Testing and the Methodology of Testing

There are two sets of data used in this experiment, GDP factors at current prices and GDP factors at 1985 constant prices (see Appendices B and C).

The first thing to be done is to run all the five GDP factors (Personal Consumption, Government Consumption, Capital Formation, Imports and Exports) to the neural network one by one.

GDP Factors at Current Prices

For this experiment we will predict the GDP values for the year 2009 divided in to quarterly data which is why our prediction size is 4, window size is 1, and iteration is 100.

Fig. 4 Personal Consumption Actual Data vs. Predicted

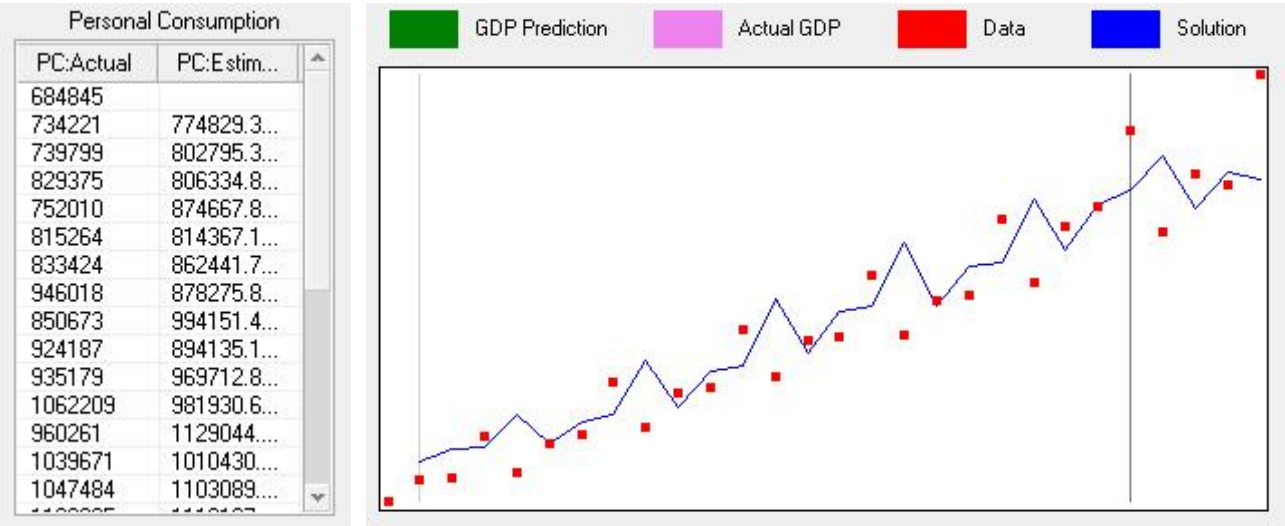


Fig.5 Government Consumption Actual Data vs. Predicted

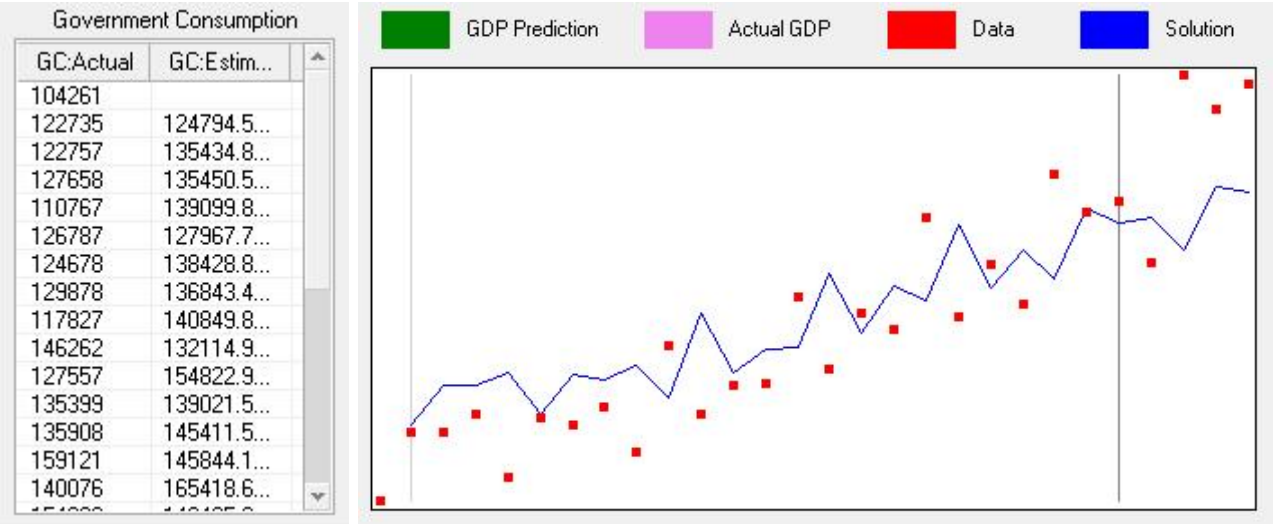


Fig. 6 Capital Formation Actual Data vs. Predicted

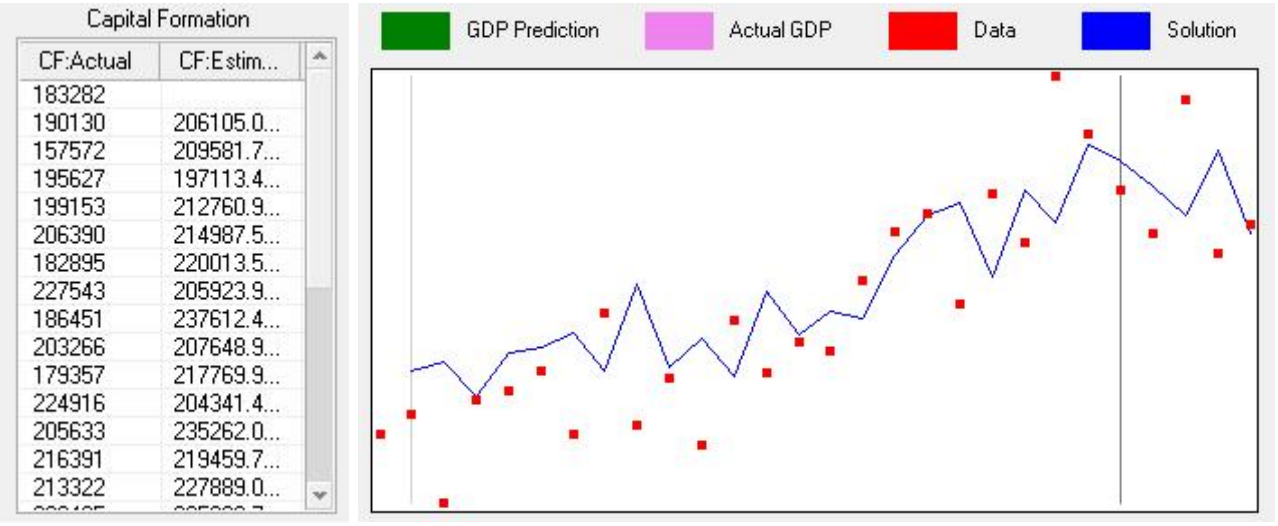


Fig. 7 Exports Actual Data vs. Predicted

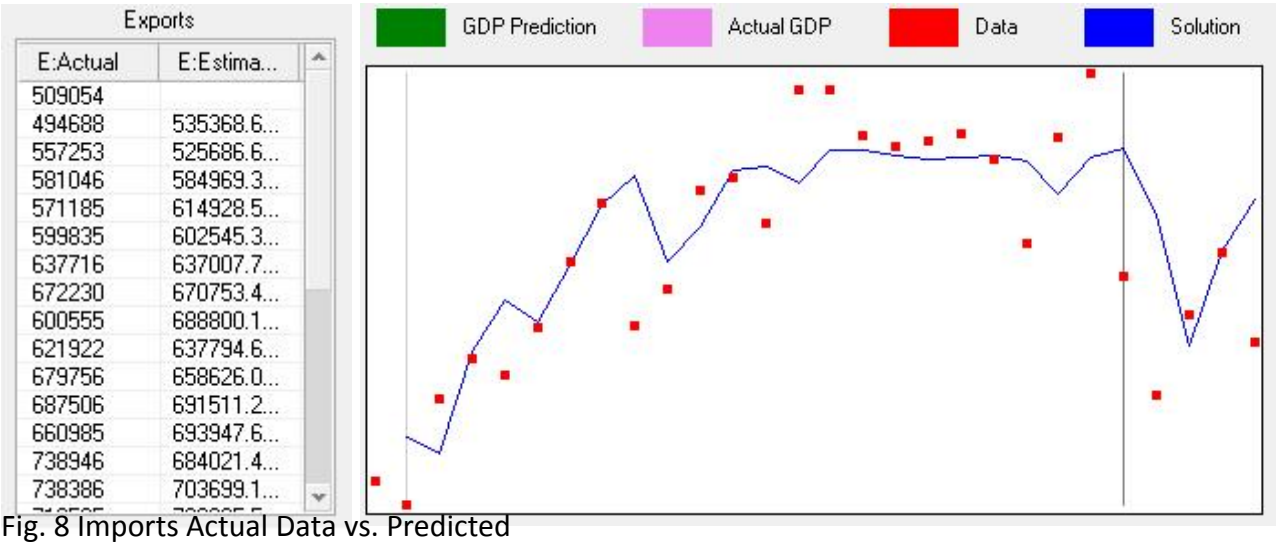
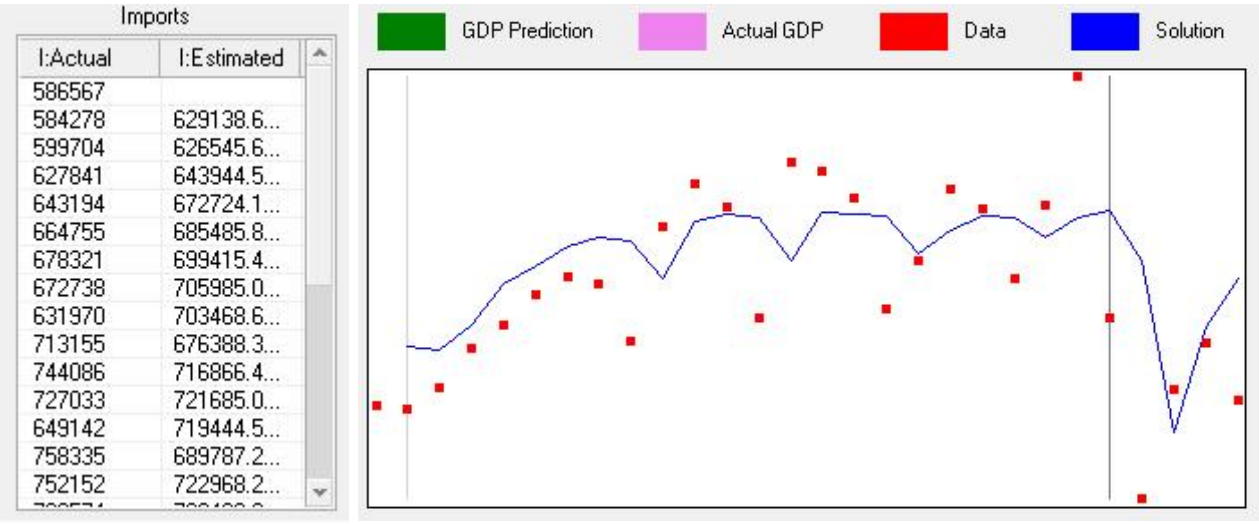


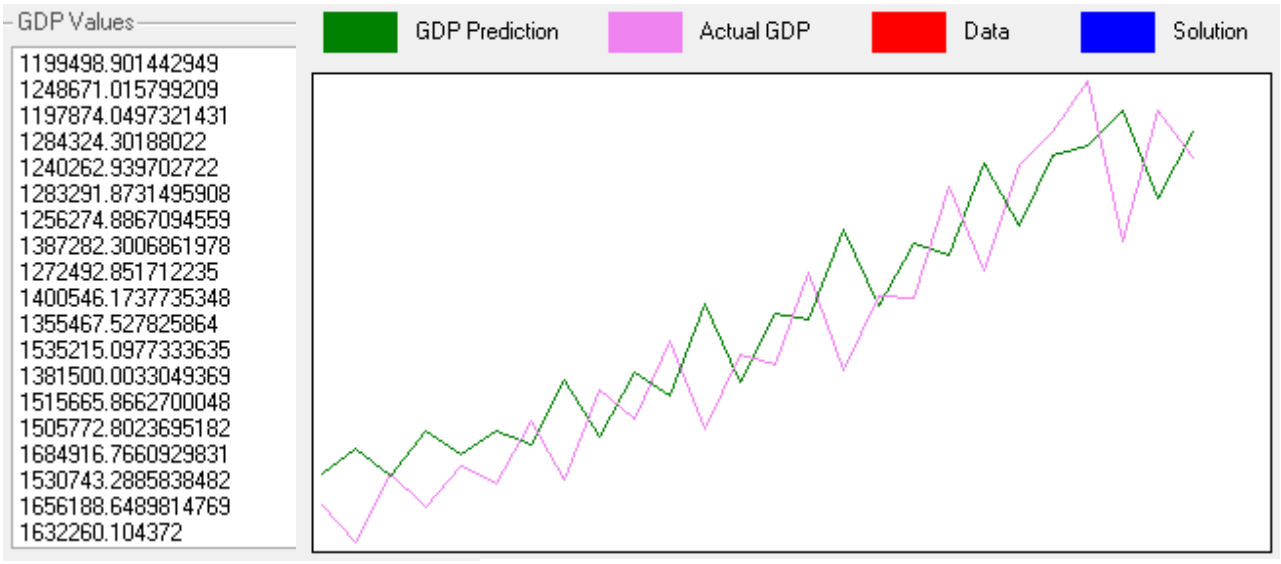
Fig. 8 Imports Actual Data vs. Predicted



Note that the red dots in all of the graphs above are the actual values from the data sources. The blue line represents the predicted values using the ANN.

After all the GDP factors have been predicted, we can now compute for the predicted GDP values using the formula GDP = Personal Consumption + Government Consumption + Capital Formation + (Exports – Imports)

Fig. 9 Actual GDP Values vs. Predicted GDP Values



The green line represents the graph of the predicted GDP values while the pink line depicts the graph of the actual GDP values.

For the MS Excel tests, the actual GDP values will be used to predict the GDP growth for the year 2009 also divided into quarters.

There are 5 functions to be tested for forecasting, namely: Linear, Power, Logarithmic, Exponential and Polynomial.

Fig. 10 GDP Forecasting using Linear Regression

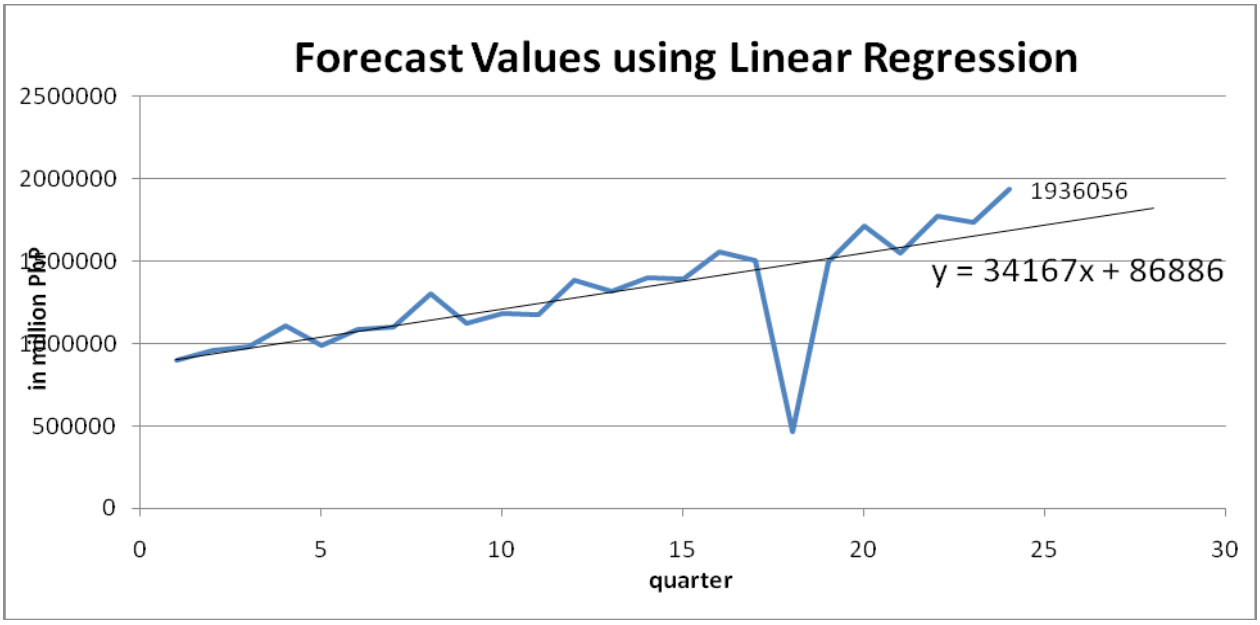


Fig. 11 GDP Forecasting using Power

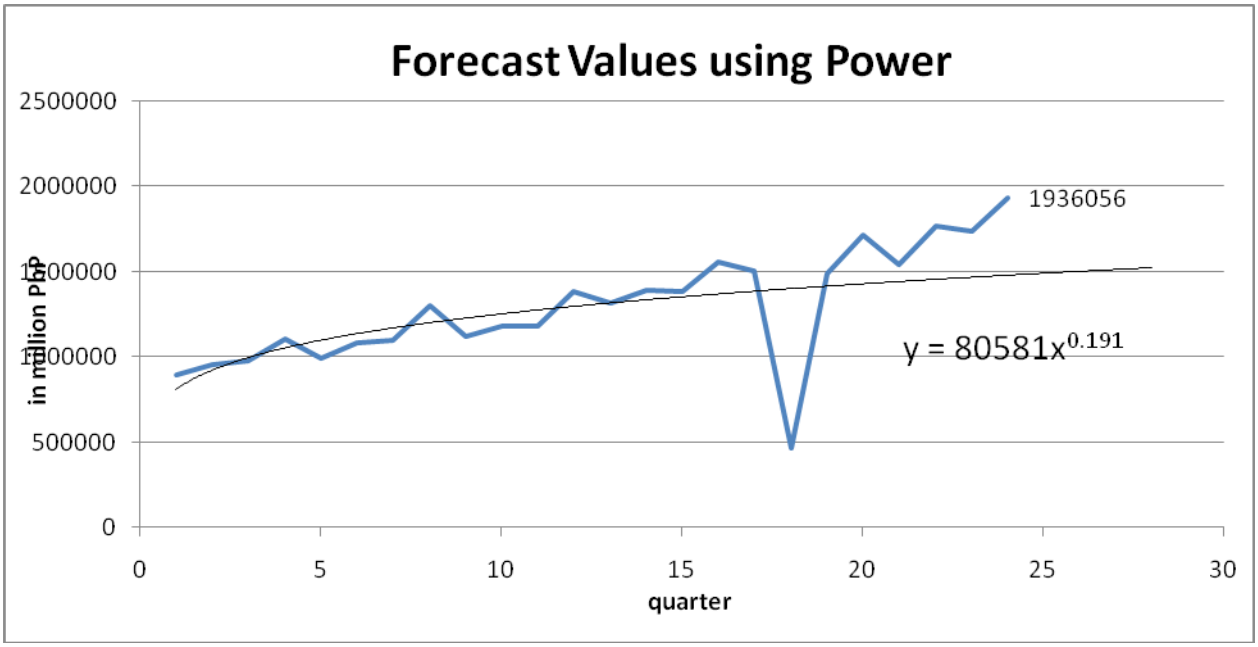


Fig. 12 GDP Forecasting using Logarithmic

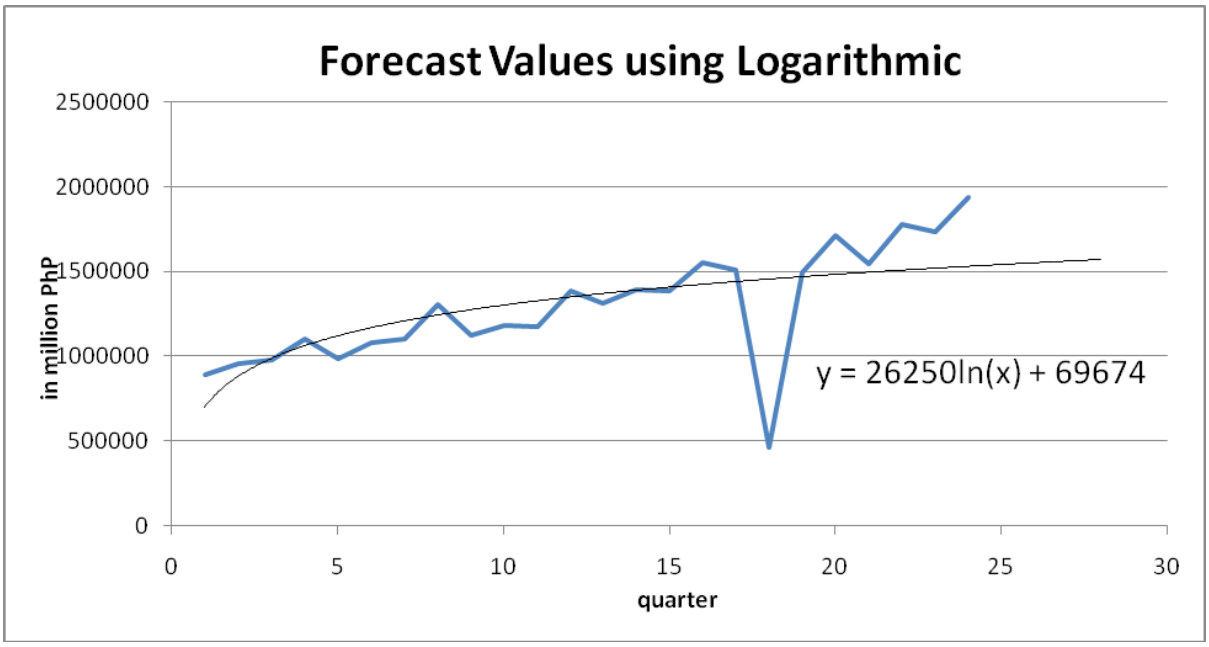


Fig. 13 GDP Forecasting using Exponential

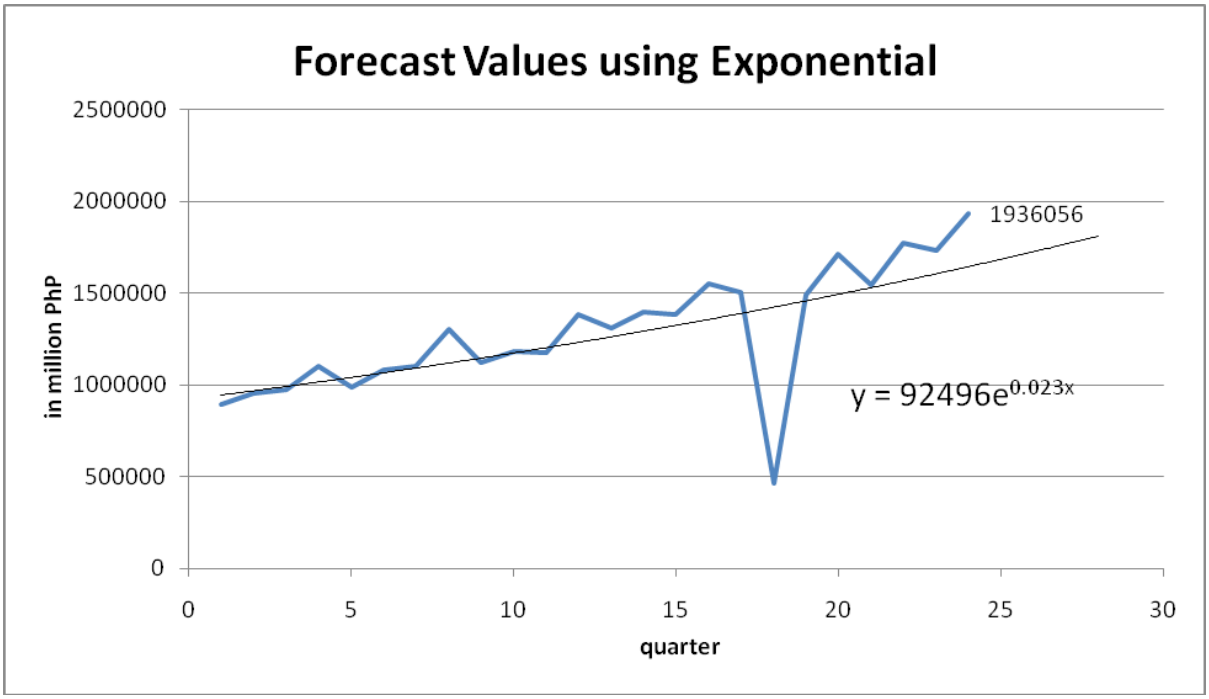
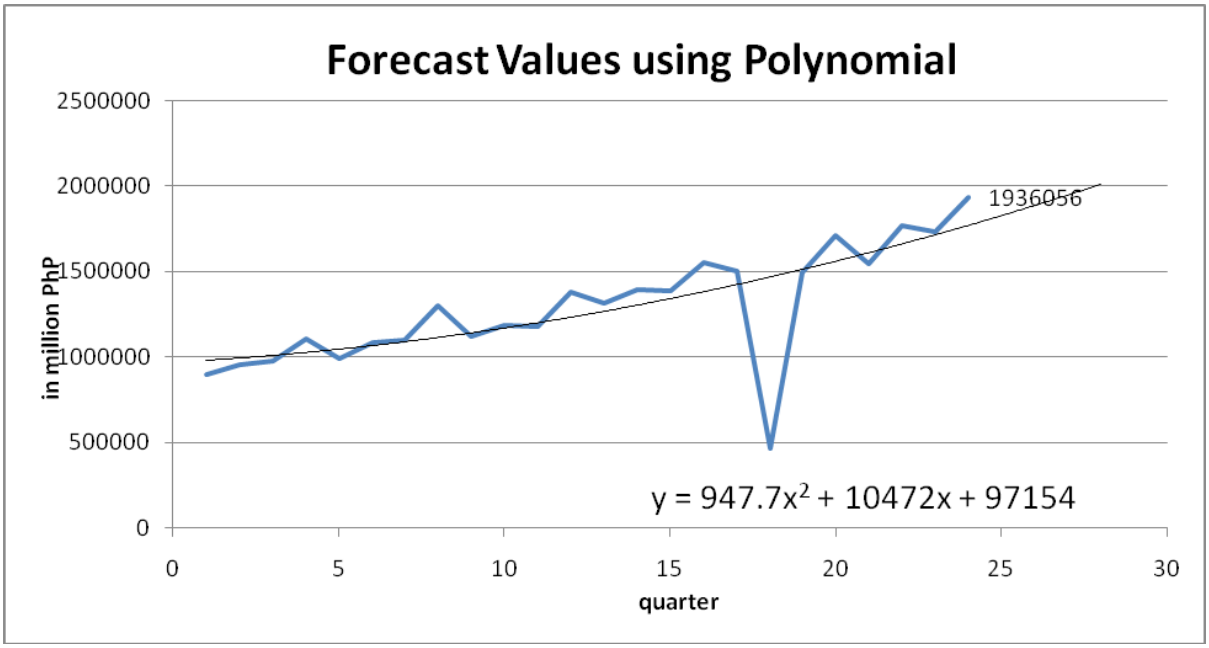


Fig. 14 Fig. 13 GDP Forecasting using Polynomial



Given the formula for y for all graphs, we can compute the values and its corresponding variance for each quarter of the year 2009.

The formula for variance is

Variance = ((Actual GDP Value – Predicted GDP Value)/Predicted GDP Value)*100

Fig. 15 GDP Values from Linear Regression

Linear Regression	
y = 34167x + 86886	variance
941061	45.86778214
975228	49.66183241
1009395	45.44176498
1043562	50.15775673

Fig. 16 GDP Values from Linear Power

Power	
$y = 80581x^{0.191}$	variance
149018.1592	91.42809716
150138.6692	92.25031942
151224.8393	91.82623223
152278.937	92.72690667

Fig. 17 GDP Values from Logarithmic

Logarithmic	
y = 26250ln(x) + 69674	variance
154169.4904	91.1318
155199.0341	91.9891
156189.7177	91.5579
157144.3684	92.4945

Fig. 18 GDP Values from Exponential

Exponential	
$y = 92496e^{0.023x}$	variance
164377.4652	90.54459089
168201.96	91.3179498
172115.4375	90.69708638
176119.9682	91.58821968

Fig. 19 GDP Values from Polynomial

Polynomial	
$y = 947.7x^2 + 10472x + 97154$	variance
951266.5	45.28073587
1010071.2	47.86333724
1070771.3	42.1243495
1133366.8	45.86853128

We will also compute for the variances for each value predicted using the Econocaster.

Fig. 20 GDP Values from Econocaster Test 1

Test 1 (Econocaster)	
window size: 1, prediction size: 4, iterations: 100	
prediction	variance
1836232.249	5.624740732
1948630.413	0.582104191
1753889.579	5.201511953
1893414.107	9.567417623

Fig. 21 GDP Values from Econocaster Test 2

Test 2 (Econocaster)	
window size: 3, prediction size: 4, iterations: 50	
prediction	variance
1898470.380	9.204836035
1967791.480	1.571137526
2083100.891	12.59250142
1975669.570	5.638760967

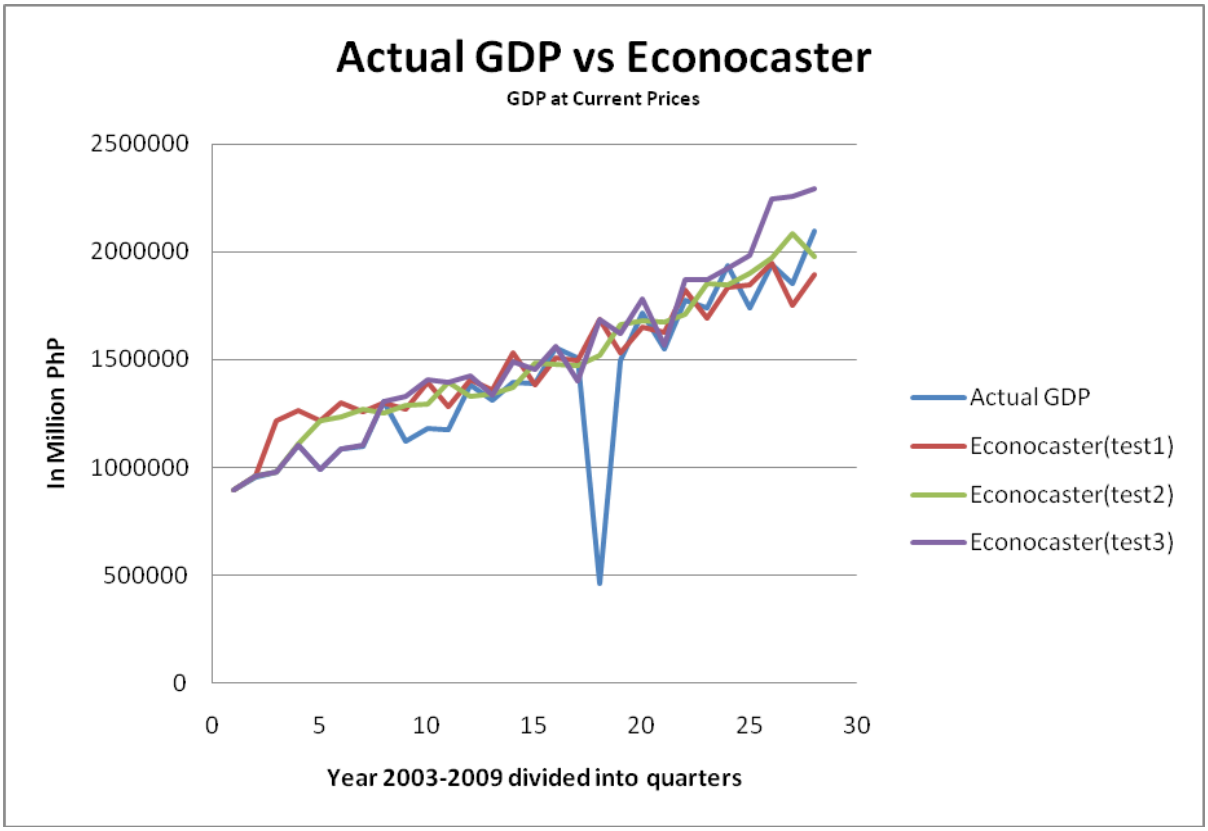
Fig. 22 GDP Values from Econocaster Test 3

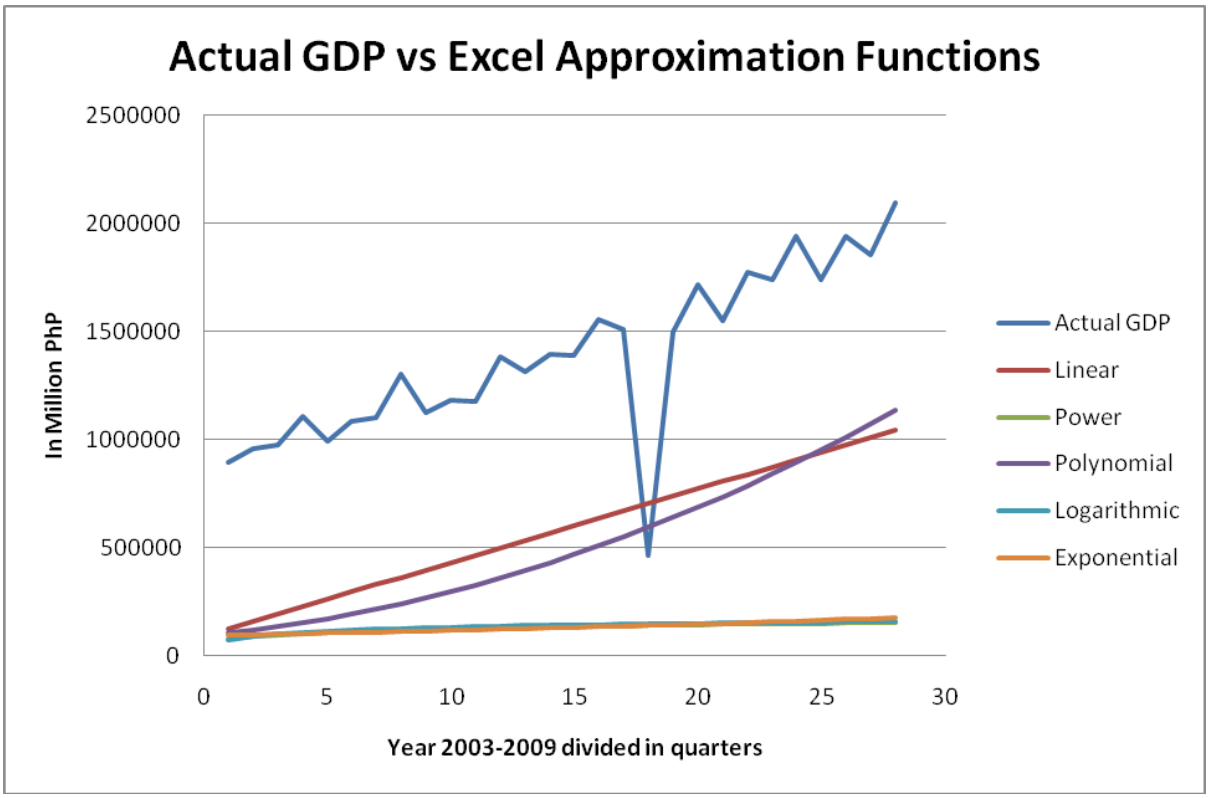
Test 3 (Econocaster)	
window size: 7, prediction size: 4, iterations: 50	
prediction	variance
1898470.380	9.204836035
1967791.480	1.571137526
2083100.891	12.59250142
1975669.570	5.638760967

As seen on the test results, prediction values using the Econocaster is significantly better compared to the results from MS Excel.

The average variance for MS Excel functions is at 73.6% compared to Econocaster's 9.3%.

Fig. 23-24 GDP Prediction: Excel vs. Econocaster against the actual GDP Values





The second set of tests will be using the GDP values at constant prices. The same methodology for testing is applied.

Fig. 25 Personal Consumption Actual Data vs. Predicted

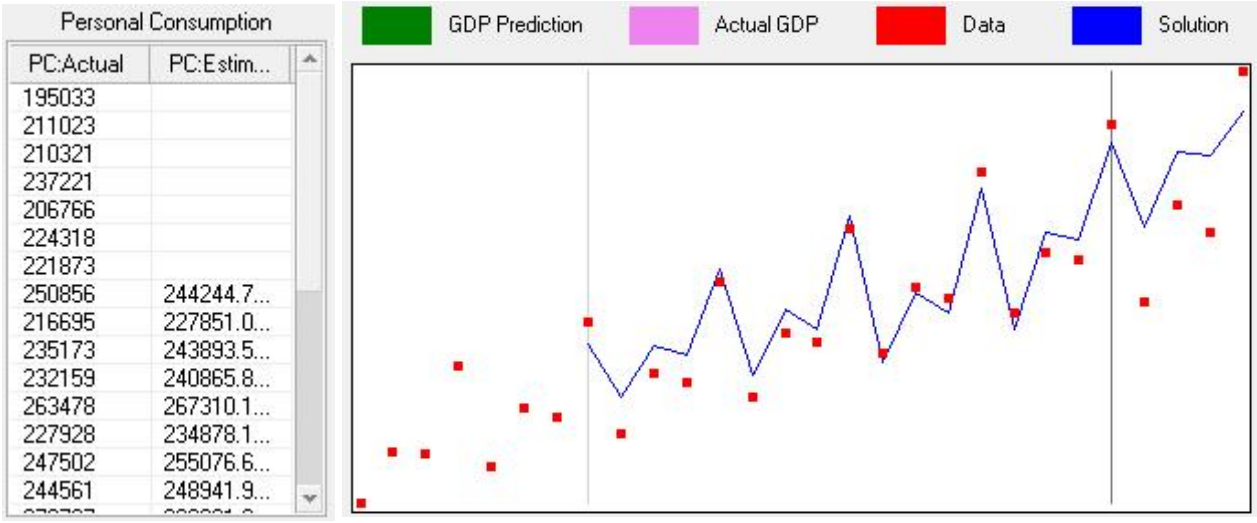


Fig. 26 Government Consumption Actual Data vs. Predicted

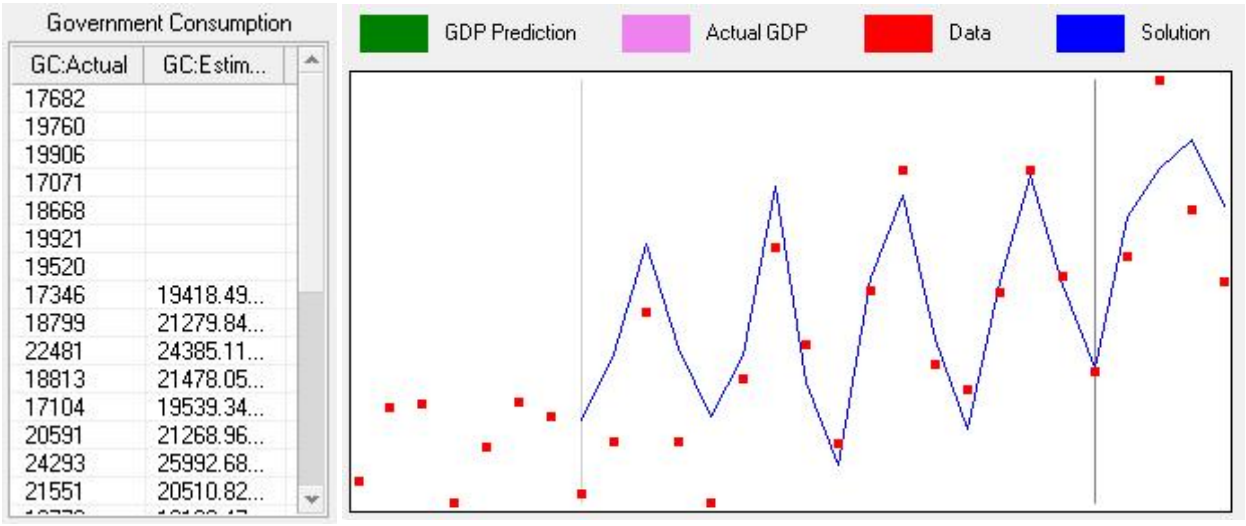


Fig. 27 Capital Formation Actual Data vs. Predicted

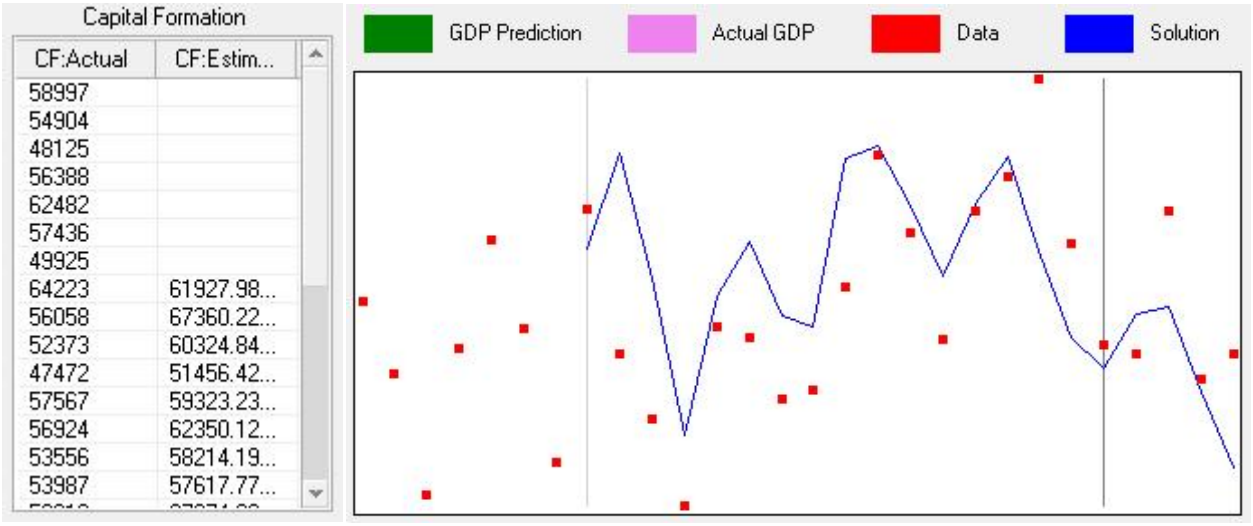


Fig. 28 Exports Actual Data vs. Predicted

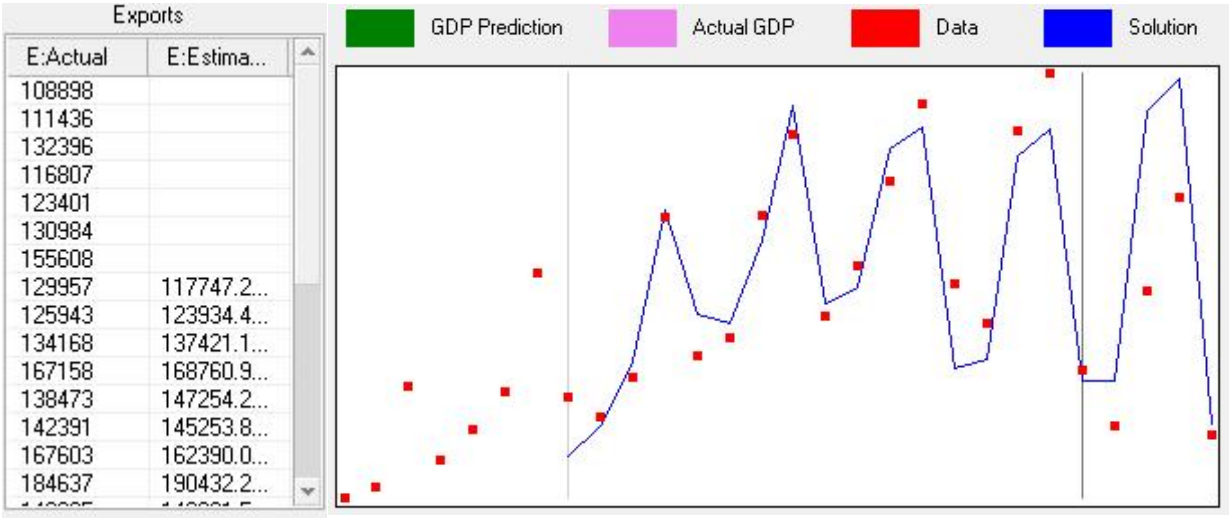


Fig. 29 Imports Actual Data vs. Predicted

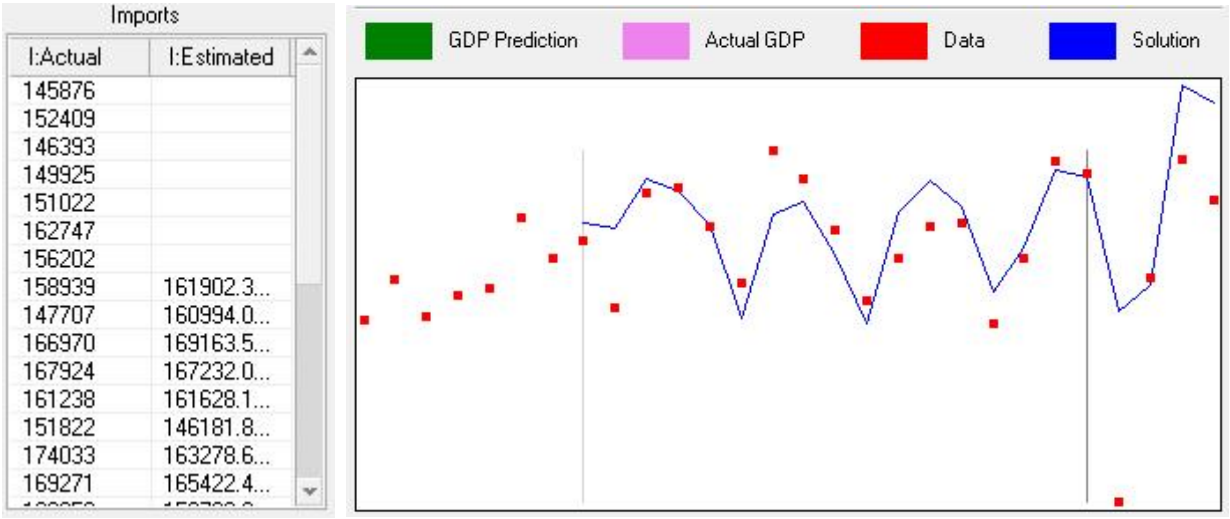
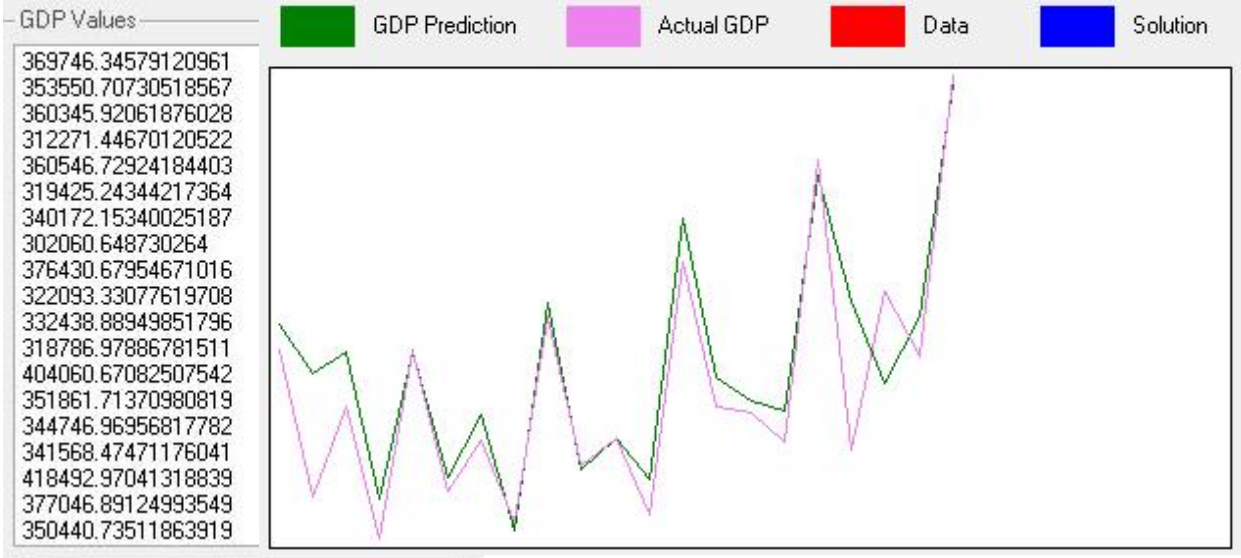


Fig. 30 Actual GDP Values vs. Predicted GDP Values



Then we plot approximation functions from excel.

Fig. 31 GDP Forecasting using Linear Regression

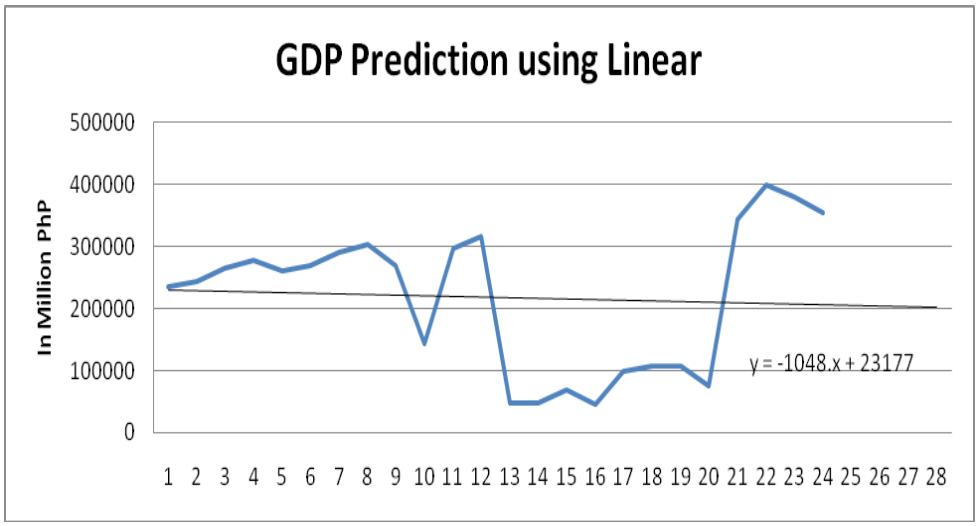


Fig. 32 GDP Forecasting using Power

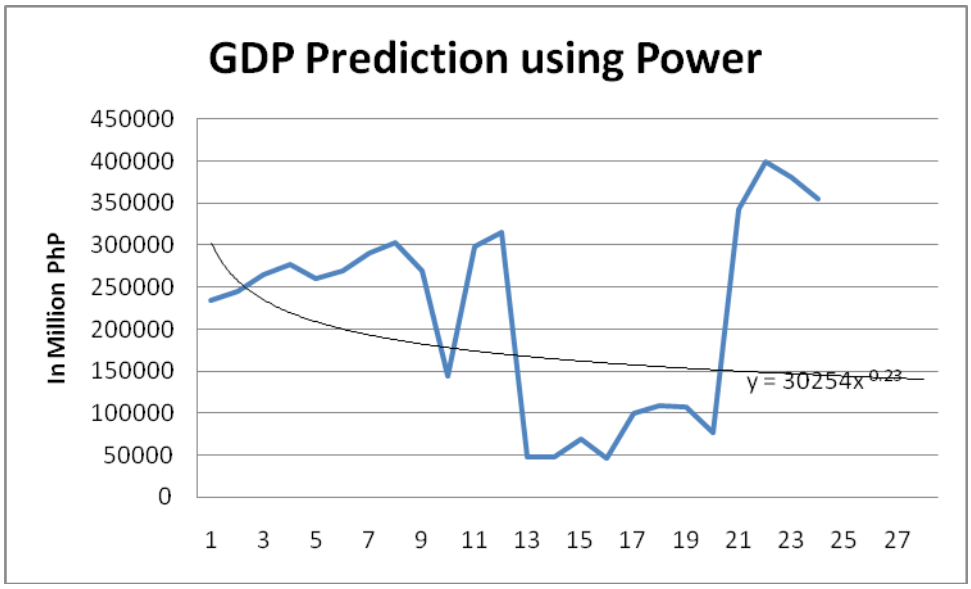


Fig. 33 GDP Forecasting using Logarithmic

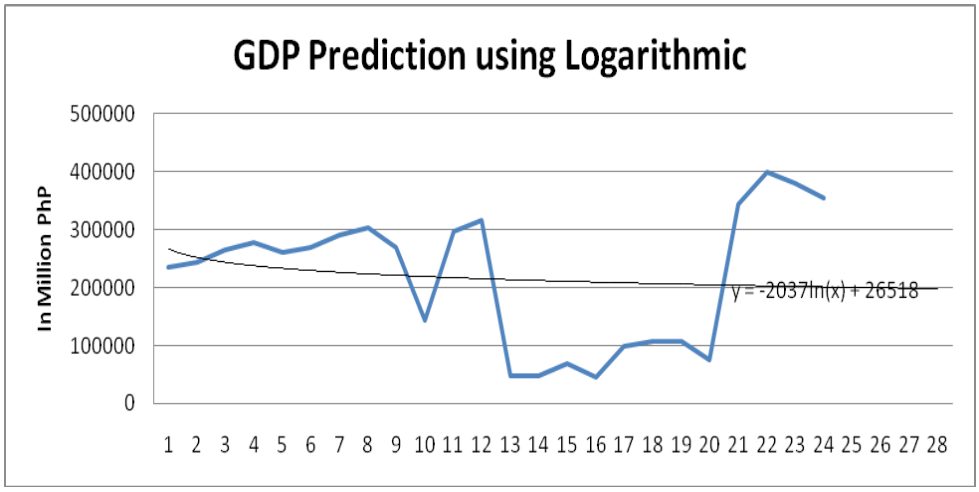


Fig. 34 GDP Forecasting using Polynomial

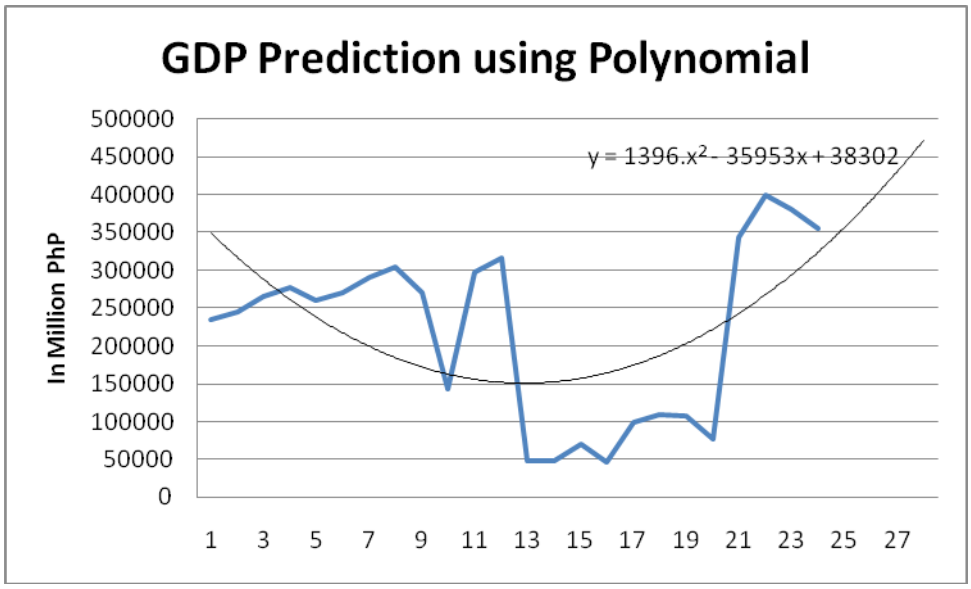
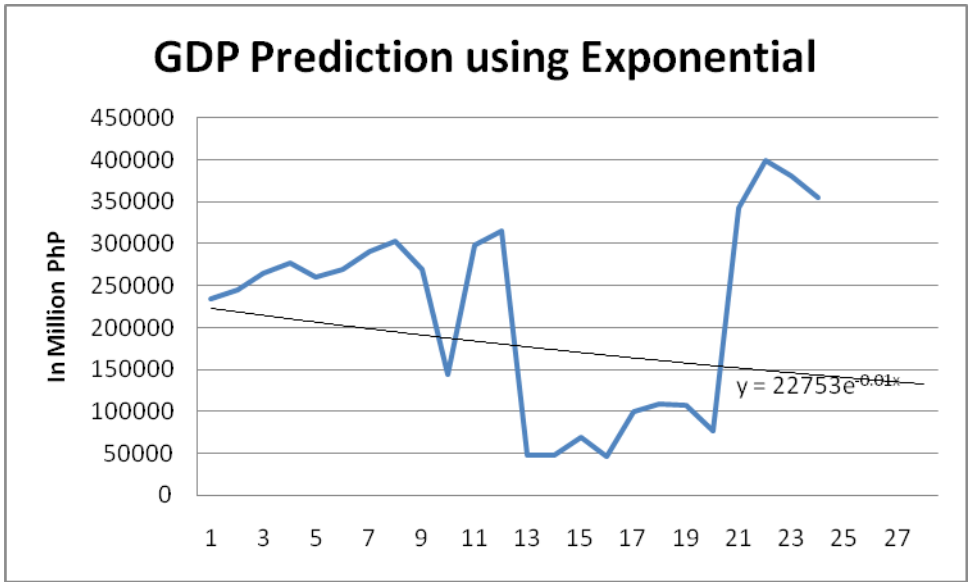


Fig. 35 GDP Forecasting using Exponential



Then compute for the variance using the same formula as for the first test set.

Fig. 36 GDP Values from Linear Regression

Linear Regression	
y = -1048.1x + 23177	variance
-3025.5	100.8754594
-4073.6	101.0745591
-5121.7	101.4323188
-6169.8	101.6985838

Fig. 37 GDP Values from Power

Power	
y = 30254x-0.23	variance
756349.77	118.8575393
786603.77	107.4951582
816857.77	128.4399255
847111.77	133.2150719

Fig. 38 GDP Values from Logarithmic

Logarithmic	
y = 26250ln(x) + 69674	variance
154169.4904	55.38948164
155199.0341	59.06064862
156189.7177	56.32046509
157144.3684	56.73719045

Fig. 39 GDP Values from Polynomial

Polynomial	
$y = 947.7x^2 + 10472x + 97154$	variance
951266.5	175.258688
1010071.2	166.442765

1070771.3	199.4486005
1133366.8	212.0228394

Fig. 40 GDP Values from Exponential

Exponential	
$y = 92496e^{0.023x}$	variance
164377.4652	52.43569976
168201.96	55.63065722
172115.4375	51.86672739
176119.9682	51.51309131

Fig. 41 GDP Values from Econocaster Test 1

Test 1 (Econocaster)	
window size: 1, prediction size: 4, iterations: 100	
prediction	variance
379917.8905	9.933126112
356996.3953	5.829305243
362558.2054	1.39190993
354279.0209	2.464810132

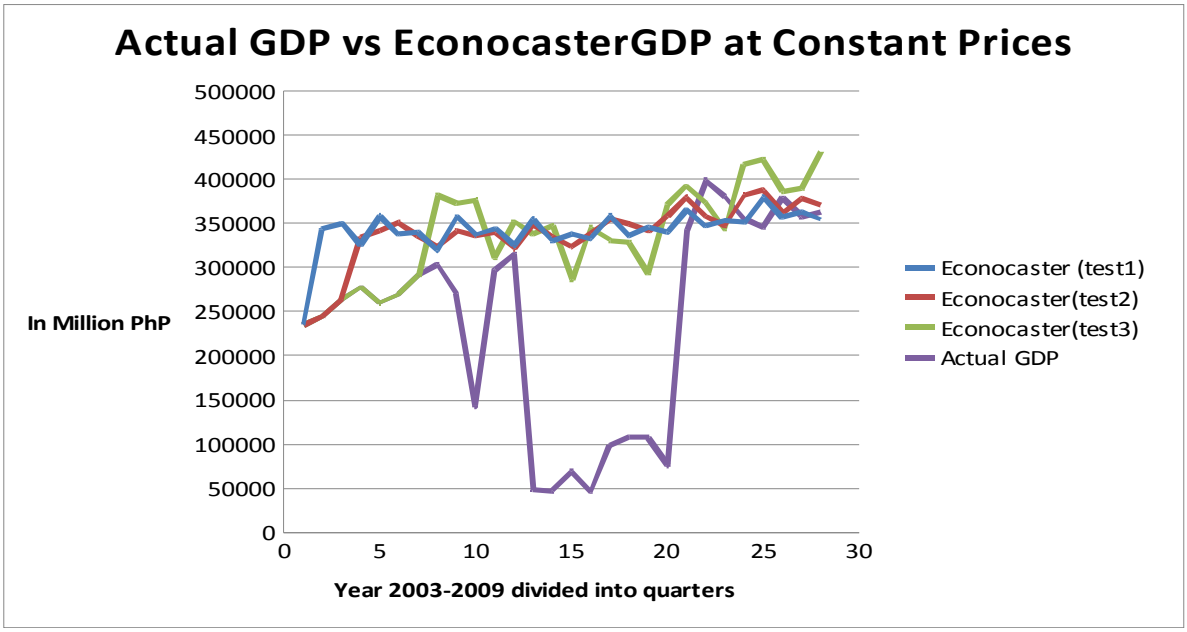
Fig. 42 GDP Values from Econocaster Test 2

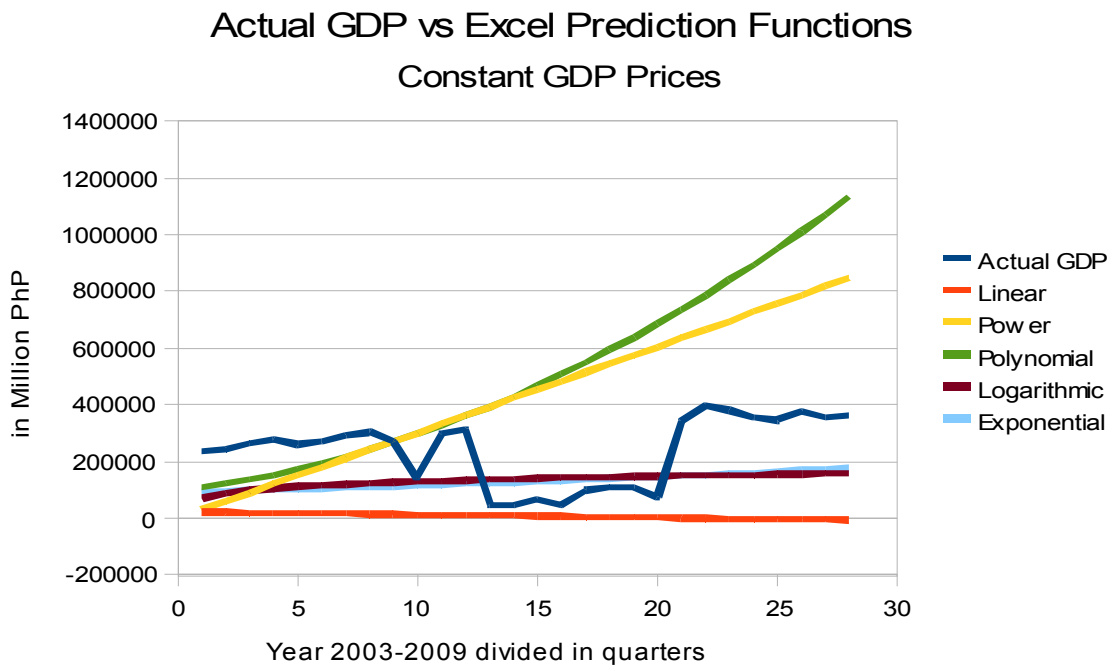
Test 2 (Econocaster)	
window size: 3, prediction size: 4, iterations: 50	
prediction	variance
387479.1381	12.1210504
362356.1045	4.41548834
378268.0179	5.78526764
370647.0998	2.041422494

Fig. 43 GDP Values from Econocaster Test 3

Test 3 (Econocaster)	
window size: 7, prediction size: 4, iterations: 50	
prediction	variance
422548.171	22.26863363
386892.1921	2.056791075
389642.9623	8.966349531
431606.4488	18.8239056

Fig. 44-45 GDP Prediction: Excel vs. Econocaster against the actual GDP Values





Conclusion

Based on the significant differences of the variances between the Excel Function Approximation Functions and the Econocaster, we can say that artificial neural networks provide a better option for approximating and predicting very complex values.