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MARGINAL PROPENSITY TO IMPORT AND TERMS OF TRADE: PANEL GRANGER CAUSALITY EVIDENCE FROM THE EAST AFRICAN COMMUNITY (EAC)

KRAŃCOWA SKŁONNOŚĆ DO IMPORTU I WARUNKI WYMIANY HANDLOWEJ: PANELOWE DOWODY PRZYCZYNOWOŚCI GRANGERA ZE WSPÓLNOTY WSCHODNIOAFRYKAŃSKIEJ (EAC)

Innocent Chile Nzeh[1](A,C,D) Uju Victoria Okoli[2](F), David Ogomegbunam Okolie[3](B), Jonathan Ibekwe Okolie[4](E)

[1]University of Agriculture and Environmental Sciences/ Uniwersytet Rolniczy i Nauk o Środowisku, Nigeria
[2]Nnamdi Azikiwe University/ Uniwersytet Nnamdi Azikiwe, Nigeria
[3]Renaissance University/ Uniwersystet Renaissance, Nigeria
[4]Enugu State University of Science and Technology/ Państwowy Uniwersytet Nauki i Technologii w Enugu, Nigeria

Authors' contribution
Wkład autorów:
A. Study design/planning zaplanowanie badań
B. Data collection/entry zebranie danych
C. Data analysis/statistics dane – analiza i statystyki
D. Data interpretation interpretacja danych
E. Preparation of manuscript przygotowanie artykułu
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Abstract

Subject and purpose of work: The nexus between the terms of trade and marginal propensity to import and the consequent policy options arising from it among economic blocs is an area that has not been given due attention in the literature. The focus of the current paper is to examine the link between the marginal propensity to import and the terms of trade in the East African Community (EAC).

Material and methods: The authors discuss and test a panel Granger causality model which is complemented with the test of impulse response function and variance decomposition using data from five EAC countries (Uganda, Tanzania, Rwanda, Kenya and Burundi).

Results: The long-run result of the study indicated that causality runs from all the variables to the terms of trade. In the short-run, results reveal that both the marginal propensity to import and the export of manufactures Granger-caused terms of trade without a feedback. The results of the impulse response function revealed that the terms of trade responded positively to shocks in the marginal propensity to import only in the first period, but afterwards the response turned negative in all the other periods. The terms of trade were equally found to respond positively to shocks in inflation rate in all the periods. The variance decomposition results indicated that apart from shocks to itself which was 100% in the first period, marginal propensity to import contributed about 0.0458% of shocks to the terms of trade, and this rose continuously in all the periods.

Conclusions: The analysis shows that both in the long-run and the short-run, marginal propensity to import determines the terms of trade among the EAC countries.

Keywords: propensity to import, terms of trade, exchange rate, panel Granger causality, economic bloc

Streszczenie

Przedmiot i cel pracy: Powiązanie między warunkami wymiany handlowej a krańcową skłonnością do importu i wynikające z tego opcje polityczne wśród bloków gospodarczych to obszar, któremu nie poświęcono należytej uwagi w literaturze. Celem niniejszego artykułu jest zbadanie związku między krańcową skłonnością do importu a warunkami wymiany handlowej we Wspólnocie Wschodnioafrykańskiej (EAC).

Materiały i metody: Autorzy omawiają i testują panelowy model przyczynowości Grangera uzupełniony testem funkcji odpowiedzi impulsowej i dekompozycji wariancji przy użyciu danych z pięciu krajów EAC (Uganda, Tanzania, Rwanda, Kenia i Burundi).

Address for correspondence/ Adres korespondencyjny: Innocent Chile Nzeh (nzechile@yahoo.com; ORCID 0000-0002-3131-9036); Department of Cooperative and Rural Development, University of Agriculture and Environmental Sciences, Umuagwo, Nigeria; Uju Victoria Okoli (uv.okoli@unizik.edu.ng; ORCID 0000-0003-0810-4018), Department of Economics, Nnamdi Azikiwe University, Nigeria; David Ogomegbunam Okolie (davidokolie799@gmail.com), Department of Accountancy, Renaissance University, Nigeria; Jonathan Ibekwe Okolie (jonalbval020@gmail.com; ORCID 0000-0001-7798-3090), Department of Business Administration, Enugu State University of Science and Technology, Nigeria.

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Wyniki: Długoterminowe wyniki badania wskazują, że przyczynowość biegnie od wszystkich zmiennych do warunków wymiany handlowej. W krótkim okresie wyniki pokazują, że zarówno krańcowa skłonność do importu, jak i eksport wyrobów przemysłowych wywołują warunki wymiany handlowej bez sprzężenia zwrotnego. Wyniki funkcji odpowiedzi na impuls ujawniły, że warunki wymiany handlowej zareagowały pozytywnie na wstrząsy krańcowej skłonności do importu tylko w pierwszym okresie, ale później reakcja stała się ujemna we wszystkich pozostałych okresach. We wszystkich okresach stwierdzono, że warunki wymiany handlowej reagowały pozytywnie na wstrząsy stopy inflacji. Wyniki dekompozycji wariancji wskazały, że oprócz wstrząsów do samego siebie, które wyniosły 100% w pierwszym okresie, krańcowa skłonność do importu przyczyniła się do około 0,0458% wstrząsów do warunków wymiany handlowej i rosła stale we wszystkich okresach.

Wnioski: Analiza pokazuje, że zarówno w długim, jak i krótkim okresie krańcowa skłonność do importu determinuje warunki wymiany handlowej między krajami EAC.

Słowa kluczowe: skłonność do importu, warunki wymiany handlowej, kurs walutowy, panelowa przyczynowość Grangera, blok gospodarczy

Introduction

The "terms of trade" means the rate at which a country's exports exchanges for its imports. This relationship between export and import is very sensitive for a country as it influences other macroeconomic variables. It is against this backdrop that several research efforts have been channeled towards investigating the impact of the terms of trade on the economy. Such studies have become necessary considering the fact that persistent recurrence in the terms of trade volatility is among the major sources of macroeconomic fluctuations (Andrews, Rees, 2009). Developing countries are more at risk with respect to the terms of trade fluctuations on grounds of the primary export commodities which they usually trade with developed countries. Theoretically, the adverse effect of deteriorating terms of trade on a country's trade balance, hence its real income, finds support in the Harberger-Laursen-Metzler hypothesis. Apart from the fact that developing countries specialize in the export of primary commodities, these countries are also known for massive consumption of imported commodities. If it is not in terms of large import of food items and other consumables to augment the shortfall in their local production, it could be in the form of the importation of intermediate products to serve their domestic industries. The penchant to import all manner of commodities from other countries is therefore among the factors driving the terms of trade in developing countries. As the income level rises in these countries, their marginal propensity to import is expected to increase. The term "Marginal Propensity to Import" is the change in import arising from one unit change in income. The Marginal Propensity to Import (MPI) is the increase/decrease in the amount of imports arising from each unit rise or fall in disposable income. Thus, as income rises/falls, there is the tendency to increase/decrease in imports. The link between the terms of trade to marginal propensity to import is that if the size of the slope of the marginal propensity to import is high, this could result in deteriorating terms of trade and thus depreciation of the domestic currency which is the bane of most developing countries. In another vein, a prolonged favorable terms of trade raises the income level of a country which could raise the propensity to import. Thus, causality could emanate from either the terms of trade or marginal propensity to import. Ideally, change in disposable income is used to measure income when calculating the marginal propensity to import, however, due to the difficulty in accessing data for disposable income across the countries and the fact that the this study adopts a macro approach, GDP is adopted to proxy income.

The quest to improve trade among countries is therefore part of the reason for the formation of economic blocs. As observed by Shinyekwa and Othieno (2013), there has been a sustained increase in regional trade agreements among countries in recent decades. This present paper focused on the economy of the East African Community (EAC) with the aim of investigating the link between the marginal propensity to consume and the terms of trade in this bloc. The EAC is a regional intergovernmental organization which came into force in 2000 and comprises Kenya, Tanzania, Uganda, Rwanda and Burundi. Among the objectives of EAC is to enlarge and deepen economic, socio-political and cultural integration so as to enhance the living standard of the people of the bloc. The EAC, with an estimated population of 300 million people and a combined gross domestic product (GDP) of USD 240 billion, is among the strongest economic blocs in Africa if to judge by the 2019 EAC statistics. However, at the world level, the economy of the EAC is still too small to influence either her export prices or the prices at which it imports. Therefore, it is pertinent to state that the terms of trade in the economic bloc are still largely determined exogenously. It is against this background that this study becomes paramount as the paper examines the link between the terms of trade and the EAC's marginal propensity to import.

The present study adds to the body of existing literature by focusing on the nexus between the terms of trade and the marginal propensity to import as against exiting literature that mainly focused on the link between economic growth and the terms of trade (Dabas, Delbianco, 2019; Jawaid, Waheed, Siddiqui, 2020; Blavasciunaite, Garsviene, Matuzeviciute, 2020). The paper argues that by focusing on the impact of the terms

of trade on GDP, past studies tended to assume the existence of a one-way causal link between trade and GDP. However, if one considers the impact of changes in income (GDP) on imports, causality may no longer only run from the terms of trade to GDP. The paper equally contends that instead of focusing on the nexus between the terms of trade and GDP, the effect of changes in the level of GDP on the terms of trade via changes in importation could make much sense for policy formulation. This is because policies such as exchange rate, inflation rate, and trade restrictions, among others, could influence the terms of trade effectively because of their direct effect on the marginal propensity to import. The specific objective of the present study is therefore, to investigate the direction of causality between the terms of trade and marginal propensity to import.

Stylized facts

In this subsection, the study provides trend analyses of some of the variables that are relevant to the study with a view to finding out their interlinkages. The trend in GDP for each of the countries sampled in the study as shown in Table 1 indicated that in all the sampled years, Kenya had the highest GDP in relation to other countries. Evidence showed that the GDP for the country improved from 2018 through 2020. Following Kenya in terms of GDP is Tanzania whose GDP experienced rapid growth from 2017 through 2020. However, the country with the least GDP within the sample period is Rwanda, whose GDP fluctuated between USD 9.4 billion and USD 9.5billion. The study also carried out a trend analysis of trade openness in the sampled countries with a view to finding out if the countries' GDP has a correlation with the size of their trade openness. Results in Table 2 revealed that Uganda, which occupied the third position with respect to GDP, had the highest degree of trade openness within the sample period. Equally, Tanzania, which had the second highest GDP within the sample period, had the second highest degree of trade openness within the period, which experienced a declining trend from 2017 through 2020. Paradoxically, Kenya which had the highest GDP among the EAC countries, up till 2014 occupied the fourth position in the degree of trade openness, after which it trended lower than other countries. However, our findings revealed that Rwanda, which had the smallest GDP among the EAC countries, up till 2014 had the least degree of trade openness, and from 2015 through 2020 it occupied the fourth position. These results imply that in these countries, the correlation between economic size and the degree of trade openness is country-specific.

Table 1. Trend of GDP in the Selected Countries in USD Billions

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Uganda	10.3	10.4	10.4	10.4	10.4	10.5	10.5	10.5	10.5	10.5	10.6
Tanzania	10.5	10.5	10.5	10.6	10.6	10.6	10.7	10.7	10.7	10.7	10.7
Burundi	9.7	9.8	9.8	9.8	9.8	9.9	9.9	9.9	10.0	10.0	10.0
Kenya	10.7	10.7	10.7	10.8	10.8	10.8	10.8	10.8	10.9	10.9	10.9
Rwanda	9.4	9.4	9.4	9.4	9.5	9.4	9.4	9.4	9.4	9.5	9.5

Note: the GDP is in log form
Source: Authors' compilation with data from the World Bank Databank's World Development Indicators.

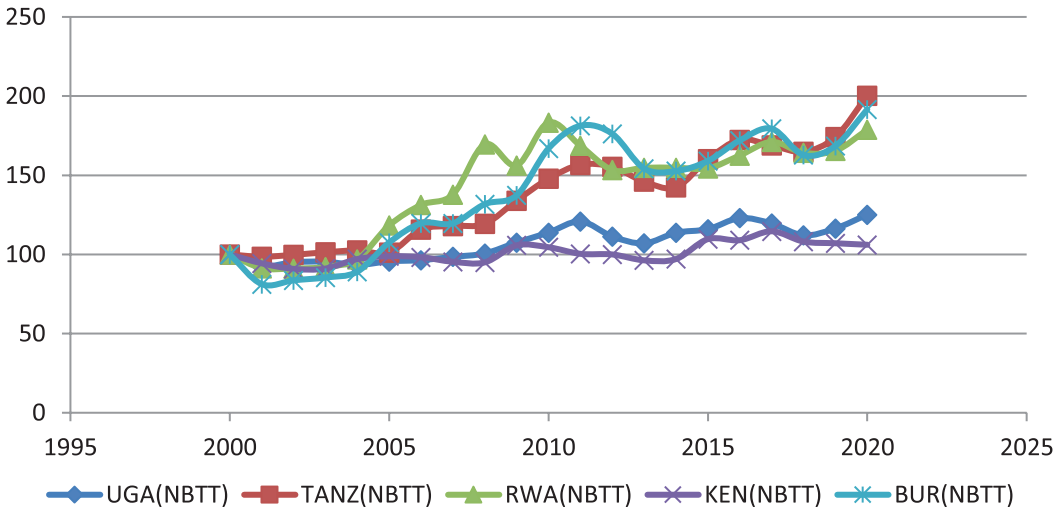
Table 2. Trend of Trade Openness in the Sampled Countries

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Uganda	2.63	2.58	2.46	2.48	2.72	2.65	2.90	2.63	2.57	2.58	2.67
Tanzania	1.86	1.87	1.87	1.87	1.87	1.86	1.86	1.85	1.85	1.85	1.84
Burundi	1.79	1.79	1.81	1.80	1.78	1.80	1.80	1.83	1.81	1.82	1.81
Kenya	0.42	0.45	0.44	0.42	0.43	0.40	0.35	0.37	0.36	0.34	0.31
Rwanda	0.31	0.34	0.37	0.39	0.41	0.45	0.46	0.52	0.52	0.57	0.55

Note: the trade openness is calculated as the ratio of the sum of export and import to GDP
Source: Authors' compilation with data from the World Bank Databank's World Development Indicators.

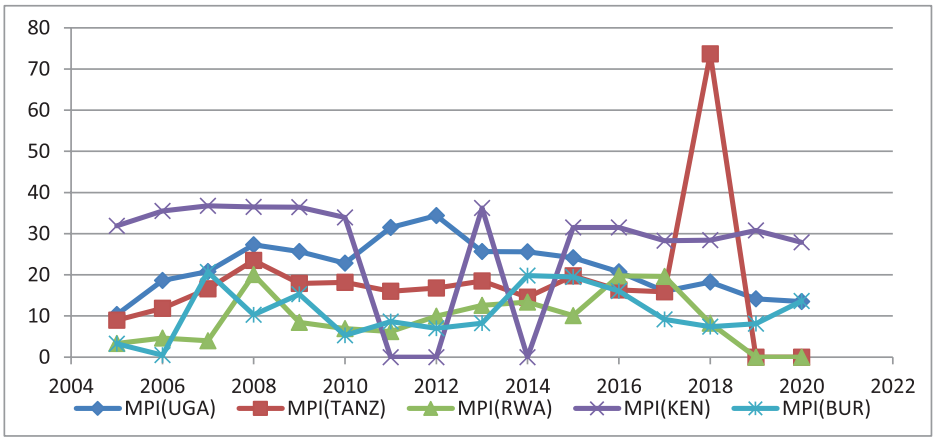
The study also did a trend analysis aimed at comparing trade openness to the terms of trade in the countries within the economic bloc. Generally, findings in Figure 1 showed that the trend in the terms of trade experienced fluctuations for all the countries within the sample period. However, from 2000 through 2011 there was a

consistent upward trend for all the countries and around 2017 the trend for all the countries rose to a peak. Our findings indicated that the trend in the terms of trade for Tanzania was highest among the countries up till 2005, however; from 2005 through 2010, the trend for Rwanda topped the others. From 2011 through 2014 Burundi had the highest terms of trade and from 2015 there was a convergence in the trend for Burundi, Tanzania and Rwanda. Comparing the trend in trade openness and the terms of trade across the countries, the study found that Uganda, which had the highest trade openness among the group, was among the countries with the lowest terms of trade within the study period. In another direction, it is found that Rwanda, which had the lowest trade openness, was among the countries with the highest terms of trade. Also, Tanzania, which was among the countries with rising trade openness, had the lowest terms of trade. The study therefor contends that the level of trade openness in these countries does not necessary correlate with the terms of trade.



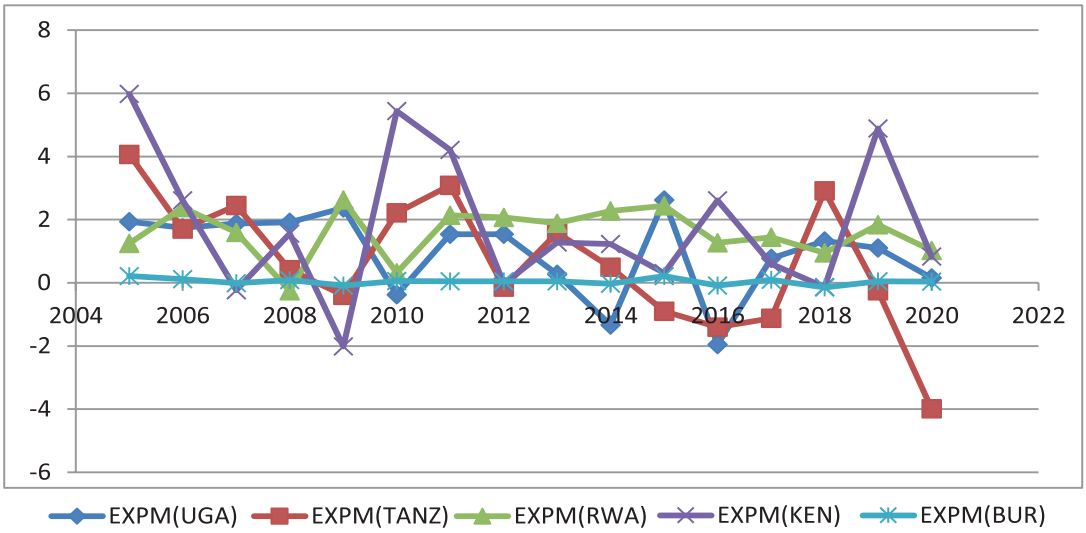
Note: NBTT = Net Barter Terms of Trade; UGA = Uganda; TANZ = Tanzania; RWA = Rwanda; KEN = Kenya; BUR = Burundi
Figure 1. Trend of The terms of Trade in the Selected Countries
Source: Authors' compilation with data from World Bank Databank's World Development Indicators.

In another direction, the trend analysis of the marginal propensity to import was conducted to examine if GDP size had any direct bearing on the countries' propensity to import. The findings shown in Figure 2 indicate that Kenya had the highest Marginal Propensity to Import up till 2010 when the trend experienced a sharp decline. However, in 2013 Kenya's trend was the highest of the five countries, and from 2015 through 2017, the country likewise occupied the top position. From 2005 to 2010,Uganda enjoyed the second-highest trend but from 2010 through to 2012; Uganda's trend was the highest of the five EAC member states. Tanzania occupied the highest position in 2018, after which its standing dropped sharply. The trend for Rwanda and Burundi was the lowest among the countries in the economic bloc. Using the trend for Kenya and Tanzania whose GDP was the highest within the sample period as cases in point, the study concludes that economic size has an implication for Marginal Propensity to Import in the economic bloc.



Note: MPI = Marginal Propensity to Import, UGA = Uganda, TANZ = Tanzania, RWA = Rwanda, KEN = Kenya, BUR = Burundi
Figure 2. Trend of Marginal Propensity to Import in the Countries
Source: Authors' compilation with data from World Bank Databank's World Development Indicators.

The last question for which the paper sought to provide an answer using trend analysis, is whether countries with the highest degree of openness also had the highest export of manufactures within the study period. Figure 3 assisted in providing answers to this question. Results of the trend analysis indicated that Kenya had the highest trend in the export of manufactures in 2006, 2010, 2011, and 2016, and from 2019 through 2020. The trend for Tanzania was highest in 2005, 2007 and 2018, while Rwanda had the highest trend in 2009 and from 2012 through 2015. The trend for Burundi was flat throughout all of the sample period. In a comparative sense, the study found that Uganda, which had the highest trade openness, was among the countries with the lowest export of manufactures. In another vein, our findings revealed that Rwanda, which was among the countries with the least trade openness, was among the countries with the highest export of manufactures. Consequently, the study contends that the degree of trade openness does not directly correlate with the export of manufactures in the sampled countries.



Note: EXPM = Export of Manufacture
Figure 3. Trend of Export of Manufactures
Source: Authors' compilation with data from World Development Indicators.

Literature review

The terms of trade and its role in the economy has found some empirical investigations both at the country-specific and cross-country level with diverse outcomes. In a country-specific study for Pakistan, Fatima (2010) found a negative impact of unfavorable terms of trade on the gross domestic product. In another study for Pakistan, Zakaria (2014) found that trade liberalization encourages export and import but it stimulates import more than it did for export. The study concluded that as trade liberalization stimulated more imports, this adversely affected trade balance. It can be contended that our study's findings are, by implication, supported by the findings of the study by Fatima (2010), i.e., trade balance is worsened by growing imports, therefore the growth in imports adversely affects a given country's economy. The outcome of these studies found further support in the finding by Jebran, Iqbal, Bhat and Ali (2018) that used the ARDL to show that the terms of trade had a significant and negative short-run and long-run impact on economic growth in China. However, in a cross-country study involving 94 developed and developing countries, Jawaid and Waheed (2011) revealed that the terms of trade exhibited a positive and significant effect on economic growth. For India, findings by Jawaid and Raza (2012) indicated that the terms of trade fluctuations impacted negatively and significantly on economic growth and this result finds support in the findings for Pakistan. As a departure from other studies that focused on the terms of trade and economic growth nexus, Umoru and Nwokoye (2014) investigated the impact of the terms of trade on the balance of payments position of Nigeria. The study revealed that the terms of trade had an adverse impact on the balance of payments. If this result is enhanced further, it is not different from other studies that found a negative link between the terms of trade and economic growth.

A cross-country study by Mputu (2016) that focused on sub-Saharan African countries revealed that the terms of trade had a positive link with GDP. For countries with different levels of development and openness, Dabas and Delbianco (2019) revealed that the terms of trade had an adverse effect on the economic growth of poor countries. Another cross-country study involving developing countries by Jawaid et al. (2020) indicated that while the terms of trade impacted positively on the economy of some countries, the impact was negative for

others. Blavasciunaite et al. (2020) found that deterioration in the terms of trade adversely affected economic growth of some countries in the European Union. In a study involving oil-producing African countries, Nzeh, Ogwuru, Okolie and Okolie (2022) revealed that although in the short-run, oil sector revenues did not have a significant impact on the marginal propensity to import, the impact was positive and significant in the long-run.

Methodology and models

The order of integration of the series is carried out in this study so as to avoid running a spurious regression, that is to say, a meaningless regression. To achieve this, this paper focused on four panel unit root tests, namely: Levin, Lin and Chu (LLC) test (Levin et al., 2002) which tests for common unit root. For individual unit root, the tests conducted are the augmented Dickey-Fuller test (ADF) (Dickey, Fuller, 1981), Im, Pesaran and Shin (IPS) test (Im et al., 2003*)* and Phillips-Perron (PP) test (Phillips, Perron, 1988). The study first performed the tests at level and then at first difference. Having ascertained the order of integration of the series, the paper examined the co-integration among the series. The Fisher panel co-integration was proposed by Maddala and Kim (1998) in order to test for co-integration by way of a combination of individual cross section with the aim of obtaining a test statistic for the overall panel. Under this test, both the trace test and the maximum eigenvalue test are provided. The trace test evaluates the null hypothesis that the co-integration rank equals *r* and this is tested against the alternative that the cointegration rank equals *k.* On the other hand, the maximum eigenvalue test relies on the null hypothesis that the co-integration rank equals *r* which is tested against the alternative hypothesis that the cointegration rank is *r+1*. This study therefore adopted the Fisher panel combined Johansen test which requires that all non-stationary series have to be in the same order of integration.

Having ascertained the cointegrating relationship among the variables, the study next investigated the causal link among them. Granger (1969) suggested that causality can be split into short-run and long-run causality. In the case of the series exhibiting no long-run relationship, Dorsman, Simpson and Westerman (2012) noted that causality should be investigated under the framework of the vector autoregressive (VAR) model, which should be specified in first difference. However, if the series are co-integrated (have a long-run relationship), the vector error correction model (VECM) is employed to examine the long-run causality, while the short-run causality should be investigated using a Wald test. Employing the panel VECM to investigate Granger causality entails the use of the Wald test to interpret the short-run causal effect, while the negative and statistically significant coefficient of the error correction term (*ECt-1*) indicates the long-run causal effects.

In order to deepen the analyses, the study investigated the impulse response and variance decomposition of the link between the terms of trade and the marginal propensity to import in the economic bloc. These tests are necessary, since the Granger causality test cannot reveal the nature of the relationship existing among the variables in terms of either a positive or negative relationship nor can it reveal the transmission mechanisms among the variables. The impulse response function shows the evolution of a variable over a period of time as a result of shock arising from another variable. On the other hand, the variance decomposition shows a portion of information coming from each variable and which explains the evolution of other variables.

Model specification

The functional form of the model is specified as follows:

$$NBTT_{it} = \delta_0 + \delta_1 MPI_{it} + \delta_3 EXCHR_{it} + \delta_4 XPMF_{it} + \delta_5 INFLR_{it} + \delta_6 TOPEN_{it} + \mu_{it} \quad (1)$$

where:

$NBTT$ = Net Barter Terms of Trade (a proxy for the terms of trade), MPI = Marginal Propensity to Import, $EXCHR$ = Exchange Rate, $EXPMF$ = Export of Manufacture, $INFLR$ = Inflation Rate, $TOPEN$ = Trade

Openness, μ= error term, δ_0 = intercept term, while the subscripts and represent the country and time. In order to examine the causal relationship among the variables, the study used the Vector Error Correction Model (VECM). The choice of the VECM was informed by the cointegration result which indicated that the series have a long-run relationship. If there is a long-run relationship among the series, the implication of the error correction is that the errors generated in each period is automatically corrected by the system in the subsequent period.

The specification of the panel VECM is as follows:

$$\begin{bmatrix} \Delta NBTT_{it} \\ \Delta MPI_{it} \\ \Delta EXCHR_{it} \\ \Delta EXPMF_{it} \\ \Delta INFLR_{it} \\ \Delta TOPEN_{it} \end{bmatrix} = \begin{bmatrix} d_1 \\ d_2 \\ d_3 \\ d_4 \\ d_5 \\ d_6 \end{bmatrix} + \begin{bmatrix} D_{1,1} & D_{1,2} & D_{1,3} & D_{1,4} & D_{1,5} & D_{1,6} \\ D_{2,1} & D_{2,2} & D_{2,3} & D_{2,4} & D_{2,5} & D_{2,6} \\ D_{3,1} & D_{3,2} & D_{3,3} & D_{3,4} & D_{3,5} & D_{3,6} \\ D_{4,1} & D_{4,2} & D_{4,3} & D_{4,4} & D_{4,5} & D_{4,6} \\ D_{5,1} & D_{5,2} & D_{5,3} & D_{5,4} & D_{5,5} & D_{5,6} \\ D_{6,1} & D_{6,2} & D_{6,3} & D_{6,4} & D_{6,5} & D_{6,6} \end{bmatrix} \begin{bmatrix} \Delta NBTT_{it-1} \\ \Delta MPI_{it-1} \\ \Delta EXCHR_{it-1} \\ \Delta EXPMF_{it-1} \\ \Delta INFLR_{it-1} \\ \Delta TOPEN_{it-1} \end{bmatrix} + \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \\ \eta_5 \\ \eta_6 \end{bmatrix} x\left(ECT_{it-1}\right) + \begin{bmatrix} \varepsilon_{1it} \\ \varepsilon_{2it} \\ \varepsilon_{3it} \\ \varepsilon_{4it} \\ \varepsilon_{5it} \\ \varepsilon_{6it} \end{bmatrix}. \quad (2)$$

where: Δ = first difference operator, ECT_{t-1}= lag one of the error correction term, $D_{ij}s$ = short-run coefficients and ε_{1t} through ε_{6t} are the error terms that are assumed not to be correlated with one another yet are assumed to be normally distributed with mean of zero.

Data and sources

Annual series were employed in the study covering the period from 1994–2020 and the choice of the sample period was influenced by data availability in the selected countries. The data sources and the measurement are shown in Table 3, below. However, it should be noted beforehand that in calculating the marginal propensity to consume, the GDP used is measured in constant 2015 USD dollars for all the countries. Also, in the calculation of trade openness, the export, import and GDP used are measured in constant 2015 USD for all the countries. The Net Barter Terms of Trade was used as a proxy for the terms of trade and has been variously used in the literature (Cashin, Pattillo, 2000; Mputu, 2016; Yousefvand, Najarzadeh, Heidari, Agheli, 2017).

Table 3. Data sources and measurement

Variable	Abbreviation	Measurement	Sources
Net Barter Terms of Trade	NBTT	Percentage ratio of the export unit value indexes to the import unit value indexes, measured relative to the base year 2000	WDI
Marginal Propensity to Import	MPI	where Δ denotes change	WDI
Exchange Rate	EXCHR	Official exchange rate in local currency unit (LCU) per United State Dollars	WDI
Export of Manufactures	EXPMF	Manufactures exports as a percentage of merchandise exports	WDI
Inflation Rate	INFLR	Annual percentage of GDP deflator	WDI
Trade Openness	TOPEN		WDI

Note: WDI = World Bank Databank's World Development Indicators
Source: Authors' compilation.

Results and comments

The descriptive statistics results in Table 4 indicated that the mean and the median of all the variables are relatively close, implying that the variables are symmetric. Export of Manufacture has the highest mean (14.15663) compared to other variables. However, Net Barter Terms of Trade has the least mean (2.079835). The relatively high mean value of the Marginal Propensity to Import is an indication of the high tendency of these countries to import products. Within the study period, the range of Marginal Propensity to Import was high, and that implies that the variable exhibited high volatility within the period. However, with low range, the Net Barter Terms of Trade exhibited low volatility.

Table 4. Descriptive statistic

	NBTT	MPI	EXCHR	EXPMF	INFR	TOPEN
Mean	2.07	5.56	2.78	14.15	9.39	1.44
Median	2.05	6.01	2.93	12.53	7.40	1.77
Maximum	2.30	16.01	3.57	73.65	85.35	4.96
Minimum	1.90	0.00	1.71	0.00	-5.23	0.00
Std. Dev.	0.09	3.09	0.52	11.84	11.09	1.09
Skewness	0.48	0.97	-0.68	1.16	3.98	0.55
Kurtosis	1.92	4.63	2.26	6.16	24.24	2.58
Jarque-Bera	11.66	36.13	13.49	86.16	2875.03	7.78
Probability	0.002	0.00	0.001	0.00	0.00	0.02
Sum	278.69	745.44	373.63	1896.98	1258.58	193.496
Sum Sq. Dev.	1.32	1270.82	36.94	18652.54	16372.93	160.722
Observations	134	134	134	134	134	134

Source: Authors' compilation.

Before the interpretation of the main results of the study, we carried out some preliminary examinations that are suitable for the proper use of the VAR model. The first of the preliminary investigations is the lag order selection. In a VAR framework, the selection of the number of lags to be included is paramount because a properly selected lag length ensures that the innovations follow a white noise process. As observed by Maddala and Kim (1998), the number of lags included play a sensitive role in the power properties of the unit roots tests. In empirical research, the Schwarz information criterion (SIC), the Akaike information criterion (AIC) and the Hannan-Quinn information criterion (HQ) are mainly the common information criteria used when selecting the lag length. The results in Table 5 indicated that while the SIC and the HQ favors Lag 1, the AIC favors Lag 2. In order to resolve the controversy, the study carried out a VAR Wald test lag exclusion so as to arrive at an optimal lag length. The VAR lag exclusion test is evaluated based on the statistical significance of the joint model variables. In Table 6, the findings show that under Lag 1 and at the 5% level of significance, the p-value of the joint model variables is statistically significant. Thus, the optimal lag length adopted in the study is Lag 1.

Table 5. VAR lag order selection criteria

Lag	Log L	LR	FPE	AIC	SIC	HQ
0	-2184.2	NA	6.98	46.60	46.76	46.66
1	-1676.1	940.4	3.04	36.55	37.69*	37.01*
2	-1633.9	72.82	2.68*	36.42*	38.53	37.27
3	-1605.1	45.91	3.20	36.57	39.66	37.82
4	-1566.0	57.47*	3.13	36.51	40.56	38.15
5	-1538.8	36.34	4.08	36.69	41.73	38.73
6	-1497.3	50.44	4.06	36.58	42.58	39.00
7	-1464.1	35.95	5.12	36.64	43.62	39.46
8	-1418.2	43.97	5.28	36.43	44.38	39.64

Source: Authors' compilation.

Table 6. VAR Lag exclusion Wald tests

	NBTT	MPI	EXCHR	EXPMF	INFR	TOPEN	Joint
Lag 1	144.5	9.49	163.9	19.27	4.95	167.67	528.1
	[0.00]	[0.14]	[0.00]	[0.00]	[0.54]	[0.00]	[0.00]
Lag 2	16.87	9.72	6.61	11.97	9.20	20.74	79.46
	[0.00]	[0.13)	[0.35]	[0.06]	[0.16]	[0.00]	[4.06]
Df	6	6	6	6	6	6	36

Source: Authors' compilation.

The second preliminary test we conducted is the VAR stability test which is vital in order to obtain valid results. The AutoRegressive (AR) root graph in Figure 4 shows the inverse roots of the characteristic polynomial. The condition for the existence of stability of the VAR is that, if the modulus of all roots is less than one and also lies inside the unit circle, the VAR is stable or stationary. It should be noted that the absence of stability in the VAR renders invalid some of the results, such as the standard errors of the impulse response. Since the result of the VAR stability test in Figure 4 has shown that the roots of the modulus are clustered inside the unit circle, we conclude that the AR process is stationary.

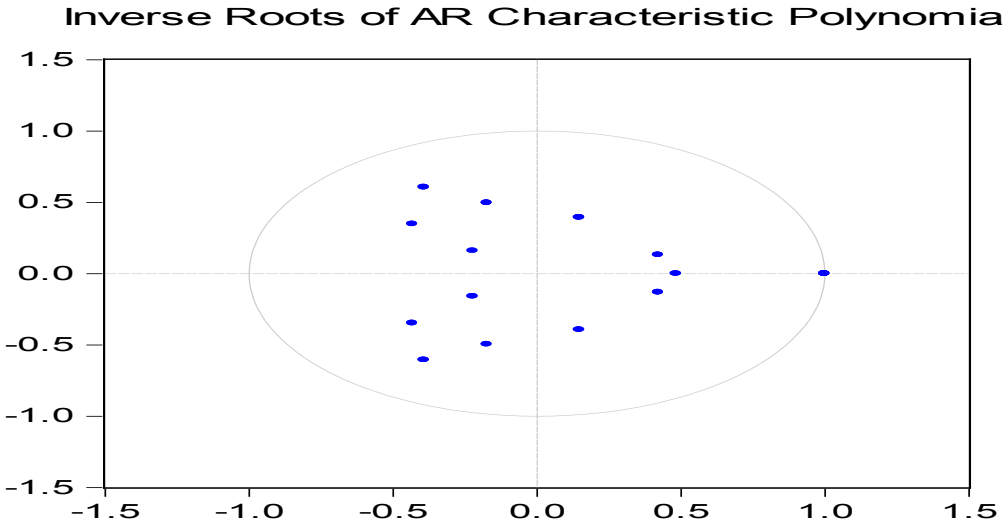


Figure 4. VAR Stability Test
Source: Authors' compilation.

Panel unit root results

As noted earlier, the test for unit root (stationary) was carried out using the panel unit root tests such as the IPS, ADF-Fisher, PP-Fisher and the LLC. The tests were evaluated at level and at first difference and at the 5% level of significance. In Table 7, the stationarity results indicated that the Marginal Propensity to Import (MPI), Export of Manufactures (EXPM) and Inflation Rate (INFR) are stationary (have no unit root) at level, other series are not stationary. However, in Table 8, the findings showed that all the series achieved stationarity after they were first differenced.

Table 7. Panel unit root results at level

	Common Unit Root	Individual Unit Root		
	LLC	IPS	ADF-Fisher	PP-Fisher
NBTT	-0.41(0.33)	-0.22(0.41)	17.8(0.05)	6.26(0.79)
MPI	-3.09(0.00)*	-4.55(0.00)*	40.0(0.00)*	82.6(0.00)*
EXCHR	0.77(0.78)	3.06(0.99)	1.68(0.99)	1.16(0.99)
EXPM	-1.93(0.02)*	-2.58(0.00)*	24.1(0.00)*	43.5(0.00)*
INFR	-5.83(0.00)*	-4.64(0.00)*	41.1(0.00)*	59.0(0.00)*
TOPEN	-0.40(0.34)	-0.30(0.37)	15.0(0.13)	-4.74 0.00)*

Source: Authors' compilation.

Table 8. Panel unit root at first difference

	Common Unit Root	Individual Unit Root		
	LLC	IPS	ADF-Fisher	PP-Fisher
ΔNBTT	-2.23(0.01)*	-4.99(0.00)*	44.6(0.00)*	76.0(0.00)*
ΔMPI	-6.39(0.00)*	-10.3(0.00)*	94.8(0.00)*	128.8(0.00)*
ΔEXCHR	-2.61(0.00)*	-4.30(0.00)*	36.9(0.00)*	54.1(0.00)*
ΔEXPM	-6.27(0.00)*	-8.04(0.00)*	72.8(0.00)*	136.4(0.00)*
ΔINFR	-7.17(0.00)*	-9.35(0.00)*	85.6(0.00)*	121.5(0.00)*
ΔTOPEN	-2.74(0.00)*	-4.97(0.00)*	43.9(0.00)*	38.5(0.00)*

Source: Authors' compilation.

Panel Co-integration results

Since the results of the unit root indicated that the series are integrated of the same order *I(1),* the study went ahead to conduct a co-integration test. The Johansen-Fisher panel co-integration test was used to test for the long-run relationship among the variables of the study. In Table 9, findings showed that both the Trace and the Maximum Eigenvalue tests indicated 4 co-integrating equations at the 5% level, respectively. In conclusion, the co-integration results revealed that the series have a long run relationship.

Table 9. Johansen Fisher Panel Cointegration Test

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	135.2	0.00	84.11	0.00
At most 1	65.11	0.00	48.34	0.00
At most 2	26.94	0.00	20.38	0.02
At most 3	12.80	0.23	10.27	0.41
At most 4	9.405	0.49	5.645	0.84
At most 5	20.81	0.02	20.81	0.02

Source: Authors' compilation.

Panel Granger causality results

Having ascertained that the series are co-integrated, the study estimated both the long-run and the short-run Granger causality using the VECM. The coefficient of the error correction term guided in the interpretation of the long-run causality and the condition is that the t-statistic of the coefficient of the error correction term has to be negative and statistically significant at a chosen level of significance. In Table 10, when the terms of trade is the dependent variable, the finding shows evidence of a long-run causality running from other variables to it. Thus, the study found that Marginal Propensity to Import, Exchange Rate, Export of Manufactures, Inflation Rate and Trade Openness jointly Granger-caused terms of trade in the long-run. When Marginal Propensity to Import is the dependent variable, the study observed a long-run causality running from other variables to the Marginal Propensity to Import, and when the Export of Manufactures is the dependent variable, a long-run causality running from other variables to Export of Manufactures was observed. However, with respect to the signs and significance of Exchange Rate, Inflation Rate and Trade Openness, the study did not observe long-run causality running from other variables to them.

Table 10. Results of long run panel Granger causality

Variables	$\Delta ECT_{t\text{-}1}$
$\Delta NBTT_{t-1}$	-0.003(0.00)*
ΔMPI_{t-1}	-0.001(0.00)*
$\Delta EXCHR_{t-1}$	0.005(0.02)
$\Delta EXPM_{-1}$	-0.007(0.00)*
$\Delta INFR_{t-1}$	0.007(0.00)
$\Delta TOPEN_{-1}$	-0.08(0.46)

*Note: * indicates the rejection of the null hypothesis of no long-run causality*
Source: Authors' compilation.

The results of short-run Granger causality test in Table 11 evaluated with the Wald test revealed that at the 5% level of significance, there was a uni-directional causality between the Net Barter Terms of Trade and Trade Openness. Thus, Net Barter Terms of Trade Granger-caused Trade Openness without a feedback. The Marginal Propensity to Import was found to Granger-cause terms of trade at the 5% level of significance without a feedback. By implication, as the Marginal Propensity to Import in the economic bloc rises, their terms of trade was influenced. The study equally noted the existence of a bi-directional causality between the Marginal Propensity to Import and Inflation Rate. As the Marginal Propensity to Import causes inflation, the reverse is also the case. Inflation Rate was also found to Granger-cause Exchange Rate and the Net Barter Terms of Trade without a feedback, while a one way causality running from Trade Openness to Inflation Rate was observed. Findings indicated that Exchange Rate Granger-caused Marginal Propensity to Import without a feedback. The study also observed a one way causality running from the Export of Manufactures to the Net Barter Terms of Trade, Marginal Propensity to Import and Trade Openness. If the Export of Manufactures varies, this pulls the terms of trade in the economic bloc as well as altering the Marginal Propensity to Import and influencing Trade Openness. The study contends that revenues generated from the Export of Manufactures in these countries contributed to the propensity to import.

Table 11. Results of short run panel Granger causality

Dependent Variable						
Indp. Variable	$\Delta NBTT_{t-1}$	ΔMPI_{t-1}	$\Delta EXCHR_{t-1}$	$\Delta EXPM_{-1}$	$\Delta INFR_{t-1}$	$\Delta TOPEN_{-1}$
$\Delta NBTT_{t-1}$	–	1.02(0.59)	1.88(0.38)	0.19(0.90)	2.71(0.25)	20.4(0.00)*
ΔMPI_{t-1}	6.1(0.04)*	–	1.13(0.56)	0.67(0.71)	4.64(0.09)**	4.41(0.11)
$\Delta EXCHR_{t-1}$	3.04(0.21)	7.08(0.02)*	–	0.08(0.95)	3.04(0.21)	3.41(0.18)
$\Delta EXPM_{-1}$	7.61(0.02)*	14.8(0.00)*	0.83(0.65)	–	0.13(0.93)	9.73(0.00)*
$\Delta INFR_{t-1}$	9.65(0.00)*	7.8(0.02)*	4.92(0.08)**	0.49(0.77)	–	0.19(0.90)
$\Delta TOPEN_{-1}$	3.16(0.20)	0.20(0.9)	0.41(0.81)	0.37(0.83)	8.96(0.01)*	–

Source: Authors' compilation.

The impulse response results in appendixes A and B revealed that the terms of trade responded positively to shocks in the Marginal Propensity to Import in the first period, but afterwards the response turned negative in all the other periods. This result is a confirmation of the Granger causality result, but the impulse response result revealed the actual link between Marginal Propensity to Import and the terms of trade. The results showed that after the first period, the more the countries in the bloc import, the more the terms of trade deteriorate. Theoretically, it is expected that, the terms of trade tend to decline the more a country engages in importation, especially if it is a country exports are predominated by primary products that have many substitutes. The terms of trade are found to respond positively to shocks in the inflation rate in all the periods. What this implies is that inflation rate pulls the terms of trade up. Our contention with regard to this result is that rising inflation reduces the ability of consumers in these countries to import foreign commodities and this tends to improve the terms of trade in this economic bloc. However, we are equally of the opinion that unregulated rise in inflationary trend could worsen the terms of trade through its transmission to production costs. The study found the terms of trade to respond positively to shocks in exchange rate only in the first period; however, subsequently the response became negative in all the other periods. The negative response of the terms of trade to shocks in Exchange Rate implies that as Exchange Rate appreciates, imports are encouraged, thus resulting in the deterioration of the terms of trade. Theoretically this result is plausible, as domestic currency appreciation reduces the import prices of foreign commodities. The findings also revealed that, except in Period Two, the terms of trade responded positively to shocks in the Export of Manufactures. This result follows the a priori expectation that the more a country exports, its terms of trade tend to improve. In another vein, the terms of trade responded negatively to Trade Openness in all the periods, except in periods One and Two. Since the countries comprising the bloc are mainly primary commodity producers, opening up their trade could lead to adverse terms of trade. In support of this finding, evidence revealed that export of manufactures responded negatively to shocks in Trade Openness in all periods but the first.

The variance decomposition results in appendix C indicated that apart from shocks to itself, 100% of which were in the first period, Marginal Propensity to Import contributed about 20% of the shocks to the terms of trade in the third period, and this rose continuously in all the periods. The Inflation Rate was also found to contribute to about 8.3% of the shocks in the terms of trade in the second period, and was persistently high in all the periods. In another vein, the second period result revealed that about 15.7% the shocks in the terms of trade was contributed by the Exchange Rate and that in all the other periods the impact of the shock was sustainably high. However, the Export of Manufactures contributed to shocks in the terms of trade by about 17.7% in the second period, after which it experienced fluctuations. The impact of the shock rose consistently from Period Six through to the final period. Trade Openness was found to contribute to about 8.9% of the shocks to the terms of trade and rose steadily through to the last period.

Conclusions

Developing countries' propensity to import all manner of products and the consequences of such with regard to deficit terms of trade and domestic currency depreciation is a major issue confronting policy makers in these countries. The formation of economic blocs is therefore among the strategies used to address this issue among member countries forming the bloc. This paper sets out to investigate the link between the Marginal Propensity to Import and the terms of trade in the East African Community with a view to providing policy direction to the economic bloc. Findings in the long-run indicated that causality runs from all the variables to the terms of trade. The short-run causality tests indicated that marginal propensity to import Granger-caused terms of trade without a feedback and the result of the impulse response function indicated that the terms of trade responded negatively to shocks in the Marginal Propensity to Import in the economic bloc. This result equally finds further support from the result of the variance decomposition. Our findings also revealed that Export of Manufactures Granger-caused terms of trade and the result of the impulse response showed that Export of Manufactures exerted a positive impact on the terms of trade. However, the terms of trade were found to respond negatively to shocks in Trade Openness. The implications of the results so far are that as income rises in the economic bloc, the propensity to import increases, which in turn transmits negatively to the terms of trade. Secondly, Trade Openness in the economic bloc did not improve the terms of trade; instead it worsened it unless the countries exported manufactured products. Thirdly, over-valuation of the domestic currency transmits to the terms of trade through the import price effect. Consequently, the study contend that apart from the high import propensity, the adverse impact of trade openness on the terms of trade in the economic bloc could be due to the heavy reliance of the countries on the export of unprocessed commodities that have high import demand elasticity and which is a typical feature of the countries sampled in the study. This study is therefore of the view that the countries in this bloc should curtail their propensity to import even in the face of rising income. If anything, the income should be channeled into improving the manufacturing sector to enhance the export of manufactures. The study is equally of the view that trade openness policies should be adopted with caution and that import-substitution policies should be given a priority, while moderating the exchange rate of the domestic currency.

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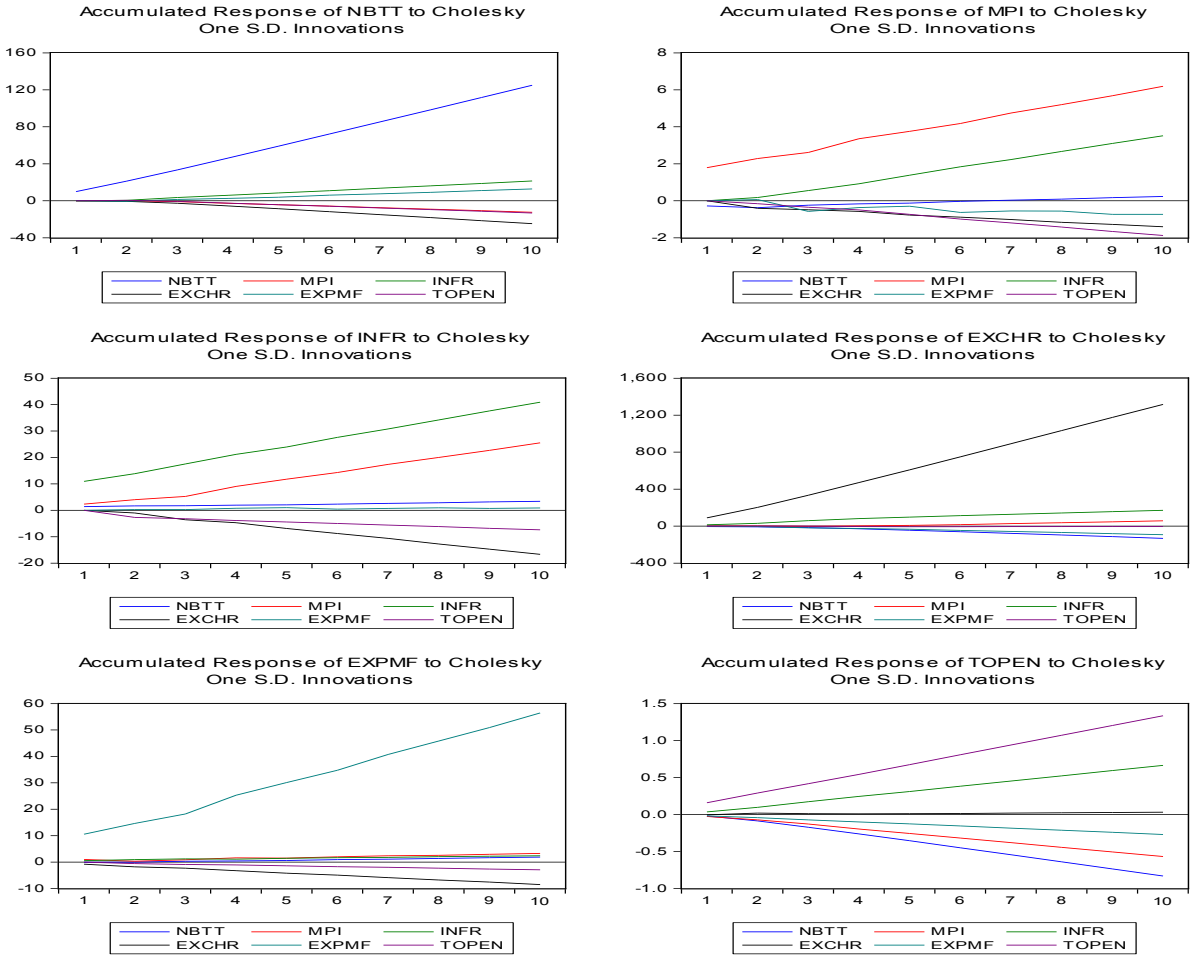
Appendix A

Panel Impulse Response Results



Appendix B

Tabular Results of Panel Impulse Response

Accumulated Response of NBTT

Period	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	9.95	0.00	0.00	0.00	0.00	0.00
2	21.29	-0.03	0.43	-0.60	-0.63	0.45
3	33.46	-0.93	3.48	-2.66	1.44	-0.63
4	46.15	-2.71	6.00	-5.53	2.51	-2.57
5	59.12	-4.34	8.43	-8.62	3.89	-4.26
6	72.16	-5.74	10.94	-11.73	6.04	-5.95
7	85.29	-7.44	13.53	-14.97	7.60	-7.74
8	98.48	-9.09	16.17	-18.19	9.15	-9.55
9	111.6	-10.71	18.77	-21.47	11.07	-11.35
10	124.8	-12.43	21.42	-24.76	12.78	-13.17

Accumulated Response of MPI

Period	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	-0.28	1.78	0.00	0.00	0.00	0.00
2	-0.37	2.28	0.17	-0.40	0.06	-0.16
3	-0.24	2.61	0.55	-0.48	-0.57	-0.34
4	-0.16	3.35	0.92	-0.57	-0.36	-0.49
5	-0.13	3.75	1.38	-0.77	-0.29	-0.73
6	-0.03	4.18	1.84	-0.88	-0.63	-0.98
7	0.03	4.74	2.23	-1.01	-0.55	-1.19
8	0.09	5.19	2.66	-1.16	-0.55	-1.42
9	0.16	5.67	3.10	-1.27	-0.73	-1.65
10	0.23	6.19	3.51	-1.40	-0.73	-1.87

Accumulated Response of INFR

Period	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	1.38	2.31	10.95	0.00	0.00	0.00
2	1.67	4.00	13.85	-1.01	0.25	-2.72
3	1.74	5.27	17.55	-3.61	0.27	-3.19
4	1.96	9.02	21.16	-4.70	0.75	-3.86
5	2.04	11.81	23.95	-6.90	1.004	-4.41
6	2.34	14.28	27.59	-8.77	0.41	-4.98
7	2.62	17.36	30.81	-10.64	0.73	-5.59
8	2.84	19.98	34.17	-12.76	0.96	-6.17
9	3.15	22.68	37.61	-14.69	0.69	-6.82
10	3.42	25.51	40.92	-16.69	0.91	-7.41

Accumulated Response of EXCHR

Period	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	-4.60	2.76	15.27	89.10	0.00	0.00
2	-7.15	1.077	30.67	203.5	-5.29	1.036
3	-15.57	-1.00	59.75	334.5	-18.44	-0.13
4	-28.34	3.42	80.88	471.0	-24.71	-4.39
5	-44.19	7.85	98.25	608.5	-33.61	-5.85
6	-60.74	16.64	114.31	750.0	-46.33	-6.10
7	-78.24	27.16	128.20	891.5	-56.64	-5.38
8	-95.99	36.64	142.69	1033.1	-68.69	-4.51
9	-113.7	47.09	156.75	1175.3	-81.49	-3.65
10	-131.6	57.62	170.54	1317.2	-92.89	-2.56

Accumulated Response of EXPMF

Period	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	-0.06	0.97	0.51	-0.82	10.52	0.00
2	-0.03	0.33	0.91	-1.78	14.62	-0.58
3	0.30	0.88	1.18	-2.32	18.19	-0.92
4	0.41	1.58	1.10	-3.26	25.28	-1.07
5	0.62	1.48	1.45	-4.20	30.09	-1.41
6	0.93	1.97	1.66	-4.92	34.78	-1.75
7	1.12	2.39	1.75	-5.87	40.75	-2.00
8	1.36	2.54	2.03	-6.76	45.81	-2.33
9	1.63	2.94	2.22	-7.58	50.91	-2.64
10	1.85	3.28	2.38	-8.50	56.45	-2.93

Accumulated Response of TOPEN

Period	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	-0.01	-0.02	0.03	-0.00	-0.01	0.15
2	-0.08	-0.07	0.09	0.02	-0.04	0.29
3	-0.17	-0.12	0.17	0.01	-0.07	0.41
4	-0.26	-0.19	0.24	0.00	-0.10	0.54
5	-0.35	-0.25	0.31	0.01	-0.12	0.67
6	-0.44	-0.31	0.38	0.01	-0.15	0.80
7	-0.54	-0.38	0.45	0.01	-0.18	0.93
8	-0.64	-0.44	0.52	0.02	-0.21	1.07
9	-0.73	-0.50	0.59	0.02	-0.24	1.20
10	-0.83	-0.56	0.66	0.03	-0.26	1.33

Appendix C

Panel Variance Decomposition Results

Variance Decomposition of NBTT

Period	S.E.	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	9.95	100.0	0.00	0.00	0.00	0.00	0.00
2	15.12	99.4	0.00	0.08	0.15	0.17	0.08
3	19.91	94.7	0.20	2.38	1.16	1.19	0.34
4	24.09	92.4	0.68	2.72	2.21	1.01	0.88
5	27.7	91.3	0.86	2.81	2.90	1.00	1.04
6	31.09	90.4	0.88	2.89	3.31	1.28	1.12
7	34.13	89.8	0.98	2.98	3.65	1.27	1.20
8	36.94	89.4	1.04	3.05	3.88	1.26	1.27
9	39.57	89.1	1.07	3.09	4.06	1.33	1.31
10	42.03	88.8	1.120	3.14	4.21	1.34	1.35

Variance Decomposition of MPI

Period	S.E.	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	1.80	2.43	97.56	0.00	0.00	0.00	0.00
2	1.93	2.36	91.61	0.84	4.38	0.11	0.68
3	2.11	2.41	79.41	3.83	3.83	9.13	1.37
4	2.28	2.15	78.32	5.90	3.42	8.60	1.56
5	2.38	2.00	74.61	9.13	3.84	7.96	2.42
6	2.50	1.96	70.50	11.60	3.68	8.98	3.26
7	2.61	1.87	69.56	12.92	3.62	8.36	3.63
8	2.70	1.80	67.89	14.68	3.69	7.83	4.09
9	2.79	1.75	66.28	16.12	3.61	7.69	4.52
10	2.88	1.70	65.46	17.16	3.60	7.22	4.83

Variance Decomposition of INFR:

Period	S.E.	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	11.27	1.51	4.20	94.28	0.00	0.00	0.00
2	12.12	1.36	5.58	87.2	0.70	0.04	5.03
3	13.01	1.18	5.79	83.88	4.58	0.03	4.50
4	14.08	1.03	12.05	78.16	4.52	0.15	4.07
5	14.80	0.94	14.4	74.31	6.29	0.16	3.82
6	15.58	0.88	15.5	72.54	7.12	0.29	3.58
7	16.33	0.83	17.73	69.91	7.79	0.30	3.40
8	17.02	0.78	18.6	68.2	8.72	0.29	3.24
9	17.69	0.75	19.61	66.93	9.25	0.29	3.14
10	18.34	0.72	20.62	65.5	9.80	0.29	3.02

Variance Decomposition of EXCHR

Period	S.E.	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	90.5	0.25	0.09	2.84	96.80	0.00	0.00
2	146.8	0.12	0.04	2.17	97.50	0.12	0.004
3	199.5	0.24	0.03	3.30	95.89	0.50	0.006
4	243.1	0.44	0.05	2.98	96.07	0.40	0.034
5	280.5	0.65	0.06	2.62	96.22	0.40	0.02
6	315.4	0.79	0.13	2.33	96.23	0.48	0.022
7	346.7	0.90	0.20	2.09	96.28	0.48	0.019
8	375.5	0.99	0.23	1.93	96.29	0.51	0.01
9	402.5	1.06	0.27	1.80	96.29	0.55	0.01
10	427.7	1.11	0.30	1.70	96.30	0.561	0.01

Variance Decomposition of EXPMF

Period	S.E.	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	10.61	0.00	0.85	0.23	0.60	98.30	0.00
2	11.46	0.003	1.04	0.32	1.22	97.14	0.25
3	12.0	0.08	1.15	0.34	1.30	96.79	0.31
4	14.02	0.06	1.098	0.25	1.41	96.91	0.24
5	14.86	0.07	0.98	0.28	1.65	96.72	0.26
6	15.61	0.11	0.99	0.27	1.71	96.61	0.29
7	16.75	0.10	0.92	0.24	1.81	96.63	0.27
8	17.53	0.11	0.84	0.24	1.91	96.54	0.28
9	18.29	0.13	0.82	0.23	1.96	96.54	0.29
10	19.14	0.13	0.78	0.22	2.018	96.54	0.28

Variance Decomposition of TOPEN

Period	S.E.	NBTT	MPI	INFR	EXCHR	EXPMF	TOPEN
1	0.16	1.36	2.69	4.66	0.08	1.29	89.90
2	0.238	8.66	4.75	8.97	1.14	1.61	74.85
3	0.30	13.43	6.67	11.92	0.81	2.02	65.119
4	0.35	16.26	8.36	12.8	0.59	2.12	59.76
5	0.39	18.13	8.90	12.7	0.46	2.04	57.70
6	0.44	19.3	9.16	12.9	0.38	2.04	56.06
7	0.48	20.2	9.41	13.1	0.33	2.13	54.76
8	0.51	20.90	9.61	13.1	0.29	2.14	53.85
9	0.55	21.42	9.74	13.2	0.26	2.14	53.16
10	0.58	21.8	9.84	13.2	0.24	2.17	52.61