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Dynamics of Mutual Funds in Relation to Stock Market: A Vector Autoregressive Causality Analysis

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ABSTRACT: In Bangladesh, primary and secondary mutual fund markets behave in a completely different way, where initial public offering (IPO) investors of mutual funds earn more than 250 percent rerun, whereas secondary market investors cannot even manage to cover the opportunity cost of their investment. There are few other abnormalities present in this market – unlike everywhere in the world, most of the mutual funds are closed-end (92 percent) and closed-end mutual funds are barred to issue bonus or right shares. A total of 714 day's observations, from January 2008 to December 2010, of four variables– DSE (Dhaka Stock Exchange) general index return, DSE general index turnover, mutual funds' return and mutual funds' turnover– are utilized. Stationarity of the variables are tested with Augmented Dickey-Fuller (ADF) unit root test and found that variables are in different order of integration. Long-term equilibrium relationships among the variables are tested with Johansen cointegration and it is found that DSE general index return and mutual funds' return are cointegrated. Toda-Yamamoto (TY) version of granger non-causality test is employed and bidirectional causality is found moving from DSE (Dhaka Stock Exchange) general index turnover to DSE general index return, whereas unidirectional causality is found moving from mutual fund's return to DSE general index return, mutual funds' return to mutual funds turnover, and DSE general index turnover to mutual funds turnover. This finding helps to conclude that equity shares' demand drives the mutual funds demand but even higher demand of mutual funds fails to raise its own price unless underlying value of the mutual funds changes.

Keywords: Mutual Fund; Dhaka Stock Exchange; Vector Auto Regressive; Augmented Dickey-Fuller; Cointegration; Stationarity
JEL Classifications: G1; G11

1. Introduction

A mutual fund is a professionally managed type of collective investment scheme that pools money from many investors and invests it in stocks, bonds, short-term money market instruments or other securities. Mutual funds are becoming an attractive investment option for investors as it offers diversification, economies of scale by increasing return and reducing costs, buying and selling flexibility, active management by professionals, and tax exemption. Day by day investment in share

capital is becoming more risky business; conversely, mutual fund investment is becoming more profitable with less risk. Consequently, many big corporations and financial institutions came up with their mutual funds which allowed the public to invest their money in mutual funds. At present, there are 36 mutual funds– 33 of them are closed-end and 3 of them are open-end. Closed-end fund is a publicly owned investment company in Bangladesh stock market which can raise a fixed amount of capital by issuing certain number of shares through initial public offering (IPO). Closed-end funds are traded in the capital market similar to general stocks, and price varies with the interaction of the market forces (demand and supply) and price sensitive information, i.e. changes in Net Asset Value (NAV) and dividend declaration. On the contrary, open-end fund by definition has no limits to raise capital by issuing shares. Unlike closed-end fund, they can issue share in response to changes in demand. They can sell as many shares as they want and in need they can buy back the shares as well and declare it closed for the new investors.

The mutual fund industry of Bangladesh has experienced remarkable growth during the last decade because of the return it offers to individual investors – investors even earned more than 250 percent return in their IPO if they sold it within three months starting from the first trading day. Abnormal return has motivated many investors to participate in the private placement and IPO of mutual funds. Open-end mutual funds can expand their capital base by issuing new shares, but closed-end funds can only expand their capital base by issuing bonus or right shares. Unlike everywhere in the world, closed-end mutual funds of Bangladesh are barred to issue bonus or right shares. This is the reason why secondary market of mutual funds has remained dull; whereas IPO investors of mutual funds are making good profit. Sluggish performance of mutual funds in the secondary market makes it difficult to recover the cost of investment and forces investors to dilute their investment to avoid further loss and minimize opportunity cost. In this circumstance, it is worth testing what explains the return and tradability of mutual funds.

Mutual funds constitute around 3-5 percent of the total market capitalization in the stock markets of Bangladesh, but little research has been done on mutual funds to assist market development and help investors to make informative decisions. As a result, it was difficult to find appropriate literature of mutual funds on Bangladesh, and in response works from different countries context has taken the place.

Most of the works on mutual funds have been done on the issue of fund flow and performance. Keswani (2011) suggests that there is no significant relationship between fund sizes on performance for micro, small, medium, and large Balanced Mutual Funds.

Pollet and Wilson (2008) argued that although asset growth has little effect on the behavior of the typical fund, they have found that large funds and small-cap funds diversify their portfolio in response to growth and greater diversification is found to be associated with better performance of small-cap funds. Alexakis et al. (2005), the closest empirical study on the subject is conducted by using the data of Greek Money Market with the objective of trying to find the relationship between stock returns and investment fund flows. Testing causality mechanism through which mutual funds flows may affect stock returns and vice versa; the study shows that mutual funds flows cause stock returns trends and outflows of cash in equity funds may affect higher and lower stock returns in Greek stock market.

Determinants of mutual fund performance and return have been examined in a number of studies in different countries with different research techniques. Life cycle study of mutual funds shows that mutual funds are managed as per the willingness of investors to accept risk. Mutual funds

may not attract wealthy investors, but less wealthy investors are attracted to these funds and get benefit out of them (Schooley and Worden, 1999). Ferreira *et al.* (2006) observed the determinants of mutual fund performance using four factor models for funds from 19 countries. The major finding of the study showed that the size of the performance of large funds was better. Before that, they found that new funds investing abroad performed better than other funds' performance.

Burucu and Contuk (2011) granger causality test findings showed that there is a relationship between investment funds flow and earnings of market stock based on Turkey stock market. There is no causal relationship between investments funds flow and earnings of market stock in their analysis result. Rakowski and Wang (2009) analyzed the dynamics of daily mutual fund flows. Through probit regressions analysis, the dynamics of daily flows with established results for monthly fund flows cited important differences between the variables. Johnson and Poterba (2008) conduct an analysis to compare daily shareholder transactions by taxable and non-taxable investors in the mutual funds of a single no-load fund complex around distribution dates and concluded that some taxable shareholders time their purchase of mutual funds to avoid tax acceleration associated with distribution. On an average, taxable shareholders who purchase shares just before distribution dates also have shorter holding periods than those who buy after a distribution.

Mutual fund industries of emerging markets have been attracted by US researchers' recently. Karlsson and Persson (2005) conclude their findings on the relative importance of various factors in the selection of mutual funds. And similarly, Ramasamy *and Yeung* (2003) analyzed mutual funds in Malaysia and concluded that consistent size of the funds, past performance, and cost of transaction were the three important factors influencing the fund performance.

Despite the growing interest of researchers in mutual funds over the world, Bangladesh's mutual fund industry has failed to attract the attention of researchers. Limited research has been done on mutual fund industry of Bangladesh. Rahman *et al*. (2012) examined mutual fund industry of Bangladesh and concluded that the growth oriented funds have not performed better in terms of total risk, and the funds are not offering advantages of diversification and professionalism to the investors. From their findings, it can also be concluded that mutual fund cannot always perform better with their expertise and beat the market.

One study conducted in the Indian context by Dash and Dinesh (2008) investigated causality between the daily returns and volatility of mutual funds and different macroeconomic variables. Modified linear Granger causality tests were employed and found that the returns and variance of mutual funds were significantly affected by the macroeconomic variables.

The remainder of this paper is organized into three sections. Section 2 covers data source and descriptive statistics including econometric methodology and brief summary of sub-section. Section 3 provides the empirical analysis and result, justification of hypothesis testing, analysis and recommendation. Finally Section 4 concludes the study with implications of the findings and suggestions for future research.

2. Data and Research Method

2.1. Data Source

Daily data of four variables – Dhaka Stock Exchange General Index Return (DGENR), Dhaka Stock Exchange General Index Turnover (DGENT), Mutual Funds' Weighted Average Return (MFR), and Mutual Funds' Weighted Average Turnover (MFT) – are employed in this paper to investigate the dynamics of mutual funds. The data for the period of three years starting from 2nd January 2008 to 30th

December 2010 are collected from Dhaka Stock Exchange (DSE) library.

Dhaka Stock Exchange General Index Return (DGENR):

DSE general index consists of A, B, G, and N share groups and excludes mutual funds, Z category shares and corporate bonds.

The equation employed to compute general index is as follows– Closing Index (CI) = [(Yesterday's Closing index * Closing Market Capitalization)/Opening Market Capitalization]

Closing Market Capitalization = ∑ (Closing Price * Total no. of indexed shares)

DSE General Index Return = (CIt-CIt-1)/CIt-1.

DSE general index return entirely reflects only the capital gain, no other return (i.e. dividend income) is considered.

Dhaka Stock Exchange General Index Turnover (DGENT):

DGENT is calculated by turnover of indexed companies share trader divided by total number of indexed companies' shares outstanding.

Mutual Funds' Weighted Average Return (MFR):

Based on the availability of data, 22 mutual funds have been selected. Mutual funds' return is calculated based on the following equation–

$$MFR = \sum_{i=1}^{n} w_i * R_i$$

where, w_i is the weight of *i*-th mutual fund and R_i is the return of *i*-th mutual fund. Weights are derived base on mutual funds relative size of Net Asset Value (NAV) to total NAV of the selected mutual funds. Mutual funds' return entirely reflects only the capital gain, no other return (i.e. dividend income) is considered.

Mutual Funds' Weighted Average Turnover (MFT):

Mutual funds weighted average turnover (MFT) is computed based on the following equation–

$$MFT = \sum_{i=1}^{n} w_i * T_i$$

Where, w_i is the weight of *i*-th mutual fund and T_i is the turnover of *i*-th mutual fund. Weights are derived base on mutual funds relative size of NAV to total NAV of the selected mutual funds.

2.2. Descriptive Statistics

A total of 714 day's observations are used. Average return of DGEN is 0.15 percent; whereas minimum return is negative 6.72 percent and maximum return is 22.61 percent. In contrast, average mutual funds' return is 0.11 percent, the best case return is 8.39 percent and the worst case return is negative 7.84 percent. Mutual fund return is more volatile than DGEN return. On an average, DGEN exhibits higher turnover and higher volatility of turnover in comparison to mutual funds (See Table 1).

Table 1. Descriptive Statistics of the Variables

	Minimum	Maximum	Mean	Standard Deviation	Obs.
DGENR	-6.72%	22.61%	0.15%	1.49%	714
DGENT	743,962,732	12,451,792,161	6,174,427,302	3,215,917,721	714
MFR	-7.837%	8.394%	0.108%	1.909%	714
MFT	386,175	11,520,888	1,728,737	1,341,801	714

2.3. Econometric Methodology

Causality model is utilized to investigate the dynamics of mutual funds – more specifically finding what causes the variation in mutual funds' return and turnover. Four variables are included in the causality analysis to figure out which variable contains useful information to explain the behavior of others. Toda-Yamamoto (TY) version of Granger causality test has been employed, since many literatures identified several drawbacks of traditional Granger causality test and Error Correction Model (ECM) employed in Vector Autoregression (VAR) from. Pretesting of stationarity and cointegration may lead to over rejection of a non-causal null (Giles and Mirza, 1999); first differencing of variables in a VAR model may provide dissatisfactory result (Enders, 2004); and Vector Error Correction Model (VECM) cannot be applied if variables are of different order of integration, and non-cointegrated (Gujarati, 1995). TY version of granger causality test can be used irrespective of order of integration and status of cointegration and also resolves the likelihood of specification bias &spurious regression; moreover it keeps the provision of stationary test and cointegration test.

Augmented Dickey-Fuller (ADF) test is conducted to test the stationarity of the variables with optimal lag length selected by Schwarz Information Criteria (SIC). Johansen method of cointegration test is utilized to examine the existence of long-run equilibrium relationship. Optimal lag length for VAR estimation is determined with sequential modified Likelihood Ratio (LR) test statistic. Finally, TY method is utilized which involved Modified Wald (MWALD) test in an augmented VAR model. The primary idea of this method is to augment the true lag length (suppose, k) with the maximum order of integration (say, dmax) and consider (p=k+dmax) as the true lag length for VAR estimation. Eventually, MWALD procedure is conducted to examine causality. A three variable (say, a, b, c) model employing the seemingly unrelated regression (SURE) framework to estimate VAR(11) is given below-

$$\begin{bmatrix} a_t \\ b_t \\ c_t \end{bmatrix} = \beta_o + \beta_1 \begin{bmatrix} a_{t-1} \\ b_{t-1} \\ c_{t-1} \end{bmatrix} + \beta_2 \begin{bmatrix} a_{t-2} \\ b_{t-2} \\ c_{t-2} \end{bmatrix} + \cdots \beta_{10} \begin{bmatrix} a_{t-10} \\ b_{t-10} \\ c_{t-10} \end{bmatrix} + \begin{bmatrix} a_{t-11} \\ b_{t-11} \\ c_{t-11} \end{bmatrix} + \begin{bmatrix} ua_t \\ ub_t \\ uc_t \end{bmatrix}$$

To test c_t does not causea_t, the null hypothesis is stated as:

$$H_0 = \beta_{12}^{(1)} = \beta_{12}^{(2)} = 0 \qquad \text{Alternatively,} \quad H_1 = \beta_{12}^{(1)} \neq \beta_{12}^{(2)} \neq 0$$

Where $\beta_{12}^{(i)}$ are the coefficients of $a_{t-i}, i = 1, 2.$

3. Empirical Results& Analysis

3.1 Unit Roots and Cointegration Test

The result of Augmented Dickey-Fuller (ADF) test shows that variables are in different order of integration, as null hypothesis of "unit root or I(1) is rejected at both 5 and 1 percent level for both DGENR and MFR, they are stationary or I(0) at level i.e., no constant no trend, with constant but no trend, with both constant and trend. All the variables are stationary or I(0) at first difference level (See Table 2).

Johansen cointegration test result is conducted with the variables of same order of integration and found they are cointegrated to maximum order of 1. Both of the test statistics 'Trace' and 'Max-Eigen' are significant at 1 percent level (See Table 3).

Table 2.Result of Augmented Dickey-Fuller (ADF) Test of Stationarity

Variables	No constant, no trend		Constant, No trend		Constant, with trend		First Difference, no trend	
	t statistic	p-value	t statistic	p-value	t statistic	p-value	t statistic	p-value
DGENR	-26.4212	0.0000**	-26.66629	0.0000**	-26.9398	0.0000**	-22.50565	0.0000**
DGENTO	0.063315	0.7026	-0.799432	0.8181	-2.744293	0.2191	-27.25867	0.0000**
MFR	-20.71369	0.0000**	-20.77571	0.0000**	-20.79135	0.0000**	-20.45967	0.0000**
MFTO	-1.145677	0.2298	-5.402196	0.0000**	-5.503467	0.0000**	-23.95289	0.0000**

Note: 1) Null hypothesis of ADF test is "Series has a unit root"

2) ** means Null hypothesis is rejected at 1 percent level

*means Null hypothesis is rejected at 5 percent level

Table 3. Result of Johansen Cointegration Test

No. of Cointegrations	Trace Statistics	Critical Value (5%)	P-Value	Max-Eigen Statistics	Critical Value (5%)	P-Value
None	148.7891	15.49471	0.0001	79.05647	14.2646	0.0000
At most 1	69.73267	3.841466	0.0000	69.73267	3.841466	0.0000

Notes: a) The first column represents the number of cointegrating vectors

b) The P-value is from MacKinnon *et al.* (1999)

Sequential modified Likelihood Ratio test statistic shows that optimal lag length should be 09 (See Annex-02**).** Once the true lag length is determined VAR model is estimated and VAR residual serial correlation test is performed. At lag 09, there is no serial correlation and VAR model is dynamically stable (See Annex-03: Inverted Root of AR Characteristic Polynomial). Finally, VAR estimation is conducted with augmented lag of 10 (the true lag length, k=9 with the maximum order of integration, dmax=1) and MWALD procedure is conducted to examine causality and direction of causality.

3.2. Hypothesis Testing and Analysis

Hypothesis 01: There is no causality between MFR and DGENR

Result 01: Unidirectional causality exists from MFR to DGENR. It means mutual funds' return contain useful information to explain the behavior of DSE (Dhaka Stock Exchange) general index return. Mutual funds work as capital market correction agents as they are managed by professionals and relatively risk averse and persistent investors invest in it. This particular unidirectional causal relationship signifies that mutual funds are effective market correction tool **(**See Annex 1**).**

Hypothesis 02: There is no causality between DGENTO and DGENR

Result 02: Bidirectional causality is found between DGENTO and DGENR which proclaims that both DSE general index turnover and DSE return contain useful information to forecast the value of each other. High share turnover reflects the liquidity of the market and raises the demand for shares. Higher demand therefore causes share prices to rise and eventually return from shares ascends. Hence, in this case higher share turnover is causing return to leap. On the other hand, any event that changes the fundamental value of share i.e. release of price sensitive information make investors to react immediately to those news which eventually raise the share turnover. Therefore, in this case share return is causing higher share turnover.

Hypothesis 03: There is no causality between MFTO and DGENR

Result 03: There is no causal relationship is found between MFT and DGENR. It indicates that neither mutual funds' turnover nor DSE general index return can be used to forecast the behavior of each other.

Hypothesis 04: There is no causality between MFR and MFTO

Result 04: Unidirectional causal relationship exists moving from MFR to MFTO which reflects mutual funds' return can explain the variation of mutual funds' turnover. When the underlying value of mutual funds (NAVs) changes, market incorporates that information; as a result, share price of mutual funds changes in line with the revealed information.

Hypothesis 05: There is no causality between MFR and DGENTO

Result 05: There exist no causality between MFR and DGENTO which indicates neither mutual funds' return nor DSE general index turnover contain useful information to influence the value of each other.

Hypothesis 06: There is no causality between DGENTO and MFTO

Result 06: Unidirectional causality is found moving from DGENTO to MFTO which suggests that general share turnover contains useful information to predict the movement of mutual funds' turnover. This particular causal relationship could be explained from supply and demand viewpoint. High turnover of DSE general index reflects the liquidity of the market and indicates demand pressure, small number of listed shares in the capital markets of Bangladesh could hardly satisfy that demand and a spillover effect of the higher demand fall over mutual funds that eventually raise the turnover of mutual funds too.

4. Conclusion

This paper has investigated the dynamics of mutual fund in relation to stock market using daily data of four variables– DSE general index return, DSE general index turnover, mutual funds' return and mutual funds' turnover. Augmented Dickey-Fuller (ADF) unit root test showed that variables are in different order of integration. Johansen cointegration test showed that DSE general index return and mutual funds' return are cointegrated. Toda-Yamamoto (TY) version of granger non-causality test is employed and bidirectional causality is found moving DSE general index turnover to DSE general index return, whereas unidirectional causality is fond moving from mutual fund's return to DSE general index return, mutual funds' return to mutual funds' turnover, and DSE general index turnover to mutual funds' turnover. This finding helps to conclude that being a corrective agent in the capital market mutual funds return effectively controls market return. Investors respond to the changes in the underlying value of mutual funds, besides they are not attracted to mutual funds unless any positive externality of the market force–higher demands for general shares–drives the demand of mutual fund.

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Annex-01:

Shows the Result of Causality

Dependent variable: DGENR			
Excluded	**Chi-sq**	**df**	**Prob.**
MFR	18.91428	9	0.0259*
DGENTO	27.11114	9	0.0013**
MFTO	12.81565	9	0.1711
All	65.48625	27	0.0000**
Dependent variable: MFR			
Excluded	**Chi-sq**	**df**	**Prob.**
DGENR	8.815824	9	0.4544
DGENTO	14.61203	9	0.1022
MFTO	8.577275	9	0.4772
All	33.28927	27	0.1877
Dependent variable: DGENTO			
Excluded	**Chi-sq**	**df**	**Prob.**
DGENR	18.80780	9	0.0269*
MFR	14.74391	9	0.0982
MFTO	10.09689	9	0.3427
All	61.77447	27	0.0002**
Dependent variable: MFTO			
Excluded	**Chi-sq**	**df**	**Prob.**
DGENR	5.828437	9	0.7570
MFR	34.67410	9	0.0001**
DGENTO	22.18012	9	0.0083**
All	59.49814	27	0.0003**

Note: ** denotes rejection of the hypothesis of no causality at the 0.01 level.
* denotes rejection of the hypothesis of no causality at the 0.05 level.

Shows the Direction of Causality

Direction of Causality		
MFR	⟶	DGENR
DGENTO	⟷	DGENR
MFTO	~	DGENR
DGENR	~	MFR
DGENTO	~	MFR
MFTO	~	MFR
DGENR	~	DGENTO
MFR	~	DGENTO
MFTO	~	DGENTO
DGENR	~	MFTO
MFR	⟶	MFTO
DGENTO	⟶	MFTO

Note: Arrow (⟶) indicates the direction of causality and Tilde (~) indicates no causal relationship.

Annex-02: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: DGENR DGENTO MFR MFTO
Exogenous variables: C
Date: 10/12/12 Time: 16:12
Sample: 1/02/2008 12/30/2010
Included observations: 292

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-12773.09	NA	1.89e+24	67.24784	67.28932	67.26430
1	-11994.11	1537.470	3.40e+22	63.23213	63.43951*	63.31442
2	-11948.85	88.37236	2.91e+22	63.07814	63.45142	63.22626
3	-11907.02	80.79519	2.54e+22	62.94220	63.48138	63.15615*
4	-11891.46	29.72267	2.55e+22	62.94453	63.64962	63.22431
5	-11869.95	40.64425	2.48e+22	62.91553	63.78651	63.26114
6	-11850.25	36.80119	2.43e+22*	62.89607*	63.93296	63.30751
7	-11838.45	21.81119	2.49e+22	62.91814	64.12093	63.39542
8	-11827.13	20.67224	2.55e+22	62.94278	64.31147	63.48588
9	-11809.22	32.33269*	2.53e+22	62.93273	64.46732	63.54166
10	-11794.71	25.88282	2.55e+22	62.94059	64.64108	63.61535

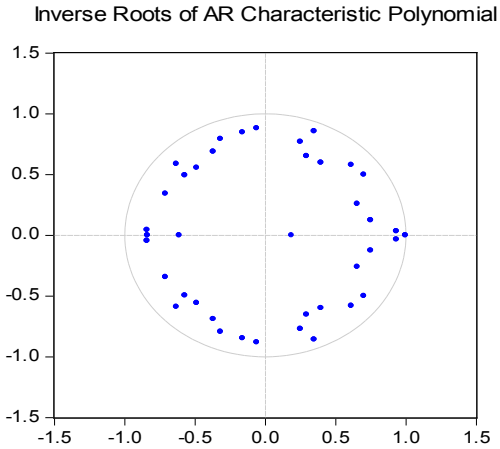
* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Annex-03: Roots of Characteristic Polynomial

Roots of Characteristic Polynomial
Endogenous variables: DGENR DGENTO MFR MFTO
Exogenous variables: C
Lag specification: 1 9
Date: 10/23/12 Time: 20:24

Root	Modulus	Root	Modulus
0.993508	0.993508	0.789195 + 0.222452i	0.819947
0.909486 - 0.014987i	0.909610	0.789195 - 0.222452i	0.819947
0.909486 + 0.014987i	0.909610	-0.752108 + 0.291806i	0.806733
-0.056015 + 0.892584i	0.894340	-0.752108 - 0.291806i	0.806733
-0.056015 - 0.892584i	0.894340	-0.366857 + 0.709073i	0.798354
0.346371 + 0.820041i	0.890191	-0.366857 - 0.709073i	0.798354
0.346371 - 0.820041i	0.890191	-0.120334 + 0.775833i	0.785110
-0.582592 - 0.619311i	0.850271	-0.120334 - 0.775833i	0.785110
-0.582592 + 0.619311i	0.850271	-0.576561 + 0.450027i	0.731401
0.500386 - 0.683349i	0.846966	-0.576561 - 0.450027i	0.731401
0.500386 + 0.683349i	0.846966	0.530263 - 0.495997i	0.726080
-0.838566 - 0.074628i	0.841880	0.530263 + 0.495997i	0.726080
-0.838566 + 0.074628i	0.841880	0.217167 - 0.690330i	0.723683
0.638563 - 0.532330i	0.831347	0.217167 + 0.690330i	0.723683
0.638563 + 0.532330i	0.831347	0.081910 + 0.670207i	0.675194
-0.422038 - 0.711802i	0.827513	0.081910 - 0.670207i	0.675194
-0.422038 + 0.711802i	0.827513	-0.548009 + 0.078778i	0.553642
0.826990	0.826990	-0.548009 - 0.078778i	0.553642

No root lies outside the unit circle.
VAR satisfies the stability condition.



Graph 1: Inverse Roots of AR Characteristics Polynomial