market performance.

Despite using alike methodologies, Mlambo *et al.*, (2013) established a weak relationship between exchange rate and foreign portfolio flows relative to Ogundipe *et al.* (2019). An identical study by Osemene *et al,* (2018) in Nigeria employed monthly time series data from 2007 to 2016. Using generalised autoregressive conditional heteroscedasticity and Two Stage Least Squares, the paper established that high volatility of exchange rate induced inflows of portfolio investment. The findings revealed the risk tolerant behaviour of foreign investors on securities listed on capital market in Nigeria. These findings are contrary to Mlambo *et al.* (2013) and Ogundipe *et al.* (2019).

Continental assessment of the nexus between exchange rate and international portfolio flows in the Asian emerging markets was done by Caporale *et al.* (2017). The study focused on several emerging countries in Asia. Following the work of Engle (1982) and Bollerslev (1986), a hybrid methodology of Markov Regime Switching and GARCH models were employed to analyse the collected data. The research established the presence of low exchange rate volatility. Hence, implying low currency risk on inflows of foreign portfolio flows within the Asian region, thus supporting (Maqsood *et al.,* 2017, King and Wadhwani, 2019)

Study by Rujiravanich (2015) examined the nature of the association among foreign equity flows, stock price and exchange rate in Thailand, using time series data. Methodology of the study included VARs, VECM and EGARCH. Findings presented from the analysis revealed a direct positive long term connection between net foreign equity investment and stock prices. During the period of study (1997-2013), high stock returns on equity securities were attributed to positive momentum trading through positive net equity investment and low exchange rate volatility.

A broad Sub-Saharan Africa approach was employed by Makoni (2020) to look on the effects of exchange rate and capital openness on foreign portfolio investment. To analyse and lend financial economics intuition to the collected panel statistics; Fixed Effects, Generalised Least Squares and Generalised Methods of Moments were applied. The study revealed that, at least for period under study, exchange rate, capital openness and inflation (as measured by consumer price index) had a negative influence on foreign portfolio investment. However, stock market development portrayed a positive significant impact on foreign portfolio flows. Such findings supported results by Rujiravanich (2015) even though their studies differ in terms of methodology employed, type of data and region of study. The results substantiate the notion put forward by the Feedback Trading Hypothesis which argues that foreign investors' trading behaviour hinges on contemporaneous market performance (as measured by stock returns). Analogous evidence was also provided by Ramlall (2017), Goh and Sapian (2017).

Although results on the association and causal path between the aforementioned variables are mixed, the majority of reviewed studies support positive link generated through vector autoregressive analysis. Others support negative and on the extreme end are those that show non-relationship between foreign portfolio flows and exchange rate. Moreover, scarce findings on Granger causality indicate evidence for theories such as investor base-broadening hypothesis (Warther, 1995) and feedback (Aydogan *et al.,* 2014) trading among others. The reviewed body of literature shows no evidence of use of hybrid of vector autoregressive model, EGARCH model, Granger causality, impulse response functions and variance decomposition jointly to examine the variables under study. It is also clear that the dynamic linkages among foreign portfolio investment, equities market volatility and exchange rate in Zimbabwe has not been fully explored. This exposes a huge gap in the literature that this study seeks to fill. In methodology section, we explored the model and diagnostic tests that the study employs to examine the relationships under study.

3. Empirical Strategy

We explored prior used methods and make necessary developments and or adjustments up to the extent where the improved methods suit the needs of the current study. To obtain a set of congruent and robust models with parsimonious specification, prerequisite data cleansing tests such as those for stationarity, cointegration, Vector Error Correction Mechanism (VECM), autocorrelation and heteroscedasticity among others are carried out. The study employs vector autoregressive (VAR) model, Granger causality and generalised autoregressive conditional heteroskedasticity (GARCH) models. The use of VARs dates back to early 1980s when Sims (1980) and Litterman (1979, 1986) argued that for the purposes of forecasting the behaviour of other economic variables, VARs are superior and surpass the predictive strength of structural equations. This is because VARs allow for use of lagged values of all variables in the system as independent explanatory factors, thus strengthening the explanatory power of the model. Thus, VARs takes policy implementation and economic agents' reaction lags into consideration. Greene (2003) posits that vector autoregressive models are well known for testing causal relationships in variables and examining impacts of various macroeconomic policies through employing impulse response functions and variance decompositions. Generalised autoregressive conditional heteroscedasticity models are employed to estimate volatility of equity market returns in the spirit of Bollerslev (1986) and the later improvements by Zakoian (1994) and Shanthi and Thamilselvan (2019). Lastly, Granger Causality will be utilised to examine the causal path among foreign equity flows, stock market performance and exchange rates.

3.1 Model Specification

The study utilises a number of data analysis models to satisfy the demands of the study objectives. These models are vector autoregressive model, recursive Granger causality, GARCH model and Impulse Response functions. The data estimation procedure follows a congruent vector autoregressive model adapted from Gumus et al., (2013), Nwosa and Adeleke (2017) and Chhimwal and Bapat (2020) as follows;

$$FPI_{t-j} = \alpha + \sum_{t=1}^{n} \beta_1 FPI_{t-j} + \sum_{t=1}^{n} \beta_2 ZSE_R eturn_{t-j} + \sum_{t=1}^{n} \beta_3 Xrate_{t-j} + \sum_{t=1}^{n} \beta_4 EGARCH01_{t-j} + \sum_{t=1}^{n} \beta_5 EGARCH01F_{t-j} + \epsilon_{1t} \ldots\ldots$$

$$ZSE_Retn_{t-j} = \alpha + \sum_{t=1}^{n}\beta_1 FPI_{t-j} + \sum_{t=1}^{n}\beta_2 ZSE_Return_{t-j} + \sum_{t=1}^{n}\beta_3 Xrate_{t-j} + \sum_{t=1}^{n}\beta_4 EGARCH01_{t-j} + \sum_{t=1}^{n}\beta_5 EGARCH01F_{t-j} + \epsilon_{1t}\ldots$$

$$Xrate_{t-j} = \alpha + \sum_{t=1}^{n}\beta_1 FPI_{t-j} + \sum_{t=1}^{n}\beta_2 ZSE_Return_{t-j} + \sum_{t=1}^{n}\beta_3 Xrate_{t-j} + \sum_{t=1}^{n}\beta_4 EGARCH01_{t-j} + \sum_{t=1}^{n}\beta_5 EGARCH01F_{t-j} + \epsilon_{1t}\ldots\ldots$$

The multi-equation model is a vector autoregressive model which elaborates the effect of exchange rate and stock market performance on foreign equity flows. From Eq. 1, FPI is foreign portfolio investment, ZSE_Return is return on All share Index, Xrate is the Reserve Bank of Zimbabwe auction exchange rate. EGARCH01 and EGARCH01F are volatility of stock market returns and foreign portfolio investment respectively as measured by the conditional variance from the EGARCH model. As postulated by Insel (2003) and Enders (2015), the inclusion of lagged terms of variables allows the model to incorporate the influence of feedback effects of all variables included in the economy being analysed by the model. We also extended the VAR model to test for causality as VAR-Granger Causality.

3.2 Modelling Stock Market Return Volatility

To estimate volatility of stock market performance, the study proposes a model within the generalised autoregressive conditional heteroscedasticity (GARCH) family models as postulated by Bollerslev (1986). The starting point is to assume that GARCH (1.1) is the appropriate model. However, foreign equity investment, exchange rates and stock markets are highly sensitive to news thus GARCH is inappropriate as it assumes symmetric behaviour of financial time series (Nelson, 1991). On the contrary, EGARCH model captures the leverage effects which are common in financial time series data (Bhowmik and Wang, 2020). Thus, the study makes use of the EGARCH model. This model accounts for the effects of bad news (policy inconsistency and high taxes) and good news (improved foreign currency allocation and low lending rates by RBZ) on *exampli gratia* volatility clustering (Nelson, 1991). In addition, it incorporates leverage effects and asymmetric effects in financial time series (Zakoian, 1994 and Shanthi and Thamilselvan, 2019). Conventional information criteria are employed to select the optimum lag length for the EGARCH model. Data permissibility and forecasting power are also considered. The study adapted EGARCH model from Jebran and Iqbal (2016) and Chaudhary et al. (2020) as follows;

$$R_t = \omega + \alpha_1 R_{t-p} + \gamma_1 FPI_{t-p} + \epsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [4]$$

$$h_t = \theta_1 + \eta_1 h_{t-p} + \lambda_1 \left|\frac{\epsilon_{t-1}}{h_{t-1}}\right| + \psi_1 \frac{\epsilon_{t-1}}{h_{t-1}} + \chi_1 FPI_{t-p} \ldots\ldots\ldots\ldots [5]$$

Equation [4] and [5] are conditional mean equation and conditional variance of the Exponential-GARCH respectively. Both equations are extended to incorporate the asymmetric effects of foreign equity investment on the volatility of returns. This process is adapted from Chaudhary et al. (2020). A positive coefficient of foreign portfolio investment in the mean equation [4] indicates increase in mean stock market returns in the presence of positive net foreign portfolio inflows. In the variance equation [5], a positive value of ψ_1 shows the presence of asymmetric effects while a negative sign implies that bad news will have a large effect on volatility (risk enhancing behaviour) of returns. In the variance equation [5], positive coefficient of FPI resembles increase in volatility (risk) of trading on Zimbabwe Stock Exchange due to presence of net foreign equity flows (Jebran and Iqbal, 2016 and Chaudhary et al, 2020). However, a negative coefficient of FPI on the variance equation signifies reduction in volatility (risk) due to presence of positive net foreign portfolio investment flows.

3.3 Data Sources

The study utilised monthly time series data to analyse the link among exchange rate, foreign portfolio investment and stock market performance. Data for stock market performance and foreign portfolio investment were collected from Zimbabwe Stock Exchange database. Exchange rate data were collected from Reserve Bank of Zimbabwe online database. The observation period of the statistics are set to monthly interval spanning from October 2009 to April 2022.

We cleaned the data and conducted conventional regression tests familiar with the models we employed. To do away with chances of obtaining spurious results, the Augmented Dickey-Fuller (ADF) tests are conducted. Following the specification and estimation of vector auto-regression models, Gujarati and Porter (2008) and Enders (2018) recommends the need to apprehend effects of impulse response functions and variance decompositions on the results of the estimated vector autoregressive models. Hence, the study estimates impulse response functions and variance decomposition. The next section presents, fully analyses and attach economic intuition to the findings.

4. Results And Discussion

We presented a logical presentation and analysis of results generated from the Vector Autoregressive model, Exponentially Generalised Autoregressive Conditional Heteroscedasticity (EGARCH) model and VAR-Granger causality. 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

To understand the nature of the collected data, the study makes use of descriptive statistics on foreign equity investment, exchange rate and stock market returns are presented on Table 1.

Table 1
Descriptive Statistics

	FPI	ZSE_Return	Xrate
Mean	-245.8093	16.60788	54.42385
Median	-93.28000	8.066205	68.94300
Maximum	356.0900	141.5350	159.3482
Minimum	-1474.410	-17.82579	1.000000
Std. Dev.	386.3323	29.57526	45.52073
Skewness	-1.191723	2.063140	0.326838
Kurtosis	4.177458	8.735354	1.908356
Jarque-Bera	12.66211	89.44086	2.900670
Source: Author's Own Computations			

Table 1 shows descriptive statistics of foreign portfolio flows, returns on the Zimbabwe Stock Exchange and the auction exchange rate in Zimbabwe for the period spanning from October 2019 to April 2022. Foreign portfolio investment revealed very high volatility with 356 standard deviations from it very low mean of -245. A relative analysis with returns and exchange rate, shows that foreign portfolio investment was enormously volatile. A negative skewness of 1.91mean that during the time under study, foreign portfolio investment assumed more negative net inflows implying that foreign investors withdrew more funds than they invested (net sellers of local securities) on the local bourse. A higher than normal kurtosis of 4.1 is confirmation that financial time series are leptokurtic in nature.

The return of financial securities on Zimbabwe Stock Exchange revealed high volatility (sensitivity) to exogenous effects as shown by 29 standard deviations from the mean. Returns on the local bourse also indicates very wide range with maximum return of 141% and minimum return of -17%. A positive skewness of 2 indicates that more values of return were positive than negative. Hence, investors who hold securities for a long period earn an average of 16.6% of returns. Kurtosis of 8 implies an excessive peakedness and leptokurtic nature.

Data for the US$/ZW$ auction exchange rate were different from foreign equity flows and returns in terms of skewness and kurtosis. Exchange rate had kurtosis of 1.9, indicating mesokurtic nature while foreign equity investment and stock market returns are leptokurtic in nature. However, exchange rate had skewness of 0.3 indicating that relative to the US$, the local current was depreciating. A minimum US$/ZW$ exchange rate of 1 and a maximum of 159 shows that the local currency lost 15894% of value during the period under study.

4.2. Lag Length Selection

To ascertain the correct lag length for the vector autoregressive model, the study employs five different information criteria.

Table 2
Lag Length Results

Lag	Logl	LR	FPE	AIC	SC	HQ
0	-661.8346	NA	6.38e + 10	33.39173	33.64506*	33.48333
1	-647.8796	24.42118*	5.00e + 10*	33.14398*	33.77731	33.37297*
2	-643.5938	6.857395	6.40e + 10	33.37969	34.39302	33.74608
3	-640.4133	4.611601	8.80e + 10	33.67067	35.06399	34.17445
NB: * *indicates correct lag length for each information criterion*						

Table 2 shows results for the VAR lag length selection process. Denoted as LR is the sequential modified LR test statistic, FPE, is the final prediction error, AIC is the Akaike information criterion, SC is the Schwarz information criterion and HQ is the Hannan-Quinn information criterion. Vector autoregressive analysis requires that the appropriate lag length must be selected before estimating the multi-equation system. Based on the decision that the correct lag length is the one with minimum values for most information criterion, the study selected 1 as the optimal lag length for the VAR model.

4.3 Results on Volatility of Returns

To model the volatility of stock market returns, the study employed the exponentially generalised autoregressive conditional heteroskedasticity model (EGARCH). The conditional variance equation of the EGARCH model incorporated foreign portfolio investment. This approach allows the study to reveal the effects of foreign portfolio investment on the volatility (implied risk) of market return on the local bourse. This was adapted from (Jebran and Iqbal, 2016 and Chaudhary et al, 2020). Results on the mean and conditional variance equation of the exponentially generalised autoregressive conditional heteroskedasticity are presented on Table 4.6.

$$h_t = c_2 + c_3\left|\frac{\epsilon_{t-1}}{\sqrt{h_{t-1}}}\right| + c_4\frac{\epsilon_{t-1}}{\sqrt{h}_{t-1}} + c_5 h_{t-p} + c_6 FPI_{t-p} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [6]$$

Table 3
Results on Asymmetric Volatility of Returns.

Variable	Coefficient	Std. Error	Z-Statistic	P. value
C2	8.952577	1.696939	5.275720	0.0000**
C3	-0.807331	0.269443	-2.996296	0.0027**
C4	0.582075	0.236927	2.456772	0.0140*
C5	-0.357645	0.288891	-1.237994	0.2157
C6	-0.001858	0.000729	-2.549106	0.0108*
*NB: ** and * denotes significance at 1% and 5% respectively*				

Presented on Table 3 are the results for the EGARCH variance equation used to estimate the volatility of stock market returns. As argued by Nelson (1991), Greene (2018) and Mamvura et al., (2020), the estimation strength of this model rests on its ability to capture asymmetric effects, good and bad news and volatility clustering. Eq. 4b shows the fitted EGARCH variance equation.

$$h_t = 8.953 - 0.807\left|\frac{\epsilon_{t-1}}{\sqrt{h_{t-1}}}\right| + 0.582\frac{\epsilon_{t-1}}{\sqrt{h}_{t-1}} - 0.358h_{t-p} - 0.002FPI_{t-p} \ldots\ldots\ldots [7]$$

The conditional variance of the market returns presented on Eq. 4b is dependent on the nature of news (C3), the asymmetric impact of volatility (C4), lagged volatility (C5) and moderating effect of foreign portfolio investment (C6). Results on Table 4.6 shows a positive constant of volatility, which support the fact that financial markets are inherently volatile or at least potentially unstable. The inverse coefficient of C3 (-0.807) which captures the impact of news on volatility implies that bad news reduces volatility of stock returns. However, such a revelation is contrary to conventional wisdom advanced by the Efficient Market Hypothesis and the theoretical foundation of the EGARCH model (Nelson, 1991).

The positive value of C4 (0.582) infers the presents of the asymmetric nature of volatility and leverage effect (volatility persistence on Zimbabwe Stock Exchange) consistent with findings by Jebran and Iqbal (2016). The autoregressive process (lagged volatility presented by C5) of volatility has an inverse but insignificant effect on current volatility. It shows that past volatility (risk) has no useful information to determine the current volatility. Lastly, positive net foreign equity investment reduces volatility of returns. The intuition is that positive net foreign portfolio investment reduce chances of bear returns and stabilises the local stock market. Thus consistent with Chaudhary et al. (2020).

4.4 Vector Auto-regression Results

The results of autoregressive model stands to answer the needs of the objective on the link among foreign investment flows, stock market performance and exchange rate. Table 5 shows findings on VAR model.

Table 5
Vector Auto-regression Results

	Xrate	ZSE_Return	FPI
Xrate(-1)	0.047590	-0.121061	0.549785
	(0.19067)	(0.17362)	(1.16204)
	[0.24960]	[-0.69728]	[0.47312]
ZSE_Return(-1)	0.336119	0.136002	2.683825
	(0.21784)	(0.19836)	(1.32765)
	[1.54298]	[0.68562]	[2.02149]*
FPI(-1)	0.020430	-0.000922	0.056426
	(0.02768)	(0.02521)	(0.16871)
	[0.73802]	[-0.03659]	[0.33445]
C	15.83699	18.76462	714.9149
	(34.3292)	(31.2601)	(209.225)
	[0.46133]	[0.60027]	[3.41697]**
EGARCH01	-0.009125	0.010723	-0.165154
	(0.01050)	(0.00956)	(0.06400)
	[-0.86903]	[1.12142]	[-2.58071]*
EGARCH01F	0.000187	-3.80E-05	-0.011083
	(0.00059)	(0.00054)	(0.00361)
	[0.31621]	[-0.07053]	[-3.07188]**
R-squared	0.190512	0.241413	0.801890
Adj. R-squared	-0.011860	0.051766	0.752362
F-statistic	0.941394	1.272959	16.19078
NB: ( ) and [ ] denotes standard errors and t-statistics respectively			
*** and * denotes significance at 1% and 5% respectively.*			
Source: Author's own computations			

Results presented on Table 5 shows regression statistics for multi-equation vector autoregressive system. For each particular equation, variable coefficients, standard errors and t-statistics are presented. Results for the first model with exchange rate (Xrate) as the dependent variable shows that the autoregressive process of exchange rate and first lag of foreign portfolio investment do not have a significant influence on exchange rate. The moderating variables which are volatility of stock market returns (EGARCH01) and volatility of foreign equity investment (EGARCH01F) are not statistically significant toward explaining movements in exchange rate in Zimbabwe. This is attributed to the fact that the primary determinant of exchange rate in Zimbabwe is the Reserve Bank of Zimbabwe's auction system.

The second vector autoregressive equation expresses stock market returns (ZSE_Return) as the endogenous factor. This model conveys the absence of a significant linear association among exchange rate, foreign equity flows, and lagged stock market returns. Once again, the moderating components of the equation which are volatility of returns and volatility of foreign equity investment do not have a significant effect on stock market returns on Zimbabwe Stock Exchange. Such results are also substantiated by a very low adjusted coefficient of determination of just 5%.

The third equation of the VAR system express foreign equity investment as the explained variable. From this equation, the one period lag of stock market returns (ZSE_return − 1) has a positive and significant influence on foreign portfolio investment. Thus, as returns on Zimbabwe Stock Exchange increase, foreign investors tends to buy more securities on the local stock market. This indicates evidence for return chasing behaviour which is alike to findings by Babalos et al. (2016). However, such findings digresses from those by Nyang'oro (2013) which established an opposite relationship between foreign equity flows and stock market returns in Kenya. Moderating variables (return volatility and foreign equity flow volatility) are inversely related to foreign portfolio flows. The intuition is that high risk on the local stock market (as measured by volatility) drives foreign investors out of the local stock market through selling the proportion of local securities in their portfolio holding.

The third model has a good adjusted coefficient of determination of 75%, which entails that explanatory variables in this model explains variations in foreign equity investment well. However the coefficient of non-determination stood at 25%, adduces that 25% of changes in foreign portfolio investment are driven by exogenous factors captured through the identically and independently distributed VAR residuals (Enders, 2015).

4.5 Granger Causality Results

To test for the nature of the causal association between variables under consideration, the study employed the pairwise approach introduced by Granger (1980). Results for the test are shown on Table 6.

Table 6
Results on Causality

Hypothesis	F-Statistic	Probability Value
ZSE_Return does not Granger Cause FPI	0.13914	0.8706
FPI does not Granger Cause ZSE_Return	0.21753	0.8056
Xrate does not Granger Cause FPI	0.52655	0.5951
FPI does not Granger Cause Xrate	1.28131	0.2900
EGARCH01 does not Granger Cause FPI	0.42556	0.6566
FPI does not Granger Cause EGARCH01	3.47424	0.0417*
EGARCH01F does not Granger Cause FPI	1.18721	0.3171
FPI does not Granger Cause EGARCH01F	16.0604	1.E-05**
Xrate does not Granger Cause ZSE_Return	0.86846	0.4282
ZSE_Return does not Granger Cause Xrate	1.65819	0.2047
EGARCH01 does not Granger Cause ZSE_Return	0.07306	0.9297
ZSE_Return does not Granger Cause EGARCH01	0.92023	0.4076
EGARCH01F does not Granger Cause ZSE_Return	0.08011	0.9232
ZSE_Return does not Granger Cause EGARCH01F	4.59801	0.0169*
EGARCH01 does not Granger Cause Xrate	0.93589	0.4016
Xrate does not Granger Cause EGARCH01	1.27294	0.2923
EGARCH01F does not Granger Cause Xrate	1.14890	0.3286
Xrate does not Granger Cause EGARCH01F	1.34929	0.2726
EGARCH01F does not Granger Cause EGARCH01	1.06401	0.3560
EGARCH01 does not Granger Cause EGARCH01F	4.20242	0.0231*
*NB: ** and * indicates significance at 1% and 5% respectively.*		
Source: *Author's own computations*		

Presented on Table 6 are the finding on the stock market performance moderated causal relationship between foreign portfolio investment and exchange rate in Zimbabwe. The concept of conditional causality or moderated causality was introduced to eliminate chances of underfitting the causality models as discovered by Wang *et al.* (2016) and Cagli (2018). The study identified a statistically significant unilateral causal connection from foreign portfolio investment (FPI) to stock market return volatility (EGARCH01). Indicating that the nature through which foreign investors buy and sell financial securities on the Zimbabwe Stock Exchange cause changes in volatility of the local market. Another significant causal nexus was established between volatility of stock market returns (EGARCH01) and volatility of foreign portfolio investment (EGARCH01F). The implication is that volatility of foreign portfolio investment is driven by the naturally unstable nature of capital markets. Following this revelation, it is at least conventional to establish that the causal path from foreign portfolio investment to volatility of foreign portfolio investment is conditional on implied risk on the capital market (stock market volatility). Thus, lending empirical support to the Base Broadening Hypothesis

Data analysis also revealed a one way causal link from stock market performance (as measured by market returns) to volatility of foreign portfolio investment. The intuition on this relationship is that when the local stock market is generating positive returns (due to good news and economic success), foreign investors net buy local financial securities thus reducing volatility of foreign investment. Conversely, when local stock market returns are negative foreign investors net sell local financial securities resulting in high volatility of foreign portfolio flows. This exposes the return chasing behaviour of foreign investors as articulated by the Feedback Trading Hypothesis

4.6 Impulse Response Functions

To realise the impact of shocks in one dependent factor in the vector autoregressive system on the rest of the variables in the vector autoregressive system, the research employed impulse response functions. Results of impulse response functions are presented on Fig. 3. Impulse response function results indicate that responses of exchange rate, stock market return and foreign portfolio investment to shocks in the exchange rate equation takes four months to disappear. Innovations or shocks in stock market return affects exchange rate, stock market return and foreign portfolio investment for five months then the effect neutralise and long term equilibrium is achieved. Innovations in foreign equity investment are matched with positive responses in stock market returns in the third month only. Furthermore, responses to market return due to its own shocks (such as return volatility or market risk) is an indication of short-run dynamics.

In addition, the reaction of exchange rate, stock market return and foreign portfolio investment due to innovations in foreign portfolio investment takes an average of four months before it offsets. Conclusively, it can be deduced that for the current study, impulse response functions of foreign equity investment, stock market performance and exchange rates exhibit short term dynamics with responses of not more than 5 months. It is also crucial to note that the initial direction of responses (positive or negative) vary significantly with the source of innovations and the response variable in the vector autoregressive system.

4.7 Variance Decompositions

The study employed variance decompositions to reveal how much of variance in each endogenous variable is accounted for by its own equation and other equations in the vector autoregressive system. Figure 4 displays variance decompositions.

Impulse response functions revealed that the majority (over 80%) of variance in foreign equity investment, stock market returns and exchange rate are as a result of their own innovations. These results substantiate the causality result which revealed that foreign portfolio investment Granger causes volatility in foreign portfolio flows. However, the percent of variance in each endogenous which is accounted for by other equations in the VAR model is very small (less than 20%) across all equations in the VAR system.

In summary, the Results on unit root test indicated that foreign equity investment, stock market performance and exchange rate were all stationary at level I(0), implying mean reverting behaviour. Residuals of the vector autoregressive model were independently and identically distributed (iid) implying a white noise process. The EGARCH (1.1) model proved to be the data permissible model for estimating volatility of stock market returns. Asymmetric analysis of stock market volatility exposed that positive net foreign equity flows significantly reduce volatility of stock market returns. Results on VAR model revealed that foreign equity flows are determined by returns on Zimbabwe Stock Exchange, volatility of returns and volatility of foreign equity investment. Findings on VAR-Granger causality indicated unilateral causality from stock market return and stock market implied risk (stock market volatility) to volatility of foreign equity investment. These findings are the cornerstone of the analysis in Chapter Five. Chapter Five provides summary, conclusion and proffers policy implications of the results presented herein Chapter.

5. Conclusion And Recommendations

As part of the research objectives, the study was anchored on demystifying the nature of the association among foreign equity investment, stock market returns and exchange rates in Zimbabwe. We exposed the asymmetric effect of foreign equity investment on stock market conditional volatility. Even though the reviewed empirical literature on the nature of the association among foreign equity flows, stock market performance and exchange rate was inconclusive, the study identified that foreign equity investors portrayed a return chasing behaviour (with portfolio diversification motive as a marginal positive externality) which correlates well with exchange rate appreciation. We also established that positive net foreign equity investment reduces the volatility of returns (implied risk) on Zimbabwe Stock Exchange. Furthermore, market returns and volatility of market returns were significantly linked to flows of foreign equity investment during the period under review. Nonetheless, we could not establish economically convincing evidence linking exchange rate to foreign portfolio flows and market return (and related implied risk). Hence, synchronising with the fact that the formal exchange rate in Zimbabwe is managed through auction system by the Reserve Bank of Zimbabwe.

The Zimbabwe Stock Market has exhibited enticing positive returns averaging 16.6% over a long period of time. However, the local bourse indicated negative returns in the short term of at most five months. In light of this analysis, retail and institutional investors are recommended to buy securities during period of least returns and hold for a prolonged period of time. This will enable them to maximise their wealth in the long-run. The Ministry of Finance is urged to reduce withholding tax and capital gains tax for long term equity and debt investors on the Zimbabwe Stock Exchange. This encourages investors to hold local securities for a long period. It also stabilises the market (reduces volatility), thereby luring marginal foreign and local investors to provide capital to local industries through participating on Zimbabwe Stock Exchange. The Reserve Bank of Zimbabwe is commended for facilitating foreign currency allocation to disinvestment and payment of dividends to foreign investors. However, the foreign currency disbursement process needs to be expedited so that foreign investors perceive investing in Zimbabwe as an easy and unhindered process. The net effect of this measure is that foreign portfolio investment inflows will increase. The current study demystified the stock market performance moderated nexus between foreign equity investment and exchange rate in Zimbabwe. Therefore, the study can only be useful for policy and managerial recommendations at country level. Consequently, there arise a gap to conduct the study at regional level such as at Southern Africa Development Community level.

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Table

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Appendices

Appendices 3-4 are not available with this version

Figures

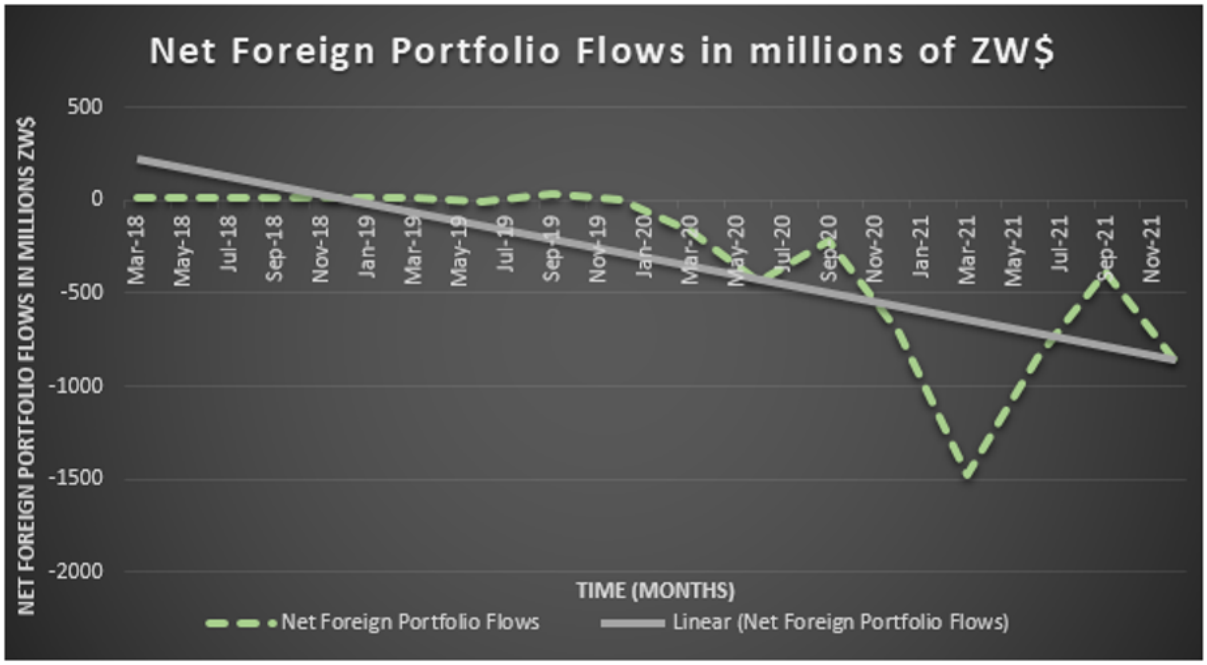

Figure 1

Net foreign Portfolio Flows from October 2018 to December 2021

Source: Zimbabwe Stock Exchange

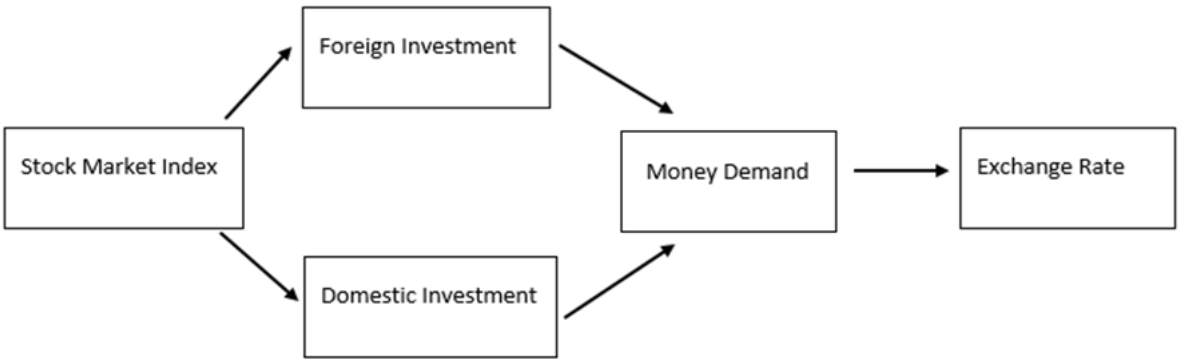

Figure 2

Stock Oriented Model

Source: Frankel 1993

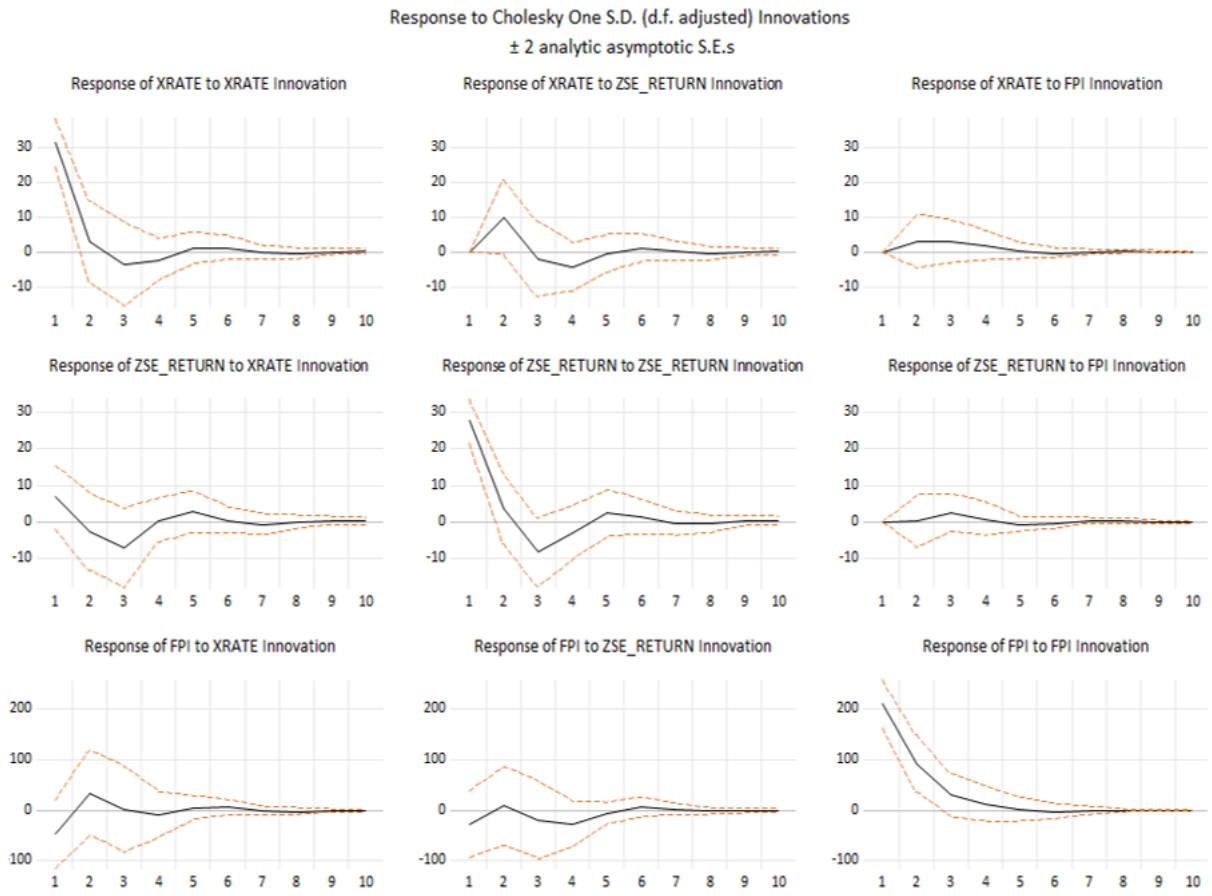

Figure 3

Impulse Response Functions

Source: *Author's own computations*

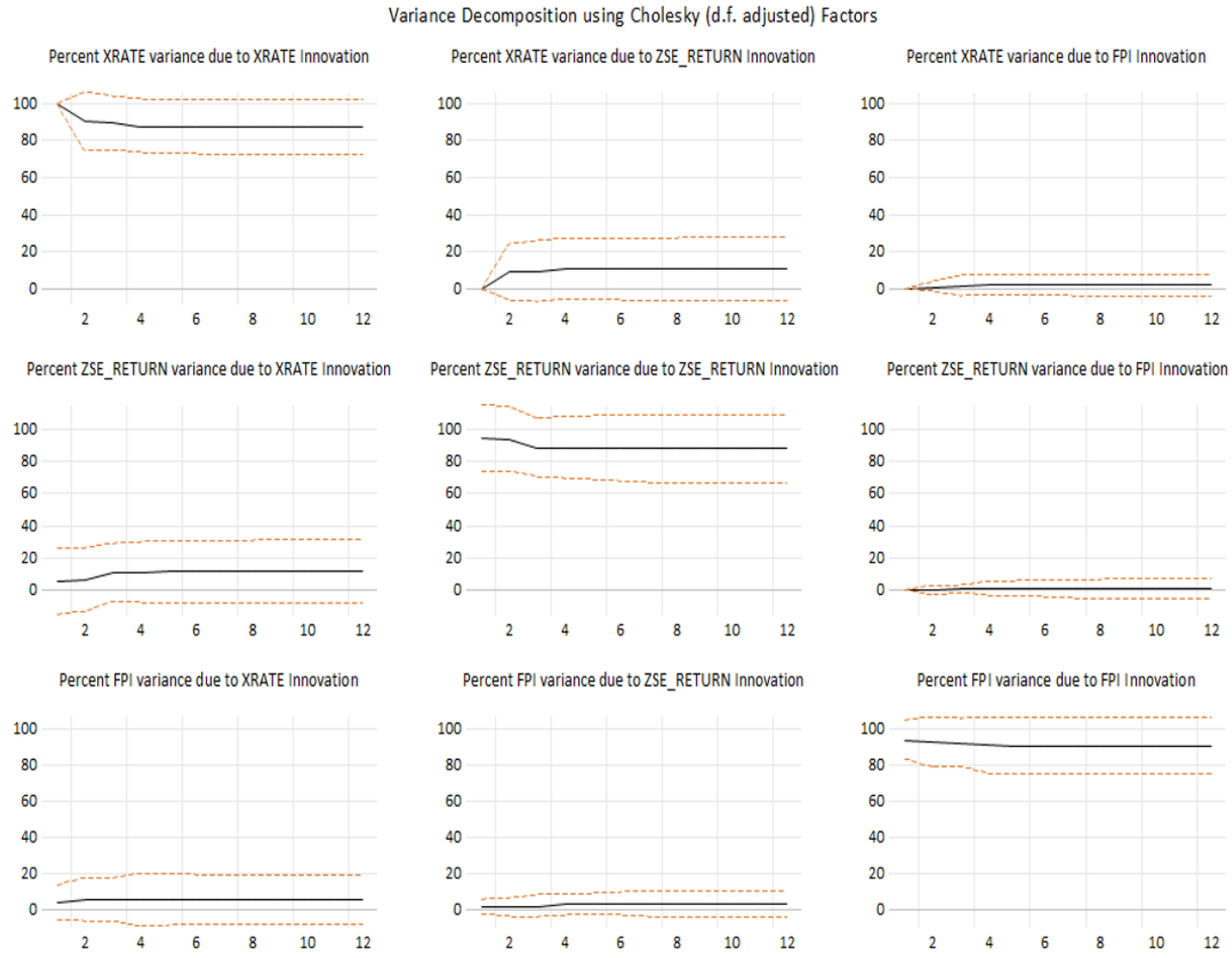

Figure 4

Variance Decomposition

Source: *Author's own computations*

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