Research Paper Commerce

Study on Association Among Lending Rates of India, China and Japan Using Var (Vector Auto Regressive) Model

Dr. JeelanBasha.V | Assistant Professor in Commerce,Government First Grade College, Mariyammanahalli-583222

ABSTRACT

This study examined the association of relationship among lending rates of Asian countries. The study employed Unit Root, Johansen, Vector Auto Regressive and Angel Granger tests using E-Views software to analyse time series secondary data collected for the period 1980 to 2014. The findings revealed that there is no long run association among the lending rates. However, they contribute positively short-run cause and effect significant among the lending rates. Validity of the tests applied on residuals namely normal distribution, serial correlation and heteroskedastisity are used. A model which passes all the tests applied on the residuals except normality test could however be used in analyses and forecasting.
It is concluded that effect of India lending rates is caused by lending rates of Japan only in the short-run but not by China lending rates.

KEYWORDS ADF , cointegration VAR.

Lending rates has a unique ability to reach the wider community, regardless of geography, and enables support and wealth mobilisation that fuels social and economic development. *L*ending rate targets are a vital tool of monetary policy and are taken into account when dealing with variables like investment, inflation, and unemployment. The central banks of countries generally tend to reduce interest rates when they wish to increase investment and consumption in the country's economy. However, a low interest rate as a macro-economic policy can be risky and may lead to the creation of an economic bubble, in which large amounts of investments are poured into the real-estate market and stock market

Lending rate is the bank rate that usually meets the short- and medium-term financing needs of the private sector. This rate is normally differentiated according to creditworthiness of borrowers and objectives of financing. The terms and conditions attached to these rates differ by country, however, limiting their comparability. Interest is charged by lenders as compensation for the loss of the asset's use. When the borrower is a low-risk party, they will usually be charged a low interest rate; if the borrower is considered high risk, the interest rate that they are charged will be higher.

In developed economies, interest-rate adjustments are thus made to keep inflation within a target range for the health of economic activities or cap the interest rate concurrently with economic growth to safeguard economic momentum. By rule interest rates have to be above the inflation rate. Otherwise, the lenders would not lend money. Usually, the long term interest rate is about 2-3% above the inflation rate. India historically had inflation above 6%, while in developed world it is about 2%. Thus, long term interest rates in India are typically above 9% while in the developed world it is about 4%. The lenders of developing country will borrow from developed countries to make investment in domestic country, only if interest rate is too low in developed country that will compensate easily inflation rates of domestic economy, then it is profitable, otherwise it is unworthy.

Objectives of the study:

1. To study the long and short term relationship using VAR model;
2. To know cause and effect of India annual lending rates on China and Japan annual lending rates.

METHODOLOGY:

This section presents the methodology employed in this study. This study examined the relationship among the annual lending rates of Asian countries namely India, China and Japan. The study employed *ex-post facto* research design. This is because *ex-post facto* research design is one in which the researcher does not have the ability to manipulate the variables. Therefore, secondary time series data for a period of 35 years from 1980 to 2014 was collected. This period was considered based on the availability of data at the time of the study and with a view to determine the long run as well as short run effect. All the quantitative data used for the study was collected from reliable sources; that is, from the World Bank and the other magazines, journals, published books.

DATA ANALYSIS:

The three main variables identified for the study are Annual Indian lending rates (dependent), China and Japan lending rates (independent). Data collected for the study was analysed using econometric analytical tools such as ADF Unit Root test, Johansen Cointegration test, and Granger Causality Tests. The analysis was conducted with the computer software E-Views 7.

MODEL SPECIFICATION:

A functional regression model of the following form was formulated to capture the relationship among India, China and Japan lending rates;

ILR = ƒ (CLR, JLR)

Where;

ILR = Indian Lending Rate (the dependent variable).

CLR =China Lending Rate (one of the independent variables)

JLR = Japan Lending Rate (the second independent variable)

$\beta 0$ = is the intercept or constant value of the regression equation.

$\beta 1$ & $\beta 2$ = Are the coefficients of the independent variables to be estimated.

U = Error term.

1. Optimum Lag Order selection:

To determine Best Linear unbiased Estimate (BLUE), Optimum lag length is an important requirement. For the selection of I,t

different criterion are available. They are AIC, SIC, LR, FPE and HQ. If all the methods indicate same lag length, there is no issue. If they are different, result of popular AIC/SIC criterion is followed. These are all selected based on the least value.

2. Augmented Dickey-Fuller test statistic for unit roots:
The foundation of time series analysis is stationarity. A stationary process is a stochastic process whose joint probability distribution does not change when shifted in time or space. Usually, most economic variables are non-stationary. It is therefore important for the research to test for stationarity before generalizing any relationship. Before estimating regression, Augmented Dickey Fuller Test (Hamilton, J., 1994) was conducted to check the stationarity of the data. If the test reveals that all the variables are non stationary at level. They were made stationary after the first difference.

3. Cointegration Test:
After the non-stationary of the data is confirmed by the unit root tests, Johansen's cointegration tests are applied to investigate the linkage of variables.Trace and Maximal Eigen value tests are conducted to test cointegration. The analysis is conducted by investigating the co-movement in a pair out of these variables. In literature, Co-integration tests, e.g. Engle and Granger (1987), Johansen (1988), Johansen and Juselius (1990), Pesaran et al (2001) etc are used to confirm the presence of potential long run equilibrium relationship between two variables. Johansen's approach is used is deciding on the number of cointegration relationships exist among variables. Engel and Granger method cannot cope with this problem.

Johansen suggests the analysis the K order VAR model. Here the VAR model is presented with the K order against vector Xt with p variables. The critical value at 5% and 10% levels are taken from Osrewald-Lenum (1992).

4. Granger Causality Test:
The Standard Granger causality test (Granger 1988) is a statistical hypothesis test for determining whether one time series is useful in forecasting another. Granger (Nobel Prize in Economics) causality technique measures the information given by one variable in explaining the latest value of another variable. In addition, it also says that variable Y is granger caused by variable X if variable X assists in predicting the value of variable Y. If this is the case it means that the lagged values of variables X are statistically significant in explaining variable Y. Causality is the relationship between two variables, the first being cause and the second being effect. There are two types of causality relationship between these variable, bidirectional causality and unidirectional causality. The relationship between these two variables should be either unidirectional or bidirectional. If F-statistic ≥ 3.84, then Alternate hypothesis is accepted. If F- statistic < 3.84 then H_o-Null hypothesis is accepted.The test is based on the following regressions.

EMPIRICAL FINDINGS AND DISCUSSION:
OPTIMUM LAG ORDER LENGTH:
It is revealed from table 1 that optimum lag order is selected at lag 2. All the methods show the same results.

Table-1 : Lag Order Selection Criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-176.59	NA	15.04425	11.22457	11.36198	11.27011
1	-104.99	125.3017	0.301893	7.312005	7.861656*	7.494199
2	-90.346	22.88469*	0.215896*	6.959117*	7.921006	7.277956*
3	-82.875	10.27225	0.248068	7.054697	8.428824	7.510181

* indicates lag order selected by the criterion

ADF UNIT ROOT TEST:
First, the study commenced with the test for unit roots, using Augmented Dickey–Fuller (ADF) to ascertain whether the variables of interest are all stationary so as to completely avoid the estimation of spurious regression. Based on the above, the Augmented Dickey–Fuller (ADF) unit root test is presented below.

Table-2: Test Statistic for Unit Root/Stationary
Augmented Dickey-Fuller Test Statistic

Variables	Test Critical Values			Constant Level Data		Constant First Difference Data	
	1% level	5% level	10% level	t-Statistic- Calculated Value	Prob.*	t-Statistic- Calculated Value	Prob.*
(ILR)India Annual Lending Rates	-3.639	-2.951	-2.614	-0.96266	0.7552	-5.68652	0
(CLR)China Annual Lending Rates	-3.639	-2.951	-2.614	-1.75965	0.3934	-5.27066	0.0001
(JLR)Japan Annual Lending Rates	-3.639	-2.951	-2.614	-1.37201	0.5834	-4.7217	0.0006
Variables	Constant and Linear Trend level data					Constant First Difference Data	
(ILR)India Annual Lending Rates	-4.252	-3.548	-3.207	-2.8541	0.1892	-5.61636	0.0003
(CLR)China Annual Lending Rates	-4.252	-3.548	-3.207	-2.41798	0.3643	-5.37983	0.0006
(JLR)Japan Annual Lending Rates	-4.252	-3.548	-3.207	-1.61688	0.7637	-4.77774	0.0029

Source: E-Views Output

Table 2 depicts that unit root test result of all the variables were integrated of same order of I (1) and thus, stationary at first difference. The results indicate that the ADF test statistics

JOHANSEN COINTEGRATION TEST RESULT:
The Johansen Cointegration test result indicates no co-integration at the 0.05 level of significance of the variables such as CLR, JLR and ILR. Thus, the null hypothesis of no co-integration is hereby accepted at the 0.05 per cent level of significance. Both Trace and Maximal Eigen Value Tests provide evidence of no long run relationship among the variables of the study. Table 3 presents the test results of Johansen Cointegration test result.

Table-3 : Johansen's Co integration Test Results

Co integrating Equations	Trace Test			Maximal Eigen value Test		
	Statistics	Critical Values at 5% level	Prob.	Statistics	Critical Values at 5% level	Prob.
None	25.75339	29.79707	0.136	14.4685	21.1316	0.3278
At most 1	11.28485	15.49471	0.195	8.97882	14.2646	0.2879
At most 2	2.306031	3.841466	0.129	2.30603	3.84147	0.1289
Trace and max-Eigen value tests indicates no co integration at the 0.05 level						
* denotes rejection of the hypothesis at the 0.05 level						
**MacKinnon-Haug-Michelis (1999) p-values						

Source: E-Views Output

GRANGER CAUSALITY TEST RESULTS:
The null hypothesis of China annual lending rate is not causing the effect of India annual Lending rates is accepted since its prob. Value of 0.4353 is more than 0.05. In turn, China annual lending rate is caused by India annual Lending rates and hence, it is unidirectional.

Japan Lending Rate does cause India annual lending rate. Whereas India lending rate does not cause Japan Lending Rate. Therefore, it appears that Granger causality runs one way from Japan Lending Rate to India lending rate and not other way.

China Lending Rate is caused by the effect of Japan lending rate and not vice versa. Therefore, it appears that Granger causality is uni-directional but not bi-directional. It is witnessed from the results that there is short run relation

Table-4 :Granger Causality Test

Null Hypotheses:	F Statistic	Probability Values	Direction of Causality
CLR does not Granger Cause ILR	0.85682	0.4353	Unidirectional
ILR does not Granger Cause CLR	4.51076	0.02	
JLR does not Granger Cause ILR	8.6226	0.0012	Unidirectional
ILR does not Granger Cause JLR	0.49242	0.6163	
JLR does not Granger Cause CLR	7.45357	0.0025	Unidirectional
CLR does not Granger Cause JLR	2.24317	0.1249	

Source: E-Views Output

VECTOR AUTO REGRESSION ESTIMATES:
The R^2 value of 0.93 form table-5 speaks that the regression model formulated is a good and proper fit in explaining the variables. The Durbin Watson statistics of 1.842 shows the absence of any autocorrelation in the model that is nearer to 2. The F-statistic prob. value of 0.009 means that the regression model cannot be faulted and it is absolutely a good fit in the explanation of the causality relationship of India, China and Japan annual lending rates.

Table-5: Vector Auto Regression Estimates

Dependent Variable: IND

IND = C(1)*IND(-1) + C(2)*IND(-2) + C(3)*CHN(-1) + C(4)*CHN(-2) + C(5) *JPN(-1) + C(6)*JPN(-2) + C(7)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.402381	0.17432	2.308331	0.0292
C(2)	-0.210831	0.1483	-1.421669	0.167
C(3)	0.297204	0.14314	2.076305	0.0479
C(4)	0.091898	0.15812	0.581189	0.5661
C(5)	1.193436	0.29966	3.982646	0.0005
C(6)	-0.43614	0.35237	-1.237732	0.2269
C(7)	5.552587	1.50719	3.684076	0.0011
R-squared	0.931581	Mean dependent var		13.83018
Adjusted R-squared	0.915792	S.D. dependent var		2.765178
S.E. of regression	0.802415	Akaike info criterion		2.58345
Sum squared resid	16.74063	Schwarz criterion		2.900891
Log likelihood	-35.62693	Hannan-Quinn criter.		2.69026
F-statistic	59.00209	Durbin-Watson stat		1.842803
Prob. (F-statistic)	0			

Source: E-Views Output

Validity of the model-Tests applied on residuals:
Validity of the model gets proved by tests applied on residuals. Residuals' series must be normally distributed, with no serial correlation and homoscedastic.

Serial Correlation of LM test is applied with null hypothesis of H0 of no serial correlation at lag order h. Our results prove the absence of serial correlation since Prob. Chi-Square value is 0.5819.

In order to test normality, Jarque-Bera test of Residual Normality is applied. The series are not jointly normally distributed whose "p value" 0, 000003 is more than 5% .

While heteroskedasticity test of Breusch-Pagan-Godfrey is used with the null hypothesis of no heteroskedasticity . The test result is evident that the series are homoskedasticity with prob. value of 0.5836 which denies the rejection of null hypothesis. A model which passes all the tests applied on the residuals except normality test, could however be used in analyses and forecasting.

CONCLUSION AND RECOMMENDATIONS:
This study investigated the relationship among India, China and Japan Annual Lending Rates for the period 1980 to 2014. The tests employed were ADF Unit Root test, Johansen test and Granger Causality tests to analyze secondary time series data obtained from the World Bank.

It was found that all the variable are converted into first difference to make stationary. There is no cointegration among the variables on the test results of Trace and Maximal Eigen value. Effects of China lending rate is caused both by India and Japan Annual Lending Rates. Japan Annual Lending Rates causes the effects of India Lending Rates. Therefore, the hypothesis that there exists significant short relationship among India, China and Japan annual lending rates cannot be rejected. A model which passes all the tests applied on the residuals except normality test could, however be used in analyses and forecasting. By and large it is said that effect of India lending rates is caused by lending rates of Japan only in the short-run but not by China lending rates.

REFERENCES:

1. Ajayi, L.B and Oke, M.O (2012), "Effect of External Debt on Economic Growth and Development in Nigeria", *International Journal of Business and Social Science,* 13 (12) 297-304
2. Akpan, E. O. and Atan, J. A,. (2012), "Effects of exchange rate movements on economic growth in Nigeria" , CBN Journal of Applied Statistics, 2(2) 1-14
3. Ayadi, F.S and Ayadi, F.O (2008), "The impact of external debt on economic growth: A comparative study of Nigeria and South Africa", *Journal of Sustainable Development in Africa* 10(3).
4. Azeez B.A and Sulaiman, L.A. (2012), "Effect of external debt on economic growth of Nigeria", *Journal of Economic and Sustainable Development* 3(3)71-79.
6. Central Bank of Nigeria (2012), Statistical Bulletin
7. Deb (Management Office (2011), States and Federal Government External Debt Stock
8. Egbetunde, T. (2012), "Public Debt and Economic Causality", *American Journal of Economic* 2 (6)101-106
9. Ejigayepai, D.A. (2013), "The effect of external debt on economic growth", *Journal of the Department of Economics,* Sodertoru University
10. Khondker, B. H., Bidisha, S. H. and Razzaque, M. A. (2012),"The exchange rate and economic growth: An empirical assessment on Bangladesh", International Growth Centre Working Paper, 1-51, www.theigc.org/wp-content, Assessed 20/04/2016 at 6.36am
11. Ogunmuyiwa, M.S. (2011),"Does external debt promote economic growth?" ,*Current Research Journal of Economic Theory,* 3(1) 29-35.

12. Pattillo, C., Poirson, H. and Ricci, L. (2002), "External debt and growth', IMF Working Paper, number WP/02/69, 1-49 https://www.imf.org/external/pubs/ft/wp/2002/wp0269.pdf, Assessed 21/04/2016.
13. Rapetti, M., Skott, P. and Razmi, A. (2011), " The exchange rate and economic growth: Are developing countries different?", Department of Economics, University of Massachuetts, Amherst, Working Paper 2011-07, https://www.umass.edu/economics/publications/2011-07.pdf, Assessed 19/04/2016 at 8.55am
14. www.data.world bank.org
15. www. moneycontrol.com
16 www. yahoofinance.com