Forecasting Covid-19 New Cases in Antigua and Barbuda

[1]**Dr. Smartson. P. NYONI,** [2]**Mr. Thabani NYONI,** [3]**Mr. Tatenda. A. CHIHOHO**

[1]ZICHIRe Project, University of Zimbabwe, Harare, Zimbabwe
[2]SAGIT Innovation Center, Harare, Zimbabwe
[3]Independent Health Economist, Harare, Zimbabwe

Abstract - **Due to the rapid spread of COVID-19 around the globe, governments continue to be compelled to swiftly find solutions to reduce infections rates and keep mortality as low as possible. In the current study, the ANN approach was applied to analyze daily COVID-19 cases in Antigua and Barbuda. This study is based on daily new cases of COVID-19 in Antigua Barbuda for the period 1 January 2020 – 25 March 2021. The out-of-sample forecast covers the period 26 March 2021 – 31 July 2021. The residuals and forecast evaluation criteria (Error, MSE and MAE) of the applied model show us that the model is stable and therefore adequate. The results of the study show that daily COVID-19 cases in Antigua and Barbuda are likely to remain low over the out-of-sample period. The government of Antigua and Barbuda should ensure the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on, in line with WHO stipulated guidelines.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The first case of coronavirus disease (COVID-19) was discovered in November in China, in a person living in Wuhan, the capital city of the country's Hubei province (Bolano-Ortiz *et al.*, 2020). Despite the fact that the origin of the virus is still questionable (Konarasinghe, 2020), early stages of COVID-19 have been linked to live animal seafood market in Wuhan; pointing to a zoonotic origin of the pandemic (Chowell *et al.*, 2020). COVID-19 produces mild symptoms in most people (fever, cough, sore throat, and difficulty breathing) but can lead to severe respiratory illness and death (Dantas *et al.*, 2020). The disease is highly contagious, and it is contracted through respiratory droplets originating from an infected person (CDC, 2020). Forecasting daily confirmed COVID-19 cases in Antigua and Barbuda is an essential empirical exercise that will go a long way in assisting policy makers in anticipating the requirement of healthcare resources and to save human lives and also helps in understanding the fast spread of COVID-19 in the country. The main of this paper is to forecast daily COVID-19 cases in Antigua and Barbuda.

II. METHODOLOGY

The Artificial Neural Network (ANN) approach, which is flexible and capable of nonlinear modeling; will be applied in this study. The ANN is a data processing system consisting of a large number of highly interconnected processing elements in architecture inspired by the way biological nervous systems of the brain appear like. Since no explicit guidelines exist for the determination of the ANN structure, the study applies the popular ANN (12, 12, 1) model based on the hyperbolic tangent activation function. This paper applies the Artificial Neural Network (ANN) approach in predicting new COVID-19 cases Antigua Barbuda.

Data Issues

This study is based on daily new cases of COVID-19 in Antigua Barbuda for the period 1 January 2020 – 25 March 2021.The out-of-sample forecast covers the period 26 March 2021 – 31 July2021.All the data employed in this research paper was gathered from the Johns Hopkins University (USA).

III. FINDINGS OF THE STUDY

ANN Model Summary

Table 1: ANN model summary

Variable	AB
Observations	438 (After Adjusting Endpoints)
Neural Network Architecture:	
Input Layer Neurons	12
Hidden Layer Neurons	12
Output Layer Neurons	1
Activation Function	Hyperbolic Tangent Function
Back Propagation Learning:	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.080863
MSE	13.903004
MAE	2.081421

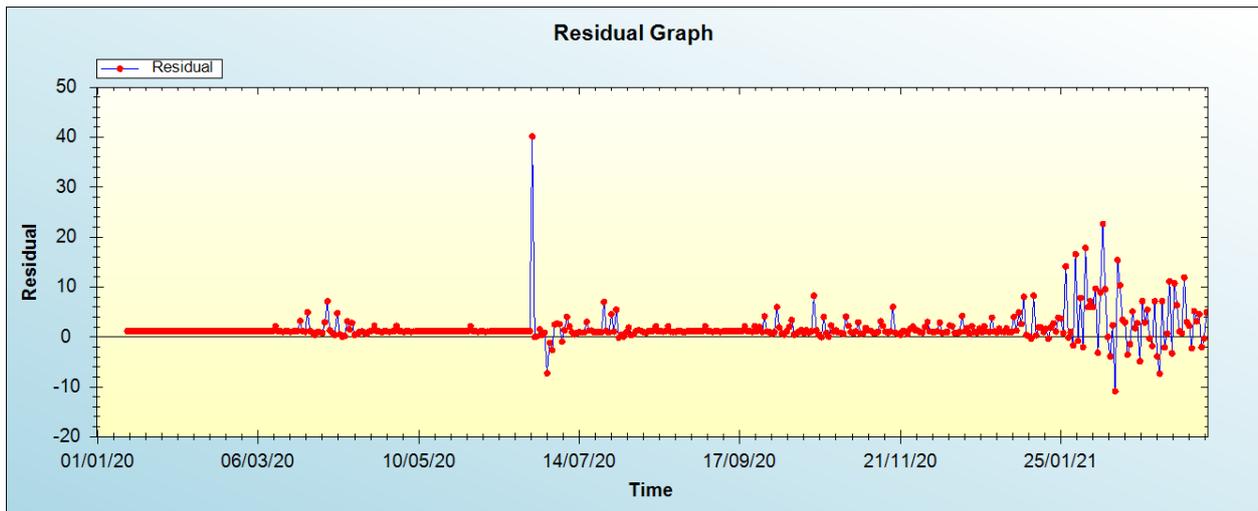*Residual Analysis for the Applied Model*

Figure 1: Residual analysis
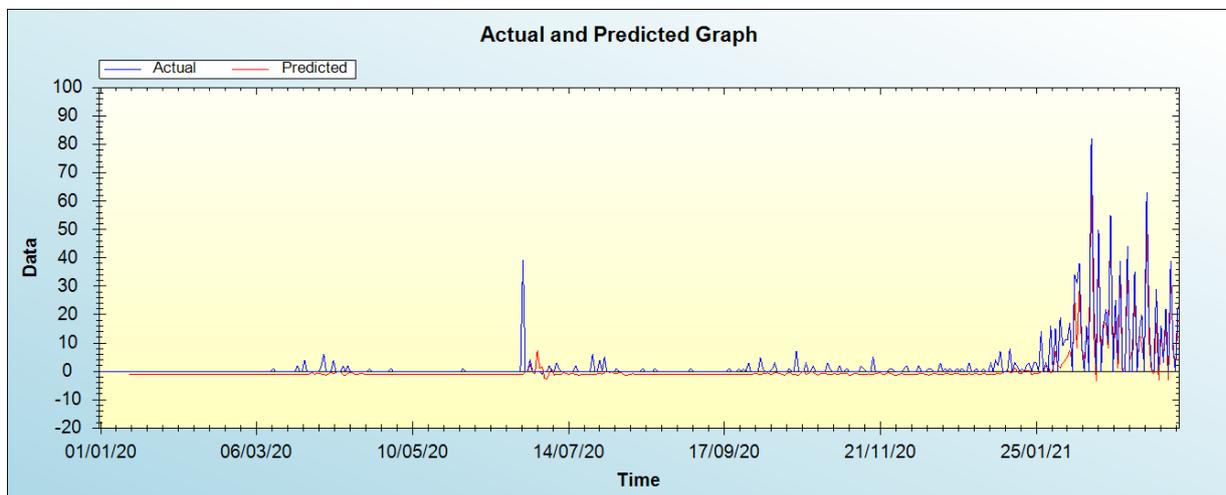
In-sample Forecast for AB

Figure 2: In-sample forecast for the AB series

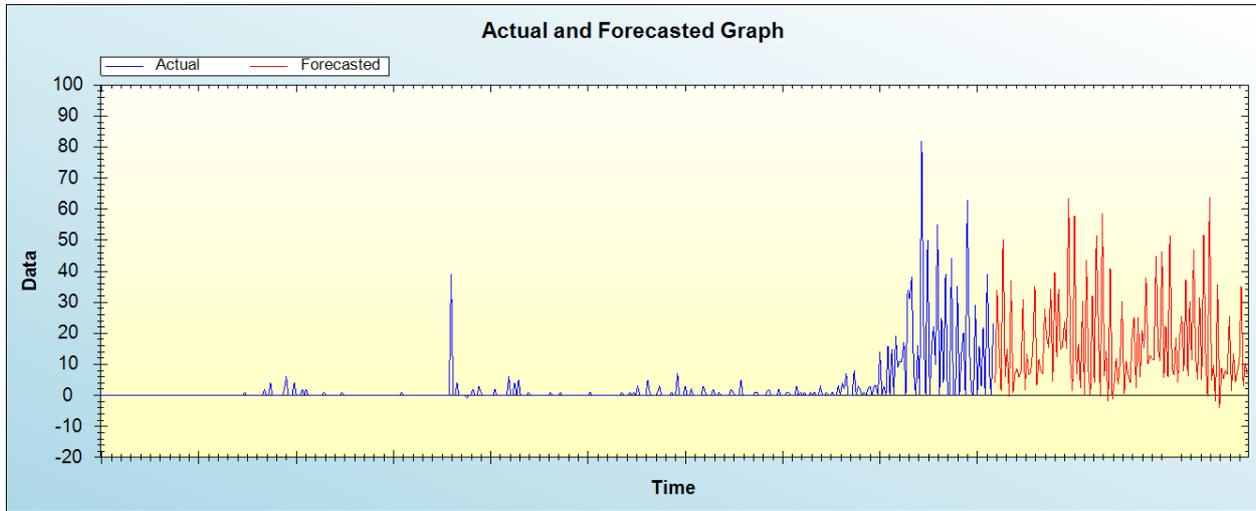*Out-of-Sample Forecast for AB: Actual and Forecasted Graph*

Figure 3: Out-of-sample forecast for AB: actual and forecasted graph

Out-of-Sample Forecast for AB: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	4.0819
27/03/21	33.8263
28/03/21	15.2588
29/03/21	1.4114
30/03/21	50.2053
31/03/21	6.0370
01/04/21	14.8639
02/04/21	-0.2794
03/04/21	36.9182
04/04/21	0.7923
05/04/21	6.8517
06/04/21	8.5444
07/04/21	5.8873
08/04/21	7.8457
09/04/21	30.9231
10/04/21	1.8261
11/04/21	13.3091
12/04/21	6.7248
13/04/21	7.4846
14/04/21	15.0585
15/04/21	35.1803
16/04/21	3.1949
17/04/21	11.5704
18/04/21	7.9008
19/04/21	7.0414
20/04/21	27.7606
21/04/21	18.8304
22/04/21	15.4730
23/04/21	34.1782
24/04/21	4.5785
25/04/21	39.8008
26/04/21	12.3478
27/04/21	34.2181
28/04/21	14.7535
29/04/21	15.9648
30/04/21	23.5193
01/05/21	14.9802

02/05/21	63.5890
03/05/21	10.4697
04/05/21	1.3012
05/05/21	57.7929
06/05/21	6.8844
07/05/21	16.5494
08/05/21	2.5205
09/05/21	30.1494
10/05/21	0.1200
11/05/21	43.5897
12/05/21	8.2075
13/05/21	0.2024
14/05/21	32.2050
15/05/21	4.2166
16/05/21	51.5750
17/05/21	21.6862
18/05/21	-0.3425
19/05/21	58.7047
20/05/21	6.4217
21/05/21	14.1905
22/05/21	-1.8259
23/05/21	40.8052
24/05/21	-1.3716
25/05/21	4.5348
26/05/21	12.0172
27/05/21	3.5283
28/05/21	10.8639
29/05/21	30.1470
30/05/21	0.5452
31/05/21	10.8919
01/06/21	6.6163
02/06/21	4.0729
03/06/21	18.9502
04/06/21	25.1156
05/06/21	2.5020
06/06/21	25.0182
07/06/21	6.1004
08/06/21	21.0335
09/06/21	15.4716
10/06/21	37.8610
11/06/21	10.0545
12/06/21	12.8570
13/06/21	11.9380
14/06/21	11.3832
15/06/21	44.6955
16/06/21	14.9017
17/06/21	11.1637
18/06/21	46.4385
19/06/21	5.7780
20/06/21	22.6075
21/06/21	5.9517
22/06/21	51.4046
23/06/21	8.7006
24/06/21	6.5750
25/06/21	18.3947
26/06/21	4.1877
27/06/21	18.9384
28/06/21	25.5174
29/06/21	7.7068
30/06/21	37.1999
01/07/21	6.2308
02/07/21	30.2844
03/07/21	11.4984
04/07/21	46.9089

05/07/21	12.5289
06/07/21	5.1789
07/07/21	31.5818
08/07/21	5.1332
09/07/21	51.7745
10/07/21	11.1268
11/07/21	-0.2161
12/07/21	63.9237
13/07/21	4.7470
14/07/21	9.5914
15/07/21	-1.7875
16/07/21	35.7715
17/07/21	-3.9967
18/07/21	8.7965
19/07/21	5.2336
20/07/21	7.8504
21/07/21	6.7647
22/07/21	25.3250
23/07/21	1.4701
24/07/21	13.4984
25/07/21	4.2406
26/07/21	7.8647
27/07/21	10.7722
28/07/21	35.0622
29/07/21	2.9393
30/07/21	10.2834
31/07/21	6.8566

The main results of the study are shown in table 1. It is clear that the model is stable as confirmed by evaluation criterion as well as the residual plot of the model shown in figure 1. It is projected that daily COVID-19 cases in Antigua and Barbuda are likely to remain low over the out-of-sample period. Hence, the pandemic is likely to be controllable over the out-of-sample period.

IV. CONCLUSION AND POLICY RECOMMENDATIONS

The outbreak of COVID-19 has adversely affected many countries around the world, including Antigua and Barbuda. Based on 450 daily observations of COVID-19 cases in Antigua and Barbuda, this research used the ANN (12, 12, 1) model to come up with forecasts ranging over the period 26 March 2021 to 31 July 2021. The government should ensure the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on, as outlined by the WHO. This will help a lot in managing the pandemic in Antigua and Barbuda.

REFERENCES

[1] Bolano-Ortiz, T. R., *et al.* (2020). Atmospheric Changes and Their Economic Impacts During the COVID-19 Pandemic Lockdown in Argentina, *Sustainability*, 12 (8661): 1 – 29.

[2] CDC (2020). COVID-19 Symptoms, *CDC*, New York.

[3] Chowell, G., *et al.* (2020). Real-time Forecasts of the COVID-19 Epidemic in China From February 5th to February 24th, 2020, *Infectious Diseases Modelling*, 5: 256 – 263.

[4] Dantas, G., *et al.* (2020). The Impact of COVID-19 Partial Lockdown on the Air Quality of the City of Rio de Janeiro, Brazil, *Science and Total Environment*, pp: 1 – 7.

[5] Konarasinghe, K. M. U. B. (2020). Modeling COVID-19 Epidemic of USA, UK and Russia, *Journal of New Frontiers in Healthcare and Biological Sciences*, 1 (1): 1 – 14.

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