The Effects of Chinese Interest Rates and Inflation: A Decomposition of The Fisher Effect

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Abstract

China's economic growth as well as global influence has been escalating in the last decades. The purpose of this investigation is to determine the impact of Chinese interest rates and inflation on other economies. The study uses data from 1982 to 2013 and applies the Toda and Yamamoto approach to Granger causality. Using data for nineteen countries, the results show that China has significant influence on interest rates and inflation dynamics of Costa Rica, Kenya and Nigeria. The study further shows that Japan and South Africa induce China's interest rates as well as inflation. It is projected that as China's economy continues to grow, her influence in global financial matters and other economies will also intensify.

JEL Classification: E43, E31

Keywords: nominal interest rates, real interest rates, inflation, economic growth

Introduction

Today as the world is progressing in terms of economic growth, the possibility of other economies having substantial effect globally is inevitable. If a country is transforming into an economic powerhouse it is likely to affect other countries in various ways such as inflation spillovers, interest rates spillovers or market-return spillovers. The US has been associated with spillovers for a considerable length of time due to her influential economic standpoint. The world witnessed how influential the US is in the stability of financial and economic systems during the global financial crisis of 2008. Even though numerous attempts have been structured to alleviate the severity of such problems in the future, the problem is what about the influence of fast growing economies such as China, India, and Brazil? How will these economies affect the stability of the world economy if they experienced a breakdown? This study focuses on the Chinese economy and attempts to determine if China has any significant bearing on other economies' inflation and interest rates.

The reasons for focusing on China are numerous. Firstly, China is the second largest economy in the world and is projected to surpass US output in forthcoming years. For this reason, it is important to recognise the effects of China on other economies. China is growing rapidly and even when other countries are experiencing a decline in economic growth during economic downturns, China tends to experienced slow economic growth as opposed to a decline. It is conceivable that China might surpass the US in output sooner than the projections. If a country is growing rapidly like China, its standpoint in global economic matters becomes more significant. Numerous countries tend to depend on major economies and this fuel the possibility of spillovers or contagion. China is therefore the right choice in this case. Additionally, China is one of the largest exporters in the world. Other nations' dependency on her exports is crucial to her economic growth. Spillovers are likely to surface when countries are major trading partners especially inflation (see Bosupeng, 2015). During international trade, exchange rates are also impinged upon. Previous studies demonstrated that exchange rate stability leads to less volatility in inflation dynamics.

The existing literature has examined US spillovers multiple times however the influence of China has not been studied in depth. China has rather been associated with high carbon dioxide emissions and high energy consumption. These factors are important of course, however the literature has side-lined the possible effects of Chinese interest rates and inflation on other economies. This paper contributes to the literature by determining how China affects other country's macroeconomic variables by applying the Toda and Yamamoto (1995) approach to Granger causality. This study is structured as follows. Next is the literature review section which will provide a detailed analysis of the existing literature. This will be followed by the methodology and empirical results. Lastly, a discussion of the results and conclusion will follow. In summary, the results of this study show that China has significant influence on other countries' inflation and nominal interest rates.

Literature Review

Nominal interest rates, real interest rates and inflation are brought together by the Fisher effect. The Fisher effect posits that nominal interest rates move together with inflation in the long run. For these reasons, one cannot side-line the Fisher effect when examining the relationships between interest rates and inflation. The literature has been extensive in providing evidence of how interest rates behave in diverse economies. Tsong and Lee (2013) examined the behaviour of interest rates in six OECD countries (Australia, Belgium, Canada, Sweden, UK, and US) using quantile cointegration methodology. The study concluded that the Fisher effect holds in a quantile sense in the six OECD economies studied over the period 1957 to 2012. Pelaez (1995) aimed to test for the long run equilibrium relationships between interest rates and inflation using cointegration methods developed by Granger (1981); Granger and Weiss (1983) and Engle and Granger (1987). The study used data for the 3-month Treasury bill over the period 1959 to 1993 and validated the Fisher effect over the material period. Previous studies tend to support the long run comovement between nominal interest rates and inflation as opposed to the short run because in the short term, these variables are highly unstable.

Olekalns (1996) examined the Fisher effect in Australia over the period 1964 to 1993 and found that the Fisher effect holds after the deregulation of the financial system. This is plausible when interest rates are fixed. This study is similar to Hawtrey (1997). The author tested the Fisher parity in Australia using short and long term interest rates data. The study further applied the Johansen methodology to validate long term series affiliations. The investigation revealed that the Fisher effect fails prior to the financial deregulation of the 1980's however there is evidence following the deregulation that the relationship is restored. Central banks and other regulatory bodies tend to fix interest rates during periods of financial regulation. Consequently, this will invalidate the Fisher effect because interest rates are not left to market dynamics. It is possible that financial regulation may affect the Fisher effect adversely.

The relationship between nominal interest rates and inflation was further considered by Lanne (2001) using data for the US over the period 1953 to 1990. The study supported the Fisher effect in the interest rate targeting period of 1953 to 1979 of the Federal Reserve but not in the period 1979 to 1990. In addition to the extant literature, Jareno and Tolentino (2013) found a positive relationship between variations in the current expected inflation rate and nominal interest rates in Europe. Incekara et al. (2012) substantiated the literature by using seasonal data from 1989 to 2011 to test for the Fisher effect using the Johansen cointegration technique and Vector Autoregression methods (VAR). The study concluded that nominal interest rates and inflation moved together in the long run. Hasan (1999) found out that interest rates failed to project inflation series in Pakistan over the period 1957 to 1991.This literature review section has validated long run relationships between nominal interest rates and inflation. Drawing from the literature review, the relationship between interest rates and inflation is bound to be affected by factors such as financial regulation as well as inflation and interest rate targeting.

Theoretical Standpoint

Section (2) above has demonstrated that interest rates and inflation move together in the long run. The Fisher effect has been verified in multiple economies (Lanne, 2001; Tsong and Lee, 2013 and Hawtrey, 1997). This paper intends to determine if Chinese interest rates and inflation have any significant bearing on other countries' interest rates and inflation dynamics. The theoretical standpoint this paper takes is that nominal interest rates and inflation trend together in the long run. Therefore if China has an impact on any economy's inflation it will surface in the long run as opposed to the short run. This paper deviates from previous studies because it does not attempt to test the Fisher effect. Rather this paper attempts to decompose the Fisher effect into its components. Whether the Fisher effect holds or not in the countries examined in this paper, is not a concern. The most important aim is to determine how each component of the Fisher effect in multiple nations (i.e. inflation, real interest rates and nominal interest rates) behaves in relation to China's series.

Data and Methodology

The data used covers the period 1982 to 2013 and was sourced from the World Bank (http://data.worldbank.org/about). The figures were not converted to natural logarithms. The reason is we already have negative values of inflation in some countries over the period 1982 to 2013. By converting them to natural logarithms, the data becomes statistically insignificant for empirical analysis. Comparatively, real interest rates and inflation correspond with those of the International Monetary Fund (IMF). Following the World Bank, real interest rates were measured as a percentage of the country's annual lending rate adjusted for inflation as measured by the GDP deflator. Furthermore, inflation was measured by the annual growth rate of the GDP implicit deflator. Following the World Bank definition, GDP implicit deflator was defined as the ratio of GDP in current local currency to GDP at local constant currency. Before proceeding with the analysis, the data has to be examined for stationarity. Bolivia registered extremely high averages of nominal interest rates and inflation over the material period. The Augmented Dickey Fuller (ADF) test is one of the common stationarity tests for determining the order of integration of macroeconomic time series following Asemota and Bala (2011). The testing technique for the ADF test is based on the model:

$$\Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \delta \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t. \quad (1)$$

The following model was used to examine unit roots for the time series

$$\therefore \Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \sum_{i=1}^{k} \delta_i \Delta y_{t-1} + \varepsilon_t. \quad (2)$$

The definition of terms is as follows. Statistically, α was allowed to be a constant, β the coefficient on a time trend following Asemota and Bala (2011). By implication, ε_t was allowed to be a white noise error term and Δy_{t-1} was equivalent to $\Delta y_{t-1} - \Delta y_{t-2}$. Table 1 shows the average values of the data set over the material period. Tables 2 to 4 present the results of the stationarity test.

Table 1: Data Set Averages (1982 to 2013)

Country	Nominal	Real	Inflation
Australia	10.731623	6.566080	4.165543
Bangladesh	14.141402	7.363424	6.779775
Bolivia	464.728192	6.042542	458.630278
Bhutan	14.6294587	7.691168	7.691190
Botswana	13.5303528	3.658549	9.871802
Canada	7.119305	4.327277	2.792028
Switzerland	4.570135	2.869266	1.700867
Chile	19.535738	8.658656	10.877128
China	7.533440	1.984464	5.548646
Cabo Verde	11.041346	7.854253	3.787091
Costa Rica	24.359996	7.549777	16.810218
Dominica	10.365600	6.353975	4.011657
UK	6.506595	2.944529	3.562065
Japan	3.625792	3.725335	-0.099540
Kenya	18.665800	7.852142	10.813660
Lesotho	15.214352	5.882410	9.331942
Nigeria	22.184500	-0.856643	23.737879
South Africa	15.184500	4.622823	10.561682
US	7.274920	4.784295	2.490620
Singapore	6.304380	4.721554	1.582828

Note: the number of observations for each country is 32. (N =32)

Table 2 results show that not all inflation series presented here are non-stationary. Note well that the following countries' inflation series were stationary over the period 1982 to 2013: Bolivia, Bhutan, Botswana, Canada, Switzerland, Chile, Cabo Verde, Costa Rica, Dominica, Lesotho, Nigeria and Singapore.

Table 2: Inflation Series Stationarity- Augmented Dickey Fuller Test Results

Country	ADF Test Statistics		
	1% level	5% level	10% level
Australia	-2.938930^{1}(-4.284580)	-2.938930^{2}(-3.562882)	-2.938930^{3}(-3.215267)
Bangladesh	-2.094357^{1}(-4.284580)	-2.094357^{2}(-3.562882)	-2.094357^{3}(-3.215267)
Bolivia	-5.286234(-4.284580)	-5.286234(-3.562882)	-5.286234(-3.215267)
Bhutan	-4.981185(-4.284580)	-4.981185(-3.562882)	-4.981185(-3.215267)
Botswana	-4.554357(-4.284580)	-4.554357(-3.562882)	-4.554357(-3.215267)
Canada	-4.843715(-4.284580)	-4.843715(-3.562882)	-4.843715(-3.215267)
Switzerland	-4.355361(-4.284580)	-4.355361(-3.562882)	-4.355361(-3.215267)
Chile	-5.532179(-4.284580)	-5.532179(-3.562882)	-5.532179(-3.215267)
China	-3.439052^{1}(-4.284580)	-3.439052^{2}(-3.562882)	-3.439052(-3.215267)
Cabo Verde	-8.545762(-4.284580)	-8.545762(-3.562882)	-8.545762(-3.215267)
Costa Rica	-12.60631(-4.284580)	-12.60631(-3.562882)	-12.60631(-3.215267)
Dominica	-5.922923(-4.284580)	-5.922923(-3.562882)	-5.922923(-3.215267)
UK	-2.796349^{1}(-4.284580)	-2.796349^{2}(-3.562882)	-2.796349^{3}(-3.215267)
Japan	-2.761289^{1}(-4.284580)	-2.761289^{2}(-3.562882)	-2.761289^{3}(-3.215267)
Kenya	-4.207375^{1}(-4.284580)	-4.207375(-3.562882)	-4.207375(-3.215267)
Lesotho	-6.999294(-4.284580)	-6.999294(-3.562882)	-6.999294(-3.215267)
Nigeria	-5.564075(-4.284580)	-5.564075(-3.562882)	-5.564075(-3.215267)
South Africa	-3.851019(-4.284580)	-3.851019(-3.562882)	-3.851019(-3.215267)
US	-3.230646^{1}(-4.284580)	-3.230646^{2}(-3.562882)	-3.230646(-3.215267)
Singapore	-4.570539(-4.284580)	-4.570539(-3.562882)	-4.570539(-3.215267)

The ADF test statistics are reported above. The critical values are as follows: -[4.284580] is the critical value at 1% level; -[3.562882] is the critical value at 5% level and -[3.215267] is the critical value at 10% level. Superscripts 1, 2, 3 indicate statistical significance at 1%, 5%, and 10% critical levels. The numbers in brackets are critical values. The results are based on the model: $\Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \sum_{i=1}^{k} \delta_i \Delta y_{t-1} + \varepsilon_t$. Eviews 7 was used to compute the ADF unit root test. The null hypothesis for the test is "series x, has a unit root".

The results below show that not all nominal interest rates series presented here are non-stationary. Note well that the following countries' series were stationary over the period 1982 to 2013: Costa Rica, Lesotho, Nigeria and South Africa.

Table 3: Nominal Interest Rates Stationarity- Augmented Dickey Fuller Test Results

Country	ADF Test Statistics		
	1% level	**5% level**	**10% level**
Australia	-3.051590^{1}(-4.284580)	-3.051590^{2}(-3.562882)	-3.051590^{3}(-3.215267)
Bangladesh	-3.807025^{1}(-4.284580)	-3.807025(-3.562882)	-3.807025(-3.215267)
Bolivia	-1.994195^{1}(-4.284580)	-1.994195^{2}(-3.562882)	-1.994195^{3} (-3.215267)
Bhutan	-1.852927^{1}(-4.284580)	-1.852927^{2}(-3.562882)	-1.852927^{3}(-3.215267)
Botswana	-4.115355^{1}(-4.284580)	-4.115355(-3.562882)	-4.115355(-3.215267)
Canada	-3.813502^{1}(-4.284580)	-3.813502(-3.562882)	-3.813502(-3.215267)
Switzerland	-3.265571^{1}(-4.284580)	-3.265571^{2}(-3.562882)	-3.265571(-3.215267)
Chile	1.208616^{1}(-4.284580)	1.208616^{2}(-3.562882)	1.208616^{3}(-3.215267)
China	-2.027565^{1}(-4.284580)	-2.027565^{2}(-3.562882)	-2.027565^{3}(-3.215267)
Cabo Verde	-3.439813^{1}(-4.284580)	-3.439813^{2}(-3.562882)	-3.439813(-3.215267)
Costa Rica	-4.551987(-4.284580)	-4.551987(-3.562882)	-4.551987(-3.215267)
Dominica	-3.163965^{1}(-4.284580)	-3.163965^{2}(-3.562882)	-3.163965^{3}(-3.215267)
UK	-2.027565^{1}(-4.284580)	-2.027565^{2}(-3.562882)	-2.027565^{3}(-3.215267)
Japan	-2.980183^{1}(-4.284580)	-2.980183^{2}(-3.562882)	-2.980183^{3}(-3.215267)
Kenya	-1.675105^{1}(-4.284580)	-1.675105^{2}(-3.562882)	-1.675105^{3}(-3.215267)
Lesotho	-6.455256(-4.284580)	-6.455256(-3.562882)	-6.455256(-3.215267)
Nigeria	-5.014304(-4.284580)	-5.014304(-3.562882)	-5.014304(-3.215267)
South Africa	-4.479709^{1}(-4.284580)	-4.479709(-3.562882)	-4.479709(-3.215267)
US	-3.815812^{1}(-4.284580)	-3.815812(-3.562882)	-3.815812(-3.215267)
Singapore	-2.976069^{1}(-4.284580)	-2.976069^{2}(-3.562882)	-2.976069^{3}(-3.215267)

The ADF test statistics are reported above. The critical values are as follows: -[4.284580] is the critical value at 1% level; -[3.562882] is the critical value at 5% level and -[3.215267] is the critical value at 10% level. The numbers in brackets are critical values. Superscripts 1, 2, 3 indicate statistical significance at 1%, 5%, and 10% critical levels. The results are based on the model: $\Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \sum_{i=1}^{k} \delta_i \Delta y_{t-1} + \varepsilon_t$. Eviews 7 was used to compute the ADF unit root test. The null hypothesis for the test is "series x, has a unit root".

The results below show that not all real interest rates series presented here are non-stationary. Note well that the following countries series were stationary over the period 1982 to 2013: Bhutan, Botswana, Canada, Switzerland, Cabo Verde, Costa Rica, Dominica and Nigeria.

Table 4: Real Interest Rates Stationarity- Augmented Dickey Fuller Test Results

Country	ADF Test Statistics		
	1% level	5% level	10% level
Australia	3.770912^{1}(-4.284580)	3.770912(-3.562882)	3.770912^{3}(-3.215267)
Bangladesh	-3.096771^{1}(-4.284580)	-3.096771^{2}(-3.562882)	-3.096771^{3}(-3.215267)
Bolivia	-1.642557^{1}(-4.284580)	-1.642557^{2}(-3.562882)	-1.642557^{3}(-3.215267)
Bhutan	-5.381634(-4.284580)	-5.381634(-3.562882)	-5.381634(-3.215267)
Botswana	-5.001460(-4.284580)	-5.001460(-3.562882)	-5.001460(-3.215267)
Canada	-4.562026(-4.284580)	-4.562026(-3.562882)	-4.562026(-3.215267)
Switzerland	-4.335026(-4.284580)	-4.335026(-3.562882)	-4.335026(-3.215267)
Chile	-3.163741^{1}(-4.284580)	-3.163741^{2}(-3.562882)	-3.163741^{3}(-3.215267)
China	-3.434267^{1}(-4.284580)	-3.434267^{2}(-3.562882)	-3.434267(-3.215267)
Cabo Verde	-7.248246(-4.284580)	-7.248246(-3.562882)	-7.248246(-3.215267)
Costa Rica	-4.733368(-4.284580)	-4.733368^{2}(-3.562882)	-4.733368(-3.215267)
Dominica	-5.827398(-4.284580)	-5.827398(-3.562882)	-5.827398(-3.215267)
UK	-3.211193^{1}(-4.284580)	-3.211193^{2}(-3.562882)	-3.211193^{3}(-3.215267)
Japan	-4.023728^{1}(-4.284580)	-4.023728(-3.562882)	-4.023728(-3.215267)
Kenya	-3.803342^{1}(-4.284580)	-3.803342(-3.562882)	-3.803342(-3.215267)
Lesotho	-3.772861^{1}(-4.284580)	-3.772861(-3.562882)	-3.772861(-3.215267)
Nigeria	-5.984172(-4.284580)	-5.984172(-3.562882)	-5.984172(-3.215267)
South Africa	-2.824676^{1}(-4.284580)	-2.824676^{2}(-3.562882)	-2.824676^{3}(-3.215267)
US	-3.060152^{1}(-4.284580)	-3.060152^{2}(-3.562882)	-3.060152^{3}(-3.215267)
Singapore	-3.992924^{1}(-4.284580)	-3.992924(-3.562882)	-3.992924(-3.215267)

The ADF test statistics are reported above. The critical values are as follows: -[4.284580] is the critical value at 1% level; -[3.562882] is the critical value at 5% level and -[3.215267] is the critical value at 10% level. The numbers in brackets are critical values. Superscripts 1, 2, 3 indicate statistical significance at 1%, 5%, and 10% critical levels. The results are based on the model: $\Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \sum_{i=1}^{k} \delta_i \Delta y_{t-1} + \varepsilon_t$. Eviews 7 was used to compute the ADF unit root test. The null hypothesis for the test is "series x, has a unit root".

The Toda and Yamamoto (1995) Approach to Granger Causality

The aim of this paper is to investigate the long run causation between inflation and interest rates. Cointegration methodology will be useful in this study if we were testing for the Fisher effect. However, in this study the interest is in determining the direction of causal affiliations between the variables. The Toda and Yamamoto (1995) approach is the most suitable because it does not require pre-tests for cointegration. The Granger causality test (see Granger, 1969) was not selected because not all data in this study is non-stationary. The Toda and Yamamoto (1995) technique can apply even if the series does not have unit roots. Granger causality also has several limitations. Firstly, if the variables under consideration are driven by a common third process with different lags, there is a possibility of failing to reject the alternative hypothesis of Granger causality. In addition, Granger causality is often based on the assumption that causal relations are a result of cointegration. The advantage of the Toda and Yamamoto (1995) approach is that the VAR's formulated in the levels can be estimated even if the processes may be integrated or cointegrated of an arbitrary order. Wolde-Rufael (2005) observed that the Toda and Yamamoto (1995) approach fits a standard vector autoregressive model in the levels of the variables. In consequence, this minimizes risks associated with the likelihood of wrongly identifying the order of integration of the series (Mavrotas and Kelly, 2001). The literature has developed a number of cointegration methods following the contributions of Saikkonen and Lütkepohl (2000a, 2000b); Johansen and Juselius (1990); Johansen (1988b, 1991a); Granger (1981); Granger and Weiss (1983); Engle and Granger (1987); Granger and Engle (1985); Stock (1987); Phillips and Durlauf (1986); Phillips and Park (1986); Phillips and Ouilaris (1986); Stock and Watson (1987); Park (1992a, 1990b); Phillips and Hansen (1990); Hovarth and Watson (1995); Saikkonen (1992) and Elliot (1998). Toda and Yamamoto (1995) noted that if economic variables are not cointegrated then the VAR should be estimated in first–order differences of the variables to validate the conventional asymptotic theory. In consequence, the Toda and Yamamoto (1995) approach is applicable even if the VAR may be stationary, integrated of an arbitrary order or cointegrated of an arbitrary order.

This study applies the Toda and Yamamoto (1995) approach as discussed by Wolde-Rufael (2005). The testing procedure starts by augmenting the correct VAR order k by the maximal order of integration d_{max} (Wolde-Rufael, 2005). Following this, a $(k + d_{max})^{\text{th}}$ order of the VAR is estimated and the coefficients of the last lagged d_{max} vector are ignored (Caporale and Pittis, 1999; Rambaldi and Doran, 1996; Rambaldi, 1997; Zapata and Rambaldi, 1997). Denote two variables as LX and LY. The VAR system of the variables can now be depicted as:

$$LX_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} LX_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} LX_{t-j} + \sum_{i=1}^{k} \emptyset_{1i} LY_{t-i} + \sum_{j=k+1}^{d_{max}} \emptyset_{2j} LY_{t-j} + \lambda_{1t} \quad (3)$$

$$LY_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} LY_{t-1} + \sum_{j=k+1}^{d_{max}} \beta_{2j} LY_{t-j} + \sum_{i=1}^{k} \delta_{1i} LX_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} LX_{t-j} + \lambda_{2t}$$

Empirical Results

Eviews 7 was used to carry out the Toda and Yamamoto (1995) approach to causality. The results show that China's inflation has significant influence on the following countries inflation dynamics: Australia, Costa Rica, Kenya and Nigeria. The countries registered ρ-values less than the 5% critical level suggesting that we have to reject the null hypothesis of non-causality. The reverse causality proved the following economies induce China's inflation: Cabo Verde, Japan and South Africa. Table 5 presents the results of the Toda and Yamamoto (1995) causality test for inflation.

Table 5: Inflation series causality Test Results

Country	$\mathbf{INF(CHI_t) \Rightarrow INF(X_t)}$		$\mathbf{INF(X_t) \Rightarrow (INF(CHI_t)}$		Direction of Causality
	Chi-sqr.	**ρ-value**	**Chi-sqr.**	**ρ-value**	
Australia	7.815909	0.020100***	1.141061	0.565200	$inf\mathrm{CHI_t} \Rightarrow \mathrm{AUS_t}inf$
Bangladesh	0.035468	0.982400	0.215242	0.898000	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{BAN_t}inf$
Bolivia	1.154895	0.561300	1.519430	0.467800	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{BOL_t}inf$
Bhutan	2.290133	0.318200	1.030859	0.597200	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{BHU_t}inf$
Botswana	0.854248	0.652400	0.929597	0.628300	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{BOT_t}inf$
Canada	1.184371	0.553100	2.372164	0.305400	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{CAN_t}inf$
Switzerland	0.797216	0.671300	4.302942	0.116300	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{SWI_t}inf$
Chile	2.275934	0.320500	4.096306	0.129000	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{CHL_t}inf$
Cabo Verde	0.548351	0.760200	8.039518	0.018000***	$inf\mathrm{CAB_t} \Rightarrow \mathrm{CHI_t}inf$
Costa Rica	7.712630	0.021100***	3.487259	0.174900	$inf\mathrm{CHI_t} \Rightarrow \mathrm{COS_t}inf$
Dominica	1.250353	0.535200	0.143970	0.928000	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{DOM_t}inf$
UK	0.331089	0.847400	4.208512	0.121900	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{UK_t}inf$
Japan	2.170556	0.337800	7.879339	0.019500***	$inf\mathrm{JAP_t} \Rightarrow \mathrm{CHI_t}inf$
Kenya	11.99560	0.002500***	1.208089	0.546600	$inf\mathrm{CHI_t} \Rightarrow \mathrm{KEN_t}inf$
Lesotho	2.159237	0.339700	5.144269	0.076400	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{LES_t}inf$
Nigeria	8.833380	0.012100***	1.1519442	0.467800	$inf\mathrm{CHI_t} \Rightarrow \mathrm{NIG_t}inf$
South Africa	1.592983	0.450900	10.03022	0.006600***	$inf\mathrm{SA_t} \Rightarrow \mathrm{CHI_t}inf$
US	1.521951	0.467200	1.973094	0.372900	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{US_t}inf$
Singapore	2.610262	0.271100	1.154147	0.561500	$inf\mathrm{CHI_t} \nLeftrightarrow \mathrm{SIN_t}inf$

Note: The arrows signify the direction of causation. ⇒ Implies causality in a given direction; ⇔ implies a bidirectional causal relationship; ⇎ implies that there is no causality between the variables. The test was carried out at 5% significant level. The null hypothesis (H_0) is that a given variable does not Granger cause the other (non-causality). Note that ρ-values less than the 5% critical level ($\rho < 0.05$) represent causality in a given direction. The null hypothesis is therefore rejected for ρ-values less than the significant level. Asterisks (***) represent a causal relationship at the 5% significant level. Eviews (7) was used to carry out the Toda andYamamoto (1995) approach to Granger causality.

The long run causal relationship between real interest rates was also examined. The results show that China's real interest rates have no significant influence on other countries' real interest rates. The reverse causality proved that only South Africa induces China's real interest rates. Table 6 presents the results of the Toda and Yamamoto (1995) causality test for real interest rates.

Table 6: Real Interest Rates Causality Test Results

Country	Chi-sqr.	-value	Chi-sqr.	-value	Direction of Causality
Australia	0.535741	0.765000	1.090107	0.579800	
Bangladesh	0.515843	0.772700	0.034429	0.982900	
Bolivia	4.024027	0.133700	4.527209	0.104000	
Bhutan	1.343099	0.510900	3.239139	0.198000	
Botswana	2.584415	0.274700	0.928777	0.628500	
Canada	1.724221	0.422300	0.519465	0.771300	
Switzerland	1.260718	0.532400	0.200485	0.904600	
Chile	0.626141	0.731200	0.226197	0.893100	
Cabo Verde	1.796001	0.407400	5.559268	0.062100	
Costa Rica	0.709039	0.701500	4.076528	0.130300	
Dominica	2.775089	0.149700	0.266185	0.875400	
UK	1.778977	0.410900	5.285715	0.071200	
Japan	2.640361	0.267100	1.685462	0.430500	
Kenya	1.726813	0.421700	4.083161	0.129800	
Lesotho	2.920033	0.232200	1.152992	0.561900	
Nigeria	5.741742	0.056600	0.730003	0.694200	
South Africa	1.259268	0.532800	6.444545	0.039900***	
US	1.059061	0.588900	1.603677	0.448500	
Singapore	2.621490	0.269600	2.392246	0.302400	

Note: The arrows signify the direction of causation. Implies causality in a given direction; implies a bidirectional causal relationship; implies that there is no causality between the variables. The test was carried out at 5% significant level. The null hypothesis is that a given variable does not Granger cause the other (non-causality). Note that ρ-values less than the 5% critical level (ρ represent causality in a given direction. The null hypothesis is therefore rejected for ρ-values less than the significant level. Asterisks (**) represent a causal relationship at the 5% significant level. Eviews (7) was used to carry out the Toda and Yamamoto (1995) approach to Granger causality.

The causal relation between nominal interest rates was investigated as well. The results show that Chinese nominal interest rates have significant influence on nominal interest rates of the following economies: Canada, Chile, Costa Rica and South Africa. The countries registered -values less than the 5% critical level suggesting that we have to reject the null hypothesis of non-causality. The reverse causality proved that UK and Japan induce an upsurge in China's nominal interest rates. Australia, Bhutan, Switzerland and Kenya are the only economies which exhibited bidirectional causal links between nominal interest rates series. Table 7 presents the results of the Toda and Yamamoto (1995) causality test for nominal interest rates.

Table 7: Nominal Interest Rates Causality Test Results

Country	Chi-sqr.	-value	Chi-sqr.	-value	Direction of Causality
Australia	7.079153	0.029000***	10.620120	0.004900***	
Bangladesh	0.128212	0.937900	1.435632	0.487800	
Bolivia	0.051735	0.974500	0.180801	0.913600	
Bhutan	6.493068	0.038900***	8.702516	0.012900***	
Botswana	2.593717	0.273400	1.671208	0.433600	
Canada	7.362506	0.025200***	1.986119	0.370400	
Switzerland	7.976610	0.018500***	13.45069	0.001200***	
Chile	7.163275	0.027800***	2.824361	0.243600	
Cabo Verde	0.491426	0.782100	1.933413	0.380300	
Costa Rica	7.630562	0.022000***	1.655349	0.437100	
Dominica	3.512721	0.172700	1.363793	0.505700	
UK	4.638158	0.098400	11.45570	0.003300***	
Japan	2.769667	0.250400	17.18510	0.000200***	
Kenya	11.18360	0.003700***	6.393807	0.040900***	
Lesotho	4.535732	0.103500	1.543801	0.462100	
Nigeria	2.511959	0.284800	0.277596	0.870400	
South Africa	6.690994	0.035200***	1.248103	0.535800	
US	1.487701	0.475300	0.407391	0.815700	
Singapore	3.735925	0.154400	2.097419	0.350700	

Note: The arrows signify the direction of causation. Implies causality in a given direction; implies a bidirectional causal relationship; implies that there is no causality between the variables. The test was carried out at 5% significant level. The null hypothesis is that a given variable does not Granger cause the other (non-causality). Note that ρ-values less than the 5% critical level (ρ represent causality in a given direction. The null hypothesis is therefore rejected for ρ-values less than the significant level. Asterisks (**) represent a causal relationship at the 5% significant level. Eviews (7) was used to carry out the Toda and Yamamoto (1995) approach to Granger causality.

The long term relations between Chinese nominal interest rates and inflation were investigated. The results show that Chinese nominal interest rates have significant influence on the following economies inflation: Bhutan, Costa Rica, Kenya and Nigeria. The countries registered ρ-values less than the 5% critical level suggesting that we have to reject the null hypothesis of non-causality. Inflation dynamics of Chile, Japan and South Africa have significant influence on Chinese nominal interest rates. Table 8 presents the results of the causality test for nominal interest rates and inflation .

Table 8: Nominal Interest Rates and Inflation causality Test Results

Country	$NOM(CHI_t) \Rightarrow INF(X_t)$		$INF(X_t) \Rightarrow NOM(CHI_t)$		Direction of Causality
	Chi-sqr.	ρ-value	Chi-sqr.	ρ-value	
Australia	2.919121	0.232300	1.799628	0.406600	$nomCHI_t \nLeftrightarrow AUS_t inf$
Bangladesh	0.692782	0.707200	2.195639	0.333600	$nomCHI_t \nLeftrightarrow BAN_t inf$
Bolivia	1.154895	0.561300	1.519430	0.467800	$nomCHI_t \nLeftrightarrow BOL_t inf$
Bhutan	7.463632	0.023900***	2.846457	0.240900	$nomCHI_t \Rightarrow BHU_t inf$
Botswana	0.143163	0.930900	3.504588	0.173400	$nomCHI_t \nLeftrightarrow BOT_t inf$
Canada	4.575381	0.101500	0.285146	0.867100	$nomCHI_t \nLeftrightarrow CAN_t inf$
Switzerland	0.561814	0.755100	3.658687	0.160500	$nomCHI_t \nLeftrightarrow SWI_t inf$
Chile	1.254554	0.534000	6.021146	0.049300***	$infCHL_t \Rightarrow CHI_t nom$
Cabo Verde	0.325847	0.849700	3.212483	0.200600	$infCHI_t \nLeftrightarrow CAB_t nom$
Costa Rica	17.76034	0.000100***	0.885262	0.642300	$nomCHI_t \Rightarrow COS_t inf$
Dominica	0.170596	0.918200	0.234504	0.889400	$nomCHI_t \nLeftrightarrow DOM_t inf$
UK	4.859922	0.088000	3.953067	0.138500	$nomCHI_t \nLeftrightarrow UK_t inf$
Japan	1.108673	0.574500	11.98068	0.002500***	$infJAP_t \Rightarrow CHI_t nom$
Kenya	7.442544	0.024200***	3.443192	0.178800	$nomCHI_t \Rightarrow KEN_t inf$
Lesotho	1.606325	0.447900	2.270534	0.321300	$nomCHI_t \nLeftrightarrow LES_t inf$
Nigeria	6.561399	0.037600***	1.141718	0.565000	$nomCHI_t \Rightarrow NIG_t inf$
South Africa	0.915374	0.632700	13.53132	0.001200***	$infSA_t \Rightarrow CHI_t nom$
US	0.731441	0.693700	0.463349	0.793200	$nomCHI_t \nLeftrightarrow US_t inf$
Singapore	2.296373	0.317200	0.167583	0.919600	$nomCHI_t \nLeftrightarrow SIN_t inf$

Note: The arrows signify the direction of causation. ⇒ Implies causality in a given direction; ⇔ implies a bidirectional causal relationship; ⇎ implies that there is no causality between the variables. The test was carried out at 5% significant level. The null hypothesis (H_0) is that a given variable does not Granger cause the other (non-causality). Note that ρ-values less than the 5% critical level ($\rho < 0.05$) represent causality in a given direction. The null hypothesis is therefore rejected for ρ-values less than the significant level. Asterisks (***) represent a causal relationship at the 5% significant level. Eviews (7) was used to carry out the Toda and Yamamoto (1995) approach to Granger causality.

In addition, statistical relations between Chinese nominal interest rates and real interest rates were investigated. The results show that Chinese nominal interest rates have significant influence on the following economies real interest rates: Chile, Costa Rica and Nigeria. The countries registered ρ-values less than the 5% critical level suggesting we have to reject the null hypothesis of non-causality. Japanese real interest rate dynamics have significant influence on Chinese nominal interest rates. Table 9 presents the results of the causality test for interest rates.

Table 9: Nominal Interest Rates and Real Interest Rates causality Test Results

Country	$\mathbf{NOM(CHI_t) \Rightarrow REAL(X_t)}$		$\mathbf{REAL(X_t) \Rightarrow NOM(CHI_t)}$		Direction of Causality
	Chi-sqr.	**ρ-value**	**Chi-sqr.**	**ρ-value**	
Australia	3.386532	0.183900	4.481046	0.106400	$nom\text{CHI}_t \nLeftrightarrow \text{AUS}_t real$
Bangladesh	0.438227	0.803800	1.775680	0.411500	$nom\text{CHI}_t \nLeftrightarrow \text{BAN}_t real$
Bolivia	1.516926	0.468400	1.174025	0.556000	$nom\text{CHI}_t \nLeftrightarrow \text{BOL}_t real$
Bhutan	4.105240	0.128400	2.030710	0.362300	$nom\text{CHI}_t \Rightarrow \text{BHU}_t real$
Botswana	0.185447	0.911400	2.508953	0.285200	$nom\text{CHI}_t \nLeftrightarrow \text{BOT}_t real$
Canada	3.238301	0.198100	1.988810	0.369900	$nom\text{CHI}_t \nLeftrightarrow \text{CAN}_t real$
Switzerland	5.621461	0.060200	0.658298	0.719500	$nom\text{CHI}_t \nLeftrightarrow \text{SWI}_t real$
Chile	7.513325	0.023400***	0.448841	0.799100	$nom\text{CHI}_t \Rightarrow \text{CHL}_t real$
Cabo Verde	2.523563	0.283100	3.078696	0.214500	$nom\text{CHI}_t \nLeftrightarrow \text{CAB}_t real$
Costa Rica	17.76034	0.000100***	0.885262	0.642300	$nom\text{CHI}_t \Rightarrow \text{COS}_t real$
Dominica	0.013973	0.993000	0.382533	0.825900	$nom\text{CHI}_t \nLeftrightarrow \text{DOM}_t real$
UK	1.231916	0.540100	5.23438	0.072300	$nom\text{CHI}_t \nLeftrightarrow \text{UK}_t real$
Japan	0.065963	0.967600	6.606093	0.036800***	$real\text{JAP}_t \Rightarrow \text{CHI}_t nom$
Kenya	0.264085	0.876300	2.535584	0.281500	$nom\text{CHI}_t \nLeftrightarrow \text{KEN}_t real$
Lesotho	1.294653	0.523500	1.287603	0.523500	$nom\text{CHI}_t \nLeftrightarrow \text{LES}_t real$
Nigeria	8.347005	0.015400***	2.128760	0.344900	$nom\text{CHI}_t \Rightarrow \text{NIG}_t real$
South Africa	4.483918	0.106300	4.911800	0.085800	$nom\text{CHI}_t \nLeftrightarrow \text{SWI}_t real$
US	3.473660	0.176100	0.309241	0.856700	$nom\text{CHI}_t \nLeftrightarrow \text{US}_t real$
Singapore	1.227867	0.541200	0.274206	0.871900	$nom\text{CHI}_t \nLeftrightarrow \text{SIN}_t real$

Note: The arrows signify the direction of causation. ⇒ Implies causality in a given direction; ⇔ implies a bidirectional causal relationship; ⇎ implies that there is no causality between the variables. The test was carried out at 5% significant level. The null hypothesis (H_0) is that a given variable does not Granger cause the other (non-causality). Note that ρ-values less than the 5% critical level ($\rho < 0.05$) represent causality in a given direction. The null hypothesis is therefore rejected for ρ-values less than the significant level. Asterisks (***) represent a causal relationship at the 5% significant level. Eviews (7) was used to carry out the Toda and Yamamoto (1995) approach to Granger causality.

Discussion and Conclusion

This paper aimed to determine the influence China has on other economies' inflation and interest rates. As China continues to expand in terms of economic growth, it is plausible that the country will have significant effects on other economies' financial and economic sectors. The reason for focusing on China is that the economy has been progressing well over time and is currently the largest economy after the US. China has been under pressure to control other problems that come with high economic growth such as reducing energy consumption and carbon dioxide emissions. This paper focused on interest rates and inflation and how China influences the dynamics of these variables in several economies. The Toda and Yamamoto (1995) causality approach was applied to validate long run affiliations between the variables over the material period (1982 to 2013). The results of the test have shown that China's inflation induces an increase in other economies' inflation namely: Australia, Costa Rica, Kenya and Nigeria. The reverse causality showed that Cabo Verde, Japan and South Africa have significant influence on China's inflation. Furthermore, the causality approach demonstrated that only South Africa has significant influence on China's real interest rates. The influential position of China revealed that Chinese nominal interest rates have significant effects on the following economies' nominal interest rates: Canada, Chile, Costa Rica, and South Africa. The reverse causality procedure showed that UK and Japan have consequential impact on Chinese nominal interest rates. Most importantly, nominal interest rates in China unveiled a number of relations between economies. For instance, Australia, Bhutan, Switzerland and Kenya proved to have a major causal link on China's nominal interest rates with feedback (bidirectional causal link). This study also took the initiative of testing the relationship between Chinese nominal interest rates and inflation. The causality approach demonstrated that China's nominal interest rates have significant effect on different economies' inflation namely: Bhutan, Costa Rica, Kenya and Nigeria. Inflation dynamics in multiple economies also had an influence on China's nominal interest rates. Chile, Japan and South Africa's inflation were found to Granger cause Chinese nominal interest rates. The results of this study also postulated that Chinese nominal interest rates have an effect on Chile, Costa Rica and Nigeria's real interest rates. Japanese real interest rates were registered to have a significant influence on China's nominal interest rates.

The most important results of this study are the significant effects Japan and South Africa have on China's inflation, real interest rates and nominal interest rates. The possible reason is that Japan was previously the second largest economy. Japan is also located in Asia thus the country's proximity and economic strength had a direct influence on China's economic and financial systems over time. It is conceivable for Japan to have a major influence on China's inflation and interest rates. South Africa's influence can be attributed to the fact that South Africa is a fast growing upper middle income economy (World Bank Indicators). South Africa is a member of the BRICS and is competing with Nigeria to become Africa's largest economy. The trade interactions between South Africa and China may explain South Africa's influence. It is important to note that China has a major effect on the following economies inflation and interest rates: Costa Rica, Kenya and Nigeria. These results depict the extent to which the countries depend on China. China is not only a global exporter, but has also provided financial support to many economies. In conclusion of this study, China has a significant influence on other nations' inflation and interest rates. China's economic growth has been impressive. This catapulted China to be one of the most important economies globally. It is likely that as China surpasses the US in economic growth, her influence in global matters will also intensify.

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