Forecasting of Agricultural Loan in Bangladesh

Md.Mosfiqur Rahman , Masuma Parvin , Sayedul Anam , M.A Rubi

Abstract*: The agriculture sector is important to meet up the challenges of twentieth century in Bangladesh. It has huge contribution to our life. This sector secures the food security, export earnings and poverty reduction (Agricultural and MSME finance'2017, BB). In this paper, we forecast the agricultural loan disbursement, overdue and recovery in Bangladesh. Moreover, we have discussed the flaw of loan disbursement, recovery and overdue and that of the way out.

***Keywords* : Time series, ARIMA, ACF, PACF, ADF, Stationary, Autoregressive, Moving average.**

I. INTRODUCTION

Bangladesh is a country freed in 1971 and after that developing gradually based on agriculture mostly. It has great impact on economy. Majority percent people depend on agriculture directly or indirectly in Bangladesh. The most significant part of gross domestic income comes from the agriculture sector. Currently the contributing rate of agriculture sector to GDP is 14.8 percent and almost 47 percent of labor force employment depending on this sector (Agricultural and MSME finance'2017, BB). Moreover, this sector provides raw material for micro, medium and small industries (Agricultural and MSME finance'2017, BB). So agriculture sector plays a vital role for the development to it's inter connected sector with the remaining part of the economy. Recently the advancement of technology that is introduced to agriculture contributed to its revolutionary production in agriculture sector. But in Bangladesh farmers are not capable to occupy with the advanced technology without the financial support from government as well as private sector. If they are facilitated with the enough financial support it will be easier to uphold the growth of agricultural product in our economy.

As the sector is key fact to achieve the target of self-sufficiency in food production, Bangladesh government has prioritized the agriculture sector. In line with the Bangladesh government, Different Banks and private sectors are making their proactive policy and support to boost up agricultural production. Banks are formulating agricultural loan policy and program accordingly.

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II. LITERATURE REVIEW

The existing procedure in financial institution is procrastinating for the disbursement of loan in Bangladesh. A farmer need to go through a long term process to avail the loan disbursement opportunity in a bank. Long term process in disbursement is a bar to secure agricultural loan. Ruhul Amin Sarker (2006) did a research work where he mentioned that the main impediment in securing loan disbursement is from institutional source recorded by 90 percent farmers. On the other hand bankers are interested to disburse loan to urban areas rather than in rural areas. The ratio of loan-deposit in urban areas is near about 85 percent that is 20 percent more than in rural areas (The Jahangirnagar economic review'2014). There is a shortage of banking operation in rural areas. The banking operation has not spread out adequately in rural areas. As a result the disbursement of agriculture loan from different banks is not quite enough for the farmers especially for medium and large farmers. The argument is accepted by farmers stated a survey (Farmers' credit survey, Sarker et al. 2006; Matias & Sousa, 2017; Nurgaliyeva et al., 2018). Moreover trivial cooperation has identified as another problems in getting bank loan.

Banking loan rules is one of others obstacle for small and marginal farmers for getting loan. Loan rule are designed very complicatedly that is not apprehended by most of the farmers. A survey conducted by (Ruhul Amin Sarker'2006; Rabbani et al., 2014) showed that 79.2 percent very small farmer in which 82.9 percent identifies the loan rules are difficult to avail the loan from bank and 78 percent of all farmers think same. Alam (1981) categorized four types of non-interested cost of bank loan such as (a) application fees, stamp and documents required in support of loan (b) form filling and writing (c) cost of traveling for loan negotiation (d) cost of entertaining people who assisted in loan negotiation.

To overcome the problems banks should be cooperative and participation among different banks should be ensured. The payment procedure of interest and principal should be readjusted. To increase the recovery rate of loan and to minimize the overdue rate of loan strict supervision is needed very badly from the lender side. Monitoring system must be expanded (Rahman'2010; Rahman'2009). Strict monitoring and supervision is therefore needed by central bank to reduce the tendency of mismanagement in disbursing loan and recovery system. If it is monitored in a proper way overdue of loan will be reduced automatically. Although disbursing rate of loan is increased yearly in amount but it is not enough for increasing demand. After disbursement time loan recovery must be proportional to disbursement to avoid the increasing rate of overdue loan.

III. METHODOLOGY

At the point when a time series isn't stationary, more often than not differencing tasks are connected at the suitable lag with the end goal to accomplish stationary.

IV. RESULTS AND DISCUSSION

The data that are used in this research is collected from the 'Bangladesh Bank' (https://www.bb.org.bd/pub/publictn.php). In this study, we want to forecast agricultural loan disbursement, recovery and overdue. The yearly data of agricultural loan are given in Data table.

Data Table: Yearly agricultural loan data (N [N], 'billion BDT').

Year	Disbursement	Recovery	Overdue
2017	209.99	188.41	67.08
2016	176.46	170.56	56.78
2015	159.78	154.07	67.29
2014	160.37	170.46	76.12
2013	146.67	143.62	52.09
2012	131.32	123.59	60.52
2011	121.84	121.48	60.97
2010	111.17	101.12	64.04
2009	92.84	83.77	60.8
2008	75.348	53.84	59.43
2007	52.92	46.76	66.35
2006	57.89	41.24	65.99
2005	49.56	31.711	57.81
2004	40.48	31.35	62.64
2003	32.78	35.16	65.26
2002	29.55	32.59	67.54
2001	30.19	28.77	67.95
2000	28.51	29.96	64.58
1999	30.06	19.16	53.99
1998	16.43	16.99	54.89
1997	15.17	15.94	53.12
1996	14.18	12.73	49.2
1995	14.9	11.24	44.9
1994	11	9.79	42.03
1993	8.42	8.69	38.54
1992	7.94	6.62	35.72
1991	5.95	6.25	39.33
1990	6.86	7.01	32.84
1989	88.07	5.78	23.55
1988	6.56	5.95	19.32
1987	6.67	11.07	15.75
1986	6.31	6.07	17.78
1985	11.53	5.84	11.58
1984	10.05	5.17	7.55
1983	6.78	3.42	4.56

V. FORECASTING AGRICULTURAL LOAN

The Agricultural loan disbursement

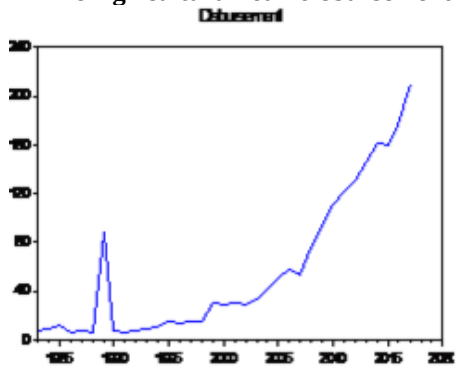

Figure 1: Time graph of loan disbursement

Null Hypothesis: DISBURSEMENT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.442545	0.9819
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

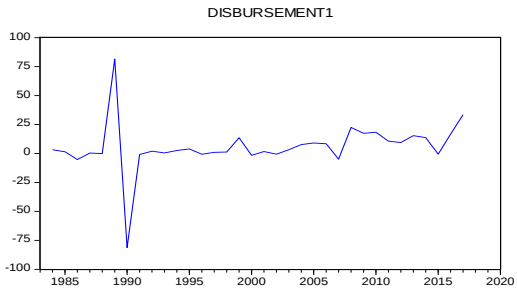

Figure 2: Lag1 of loan disbursement

Table-2: Lag1 table of loan disbursement data

Null Hypothesis: DISBURSEMENT1 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-8.061262	0.0000
Test critical values:	1% level		-3.646342	
	5% level		-2.954021	
	10% level		-2.615817	
*MacKinnon (1996) one-sided p-values.				

Table-3: Correlogram table for ACF and PC

Date: 10/02/18 Time: 23:40
Sample: 1983 2020
Included observations: 34

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.361	-0.361	4.8277	0.028
		2	0.018	-0.129	4.8403	0.089
		3	0.027	-0.014	4.8696	0.182
		4	0.083	0.107	5.1506	0.272
		5	0.048	0.145	5.2463	0.387
		6	0.067	0.176	5.4426	0.488
		7	0.023	0.139	5.4661	0.603
		8	0.027	0.093	5.4995	0.703
		9	-0.030	-0.020	5.5425	0.785
		10	0.067	-0.000	5.7691	0.834
		11	-0.007	-0.038	5.7716	0.888
		12	0.011	-0.045	5.7783	0.927
		13	-0.029	-0.080	5.8268	0.952
		14	-0.032	-0.118	5.8909	0.969
		15	-0.023	-0.124	5.9259	0.981
		16	-0.020	-0.115	5.9529	0.989

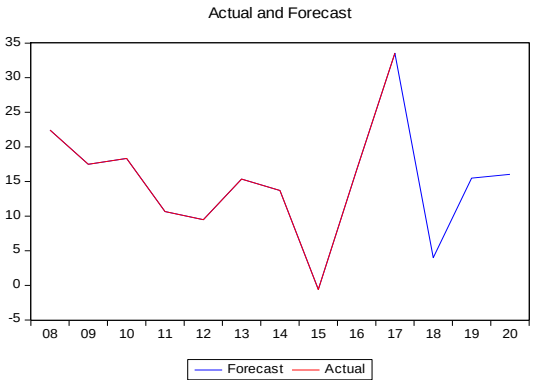

Figure 4: Forecasted graph of loan disbursemen

Automatic ARIMA Forecasting
Selected dependent variable: D(DISBURSEMENT1)
Date: 10/03/18 Time: 21:54
Sample: 1983 2020
Included observations: 33
Forecast length: 0

Number of estimated ARMA models: 25
Number of non-converged estimations: 0
Selected ARMA model: (0,2)(0,0)
AIC value: 7.79177862209

Dependent Variable: D(DISBURSEMENT1)
Method: ARMA Maximum Likelihood (BFGS)
Date: 10/03/18 Time: 21:54
Sample: 1985 2017
Included observations: 33
Convergence achieved after 43 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.546990	0.229916	2.379084	0.024 2
MA(1)	-1.678808	87.60015	-0.01916 4	0.984 8
MA(2)	0.678809	64.47233	0.010529	0.991 7
SIGMA SQ	299.3663	14659.67	0.020421	0.983 8

Model Selection Criteria Table
Dependent Variable: D(DISBURSEMENT1)
Date: 10/03/18 Time: 21:54
Sample: 1983 2020
Included observations: 33

Model	LogL	AIC*	BIC	HQ
(0,2)(0,0)	-144.043794	7.791779	7.964156	7.853109
(0,3)(0,0)	-144.035322	7.843964	8.059436	7.920628
(1,2)(0,0)	-144.035914	7.843995	8.059467	7.920659
(2,1)(0,0)	-144.809993	7.884736	8.100208	7.961400
(1,1)(0,0)	-146.006630	7.895086	8.067463	7.956416
(2,2)(0,0)	-144.026224	7.896117	8.154683	7.988113
(0,4)(0,0)	-144.027802	7.896200	8.154766	7.988196
(1,3)(0,0)	-144.032852	7.896466	8.155032	7.988462
(3,1)(0,0)	-144.177136	7.904060	8.162626	7.996056
(3,2)(0,0)	-144.018158	7.948324	8.249985	8.055653
(2,3)(0,0)	-144.034751	7.949197	8.250858	8.056526
(4,1)(0,0)	-144.051090	7.950057	8.251718	8.057386
(4,2)(0,0)	-143.891004	7.994263	8.339018	8.116925
(3,3)(0,0)	-144.014076	8.000741	8.345496	8.123402
(0,1)(0,0)	-149.218911	8.011522	8.140805	8.057520
(4,3)(0,0)	-144.015185	8.053431	8.441280	8.191425
(4,4)(0,0)	-143.587776	8.083567	8.514511	8.236894
(4,0)(0,0)	-147.799696	8.094721	8.353287	8.186717
(3,0)(0,0)	-149.663080	8.140162	8.355634	8.216825
(2,0)(0,0)	-152.421990	8.232736	8.405114	8.294067
(1,0)(0,0)	-156.227186	8.380378	8.509661	8.426376
(0,0)(0,0)	-164.763848	8.777045	8.863233	8.807710
(1,4)(0,0)	-164.856897	9.045100	9.346760	9.152428
(2,4)(0,0)	-164.844606	9.097085	9.441839	9.219746
(3,4)(0,0)	-164.846813	9.149832	9.537682	9.287826

Table 4: Regression co-efficient

Hence, the fitted ARIMA (2, 1, 0) model and the forecasting graph (**Fig-4**) can be stated as follows: $y_t = 0.546990 - 1.678808\mu_t + 0.678809\mu_{t-1}$

The Overdue loan

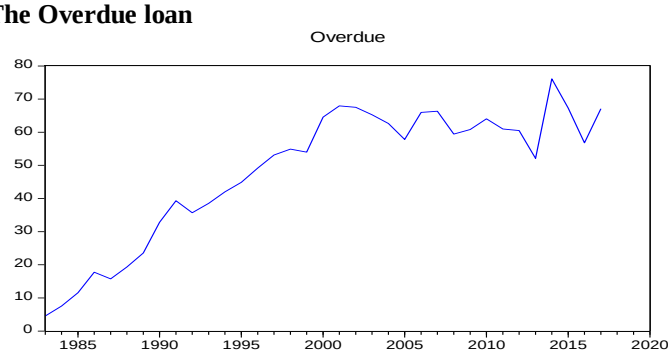

Figure 5: Time graph of overdue loan

Null Hypothesis: OVERDUE has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.886277	0.0581
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

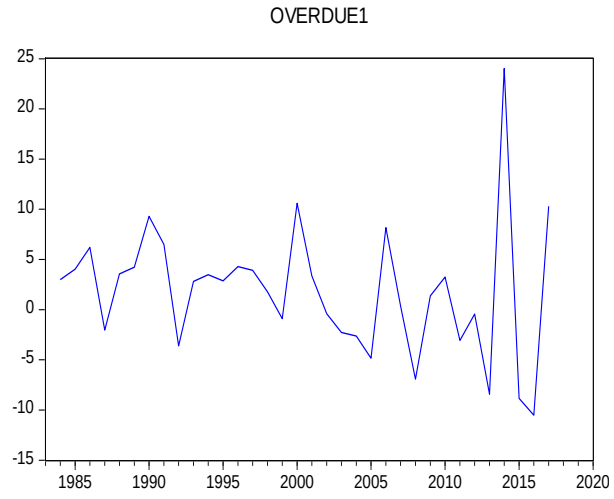

Table 5: Lag1 table of overdue data

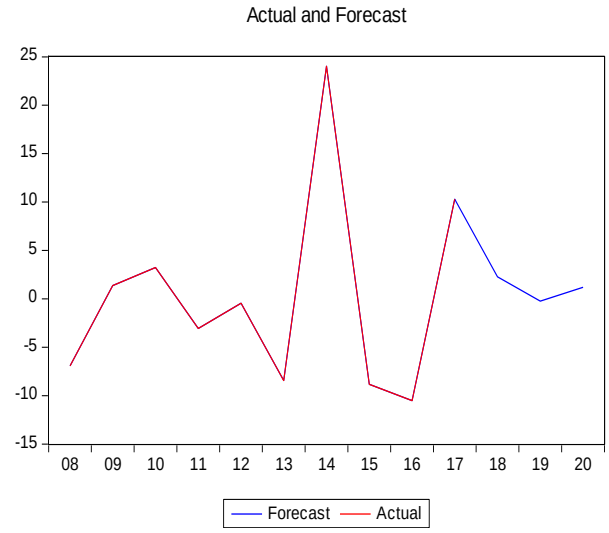

Figure 7: Forecasted graph of overdue loan

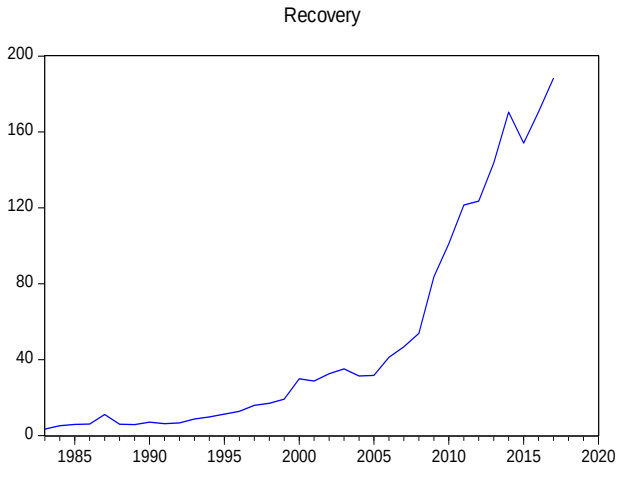

Figure 8: Time graph of loan recovery

Null Hypothesis: RECOVERY has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		3.161694	1.0000
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

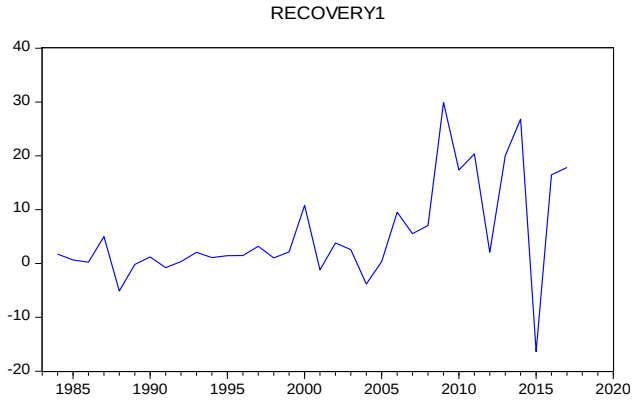

Figure 9: Lag1 graph of loan recovery

Table-8: Lag1 table of loan recovery

Null Hypothesis: RECOVERY1 has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.450644	0.5447
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

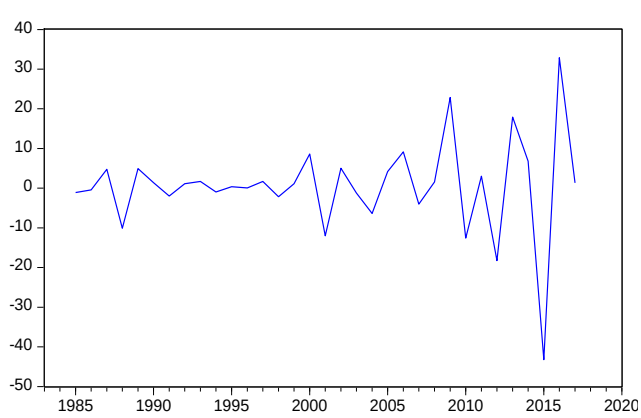

Figure 10: Lag2 graph of loan recovery

Table-9: Lag2 table of loan recovery

Null Hypothesis: D(RECOVERY2) has a unit root

Exogenous: Constant

Lag Length: 3 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.163520	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Table-10: Correlogram table for ACF and PC

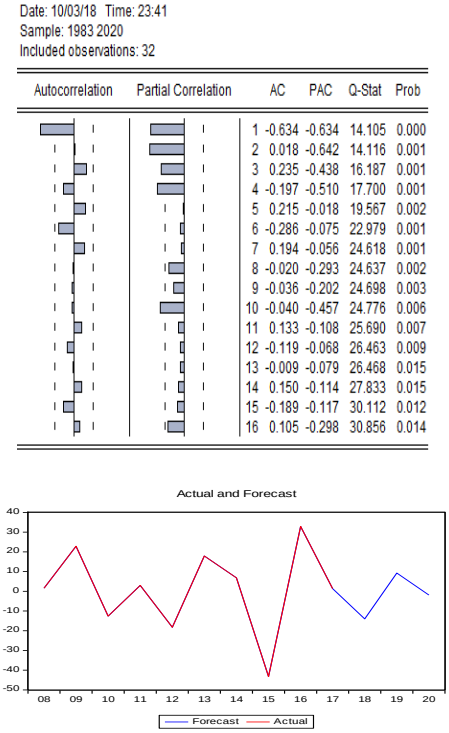

Figure 11: Forecasted graph of loan recovery

Automatic ARIMA Forecasting

Selected dependent variable: RECOVERY2

Date: 10/03/18 Time: 23:47

Sample: 1983 2017

Included observations: 33

Forecast length: 3

Number of estimated ARMA models: 25

Number of non-converged estimations: 0

Selected ARMA model: (0,4)(0,0)

AIC value: 6.59922717625

Table-11: Regression Co-efficient

Model Selection Criteria Table
Dependent Variable: RECOVERY2
Date: 10/03/18 Time: 23:47
Sample: 1983 2017
Included observations: 33

Model	LogL	AIC*	BIC	HQ
(0,4)(0,0)	-109.486476	6.599227	6.865858	6.691268
(1,4)(0,0)	-109.431207	6.653212	6.964281	6.760593
(2,4)(0,0)	-109.395721	6.708327	7.063835	6.831048
(3,4)(0,0)	-109.395703	6.765469	7.165415	6.903530
(4,4)(0,0)	-109.369187	6.821096	7.265482	6.974498
(4,3)(0,0)	-111.041799	6.859531	7.259478	6.997593
(2,3)(0,0)	-113.327944	6.875883	7.186952	6.983264
(3,3)(0,0)	-112.405763	6.880329	7.235837	7.003051
(4,2)(0,0)	-112.475388	6.884308	7.239816	7.007029
(2,2)(0,0)	-114.500041	6.885717	7.152348	6.977758
(3,2)(0,0)	-113.739504	6.899400	7.210470	7.006781
(0,1)(0,0)	-117.923824	6.909933	7.043248	6.955953
(4,1)(0,0)	-114.140221	6.922298	7.233368	7.029680
(1,2)(0,0)	-116.150865	6.922907	7.145099	6.999607
(1,3)(0,0)	-115.223300	6.927046	7.193677	7.019087
(2,0)(0,0)	-117.228006	6.927315	7.105069	6.988675
(0,2)(0,0)	-117.760686	6.957754	7.135508	7.019114
(1,1)(0,0)	-117.778835	6.958791	7.136545	7.020151
(2,1)(0,0)	-117.133348	6.979048	7.201241	7.055749
(3,0)(0,0)	-117.138665	6.979352	7.201545	7.056053
(4,0)(0,0)	-117.084432	7.033396	7.300027	7.125437
(3,1)(0,0)	-117.132356	7.036135	7.302766	7.128176
(0,3)(0,0)	-119.383690	7.107639	7.329832	7.184340
(1,0)(0,0)	-124.485528	7.284887	7.418203	7.330908
(0,0)(0,0)	-129.368412	7.506766	7.595643	7.537447

Dependent Variable: RECOVERY2

Method: ARMA Maximum Likelihood (BFGS)

Date: 10/03/18 Time: 23:47

Sample: 1985 2017

Included observations: 33

Failure to improve objective (non-zero gradients) after 76 iterations

Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.410885	0.200009	2.054339	0.0497
MA(1)	-0.990055	2791.294	-0.000355	0.9997
MA(2)	1.72E-07	4915.463	3.50E-11	1.0000
MA(3)	0.990052	4609.508	0.000215	0.9998
MA(4)	-0.999996	7472.441	-0.000134	0.9999
SIGMASQ	33.20190	10573.65	0.003140	0.9975

Hence, the fitted ARIMA (4, 2, 0) model and the forecasting graph (Fig-11) can be stated as follows:

$$y_t = 0.410885 - 0.990055\mu_t + 1.72E-07\mu_{t-1} + 0.99005214\mu_{t-2} - 0.999996\mu_{t-3}$$

Finally the fitted ARIMA (2, 1, 0) for the loan disbursement calculated the forecasted loan disbursement that is gradually increasing in amount but the fitted ARIMA (4, 2, 0) for loan recovery forecasting the declining rate of loan recovery to the disbursement that leads the fitted ARIMA (3, 1, 0) for overdue rate calculating the forecasted value of overdue rate is scattered.

VI. CONCLUSION

Exploring the current scenario of agricultural loan in Bangladesh is the main purpose of this study and to identify the liable reason for the growth of agricultural loan in Bangladesh mathematically. Analyzing the data above it is obvious that there are no harmony among loan disbursement, recovery and overdue. Huge difference is observed in between loan disbursement and recovery. Data simulation showing the loan disbursement gradually increasing but at the same time recovery of loan is gradually decreasing. To achieve great success in this sector it is mandatory to keep balance among these factors disbursement, recovery and overdue loan.

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