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Testing the Relationship between Interest Rates Volatility and Market Capitalization: the case of Mauritius

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Abstract:
This paper tests the relationship between interest rates volatility and market capitalization in Mauritius. Using annual time series data sourced from the Financial Services Commission Annual Statistical Bulletin of Mauritius during the period 2006 through 2010, data of interest rates volatility and market capitalization were estimated in a non-linear model using the Vector Auto-regression technique. The study found that interest rates volatility has significant effect on the level of market capitalization although a negative effect. This implies a negative relationship between interest rates volatility and market capitalization. Thus, if market capitalization is affected by interest rates, then the economy becomes highly susceptible to volatile external distress. This indicates some dangers for the economic survival of Mauritius. It was on this note that we recommended an effective policy aimed at stabilizing macroeconomic variable like interest rates, focusing at the same time on alternative measures of promoting market capitalization if aggregate economic growth must be harnessed. Policymakers should design the optimal policy mix that would help the nation cope efficiently with the economic and social costs of the external distress accompanying higher and dwindling interest rates in Mauritius.

Keywords: Interest Rates Volatility, Market Capitalization, Mauritius

Introduction

Over the years, the sectoral composition of Mauritius economy has changed profoundly between the period 1976 and 2010 (Ali, 2011). These changes may have been as a result of the movements in concentration in the economy. Such movements in the economy may have resulted into two economic possibilities a "rise" or "decline" in economic growth. In emerging and frontier economies like Mauritius, the national economies are particularly susceptible to a host of variables such as competition, protection of minority investors, overall business productivity, changes in interest, exchange, inflation rates (ACCA, 2012) and a host of other macroeconomics policy. Janke (2003) notes that understanding the behavior of interest rates is crucial for appropriate monetary policy particularly for frontier country like Mauritius that have instituted a number of financial reforms in order to liberalize interest rates. Thus, economic growth can be achieved through an unimpeded interest rates that is neither dwindling in tandem with a stable capital market performance. ACCA (2012) opines that capital market promote economic development and growth by facilitating and diversifying firms' access to finance. In order to do this, they rely on sound economic policy that assures the market of stable interest rates. Interest rates volatility is the instability, changes, dynamism, rise or decline in lending rates. These lending rates are either rising or declining. The volatility in the rates may positively or negatively affect market capitalization and the aggregate economy. Consequently, this paper considers the relationship between interest rates volatility and market capitalization and how policymakers can build on them in order to ensure economic growth in Mauritius. Towards this end, this paper discusses the issues in four sections: prior literature, model specification, findings and discussion, conclusion and recommendations.

Prior Literature

There are no empirical evidences on the relationship between interest rates volatility and market capitalization in developing economies like Mauritius. Majority of these empirical evidences amongst others have been centered on financial liberalization and interest rates (Jankee, 1999; Honohan, 2000); economic growth performance (Shyam and Yeti, 2003); determinants of interest rates in post-financial liberalization regime (Jankee, 2003); Mauritius experience with Lombard Rate (Vikram, 2004); the level of efficiency of the stock exchange towards economic growth in Mauritius (Fowdar, *et.al*, 2007; Ushad and Raja, 2010, Masafumi, 2012); financial crisis and stock markets (Lemma and Amar, 2009); the equilibrium value of the Mauritian rupee (Patrick and Camelia, 2011) and key determinants of African government securities market and corporate bond market capitalization (Yibin, Phelps and Janet, 2013) without considerable attention on the relationship between interest rates volatility and market capitalization in Mauritius. Thus, this has led to disintegration in literature as regards the issue under consideration.

Elaborating on the above empirical evidences inter-alia, for instance, Jankee (1999) examined the effectiveness of the financial liberalization and monetary control reform in Mauritius. The study found that financial liberalization experience seems to be a puzzle to Mauritian policymakers as a result of a declining trend in savings, investment as well as the growth rate of the financial services sector in the post-liberalization period. Honohan (2000) investigated how interest rates changed under the era of financial liberalization. The study showed that as more and more countries liberalized, the level and dynamic behavior of developing country like Mauritius interest rates converged to industrial country norms. In addition, government Treasury bill rates and bank spreads were evidently the most repressed and they showed the greatest increase as liberalization shifted substantial rents from the public sector and favored borrowers. Shyam and Yeti (2003) while explaining the economic growth performance in Mauritius using an unrestricted VAR approach found that a large part of the increase in wages is explained by higher profits of exports firms due to protected markets for their products in the foreign markets. Also, it was revealed that the incidence of poverty is much greater in rural areas

of Mauritius whereas, poverty rates vary substantially across geographical districts and locations due to the ethnic differences.

Jankee (2003) analyses the determinants of interest rates in the post-financial liberalization regime in Mauritius by developing an empirical model to determine the impact of foreign interest rate adjusted for changes in exchange, money supply, real income and expected inflation rates in line with Edwards and Khan (1985) empirical model. The empirical evidence suggests a low degree of financial linkages with external financial markets and greater role of domestic factors in interest rate determination. Also, the interest rate parity theory as well as the Fisher effect did not hold in the Mauritius case. The Ministry of Industry, Financial Services and Corporate Affairs (2004) provides that to increase the confidence of investors in Mauritian capital market, it is essential that Mauritian institutional investors follow the lead given by their counterparts in overseas capital markets and increase their level of activism both at meetings of shareholders and during private meetings with company chairpersons and CEOs. When there is an increase in the level of activism, a robust market capitalization and stock market indicators will be positively harnessed. Vikram (2004) presented an overview of the experience of Mauritius with Lombard Rate. The experience drawn was that there is no ideal monetary management framework that can deal with all the potential problems that a developing economy like Mauritius might possibly be faced with. The signs that the monetary management framework is once again under strain is due to excessive liquidity in the stock market.

Fowdar, *et.al* (2007) used a sample of the daily market returns to assess the level of efficiency of the Stock Exchange of Mauritius during the period 1999 through 2004 and found that the market in Mauritius do not follow a random walk. Also, the study established a serial correlation in the stock prices such that the future predictions on the market are possible. Lemma and Amar (2009) tested the relationship between financial crisis and stock markets in 63 countries including Mauritius. The findings indicated that the global financial crisis has engendered collateral damage to several countries without fault of their own. Also, comparative stock market performance across countries including Mauritius during the pre-crisis and post-crisis period in absolute and risk adjusted terms were affected. The effects were attributed to the institutional investors' ratings, sectoral concentration,

market depth and liquidity level in the sampled countries. Ushad and Raja (2010) explored the contribution of the stock market towards economic growth in Mauritius during the period 1976 to 2008. A time series regression analysis was conducted. The study showed no statistical significant relationship between stock market and economic growth while controlling for several macroeconomics variables. A plausible explanation for this result may be as a result of the structure of the Mauritian financial system which is mainly banking oriented.

Patrick and Camelia (2011) assessed the equilibrium value of the Mauritian rupee in 2006 – 2007 and over the medium run using two structural models. The study revealed that the Mauritian rupee was aligned with its equilibrium value in 2006 – 2007 and little adjustment appeared necessary over the medium run. Masafumi (2012) investigated capital market integration in the East African Community (EAC) Monetary Union where Mauritius belongs to. The study found that capital market integration has not deepened during the past few years. Also, the study observed that countries within the EAC would benefit from the integration of capital market in the area of harmonization of market infrastructure, strengthening of regional surveillance mechanisms, encouraging local currency bond issuance by multilateral financial institutions and building the capacity of the existing regional institutions. Yibin, Phelps and Janet (2013) studied bond market in Africa with an econometric model to analyze the key determinants of African government securities market and corporate bond market capitalization. The study found evidence that market capitalization is directly related to better institutions and interest rate volatility and inversely related to the fiscal balance, higher interest rate spreads, exchange rate volatility, current and capital accounts openness. Also, the results from their study suggests that corporate bond market capitalization is directly linked to economic size, the level of development of the economy and financial markets, better institutions and interest rate volatility, and inversely related to higher interest rate spreads and current accounts openness.

To conclude this section, it is interesting to note that in other countries either developed or developing, there is the possibility that interest rate volatility "do" or may "not" influence market capitalization. The opposite may be the case for Mauritius or not being a developing country. Thus, if this is the case, then there is the

likelihood of testing the relationship between interest rates volatility and capital market capitalization in Mauritius, whether such signs exist or not.

Model Specification

This study was carried out to test the relationship between interest rates volatility and the level of market capitalization in Mauritius stock market. An unrestricted Vector Auto-Regression (VAR) Model was used. VAR model provides a multivariate framework where changes in a particular variable are related to changes in its own lags and to changes in other variable as well as their lags. VAR treats all variables as endogenous and does not impose a-priori restriction on structural relationship (Gujarati, 2003). In our analysis, we provided a co-integration and normality test so as to determine whether the error terms of the variables were normally distributed. The econometric model considered in this study takes Market Capitalization (MCAPZ) as dependent variable, Interest Rate (IR) and Interest Rate Volatility (IRV) as the independent variables. Generally a VAR model can be specified as:

$$Y_t = m_0 + A_1Y_{t-1} + A_2Y_{t-2} + \ldots + A_pY_1p + €_t \qquad (eq.1)$$

The above equation (1) denotes the general VAR process, where A_1 (i=1,2,…p) are K x K matrices of coefficients, m is a K x 1 vector of constant and $€_t$ is a vector of white noise process. In line with equation (1), we expressed market capitalization as a function of interest rate and interest rate volatility:

$$MCAPZ = F\ (IR, IRV) \qquad (eq.2)$$

where:

MCAPZ	=	Market Capitalization
IR	=	Interest Rate
IRV	=	Interest Rate Volatility

To estimate equation (1 & 2) we can translate this into equation 3 as expressed below:

$$MCAPZ = m_0 + A_1IR_{t-1} + A_2IRV_{t-1} + €t \qquad (eq.3)$$

The data for this study were obtained from the Financial Services Commission Annual Statistical Bulletin of Mauritius during the period 2006 through 2010 (a period of 5 years).

Findings and Discussion

This section provides the findings and discussion of results. The tests were done in order of precedence. First, was the Augmented Dickey Fuller (ADF) Unit Root Test, which was closely followed by Co-integration Test, Over-parameterized and Parsimonious Error Correction Test and Diagnostic Test. The Variance Decomposition Test concludes this part.

a. Augmented Dickey Fuller (ADF) Unit Root Test

Table no. 1: Summary of ADF Unit Root Test

Variables	Level date	1st diff	1% CV	5% CV	10% CV	Order of Integration
IRV	-4.20*	-6.38	-3.69	-2.97	-2.62	I(0)
IR	0.66	-2.86***	-3.69	-2.97	-2.62	I(1)
MCAPZ	1.37	-5.08*	-3.69	-2.97	-2.62	I(1)

* Statistically Significant @ 1% level

*** Statistically Significant @ 10% level

The Augmented Dickey Fuller (ADF) Unit Root Test was used to test whether the variables are stationery or not and their order of integration. The result of the ADF unit root test is shown in table no.1 above. The result of the ADF unit root test followed expectations. All the variables except interest rate volatility were non-stationery. However it became stationary after taking the first order difference. The interest rate volatility was stationary at the level probably because it is computed in ratio. This set the pace for the next stage of the analysis which is the co-integration test.

b. Co-integration Test

The Johansen co-integration test was used to test for the long run relationship among the variables. The result of the Johansen co-integration test is shown in tables' no. 2a and 2b.

Table no. 2a: Summary of Johansen Co-integration Test Result

Hypothesize No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.640692	77.78483	68.52	76.07
At most 1	0.431028	21.37075	29.68	35.65
At most 2	0.143147	5.016967	15.41	20.04
At most 3	0.018340	0.536789	3.76	6.65

Table no. 2b: Summary of Johansen Co-integration Test Result

Hypothesize No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None	0.640692	29.68365	33.46	38.77
At most 1	0.431028	16.35379	20.97	25.52
At most 2	0.143147	4.480178	14.07	18.63
At most 3	0.018340	0.536789	3.76	6.65

The results of the Johansen co-integration test in tables 2a and 2b above showed that a long run relationship exists among interest rate volatility, interest rate and market capitalization. The trace test indicated two co-integrating equation while the max-eigen statistic indicated one co-integrating equation. Once there is co-integrating vector, a long run relationship is concluded (Gujarati, 2003). The existence of at least one co-integrating equation permits us to estimate over-parameterize and parsimonious error correction test.

c. Over-parameterized and Parsimonious Error Correction Test

The over-parameterized and parsimonious error correction test is shown in table no. 3.

Table no. 3: Summary of Over-parameterized ECM
Result Dependent Variable: DLMCAPZ

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLIR	0.483866	0.105695	4.577960	0.0001
DLIR(-1)	0.300630	0.293394	1.024661	0.3184
DLIR(-2)	0.023727	0.281602	0.084259	0.9337
IRV	-0.889766	0.181262	-4.908717	0.0000
ECM(-1)	-0.454316	0.167069	-2.719327	0.0105
C	0.068255	0.169144	0.403534	0.6911

$R^2 = 0.73$, $R^2 = 0.61$, AIC = 1.96, SC = 2.38, Dw = 2.07

The over-parameterized error correction model (ECM) includes various lags of the variables. The parsimonious ECM model (or preferred model is gotten by deleting the insignificant variables from the over-parameterized ECM model. The Schwarz criterion and the

Akaike information criteria were used to select the appropriate lag length.

d. Vector Error Correction (VEC)

The portion of the VEC result that is of most significance is shown in table no. 4.

Table no. 4: Summary of Vector Error Correction Results

Co-integrating Eq:	**Co-integrating Eq 2**		
LMCAPZ(-1)	1.000000		
LIR(-1)	47.35423		
	(14.2973)		
	[3.31212]		
IRV(-1)	-848.8212		
	(91.2922)		
	[-9.29785]		
C	-2128.183		
Error Correction:	**D(LMCAPZ)**	**D(LIR)**	**D(LIRV)**
CointEq1	-0.000966	-0.407183	-0.173256
	(0.00086)	(0.05926)	(0.05639)
	[-1.12841]	[-6.87080]	[-3.07275]

The result of the VEC showed that IR and IRV equations represent the co-integrating equation. The other is statistically flawed. It has the right sign but not statistically significant.

e. Diagnostic Test

The diagnostic test is used to test whether the errors are normally distributed, whether the variance is constant or not and whether the errors are serially correlated. Table no. 5 presents the result of the diagnostic test.

Table no. 5: Diagnostic Test Result: Jarque-Bera

Jarque-bear	0.59	Probability	0.75
White Heteroskedasticity test			
f-statistic	1.01	Probability	0.30
Breusch Godfrey Serial Correlation LM test			
f-statistic	0.14	Probability	0.87

The result of the Jarque-Bera normality test shows that the errors are normally distributed. The white heteroscedasticity test shows that the errors are homeskedastic and the result of the Breusch Godfrey Serial Correlation LM test indicated no evidence of serial correlation in the residuals.

f. Variance Decomposition Test

The variance decomposition test is the proportion of changes in the dependent variable that has been explained by the volatility in the independent variables. The result of the variance decomposition is shown in table no. 6.

Table no. 6: Summary of Variance Decomposition Result

Period	S.E.	Variance MCAPZ	IR	IRV
1	1780142.	100.0000	0.000000	0.000000
2	3285982.	34.58371	40.52078	7.103264
3	3832300.	45.29962	33.98349	5.222418
4	4242651.	50.02630	31.11930	6.006581
5	9332918.	61.39760	20.41590	3.188355

The result indicated that interest rate volatility did not explain significant percentages of the changes in the level of market capitalization growth during the first period. Volatility to interest rate explained 7 percent of the changes in level of market capitalization in the second period and this reduced to 6 percent in the fourth period and 3 percent in the fifth period, reflecting the problem caused by interest rate volatility to market capitalization. The volatility to interest rates however explained a significant percentage of changes in market capitalization. Volatility to interest rate explained 41 percent of changes in interest rate in the second period and this reduced to 34 and 31 percents in the third and fourth periods and declined further to 20 percent in the fifth period.

Conclusion and Recommendations

To the best of our knowledge, there is no empirical evidence establishing robust results in Mauritius on the connection between interest rates volatility and market capitalization. Our study is one of the

first that tested the relationship between interest rates volatility and the level of market capitalization in Mauritius during the period 2006 through 2010, with an unrestricted Vector Auto-regression (VAR) Model. The study found that interest rates volatility has significant effect on the level of market capitalization although a negative effect. This implies a negative relationship between interest rates volatility and market capitalization. If market capitalization is affected by volatility in interest rates, then the economy becomes highly susceptible to volatile external distress. This therefore indicates some dangers for the economic survival of Mauritius. It was on this note that we recommended an effective policy aimed at stabilizing macroeconomic variable like interest rates while at the same time focusing on alternative measures of promoting market capitalization if aggregate economic growth must be harnessed. Policymakers should design the optimal policy mix that would help the nation cope efficiently with the economic and social costs of the external distress accompanying higher and dwindling interest rates.

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