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ASYMMETRIC REAL EXCHANGE RATE AND INFLATION CAUSALITY BASED ON TODA-YAMAMOTO DYNAMIC GRANGER CAUSALITY TEST

This study re-investigates the causal relationship between real exchange rate and inflation using asymmetric causality based on Toda-Yamamoto (1995) augmented Granger causality test. The study is conducted on Malaysia, Nigeria, the Philippines and South Africa. We simulate the critical values used in this study based on leverage bootstrapping and asymmetric causality test. The results are compared between the Granger asymptotic chi-square distribution and the leverage bootstrapped distribution with asymmetric test. Conflicting findings are obtained which prove the existence of size distortion and nuisance parameter estimates when the former method is applied. The Toda-Yamamoto results with asymmetric causality test reveal that policy intervention on positive cumulative inflation shocks can stabilize real exchange rate in Malaysia, the Philippines (including negative cumulative inflation shocks) and South Africa but not vice versa. The results also show the existence of one way causation from positive cumulative shocks in real exchange rate to inflation in Nigeria. The policy implication of this finding is that a strong price stabilization policy during positive cumulative price shocks can stabilize real exchange rate fluctuations in all the countries under study except Nigeria.

Keywords: *asymmetric causality; leverage bootstrap; Toda-Yamamoto causality; real exchange rate; inflation; structural break.*
JEL classification: C100; E310; F310.

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АСИМЕТРИЧНИЙ ПРИЧИННО-НАСЛІДКОВИЙ ЗВ'ЯЗОК МІЖ РЕАЛЬНИМ ВАЛЮТНИМ КУРСОМ ТА ІНФЛЯЦІЄЮ: ЗА ДАНИМИ ТЕСТУ ТОДА-ЯМАМОТО НА ДИНАМІЧНУ ПРИЧИННІСТЬ ЗА ГРЕНДЖЕРОМ

У статті досліджено причинно-наслідкові взаємовідносини між реальним обмінним курсом та інфляцією, використовуючи тест Гренджера на причинніть у версії Тода-Ямамото (за асиметричної причинності). Дослідження проведено за даними Малайзії, Нігерії, Філіппін та Південно-Африканської Республіки (ПАР). Змодельовано критичні значення змінних на основі бутстрепу та тесту на асиметричну причинність. Проведено порівняння результатів при асимптотичному розподілі та при бутстреп-розподілі впливовості. Суперечливі результати порівняння свідчать про викривленість деяких величин та технічні перешкоди при застосування першого методу. Результати тесту за Тода-Ямамото вказують на те, що політика державного втручання за позитивних кумулятивних інфляційних шоків може стабілізувати реальний обмінний курс в Малайзії, Філіппінах (включаючи також негативні кумулятивні інфляційні шоки) та в ПАР, однак у зворотньому напрямку даний зв'язок не працює. Результати також демонструють наявність однобічної причинності від позитивних кумулятивних шоків в обмінному курсі до інфляції у випадку Нігерії. Також вказано, що стабілізаційна політика сильних цін в періоди позитивних кумулятивних цінових шоків може стабілізувати реальний обмінний курс в усіх досліджених країнах, крім Нігерії.

Ключові слова: *асиметрична причинність; бутстреп фактора впливовості; причинність за Тода-Ямамото; реальний обмінний курс; інфляція; структурні розриви.*
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АСИММЕТРИЧНАЯ ПРИЧИННО-СЛЕДСТВЕННАЯ СВЯЗЬ МЕЖДУ РЕАЛЬНЫМ ВАЛЮТНЫМ КУРСОМ И ИНФЛЯЦИЕЙ: ПО ДАННЫМ ТЕСТА ТОДА-ЯМАМОТО НА ДИНАМИЧЕСКУЮ ПРИЧИННОСТЬ ПО ГРЕНДЖЕРУ

В статье исследованы причинно-следственные взаимоотношения между реальным обменным курсом и инфляцией с использованием теста Гренджера на причинность в версии Тода-Ямамото (при асимметричной причинности). Исследование проведено по данным Малайзии, Нигерии, Филиппин и Южно-Африканской Республики (ЮАР). Смоделированы критические значения переменных на основе бутстрепа и теста на асимметрическую причинность. Проведено сравнение результатов при асимптотическом распределении и при бутстреп-распределении влиятельности. Противоречивые результаты сравнения свидетельствуют о наличии искажений в величинах и помехах при применении первого метода. Результаты теста по Тода-Ямамото указывают на то, что политика государственного вмешательства при позитивных кумулятивных инфляционных шоках может стабилизировать реальный обменный курс в Малайзии, Филиппинах (включая также негативные кумулятивных инфляционные шоки) и в ЮАР, однако наоборот эта связь не работает. Результаты также демонстрируют существование односторонней причинности от позитивных кумулятивных шоков в обменном курсе к инфляции в случае Нигерии. Также указано, что стабилизационная политика сильных цен в периоды позитивных кумулятивных ценовых шоков может стабилизировать реальный обменный курс во всех исследованных странах, кроме Нигерии.

Ключевые слова: *асимметрическая причинность; бутстреп фактора влиятельности; причинность по Тода-Ямамото; реальный обменный курс; инфляция; структурные разрывы.*

Introduction. For many decades, the nature of causality between real exchange rate and inflation has been the subject of concern in international macroeconomics. Previous findings reveal conflicting results which suffer from methodological problems and hamper appropriate policy formulation (Toda and Yamamoto, 1995). The previous findings were confronted with invalid inference mechanisms due to the application of Granger non-causality test on integrated and non-integrated variables. Moreover, traditional Granger non-causality test was developed on asymptotic distribution theory which leads to a spurious conclusion when variables are integrated (Granger and Newbold, 1974). Additionally, the null hypothesis at level estimation suffers from non-standard asymptotic distribution, whereas the integrated Granger causality suffers from independence of nuisance parameter estimates (Sims, Stock and Watson, 1990; Toda and Philips, 1993). The Wald and likelihood ratio test statistics for Granger test are associated with rank deficiency which leads to size distortion under null hypothesis (Toda and Philips, 1993). These inherent shortcomings lead to nuisance parameter estimates (Guru Gharana, 2012). Furthermore, previous test for causality hardly distinguish between the effect of positive and negative shocks which are expected to provide different causal relationships based on the principle of asymmetric information (Hatemi-J, 2012).

Causal relationship between real exchange rate and inflation is further investigated using Toda-Yamamoto causality and modified leverage bootstrap distribution as well as asymmetric causality test in order to provide wider comparison and draw sound inferences. Unlike the traditional technique which leads to size distortion under small sample size like in (Sims et al. 1990), these methods (modified leverage bootstrapping and asymmetric causality) work better under small sample size, violation of the normality assumption and in the presence of autoregressive conditional heteroscedasticity (ARCH) effect and finally, the later distinguishes causality during the periods of positive and negative shocks (Hatemi-J and Irandoust, 2006; Hatemi-J, 2012). Moreover, most previous studies test the stationarity of the variables using the traditional Augmented Dickey-Fuller (ADF) proposed by (Dickey and Fuller, 1979). This is found deficient and leads to bias and less power to reject the null hypothesis especially if structural breaks exist (Perron, 1989; Zivot and Andrews, 1992). As an alternative, this study employs J. Lee and M.C. Strazicich (2003) minimum lagrange multiplier (LM) with two structural breaks to test the integration properties for determining the maximum order of integration of series. The test is breakpoint nuisance invariant under both null and alternative hypothesis suffering neither size, nor location distortion. This makes the test free from spurious rejection and unaffected by size and incorrect estimation irrespective of whether structural break exists or not (Lee and Strazicich, 2013). Moreover, to the best of our knowledge, the combination of these approaches – asymmetric causality test, leverage bootstrapping and Toda-Yamamoto dynamic causality – have not been widely used in the context of causation between inflation and real exchange rates especially in emerging and developing economies.

The rest of the paper is presented under 5 headings. Section 2 reviews previous literature on the causal relationship between exchange rate and inflation. Section 3 presents the theoretical framework. Section 4 describes the data. Section 5 deals with methodology and empirical result and Section 6 concludes the paper and offers policy implications.

Literature review. The empirical findings on the causal relationship between exchange rate and inflation have been conflicting and inconsistent results in literature. Some studies reveal a bidirectional causality between exchange rate and inflation. These include the studies of (Arabi, 2012; Arize and Malindretes, 1997; Madesha, Chidoko and Zivanomoyo, 2013). Despite the fact that the nature of causal relationship between exchange rate and inflation has not been consistent in the literature yet, K.A.M. Arabi (2012) and W. Madesha et al., (2013) found a simultaneous long-run feedback possibility between exchange rate fluctuations and its determinants such as inflation. In other words, inflation and exchange rate Granger cause each other. Nonetheless, the presence of ARCH effect renders Granger non-causality test to be inefficient (Hacker and Hatemi-J, 2006). A.C. Arize and J. Malindretes (1997) study exchange rate volatility as a factor that causes variability in inflation in 41 countries. The result indicates the existence of bidirectional linkage between exchange rate variability and inflation under flexible exchange rate regime.

However, N.A. Achsani et al. (2010); B. Imimola and A. Enoma (2011) and D.G. Omotor (2008), found a unidirectional causality running from exchange rate to inflation. N.A. Achsani et al. (2010) examine the relationship between inflation and exchange rates in Asean+3, the EU and the North America. They discover one-way causality in Asia with strong correlation between inflation and exchange rate in most of Asian countries except Malaysia. They further find that the sensitivity of inflation to fluctuations exchange rate to be higher in Asia than the EU and North America. Similarly, B. Imimola and A. Enoma (2011) and D.G. Omotor (2008) study the impact of exchange rate depreciation on inflation in Nigeria. Their findings indicate that exchange rate depreciation, money supply and output largely influence inflation.

Conversely, some other studies show no causality between inflation and exchange rate (Cairns, Ho and McCaulay, 2007; Chen and Wu 2001; Emmanuel, 2013; Kamas, 1995; Nnamdi and Ifionu, 2013; Parvar, Mohammed and Hassan, 2011). However, causality in these studies is conducted on Johansen Jesulius co-integration, vector error correction, ordinary least squares (OLS) regressions and VAR models without lag augmentation, the results might suffer from invalid inferences as highlighted by H.Y. Toda and T. Yamamoto (1995). This leads to non-standard asymptotic distribution, nuisance parameter estimates and rank deficiency which cause size distortion under null hypothesis (Guru Gharana, 2012; Toda and Philips, 1993).

Theoretical framework. In this paper, the theoretical framework underpinning the study is the monetary theory of exchange rate determination divided into flexible-price version suggested by J. Frankel (1979) and M. Mussa (1976) and sticky-price model developed by R. Dornbusch (1976). The theory of exchange rate started with the "inflation theory of exchange rate" without which exchange rate disequilibrium cannot be determined (Cassel, 1918). It is denoted as partial equilibrium theory because of its inability to explain the phenomenon of money market and balances of foreign payment in the determination of exchange rate (Kanamori and Zhao, 2006). The monetary approach to exchange rate determination explains the significance of money and other variables (assets) in defining the factors responsible for determining exchange rate under flexible regime and balance of payment under pegged regime (Frankel, 1976 in Frenkel and Johnson, 2013). On causal relationship between exchange rate and inflation some scholars recognized that exchange rate and inflation are simultaneously determined, however G. Cassel (1921) as emphasized by N.R. Whitney (1922) and J. Frankel (1979) argue that causation flows from price (inflation) to exchange rate, whereas P. Einzig (1935) claims that inflation is caused by exchange rate.

Data. This study employs annual data spanning from 1980 to 2012. The data was collected on real effective exchange rate, inflation, interest rate and money supply from the World Development Indicators (WDI) and Financial Statistics of International Monetary Fund (IMF) for Malaysia, Nigeria, the Philippines and South Africa. The main concern of this study is to determine the direction of causality among inflation and exchange rate. That is, the extent to which one variable scientifically influence changes in another variable by observing the connection of previous values of a particular variable on another variable. The other variables apart from exchange rate and inflation are regarded as controlled variables in the model. These variables are employed to take care of omitted variables bias in test for Granger non-causality (Granger, 1980).

Methodology. We apply asymmetric causality and leverage bootstrap distribution developed by (Hatemi-J, 2012; Hacker and Hatemi-J, 2006) respectively on H.Y. Toda and T. Yamamoto (1995) causality approach. The stationarity properties of the variables were investigated using J. Lee and M.C. Strazicich (2003) to account for structural breaks. The paper also aims at improving the soundness of the inferences to be drawn by solving the highlighted problems associated with C.W.J. Granger (1969) causality approach.

1. LS unit root test with two structural breaks. The unit root properties is not the major concern in this methodology due to applicability of the approach irrespective of whether series are stationary at level I(0), integrated of the same order I(1), arbitrarily integrated or co-integrated of arbitrary order (Hacker and Hatemi-J, 2006; Lee, Lin and Wu, 2002). However, this paper adopts the robust J. Lee and M.C. Strazicich (2003) minimum LM test with two structural breaks to test the integration properties for determining the maximum order of series integration. The test solves the problem of weak assumption of absence of break in the null hypothesis associated with endogenous break determined test. The test is break point nuisance invariant under both null and alternative hypothesis, unaffected by neither size, nor location distortion.

2. Toda-Yamamoto dynamic Granger causality. In an attempt to test the causal relationship between real exchange rate and inflation while controlling for interest rate and money supply, the study uses H.Y. Toda and T. Yamamoto (1995) modified Wald test statistics based on augmented Vector Autoregressive VAR(p+dmax) framework. Following H.Y. Toda and T. Yamamoto (1995); J. Shan and F. Sun (1998) and H.O. Zapata and A.N. Rambaldi (1997) methodology, the following VAR system is estimated:

$$\begin{bmatrix} RER_t \\ INF_t \\ INT_t \\ MSS_t \end{bmatrix} = \begin{bmatrix} a_0^{RER} \\ a_0^{INF} \\ a_0^{INT} \\ a_0^{MSS} \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix} \begin{bmatrix} RER_{t-1} \\ INF_{t-1} \\ INT_{t-1} \\ MSS_{t-1} \end{bmatrix} + \\ + \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix} \begin{bmatrix} RER_{t-2} \\ INF_{t-2} \\ INT_{t-2} \\ MSS_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_{RER_t} \\ \varepsilon_{INF_t} \\ \varepsilon_{INT\,t} \\ \varepsilon_{MSS_t} \end{bmatrix}. \quad (1)$$

where EXC denotes exchange rate; INF represents domestic inflation rate; INT denotes interest rate; MSS represents money supply. To test the null hypothesis of whether inflation rate causes real exchange rate, the following restriction is specified H_0: $a_{12} = 0$, where a_{12} is the coefficient of the restricted lag value of inflation rate variable in the model. Similarly, the second hypothesis that exchange rate does not cause inflation rate is tested by imposing the following restrictions: H_0: $a_{11} = 0$, where a_{11} is the coefficient of the lag value of the exchange rate. The significance of the MWALD statistics on lagged values of explanatory variables in the two hypotheses respectively indicate the rejection of the null hypothesis of no Granger causality from inflation rate to exchange rate and vice versa. The appropriate lag length of the VAR model is chosen through testing the significance of lags in (1) for $p > k$ condition (Toda and Yamamoto, 1995) and minimizing the A. Hatemi-J (2003) information criterion described below.

$$HJC = \ln(|\cap_z|) + zxv^2 + \left(\frac{\ln N + 2\ln(\ln N)}{2N}\right) \quad z = 0,\ldots,p, \tag{2}$$

where HJC denotes Hatemi-J information criterion; ln represents natural logarithm; $|\cap_z|$ indicates the lag order z determinant of the estimated white noise variance-covariance matrix in the VAR framework; v and N denote the number of variables and observations used in the VAR model respectively. Furthermore, (2) has been tested to work better especially for integrated variables (Hatemi-J, 2003). Nevertheless, the presence of ARCH effect and non-normality of residuals cause the usual asymptotic distribution theory to work less efficiently (Hatemi-J and Irandoust, 2006; Hatemi-J, 2012). Therefore, we employ more reliable asymmetric causality test and leverage bootstrap distribution theory especially in this type of finite sample study to avoid spurious deductions and size distortion.

2.1.Asymmetric causality test. We performed the asymmetric causality following A. Hatemi-J (2012). The above process is replicated assuming both positive and negative specifications. The following VAR(p) order is applied as shown in (3) and (4) for positive and negative specifications respectively:

$$y_t^+ = \varphi + B_1 y_{t-1}^+ + \ldots + B_p y_{t-p}^+ + e_t^+; \tag{3}$$

$$y_t^- = \varphi + B_1 y_{t-1}^- + \ldots + B_p y_{t-p}^- + e_t^-, \tag{4}$$

where y^+ and y^- represent the vector of positive and negative variables in (3) and (4) respectively. φ is the vector of constant parameters. B is the vector of parameters to be estimated and ε^+ and ε^- denote the vectors of both positive and negative error components for the cumulative sum of positive and negative shocks respectively in the integrated variables analysis and positive and negative changes for the stationary variables. The information criteria in (2) is also adjusted to include the squares of the number of variables N^2 in the VAR model (Hatemi-J, 2012). The remaining process is as presented in the following section taking into account the asymmetric condition of positive and negative shocks in the model.

3. Leverage bootstrapping. In the present study, the critical values are generated based on the underlying empirical data through bootstrap simulation. The iteration is conducted 10,000 times and MWALD t-statistics are estimated after every iteration to determine the upper quantile of the bootstrapped distribution of the MWALD t-statistics in order to generate 1%, 5% and 10% bootstrapped critical values. Finally, the raw data rather than the bootstrapped one is utilized to calculate the MWALD statistics. The hypothesis of non-Granger causality is rejected if the MWALD statistics calculated using the original data is greater than the bootstrapped critical values.

4. Empirical results. The integration properties of series is tested using LS test (Lee and Strazicich, 2003) in order to define the maximum integration order of the variables. The result of the estimate is available on request to preserve space. The significance of the test is to know the highest order of integration of the variables. The test rejects the null hypothesis that series are I(2) at all levels of significance. Therefore, the maximum order of integration of all the variables for all countries is found to be I(1) order. This signifies that the lag augmentation in estimating Toda-Yamamoto (1995) vector autoregressive model for each country is determined as one.

We test for the existence of ARCH effect and normality of residuals in the VAR model to see if the Granger causality based on asymptotic distribution theory is appropriate, especially for this dataset. The results are presented in Table 1. The null hypothesis of normality of residuals in the VAR model is rejected for all the countries under study. Moreover, the null hypothesis of non-existence of multivariate ARCH effect is also rejected for Nigeria and the Philippines whereas, the hypothesis cannot be rejected for Malaysia and South Africa. However, the failure to fulfill the normality assumption and the existence of ARCH effect at least for Nigeria and Philippines render the usual asymptotic distribution theory to be less appropriate (Hatemi-J and Irandoust, 2006). This justifies employing more reliable leverage bootstrap distribution theory and asymmetric causality test which perform better in the presence of non-normality and ARCH effect as well as distinguishes between causality in good and bad times.

Table 1. **Test for ARCH effect and normality in the VAR model,** *authors' computation*

Country	ARCH effect	Normality
Malaysia	0.1891	0.0059***
Nigeria	0.0289**	0.0079***
Philippines	0.0517**	0.0223**
South Africa	0.1058	0.0000***

*** and ** represent rejection of the null hypothesis at 1% and 5% significant level respectively.

Table 2 presents the estimated results of Granger non-causality, critical values of the modified WALD test statistics for leverage bootstrap and asymmetric causality based on the underlying empirical data distribution employed in this study. The result of non-Granger causality in column two of Table 2 indicates the rejection of the null hypothesis of non-Granger causality running from inflation to exchange rate in all the countries with only one feedback causation for Nigeria. However, non-Granger causality was developed based on asymptotic distribution theory which is seen to cause a spurious conclusion. The null hypothesis at level estimation suffers from non-standard asymptotic distribution, whereas, the integrated Granger causality suffers the independence of nuisance parameter estimates (Sims et al., 1990; Toda and Philips, 1993).

However, the result of the modified WALD test shows different findings as compared to Granger non-causality except for the Philippines and South Africa where the direction of causality remains the same. Considering H.Y. Toda and T. Yamamoto (1995) MWALD leverage bootstrapped result without asymmetric effect, the results establish a unidirectional causality running from inflation to real exchange rate in the Philippines and South Africa without feedback from real exchange rate and neither causation in Malaysia and Nigeria. Nonetheless, A. Hatemi-J (2012) argues that response to positive and negative asymmetric shocks may lead to varying causal relationship which has been neglected in the previous literature. The asymmetric causality test indicates the rejection of null hypothesis of non-Granger causality running from inflation to real exchange rate for Malaysia, the Philippines and South Africa in the presence of positive cumulative inflation shocks. The result further shows a similar direction of causality in negative cumulative inflation shocks for the Philippines.

Whereas the causality flow from real exchange rate to inflation in Nigeria for positive cumulative shocks in real exchange rate without feedback causality from inflation.

Table 2. **The result of Granger, Toda-Yamamoto, Asymmetric causality and Bootstrap simulation,** *authors' computations using RATS and GAUSS versions 8 and 11 respectively*

			Leverage bootstrap		
The null hypothesis	**Non-Granger causality**	**MWALD test statistics**	**1% CV**	**5% CV**	**10% CV**
		Malaysia			
$INF \neq> RER$	12.727(0.000)	0.254	8.108	4.360	2.962
$INF^+ \neq> RER^+$		6.249**	8.621	4.479	3.072
$INF^- \neq> RER^-$		0.030	8.713	4.371	2.909
$RER \neq> INF$	0.696(0.404)	0.006	8.430	4.507	3.000
$RER^+ \neq> INF^+$		0.047	8.833	4.314	3.034
$RER^- \neq> INF^-$		0.535	7.614	4.154	2.970
		Nigeria			
$INF \neq> RER$	4.251(0.039)	1.310	8.537	4.604	3.180
$INF^+ \neq> RER^+$		0.271	8.827	4.434	3.036
$INF^- \neq> RER^-$		0.393	8.041	4.360	2.980
$RER \neq> INF$	4.149(0.042)	0.459	8.925	4.581	3.135
$RER^+ \neq> INF^+$		7.150**	8.910	4.753	3.188
$RER^- \neq> INF^-$		0.087	8.389	4.403	2.942
		Philippines			
$INF \neq> RER$	5.043(0.025)	4.214*	7.863	4.313	3.017
$INF^+ \neq> RER^+$		9.232***	7.403	4.359	2.953
$INF^- \neq> RER^-$		16.135***	9.104	4.479	3.049
$RER \neq> INF$	0.316(0.574)	0.821	7.883	4.393	2.971
$RER^+ \neq> INF^+$		0.977	8.449	4.440	3.109
$RER^- \neq> INF^-$		0.078	10.992	4.569	2.946
		South Africa			
$INF \neq> RER$	5.525(0.019)	19.600**	36.157	19.457	13.778
$INF^+ \neq> RER^+$		5.972**	8.630	4.615	3.115
$INF^- \neq> RER^-$		5.698	21.004	12.273	9.034
$RER \neq> INF$	1.164(0.281)	4.196	32.301	17.951	12.862
$RER^+ \neq> INF^+$		0.359	8.261	4.577	3.086
$RER^- \neq> INF^-$		1.279	22.568	12.729	9.217

***, ** and * represent the rejection of null hypothesis at 1%, 5% and 10% significance levels respectively, with reference to bootstrap simulated critical values. The symbol $\neq>$ represents Granger non-causality. The estimated order of VAR($p+d_{max}$) model is determined to be 2 for all countries. This is made up of the VAR order p and a constant one lag augmentation, because the maximum order of integration does not exceed one for all series. The figures enclose in parenthesis under column two represent the p values of Granger non-causality.

The findings portray the advantage of employing asymmetric causality test which differentiates the existence of causality during good and bad times. Except for Nigeria, the findings indicate that decrease in inflation causes real exchange rate appreciation. Philippines' data further shows that a decrease in real exchange rate is caused by the increase of inflationary pressure. This finding is in line with G. Cassel

(1921) hypothesis who argues that causality runs from inflation to real exchange rate. The result reveals that during good period, policy intervention on inflation can stabilize the Malaysian, Philippine and South African real exchange rates without feedback effect. However, based on Nigerian data, it is the increase in exchange rate that causes inflation in the economy. The result for Nigeria is supporting (Einzig, 1935) proposition that exchange rate causes inflation. Therefore, any policy intervention formulated on exchange rate can stabilize the rate of inflation especially during the real exchange rate appreciation.

Conclusions and policy implication. The empirical finding based on the simulated critical values indicates the ability of inflation rate in positive cumulative shocks to Granger cause real exchange rates in Malaysia, the Philippines (including negative cumulative shocks) and South Africa without being influenced by the later. The result also shows the existence of one-way causation from positive cumulative shocks in real exchange rate to inflation in Nigeria. The contradictory findings obtained from the estimates presented in Table 2 proved the existence of size distortion and nuisance parameter estimates when the asymptotic Granger method is applied. This is usually the case when ARCH effect exists; integrated series are used in investigation, and normality assumption of the empirical data is disregarded.

The recommendation of this study is that monetary authorities of Malaysia and South Africa should stabilized positive real exchange rate fluctuations by reducing positive shocks in the rate of consumer prices in their economies. Moreover, the authorities can manipulate real exchange rate in the Philippines irrespective of positive and negative cumulative inflation shocks (good or bad times). This means that monitoring inflation rate in these countries can regulate the level of instability in real exchange rates, whereas, the other instrument (real exchange rate) can only be manipulated in Nigeria to avoid deflationary spirals in the economy. This implies that it is only in Nigeria that monitoring real exchange rates in good time can stabilize inflationary pressure for the sample period. However, such a conclusion does not hold for Malaysia, the Philippines and South Africa at least for the period under study.

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