

Effect of Foreign Direct Investment, Inflation, Real Exchange Rate and Transfer Payments on Trade Deficit in Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. Author EOO designed the study, managed the literature searches, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors DN and NO managed the flow and analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

Across all the countries, the balance of trade has remained a key indicator of economic activities as it shows a country's level of competitiveness in the world market. Economists are divided on whether a persistent trade deficit is good or bad for a developing country like Kenya. Contrary to most of the similar previous studies, this study included trade in services as well as some of the key factors affecting trade balance such as inflation and transfer payments and sought to establish the nature and strength of their connection with the trade deficit in Kenya as well as their respective impulse responses. This study adapted a reduced form of the balance of trade model by hypothesizing that balance of trade is a function of FDI, inflation, real exchange rate and transfer payments. The study embraced an ex post facto correlational research design to gauge the elements and earnestness of synergy between the variables and used time series data obtained from the World Bank ranging from the year 1978 up to the year 2014 with annual frequency. This study also employed use of descriptive statistics, Cointegration, Vector Error Correction Model, Granger causality, impulse response function tests as well as a range of other diagnostics tests.

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This study concluded that in the long-run, only inflation and transfer payments have positive and negative significant effects respectively on both trade deficit and also foreign direct investments through there is no respective causality. This study also established that trade deficit has positive significant short-run effects on transfer payments while real exchange rate has positive significant short-run effects on inflation though there is also no respective causality. This study found that any shocks need to be addressed within the shortest possible timeframe as the impulse response functions indicate the effects being adverse within the first few years as effects only begin to die out from the fourth year. The study therefore concluded that trade deficit is not really bad for Kenya as measures that should reduce it actually reduces foreign direct investments which are really important for a growing economy like Kenya.

Keywords: Trade deficit; FDI; real exchange rate; inflation; transfer payments; VECM.

1. INTRODUCTION

The role of trade on a country's economic growth cannot be overstressed as it enables the country manage stabilization of policies, help increase national income, improve a country's capital flows and generally help improve the standard of living for the local citizens among others. Across all the countries, balance of trade has prevailed to be a key index of economic activities as it indicates the economies level of competitiveness to the rest of the world. Exponents of trade deficit contend that it is not a bad thing as it provides the locals with a broad range of goods and services at more competitive prices thus raising their living standards and so lessening the threat of inflation.

According to [1], trade deficit signifies that local consumers access and enjoy broad range of services and goods at lower prices while, a trade surplus signifies that an economy exports services and goods that locals do not get to consume thus paying higher price for the services and goods locally consumed. Pundits however portends that trade deficit leads to current account deficit as the country has to borrow from other countries in order to pay for her enormous imports hence a country that endlessly runs trade deficit is liquidating capital assets in order to fund current purchase of services and goods.

According to [2], balance of trade of developing and developed countries for goods and services continue to deviate from each other with those in Africa running overall trade deficits of about \$100.4 billion in 2013 while developed countries such as Europe ran an aggregate trade surplus of about \$630 billion the same year. As for the Sub-Saharan Africa countries, the region has experienced trade surpluses only in the late 1980s and early 2000s years over the past three

decades. Since the year 2008, the region has experienced persistent trade deficit. Scholars and policy makers argue that for the Kenya to achieve her general objective of becoming middle-income by the year 2030 as envisioned in her Vision 2030 blueprint, the country needs to guarantee that trade remains the foundation upon which her development and industrialization strategy is anchored. Contrarily, the country has experienced persistent aggregate trade deficits (including goods and services) since the year 1978. Over the years, Kenya has embraced different policies and or strategies that affect trade. During the epoch of Kenya's pre-independence, the country produced mainly agricultural products and other primary products for the Europe's manufacturing sector with some safeguard in the local market [3]. Kenya embraced an import-substitution strategy forthwith after the independence in the year 1963. It is reported that though the strategy safeguarded the country for the availability of products that were formerly imported, it led to inadequate technical productivity, encouraged the formation of surplus capacity as well successive incapacity to infiltrate external markets [4].

Previous studies on the effect of real exchange rate on trade balance have revealed mixed results. A study by [5] in Kenya found that real exchange rate was negatively significant. This coincided by the studies by [6,7,8,9,10] which all established that real exchange rate was significant with a negative sign. However, studies by [11] and that of [12] on the other hand all revealed that real exchange rate positively and significant affects. A different study by [13] further revealed that real exchange rate was insignificant with a negative sign. These reviewed studies excluded trade in services which is key for a developing country like Kenya. This study explored the causal effects of real

exchange rate on trade deficit and includes other key variables such as foreign direct investments, inflation and transfer payments. This study also explored the impulse response of trade deficit due to shocks in FDI, inflation, real exchange and transfer payments. Even though [10] included the inflation and transfers, the period of study 2005-2013 with annual frequency was statistically very short.

Latest research on the effect of foreign direct investments on balance of trade have also reported mixed results. In as much as studies by [5,12,9] all revealed that foreign direct investment were positively significant, different studies by [7] and [13] established that it was insignificant with a positive sign. Additionally, [10] variously established that FDI was insignificant with a negative sign. These reviewed studies did not include trade in services which is key to a service economy like Kenya. In addition to determining the causal relationship between Foreign Direct Investment (FDI) and trade deficit as well as impulse response due to shocks, this study also included other variables key to trade such as transfer payments, inflation and real exchange rate.

A study by [10] established that inflation was significant with a negative sign. Contrarily, [9] on the other hand revealed that inflation had a positive sign and was insignificant. These studies excluded trade in services which is a key factor for service economy like Kenya. This study explores the interactions between inflation and trade deficit and also includes other key variables to Kenya's trade such as foreign direct investment, transfer payments and real exchange rate. Lastly, all the reviewed studies excluded the interactions between transfer payments and trade deficit.

1.1 Objectives of the Study

The broad objective of the study was to establish the effect of foreign direct investment, inflation, real exchange rate and transfer payments on trade deficit in Kenya.

1.2 Research Hypothesis

1. FDI does not affect Trade deficit.
2. Inflation does not affect trade deficit.
3. Real exchange rate does not affect trade deficit.
4. Transfer payments does not affect trade deficit.

1.3 Theoretical Framework

This study sought to establish the effect of foreign direct investment, inflation, real exchange rate and transfer payments on trade deficit in Kenya. The study hypothesized that balance of trade is a function of foreign direct investment, inflation, real exchange rate and transfer payments. The study adopted the use a reduced form of the trade balance model that was developed by [14] and later modified by [15]. The [14]'s model is illustrated as indicated below in which equation 1.1 represents the import demand function while equation 1.2 represents the export demand function.

$$\ln M_{it}^d = a_0 + a_1 \ln(PM_i/PD_i)_t + a_2 \ln Y_{it} + U_t \quad (1.1)$$

$$\ln X_{it}^d = b_0 + b_1 \ln(PX_i/PW_i)_t + b_2 \ln W_{it} + Z_t \quad (1.2)$$

From the above equations 1.1 and 1.2, M_{it}^d , X_{it}^d , PM_{it} , PX_{it} , PD_{it} , PW_{it} , Y_{it} , W_{it} and U_t/Z_t are the quantity if imports, quantity of exports, unit price of imports, unit price of exports, domestic price level, world price level, real gross national product, real world income and error term associated with each observation respectively of country (i) at time (t).

The [15] model is illustrated as indicated below in which equation 1.3 represents the import demand function and equation 1.4 represents the export demand function.

$$\ln M_t^d = a + b \ln Y_t + c \ln(PM/PD)_t + d \ln E_t + U_t \quad (1.3)$$

$$\ln X_t^d = a + b \ln YW_t + c \ln(PX/PXW)_t + d \ln E_t + Z_t \quad (1.4)$$

From the above equations 1.3 and 1.4, M_t^d , X_t^d , PM_t , PX_t , PD_t , Y_t , YW_t , PXW_t , W_t , E_t and U_t/Z_t are the quantity if imports, quantity of exports, unit price of imports, unit price of exports, domestic price level, real gross national product (GNP), weighted average GNP of the country's trading partners, weighted average export prices, real world income, export weighted effective exchange rate and error term associated with each observation respectively at time (t).

1.4 Empirical Literature Review

The empirical studies undertaken with an objective of establishing the relationship between

trade balance and various factors of the economy including Foreign Direct Investment (FDI), inflation, real exchange rate and secondary income which established different results which are explained as follows;

A study undertaken by [5] in Kenya using annual data for the period 1970 – 2010 based on trade balance model approach. The study employed Cointegration and Error Correction Model (ECM) and other nonparametric method model and found that real exchange rate was negatively significant, government expenditure was positively significant, foreign direct investments was positively significant, domestic income was domestic income as well as money supply were also both significant with a negative and positive sign respectively. The study established that though foreign income had a positive sign, it was not significant and recommended that trade balance could be improved through policies on income or growth and money supply rather than exchange rate regime. The study however did not include trade in services which is key given the rise of service sector in developing countries such as Kenya. Additionally, the period of the study that is from the year 1970 – 2010, Kenya experienced both surplus and deficit balance of trade. Finally, the study excluded other key factors such as Inflation, transfers among others. This study focused on the periods that Kenya has experienced persistent trade deficit and included trade in both goods and services. This study also included inflation and transfer payments among others which are considered key factors that influence balance of trade.

An examination of the Marshall-Lerner (ML) condition by [6] for the Kenyan economy using quarterly data for the time period 1996q1 – 2011q4. The study employed fractional integration and cointegration methods among other techniques based on the concept of long memory or long-range dependence and established that real exchange rate, as well as relative income, were both significant with a negative sign. The study concluded that exchange rate can be used to address external balance as depreciation leads to a reduction of import expenditure and an increase in export sales. The techniques used in the analysis i.e mainly fractional integration and cointegration are empirically known to be very general allowing only for integer degrees of differentiation which is their main undoing. This study employed the use of vector error correction model which helped to reduce the absolute error in the model

hence tranquilizing the assumption of homoscedasticity.

Another study conducted by [8] using panel data for the time period 1970 – 2013 for Kenya's bilateral trade. The study employed extended trade balance model as well as cointegration with Autoregressive- Distributed Lag (ARDL) model and extended trade balance model. This study established that bilateral real exchange rate was significant with a negative sign while both incomes of the trading partner as well as the per capita income of the trading partner were both significant with a positive sign. The study concluded that in addition to maintaining a stable exchange rate, maintaining a highly overvalued bilateral exchange rate could help discourage exports. Additionally, the study also recommended currency devaluation in bilateral terms as a way of improving the trade balance. The study was however limited to a few factors as it excluded other key factors such as foreign direct investment, Inflation, transfers among others. This study sought to include all the excluded key factors that is foreign direct investment, inflation as well as transfer payment.

A study done by [11] in Kenya using annual data for the period 1963-2013 to establish the relationship and effect of the real exchange rate on trade the trade balance. The study employed a two-country imperfect substitute model of [16] and also used cointegration vector autoregressive and vector error correction modeling. The study established that real exchange rate and foreign income were both significant with a positive sign while domestic income, as well as broad money supply, were both insignificant with a negative and positive sign respectively. Exchange rate regime was also found to be insignificant with a negative sign. The study concluded that both monetary and exchange rate policies need to be implemented together to enhance the better position of trade balance. The resultant sign on domestic income is however inconsistent with the monetary approach in which the rise in domestic income raises money demand hence increasing exports. The study also used an incorrect formula for calculating real exchange rate. This study sought to use the correct formula in calculating the real exchange rate before subjecting it to the analysis along the other key factors.

Another study done by [7] aimed at identifying the main factors that causing trade deficit in

Tanzania using annual data for the period 1970-2006. The study employed simple reduced form model of the trade balance as well as cointegration procedure and Error Correction Modeling (ECM). The study established that household consumption expenditure, government expenditure and income from the rest of the world were all significant with a positive sign while real exchange rate was found to be significant with a negative sign. It established that foreign direct investment and trade openness were both insignificant with a positive and negative sign respectively. The study concluded that fiscal discipline can help improve trade balance and should entail efficient collection of revenue accompanied with strict expenditure management and controls with expenditures being geared towards productive activities. The sign for government expenditure was however not as per the priori expectations. Moreover, the study only covered merchandise trade and left out trade in services which is currently key for most developing countries. The study excluded the trade in both goods and services since service sector is considered one of the sectors for developing countries.

A study by [10] sought to identify and estimate the factors affecting the Ghanaian trade balance using annual data for the period 2005-2013. The study employed Ordinary Least Squares (OLS) and other nonparametric method model and established that Foreign Direct Investment (FDI) was not significant with a negative sign while government expenditure, net income, real exchange rate and inflation were all significant with a negative sign. The study concluded that there is need to reduce both government and household consumption expenditure to improve the balance of trade.

A study by [13] employed cointegration in undertaking a study in Tanzania on determinants of trade balance using annual data for the period 2070-2013. The study revealed that government expenditure, as well as income from rest of the world, were both significant with a positive sign while household consumption expenditure and trade liberalization were both significant with a negative sign. The study however established that real exchange rate and foreign direct investment were both insignificant with a negative and positive sign respectively. The study concluded that government expenditure and private consumption are the main contributing factors to trade deficit. The study

however excluded other key factors such as Inflation, transfers among others.

A study by [9] on determinants of Trade Balance in Somalia using annual data for the period 2070-2010. The study employed OLS and two-country imperfect substitute model and established that real exchange rate and foreign direct investment were both significant with a negative and positive sign respectively. Though inflation was having a positive sign, it was insignificant. The study concluded that export promotion strategies, as well as currency stabilization, are critical in improving the trade balance. The study was however only limited to three factors affecting trade balance yet there are so many factors that influence trade balance.

Another study by [12] used annual data for the period 1963-2012 to establish the major determinants of trade balance in Kenya. This study employed Marshall-Lerner condition approach as well as cointegration approaches and Error correction modeling (ECM). The study established that foreign direct investment as well as real effective exchange rate to be both significant with a positive sign while the budget deficits was insignificant with a positive sign. The study concluded that the country should formulate and adjust external trade policies to address issues such as social and physical infrastructure, reduce price of electricity, reduce high rates of interest adjust tax and tariff structures accordingly. The study was however limited to testing the Marshall -Lerner condition in Kenya and so did not test the relationship of the real exchange rate on the trade balance.

Against the background, Kenya has persistently run an aggregate trade deficit since the year 1978. The reviewed, previous studies that have sought to establish the key factors contributing to trade deficit have not only found different results but have also used different methodologies. Most of the existing studies have also neglected to establish the causal effects as well as the respective impulse responses. Additionally, most of the studies only covered trade in merchandise and left out the trade in services as well as inflation which are not only critical for a developing country like Kenya but are also key factors affecting international trade. This presents the need for this study that aimed to establish long and short-run effects as well as the causal relationships and the respective impulse responses due to possible sudden shocks but also includes the trade in services.

2. METHODOLOGY

This study employed an ex post facto correlational research design which evaluates the nature and extent of association between two or more naturally occurring variables [17]. Therefore, the study plan involved gathering of information on the relationship between foreign direct investment, inflation, real exchange rate, transfer payments and trade deficit in Kenya for the period 1978 to 2014. Any determined differences were considered to be ex post facto in nature in that they stemmed from differences in results in the measurement efforts of the variables.

This study adopted a behavioral function of a reduced form of trade balance model as mirrored in the work of [15] and adapted in order to establish how Kenya's trade deficit is affected by and affects FDI, inflation, real exchange rate and transfer payments. Due to data availability constraints, the study selected the longest possible sample period to avoid the small sample bias. In this regard, the study used a sample of 37 years for the period of 1978 to 2014 with annual frequency. The study involved an empirical examination of the effect of trade deficits on Kenya's economy. The study used STATA to analyze the data. Given that the study employed use of secondary data, the augmented Dickey-Fuller unit-root test was used to test the stationarity of the data. Pairwise correlational analysis was used to establish the interaction between the variables under study. The Johansen's, (1995) maximum likelihood technique was also used to establish if the non-stationary variable are cointegrated and the Vector Error Correction Model (VECM) was used to establish both short-run and long-run relationships of the variables under study. Granger causality test was also conducted in order to establish the causal relationships between the variables under examination.

Given that the study employed the use of secondary data, augmented Dickey-Fuller unit-root test was used to test the stationarity of the data. Breusch and Godfrey test [18] was used to test for autocorrelation. Breusch-Pagan test [19] also known as Cook's Weisberg's test [20] was used to test for heteroskedasticity. Variance Inflation Factors (VIF) was used to test for multicollinearity and link test was also conducted to check for any possible specification error in the model. Impulse Response Function (IRF) was used to establish how shocks of each

variable affects the other variables over time [21].

2.1 Data Type, Source and Statistical Package

The study used time series data obtained from the World Bank data bank. Years were chosen from the year 1978 which is the year when the Country began to have persistent trade deficit up to the year 2014 with annual frequency due to data availability. The real exchange rate was calculated from the nominal exchange rates and the CPIs for both Kenya and the United States. The analysis was done using STATA version 14 which is a statistical package for econometric analysis.

2.2 Specification of the Model

The specification of the model for this study mirrors the works of [8,5] and [22]. It was modified to fit the study by including foreign direct investment, inflation and transfer payments. The simple reduced form of the trade balance model was adopted a modified extend trade balance model that includes foreign direct investment, inflation, real exchange rate and transfer payments as indicated below.

$$TB = f(REXR, Y, Y^*) \quad (2.1)$$

$$TB = f(FDI, INFL, REXR, TRF) \quad (2.2)$$

$$TRDCTS_t = \lambda_0 + \lambda_1 FDI_t + \lambda_2 INFL_t + \lambda_3 REXR_t + \lambda_4 TRF_t \quad (2.3)$$

When we incorporate the disturbance term (ε_t) into the equation, the trade deficit equation becomes:

$$TRDCTS_t = \lambda_0 + \lambda_1 FDI_t + \lambda_2 INFL_t + \lambda_3 REXR_t + \lambda_4 TRF_t + \varepsilon_t \quad (2.4)$$

Our priori expectation is that; $\lambda_1, \lambda_2, \lambda_4 > 0$ and $\lambda_3 < 0$

Where:

λ_0 = the intercept
 $\lambda_1, \lambda_2, \lambda_3,$ and λ_4 = the coefficients of the regression equation;

$TRDCTS_t$ = Trade Deficit at time (t) which represents the dependent variable;

The independent variables are: Foreign Direct Investment (FDI), Inflation ($INFL$), Real

Exchange Rate (REXR), Transfer Payments (TRF); and ε_t is the error term.

The assumptions governing the explanatory variables are as follows:

1. They are non-stochastic in nature
2. Have fixed values in repeated sampling
3. In multiple regressions, there is no multicollinearity between two or more regressors.
4. As $m \rightarrow \infty$, the sample variance tends to a fixed constant ($s_x^2 = k$)

The assumptions governing the disturbance term ε_t are as follows:

1. The zero mean assumption: Formally, $\mu[\varepsilon_t|X_t] = 0$ for each time (t)
2. The assumption of homoscedasticity or equal variance of ε_t

$$Var[\varepsilon_t|X_t] = \mu[\varepsilon_t - \mu(\varepsilon_t)|X_t]^2 = \mu(\varepsilon_t^2|X_t) = \delta^2$$

3. The assumption of non-autocorrelation between the disturbances ε_i and ε_j ($i \neq j$):

$$Cov(\varepsilon_i, \varepsilon_j|X_i, X_j) = \mu\{[\varepsilon_i - \mu(\varepsilon_i)|X_i][\varepsilon_j - \mu(\varepsilon_j)|X_j]\} = \mu(\varepsilon_i|X_i)(\varepsilon_j|X_j) = 0$$

4. The disturbance term is normally distributed: $\varepsilon_i \sim N(0, \delta^2)$

3. RESULTS AND DISCUSSION

3.1 Correlation of Variables

The pairwise correlational analysis was conducted to establish the statistical relationship between each of the variables under study. The Pearson correlation coefficient for trade deficit and inflation is 0.2003 with *p-value* of 0.2346 indicating there is a positive relationship between trade deficit and inflation and that the relationship is insignificant implying that trade deficit increases by a very small margin as inflation increases. The table also indicates that Pearson correlation coefficient for trade deficit and foreign direct investment is 0.8387 with *p-value* of 0.0000 indicating there is a positive relationship between trade deficit and foreign direct investment that is statistically significant implying that trade deficit increases by a very high margin as foreign direct investments increases. The Pearson correlation coefficients for trade deficit

and real exchange rate as well as trade deficit and transfer payments are 0.6992 and -0.6391 respectively with *p-values* of 0.0000 indicating there is a positive and a negative relationship between trade deficit and real exchange rate as well as trade deficit and transfer payments respectively that are statistically significant implying that trade deficit increases by a large margin as real exchange rate increases while trade deficit decreases immensely as transfer payments increases. The table also indicates the Pearson correlation coefficients for foreign direct investment and real exchange rate, foreign direct investment and transfer payments, and real exchange rate and transfer payments to be 0.6094, -0.5042 and -0.4646 with the respective *p-values* being 0.0001, 0.0015 and 0.0038 which are all statistically significant implying that foreign direct investment increases immensely as real exchange rate increases while foreign direct investment and real exchange rate decreases greatly as transfer payments increases.

Finally, the table indicates the Pearson correlation coefficients for inflation and foreign direct investment, inflation and real exchange rate, and inflation and transfer payments to be 0.1442, 0.2310 and -0.1067 respectively with respective *p-values* of 0.3946, 0.1690 and 0.5298 indicating that positive insignificant relationship between inflation and foreign direct investment and that of inflation and real exchange rate but a negative insignificant relationship between inflation and transfer payments. This imply that inflation increases by a very small proportion as foreign direct investment and real exchange rate increases while inflation decreases by a very small margin as transfer payments increases. The results of the pairwise correlation analysis are presented as indicated in the Table 1.

Given the results of the skewness and kurtosis as well as the fact that the variables are all in different units, the pairwise correlation analysis may not accurately give the association of the variables. The data was therefore subjected to further analysis.

3.2 Stationarity Analysis

Several diagnostic tests were carried out to establish the features of the data used. Unit root tests were the initial tests conducted to establish the stationarity or non-stationarity of the time series data as well as identify the integration order before undertaking the cointegration

procedure [23] and [24]. In this regard, the study employed the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test which both give almost similar conclusions.

The results on both ADF and PP indicates that we reject the null hypothesis that inflation were generated by a stationary process at 5% significance levels since the *p-value* of test statistic is less than 0.05. The results further indicate that on both Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), we accept the null hypothesis that trade deficit, foreign direct investments, real exchange rate and transfer payments are all generated by a stationary process at 5% significance levels since their respective *p-values* of the test statistics are all more than 0.05.

After differencing the results indicates that FDI, real exchange rate and transfer payments all become stationary at first difference hence integrated of order I(1) and so we reject the null hypothesis of non-stationarity. The endogenous variable trade deficit on the other hand become stationary at second difference hence integrated of order I(2) and so we reject the null hypothesis

of non-stationarity. The results coincided with the work of [25] who also found real exchange rate to be integrated of order I (1). The results for the unit root tests for the difference at different levels are shown in Table 2.

3.3 Cointegration

Prior to conducting the cointegration test, the lag length was established. The lag length is identified by the selection criterion which comprises of the Likelihood Ratio (LR) tests, Final Prediction Error Criteria (FPE), the Akaike's Information Criteria (AIC), Hannan-Quinn Information Criteria (HQIC) and Swartz-Bayesian Information Criteria (SBIC). These set of criteria are used to outline the optimal lag length where a criterion that has lowest value in every is selected [23]. The results indicate the optimal lag length to be 1 since all the selection criteria Final Prediction Error (FPE), Akaike's Information Criterion (AIC), Schwarz's Bayesian Information Criterion (SBIC) and Hannan and Quinn information criterion (HQIC) all except Likelihood Ration (LR) criteria tests have the lowest value at the lag length of 1. The results for all the lag selection criteria are as indicated in the Table 4.

Table 1. Pairwise correlational analysis

	LN_TRDCTS	INFL	LN_FDI	LN_REXR	LN_TRF
LN_TRDCTS	1.0000				
INFL	0.2003 (0.2346)	1.0000			
LN_FDI	0.8387* (0.0000)	0.1442 (0.3946)	1.0000		
LN_REXR	0.6992* (0.0000)	0.2310 (0.1690)	0.6074* (0.0001)	1.0000	
LN_TRF	-0.6391* (0.0000)	-0.1067 (0.5298)	-0.5042* (0.0015)	-0.4646* (0.0038)	1.0000

Note: * denotes significant correlation at 5% significance level

Source: Author

Table 2. Unit root test results after differencing

ADF test					
	Test Statistics	1% Critical Value	5% Critical Value	10% Critical Value	P-Value Z(t)
D2LN_TRDCTS	-4.815	-4.279	-3.564	-3.218	0.0004
INFL	-3.566	-4.279	-3.556	-3.214	0.0329
DLN_FDI	-7.492	-4.288	-3.560	-3.216	0.0000
DLN_REXR	-6.599	-4.288	-3.560	-3.216	0.0000
DLN_TRF	-7.233	-4.288	-3.560	-3.216	0.0000
PP test					
LN_TRDCTS	-4.262	-4.297	-3.564	-3.218	0.0036
INFL	-3.560	-4.279	-3.556	-3.214	0.0334
DLN_FDI	-8.058	-4.288	-3.560	-3.216	0.0000
DLN_REXR	-6.593	-4.288	-3.560	-3.216	0.0000
DLN_TRF	-7.584	-4.288	-3.560	-3.216	0.0000

Source: Author

Given that the optimal lag length has been established, the Johansen cointegration test using trace statistics was conducted to establish the number of possible cointegrating equations. The results in the Table 4 indicate that there exists a rank of 2 in trace test and hence we reject the null hypothesis of no cointegrating equation and accept the alternative hypothesis that there are at least more than one cointegrating equation in the multivariate model. Since there is a cointegrating equation at 5% significance levels, the series can be combined in a linear fashion and that there is both long-run and short-run relationship among the variables; trade deficit, inflation, foreign direct investment, real exchange rate and transfer payments. The existence of cointegrating equation also imply that even if there are shocks in the short-run that may affect the movement in the individual series, that they would converge with time in the long-run. The results presented above indicates that the residuals are non-stationary and given that cointegration in the multivariate model has been established, Vector Error Correction Model (VECM) was conducted to establish both short-run and long-run adjustments, [26]. The results for the Johansen's cointegration test are presented in Table 4.

3.4 Vector Error Correction Model (VECM)

The Johansen's cointegration test results presented above indicates that the Vector Error Correction Model should be based on two rank and one lag. From the VECM short-run equations results, the respective coefficients for inflation, real exchange rate and transfer payments to be 0.002344, 0.097035, and 0.115523 which are all positive except for FDI with a coefficient of -2.66861 implying that in the short-run, as inflation, real exchange rate and transfer payments increases, trade deficit increases and that as FDI increases, trade deficit decreases. The *p-values* for the first lag of FDI, inflation, real exchange rate, and transfer payments are 0.501, 0.741, 0.857 and 0.530 respectively which are all greater than 0.05 suggesting insignificant short-term effects of FDI, inflation, real exchange rate and transfer payments on trade deficit. The signs for all the coefficient for inflation in the short-run is consistent with the coefficient in the long-run results while the coefficients for real exchange rate and transfer payments are inconsistent with the respective coefficients in the long-term. The results of short-run effects of FDI, inflation, real exchange rate and transfer payments on trade

deficit are all consistent with priori expectations [27].

The coefficients for trade deficit, inflation, real exchange rate and transfer payments are -0.02764, 0.0000207, -0.00954 and 0.012736 respectively which are all negative except for inflation and transfer payments suggesting that in the short-run, FDI increases as inflation and transfer payments increases while it decreases as trade deficit and real exchange rate increases. The *p-values* of the first lag of trade deficit, inflation, real exchange rate and transfer payments are 0.231, 0.972, 0.832 and 0.406 respectively which are all over 0.05 indicating insignificant short-term causality between each of the trade deficit, inflation, real exchange rate and transfer payments on FDI. The signs for the coefficients for inflation and real exchange rate in the short-run are consistent with the respective signs in the long-run results while that of transfer payments is inconsistent with the respective coefficient sign in the long-run results. The sign for inflation in the short-term is inconsistent with the priori expectations while that of trade deficit, real exchange rate and transfer payments are all consistent with the long-run priori expectations [28].

The coefficients for trade deficit, FDI, real exchange rate and transfer payments are 2.205181, 64.96024, 31.93395 and 5.000184 which are positive implying that in the short-run inflation increases as trade deficit, FDI, real exchange rate and transfer payments increases. The respective *p-values* of trade deficit, FDI, and transfer payments are 0.776, 0.558 and 0.331 which are all greater than 0.05 suggesting insignificant short-term causality between each of the trade deficit, FDI and transfer payments on inflation. The *p-value* for real exchange rate is 0.034 which imply a significant short-run effects of real exchange rate on inflation. The signs for trade deficit, real exchange rates and transfer payments in the short-run are consistent with the long-term priori expectations while that of FDI is inconsistent with the long-term priori expectations [28].

The respective coefficients for trade deficit, FDI, inflation, and transfer payments to be interpreted as 0.074503, 0.739674, -0.00352, and -0.00503 which are all positive except for inflation and transfer payments which are negative suggesting that in the short-run, real exchange rate depreciates as trade deficit, FDI, and inflation

Table 3. Optimal lag selection criterion

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	-81.7827				0.000098	4.95901	5.03571	5.1812
1	39.0215	241.61	25	0.000	4.2e-07*	-0.515517*	-0.055312*	0.817639*
2	59.6957	41.348*	25	0.021	5.9e-07	-0.268325	0.575384	2.17579

Note: * denotes the optimal lag length in the criteria
Source: Author

Table 4. Johansen's cointegration test using trace statistics

Max. rank	Parms	LL	Eigenvalue	Trace statistic	5% Level	1% Level	Max statistic	5% critical value	1% critical value
0	5	-13.733734	-	109.4550	68.52	76.06	53.7471	33.46	38.77
1	14	13.139797	0.77530	55.7079	47.21	54.46	26.5462	27.07	32.24
2	21	26.412891	0.52164	29.1617 ¹⁵	29.68	35.65	19.6873	20.97	25.52
3	26	36.256545	0.42124	9.4744	15.41	20.04	9.1031	14.07	18.63
4	29	40.808080	0.22343	0.3713	3.76	6.65	0.3713	3.76	6.65
5	30	40.993753	0.01026	-	-	-	-	-	-

Note: ¹⁵ denotes presence of cointegration at rank 3 at 5% significance level
Source: Author

increases while it appreciates as trade deficit and FDI increases. The *p-values* of trade deficit, FDI, inflation, and transfer payments are 0.386, 0.548, 0.109, and 0.930 respectively which are all greater than 0.05 indicating insignificant short-term effects between trade deficit, FDI, inflation, and transfer payment with real exchange rate. The signs for FDI, inflation and transfer payments in the short-run are inconsistent with the long-term priori expectations while only that trade deficit is consistent with the priori expectations [29].

Finally, the coefficients for trade deficit and inflation which are interpreted to be 1.013873 and 0.004918 which are both positive implying that in the short-term transfer payments increases as trade deficit and inflation increases. The coefficients for FDI and real exchange rate are -5.46475 and -0.03733 which are both negative suggesting that in the short-run transfer payments decreases as FDI and real exchange rate increases. The respective *p-values* of FDI, inflation, and real exchange rate are 0.240, 0.554, and 0.953 which are all greater than 0.05 suggesting insignificant short-run effects between FDI, inflation, and real exchange rate with transfer payments. The *p-value* for trade deficit is 0.002 suggesting significant short-run effects of trade deficit on transfer payments. The signs for trade deficit and inflation in the short-run are consistent with the long-term priori expectations while that of FDI and real exchange rate are inconsistent with the priori expectations [30]. The short-run coefficients results are shown in Table 5.

The Vector Error Correction Model results with normalization restriction-imposed results indicate the existence of two cointegrating equations *_ce1*, and *_ce2*. The signs of the coefficients of the cointegration with imposed normalization restriction since the normalization renders the model to be related to the dependent variable [31]. These equations can be illustrated as indicated below.

$$dln_trdcts = -0.073877 + 0.0107813infl - 0.6202882dln_rexr - 0.9304521dln_trf \quad (3.1)$$

$$dln_fdi = -0.0047321 + 0.0006526infl - 0.0279886dln_rexr - 0.0596212dln_trf \quad (3.2)$$

From cointegration equation 3.1, the coefficient for inflation is 0.0107813 with a *p-value* of 0.008

implying a positive significant effect and so in the long-run, as inflation increases by a unit, trade deficit increases by $1^{0.0107813}$ units. This result is however in consistent with the *priori* expectation which should be a positive relationship implying that inflation makes the exports to be costly as the imports become cheaper hence leading to an increase in trade deficit [32]. This is contrary to [10] that found negative significant effects as well as that of [9] that found positive insignificant effects of between inflation and trade deficit. The coefficient for real exchange rate is -0.6202882 with *p-value* of 0.099 implying a negative insignificant effect trade deficit and so as real exchange rate increases by a unit, trade deficit depreciates by $1^{0.6202882}$ units. This coincides with the results from [5,6,8,10,7] who all found negative significant effects of real exchange rate on trade deficit. This besides being contrary to our priori expectations, is also contrary to results from [9,11,12] that all found positive significant effects of real exchange rate on trade deficit as well as [13] that found insignificant negative effects. The coefficient for transfer payments is -0.9304521 with the *p-value* of 0.000 implying a significant negative effects of transfer payments on trade deficit hence as transfer payments increases by a unit, trade deficit depreciates by $1^{0.9304521}$ units. The result is contrary to [13] and [33] who both found a positive significant effect of transfer payments on trade deficit.

From cointegrating equation 3.2, the coefficient for inflation is 0.0006526 with a *p-value* of 0.049 implying a significant positive effect of inflation on FDI and so in the long run as inflation increases by a unit, FDI increases by $1^{0.0006526}$ units. The coefficient for transfer payments is -0.0596212 with the *p-value* of 0.000 implying a significant negative effect of transfer payments on FDI and so as transfer payments increases by a unit, FDI depreciates by $1^{0.0596212}$ units. The coefficient for the real exchange rate on the other hand is -0.0279886 with *p-value* of 0.360 implying a negative insignificant effect of real exchange rate on FDI.

3.5 Post Estimation Tests

3.5.1 Autocorrelation test

In order to establish the interaction of each of the variables with the other variables under study, autocorrelation test of the residuals was conducted. The Breusch and Godfrey, (1978) LM test was used to tests for higher-order serial

Table 5. Vector error correction model short-run equations

		Coef.	Std. Err.	Z	P>z	[95% Conf. Interval]	
D_dln_trdcts	_ce1_L1.	-0.719	0.394	-1.830	0.068	-1.491	0.053
	_ce2_L1.	10.717	5.796	1.850	0.064	-0.643	22.076
	dln_fdi_LD.	-2.669	3.967	-0.670	0.501	-10.444	5.106
	infl_LD.	0.002	0.007	0.330	0.741	-0.012	0.016
	dln_rexr_D.	0.097	0.539	0.180	0.857	-0.959	1.153
	dln_trf_LD.	0.116	0.184	0.630	0.530	-0.245	0.476
	_CONS	-0.034	0.051	-0.670	0.503	-0.133	0.065
D_dln_fdi	_ce1_L1.	0.087	0.033	2.670	0.008	0.023	0.152
	_ce2_L1.	-1.601	0.483	-3.320	0.001	-2.547	-0.655
	dln_trdcts_LD.	-0.028	0.023	-1.200	0.231	-0.073	0.018
	infl_LD.	0.000	0.001	0.040	0.972	-0.001	0.001
	dln_rexr_LD.	-0.010	0.045	-0.210	0.832	-0.098	0.078
	dln_trf_LD.	0.013	0.015	0.830	0.406	-0.017	0.043
	_CONS	-0.002	0.004	-0.450	0.650	-0.010	0.006
D_infl	_ce1_L1.	-1.112	11.006	-0.100	0.920	-22.683	20.458
	_ce2_L1.	-289.969	161.964	-1.790	0.073	-607.411	27.474
	dln_trdcts_LD.	2.205	7.740	0.280	0.776	-12.965	17.375
	dln_fdi_LD.	64.960	110.859	0.590	0.558	-152.319	282.240
	dln_rexr_LD.	31.934	15.060	2.120	0.034	2.417	61.451
	dln_trf_LD.	5.000	5.142	0.970	0.331	-5.079	15.079
	_CONS	-0.001	1.412	0.000	0.999	-2.768	2.765
D_dln_rexr	_ce1_L1.	-0.235	0.122	-1.920	0.055	-0.475	0.005
	_ce2_L1.	0.411	1.799	0.230	0.819	-3.116	3.937
	dln_trdcts_LD.	0.075	0.086	0.870	0.386	-0.094	0.243
	dln_fdi_LD.	0.740	1.232	0.600	0.548	-1.674	3.154
	infl_LD.	-0.004	0.002	-1.600	0.109	-0.008	0.001
	dln_trf_LD.	-0.005	0.057	-0.090	0.930	-0.117	0.107
	_CONS	-0.005	0.016	-0.330	0.738	-0.036	0.025
D_dln_trf	_ce1_L1.	-2.099	0.462	-4.550	0.000	-3.004	-1.194
	_ce2_L1.	0.533	6.794	0.080	0.938	-12.784	13.849
	dln_trdcts_LD.	1.014	0.325	3.120	0.002	0.377	1.650
	dln_fdi_LD.	-5.465	4.651	-1.180	0.240	-14.580	3.650
	infl_LD.	0.005	0.008	0.590	0.554	-0.011	0.021
	dln_rexr_LD.	-0.037	0.632	-0.060	0.953	-1.276	1.201
	_CONS	0.013	0.059	0.220	0.830	-0.103	0.129

Source: Author

correlation. The results presented in Table 6 indicates that the *p-value* to be 0.0451 which is less than 0.05 and so we accept the null hypothesis that there is no serial correlation of the residuals. This is inconsistent with [12] that found the *p-value* of 0.3107 which is greater than 0.05.

3.5.2 Heteroskedasticity

The study used the Breusch-Pagan, (1979) and Cook-Weisberg, (1983) test to test for heteroskedasticity. The null hypothesis is that there is no heteroskedasticity which means that the error variances are all equal. The results of the Breusch-Pagan, and Cook-Weisberg test presented in the Table 7 indicates that the *p-value* is 0.1642 which is more than 0.05 and so

we accept the null hypothesis that there is no heteroskedasticity. The *chi-square* value is small at 1.94, indicating that heteroskedasticity is probably not a problem (or at least that if it is a problem, it isn't a multiplicative function of the predicted values).

3.5.3 Variance Inflation Factors (VIF) tests

The Variance Inflation Factors (VIF) tests was used to calculate the centered or uncentered variance inflation factors (VIFs) for the independent variables specified in the linear regression model. The VIF results presented in Table 8 indicates that all the independent variables have a VIF under 10 that is 1.27, 1.25, 1.19 and 1.15 for transfer payments, real exchange rate, FDI, and inflation respectively

hence we conclude that there is no multicollinearity. This also coincided with the Belsley, Kuh, and Welsch's (1980) test aimed at evaluating collinearity in the linear regression in which we observed that the condition number to be 3.96 which is less than 15 hence we conclude that multicollinearity is not a concern for the regression.

3.5.4 Model specification error tests

A link test was conducted to check if there is any possible specification error in the model. The link test is a test that, conditional on the specification, test that the independent variables are specified incorrectly. The results indicate the *_hatsq* to be insignificant with a *P-Value* of 0.083 which is greater than 0.05 hence we conclude that both dependent and independent variables are specified correctly. This result also coincided with the [34] regression specification-error test (RESET) which tests for omitted variables which indicated the *P-Value* to be 0.3822 which is greater than 0.05, we accept the null hypothesis that there are no omitted values in the regression and hence there is no need to add more variables.

In a bid to establish the causality of each pair of the variables, granger causality Wald tests was conducted. In this test, for a given pair of variables, variable X is said to granger cause variable Y if the estimation for variable Y can be improved by the lags of variable X. The results indicates that in as much as FDI granger causes trade deficit in the short-run, trade deficit does not granger cause FDI at 5% significance levels with *p-values* of 0.040 and 0.398 respectively. This result coincides with [35] that established that established lack of mutual causality between FDI and trade deficit. Inflation does not granger cause trade deficit and the reciprocal causality does not exist either at 5% significance level with the respective *p-values* of 0.927 and 0.629. In the same way, real exchange rate does not granger cause trade deficit with no reverse causality with respective *p-values* of 0.344 and 0.631. Transfer payments also does not granger cause trade deficit with no mutual causality at 5% significance level with respective *p-values* of 0.980 and 0.188. FDI, inflation, real exchange

rate and transfer payments jointly does not jointly granger cause trade deficit at 5% significance level with a *p-value* of 0.394. These results are in coherence with [36] that also established that FDI granger causes inflation, but the results are inconsistent with the results of [37] who established that FDI granger causes real exchange rate. The results also indicate that in as much as FDI granger causes inflation, there is no reciprocal causality between FDI and inflation at 5% significance level with the respective *p-values* of 0.008 and 0.388. Real exchange rate does not granger cause FDI and there is no reciprocal causality either at 5% significance level with respective *p-values* of 0.315 and 0.051. Results further indicates that in as much as transfer payments granger causes FDI, the reverse causality does not exist at 5% significance level with the respective *p-values* of 0.015 and 0.541. All the variables trade deficit, inflation, real exchange rate and transfer payments jointly does not jointly granger causes FDI with a *p-value* of 0.719.

3.6 Causality Tests

The results further indicate that inflation granger causes transfer payments and that there is a reverse causality at 5% significance level with respective *p-values* 0.022 and 0.001 which coincides with our priori expectations. The results further indicate that real exchange rate does not granger cause inflation and there is no feedback causality either with respective *p-values* of 0.139 and 0.834. This is contrary to results by [38] who established that real exchange rate granger causes inflation without a reverse causality. The results also indicate that real exchange rate granger causes transfer payments and that there is a reverse causality with the respective *p-values* of 0.09 and 0.001. All the variables trade deficit, FDI, real exchange rate, and transfer payments jointly granger causes inflation with a *p-value* of 0.020. Additionally, all the variables trade deficit, FDI, inflation and transfer payments jointly granger causes real exchange rate at 5% significance level with a *p-value* of 0.000. Lastly, all the variables trade deficit, FDI, inflation, and real exchange rate jointly with a *p-value* of 0.001 granger causes transfer payments at 5% significance level.

Table 6. Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	Df	Prob > chi2
1	4.016	1	0.0451

H₀: no serial correlation

Source: Author

Table 7. Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

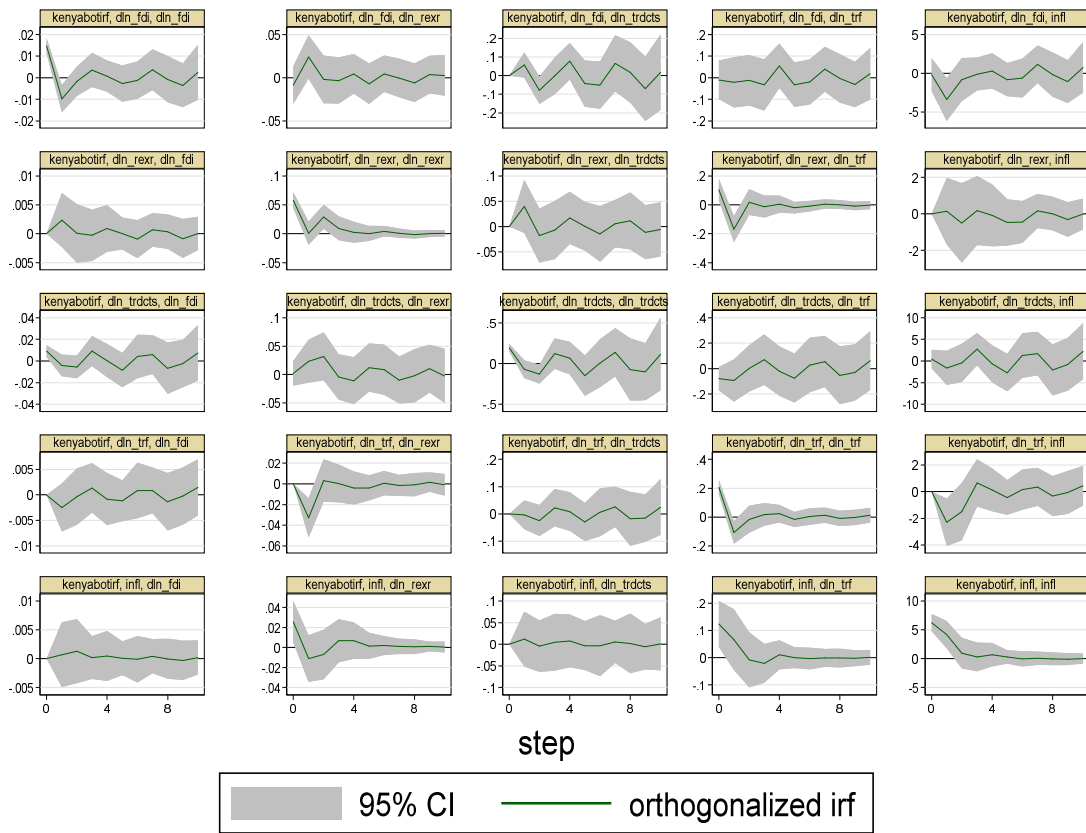
chi2(1)	=	1.94
Prob > chi2	=	0.1642
H_0 : Constant variance		

Source: Author

Table 8. Variance inflation factors results

Variable	VIF	1/VIF
dln_trf	1.27	0.787965
dln_rexr	1.25	0.797247
dln_fdi	1.19	0.836969
Infl	1.15	0.868501
Mean VIF	1.22	

Source: Author



Graphs by irfname, impulse variable, and response variable

Fig. 1. Impulse response functions

Source: Author

3.7 Impulse Response Functions

In order to establish how the shocks of the variables affects the other variables over time, impulse response function was conducted [21].

Fig. 1 indicates the impulse response graphs for the variables under study. The figure indicates through a ten-year period, an unanticipated change in real exchange rate and inflation may or may not lead to a change in trade deficit. The

unanticipated changes in FDI and transfer payments will only surely lead to change in trade deficit in the first year but from the second year, the changes in trade deficit may or may not take place. In as much as unanticipated change in real exchange rate may or may not affect FDI, FDI is affected by unexpected change in trade deficit and inflation but only for within the first two years but from the third year, the changes may or may not take place. An unanticipated change in transfer payments on the other hand will only surely lead to changes FDI in the fourth year but the rest if the periods, the expected changes in FDI may or may not take place. In as much as any unanticipated change in FDI, real exchange rate and trade deficit may or may not affect inflation., inflation is only surely affected by changes in transfer payments but from the second year, the changes may or may not take place. An unanticipated change in transfer payments will only surely lead to change in real exchange rate within the first two years but from the third year, the expected change may or may not happen. Contrarily, changes in real exchange rate may or may not be affected by any unanticipated change in FDI, trade deficit, and inflation throughout the ten-year period. Lastly, through the ten-year period, unanticipated change in trade deficit, inflation and FDI may or may not affect transfer payments but transfer payments is only surely affected by change in real exchange rate within the first two years but from the third year, the effects may or may not take place.

4. CONCLUSION AND POLICY IMPLICATIONS

This study concluded that in as much as only FDI granger causes trade deficit, in the short run FDI, inflation, real exchange rate and transfer payments all do not affect trade deficit in the short-run. Contrarily, in the long-run only inflation and transfer payments significantly affect trade deficit, but real exchange rate has insignificant effects on trade deficit. The study also found that trade deficit, inflation, real exchange rate and transfer payments do not cause FDI in the short-run and also have insignificant effects on FDI in the short-run. In the long-run, FDI is significantly affected by inflation and transfer payments but real exchange had insignificant effects on FDI in the long-run. The study also found that in as much as only FDI and transfer payments causes inflation in the short-run, only real exchange rate affects inflation in the short-run. Though only transfer payments causes real exchange rate in

the short-run, all the variables under study i.e trade deficit, FDI, inflation and transfer payments have insignificant effects on real exchange rate in the short-run. Only trade deficit does not cause transfer payments but FDI, inflation and real exchange rate all causes transfer payments in the short-run. Contrarily, only trade deficit have significant effects on transfer payments in the short-run as FDI, inflation and real exchange rate all have insignificant effects on transfer payments in the short-run.

The study therefore established that Kenya's persistent trade deficit can only be addressed in the long-run by increasing transfer payments as well as reducing inflation. However, addressing the trade deficit would come at a cost to the economy in the form of reduced foreign direct investments. In this regard, instead of focusing on addressing the trade deficit, it makes sense for Kenyan policy makers to take measures that would help increase FDI in the long-term which includes increasing inflation and reducing transfer payments. This study also revealed that any shocks need to be addressed within the shortest possible timeframe as the impulse response functions indicate the effects being adverse within the first few years as effects only begin to die out from the fourth year.

5. LIMITATIONS OF THE STUDY

This study was limited by the availability of Kenya's trade data, especially on exchange rate, which started from late 1980s and 1990s. This study used secondary data as opposed to primary data. The real exchange rate was calculated using the Consumer Price Index (CPI). The data was obtained from the World Banks data portal which is a credible source of data.

6. SUGGESTIONS FOR FURTHER RESEARCH

This study mainly focused on establishing the effects of foreign direct investment, transfer payments, inflation and real exchange rate on trade deficit, their causalities as well as the timeframe for the respective impulse responses. This study has revealed that the measures required for Kenya to address the persistent trade deficit would negatively impact on other key economic development indicators like foreign direct investments. In this regard, future study should assess how the economy's trade deficit, FDI and inflation affects the per capita income.

Additionally, this study was also limited to data availability and so future studies on trade deficit should use weighted real effective exchange rate that is based on Kenya's fundamental trade associates. Given the recent upsurge entry of individual foreigners into the country, future research on trade deficit should also focus on the effect of net foreign assets on trade deficit if reliable data can be found.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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