Week 8 Graded Assignment - Question Activity

Date	Adidas Revenue (£)	Adidas Europe GDP (£)	Adidas China GDP (:	Adidas Price index (	Nike Revenue (£)
Jan-00	1517	1728.244	257.65	246.5	2161.6
Apr-00	1248	1749.6	290.44	326.4	2272.7
Jul-00	1677	1769.2586	310.55	322.5	2636.7
Oct-00	1393	1789.2533	352.7	321	2198.7
Jan-01	1558	1819.1398	290.97	329.4	2170.1
Apr-01	1368	1833.7128	322.92	329.8	2483.3
Jul-01	1790	1845.8787	342.32	313.3	2613.7
Oct-01	1396	1861.9357	383.2	302.1	2336.8
Jan-02	1638	1878.7827	317.67	296.5	2260.3
Apr-02	1507	1893.8006	352.72	301	2682.2
Jul-02	1868	1914.8373	377.63	298.9	2796.3
Oct-02	1510	1927.3414	422.48	292.2	2514.7

Table 1 – Adidas Dataset

1. **Could you make a prediction about the trend of the total revenue for the third quarter for both Adidas and Nike? If yes, do you expect the revenue of 2003 to increase or decrease during the same quarter?**

To make a prediction about a trend, I would use a times series forecasting. I will first do it for Adidas and then for Nike. Even if the exercise ask is about a specific quarter (Q3-2003). I would use all the data points available to create a more robust forecasting model.

The first step is to split the data for training and validation: I will use 2000 and 2001 data as training, 2002 as validation.

Training Model Adidas				
Timelir	Values	Forecast	Lower Confidenc	Upper Confidenc
Jan-00	1517			
Apr-00	1248			
Jul-00	1677			
Oct-00	1393			
Jan-01	1558			
Apr-01	1368			
Jul-01	1790			
Oct-01	1396	1396	1396.00	1396.00
Jan-02		1754.076015	1621.54	1886.61
Apr-02		1485.587028	1351.99	1619.19
Jul-02		1808.752779	1674.06	1943.44
Oct-02		1540.263792	1404.49	1676.03

Table 2 – Adidas Training model summary table

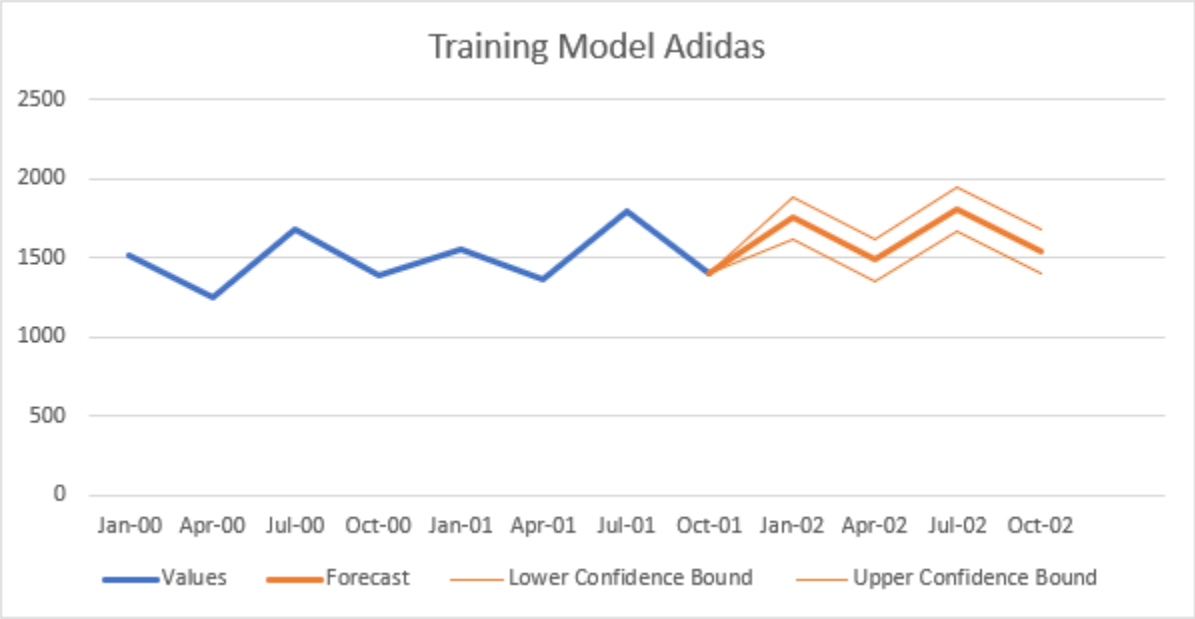

Chart 1 – Adidas Training model trend for 2002

I have now created a forecast for 2002 (Chart 1 & Table 2) with a lower confidence interval and upper confidence interval (95%). From the model there is a positive trend, meaning the revenue is likely to increase. The model seems to pick up seasonality as well, with picks always around Q1 and Q3 where Adidas sells more.

At this point I can validate the 2002 forecast, against the actual 2002 data to calculate the Mean Absolute Percentage Error (MAPE) – in other words, the error of the model. From the table below the MAPE is low (around 3%) which seems to be a highly accurate forecast.

Date	Actual	Forecast	Error
Jan-02	1,638.00	1754.076015	7%
Apr-02	1,507.00	1485.587028	1%
Jul-02	1,868.00	1808.752779	3%
Oct-02	1,510.00	1540.263792	2%
		MAPE	3%

MAPE	Interpretation
<10	Highly accurate forecasting
10-20	Good forecasting
20-50	Reasonable forecasting
>50	Inaccurate forecasting

Source: Lewis (1982, p. 40)

Table 3 – MAPE calculation for adidas model & MAPE interpretation reference.

I can now also use 2002 data into the model and create a forecast for 2003 (all quarters), giving that the model will have a 3% error.

Adidas Forecast Model				
Date	Adidas Revenue (£)	Forecast(Adidas Revenue	Lower Confidenc	Upper Confidenc
Jan-00	1517			
Apr-00	1248			
Jul-00	1677			
Oct-00	1393			
Jan-01	1558			
Apr-01	1368			
Jul-01	1790			
Oct-01	1396			
Jan-02	1638			
Apr-02	1507			
Jul-02	1868			
Oct-02	1510	1510	1510.00	1510.00
Jan-03		1834.871205	1697.73	1972.01
Apr-03		1575.402278	1438.26	1712.54
Jul-03		1884.704514	1746.43	2022.98
Oct-03		1625.235586	1486.96	1763.51

Table 4 – Adidas Forecast model for 2003

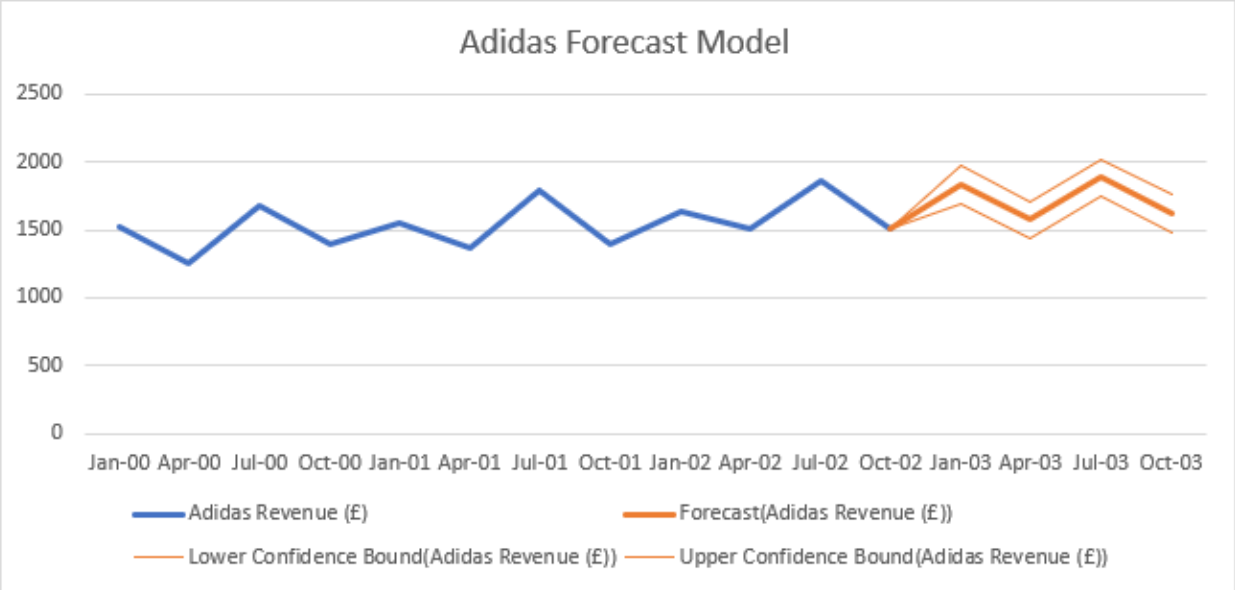

Chart 2 – Adidas forecasting model for 2003

The forecast shows an increase of Revenue from £ 1868 (Q3 - 2002) to £ 1884 in (Q3-2002). Which is around 1% so not a huge increase. However, the beauty of a forecast with an upper and lower bound is

that the business can decide to use one of the three values according to their knowledge of the market. For example, if there is a plan to open new shops in a city center, hence good reasons to believe in an increase of revenue, then the upper bound can be used to forecast revenue (£ 2023). Or the lower if there are good reasons to believe in a drop of sales.

Times series forecasting learns from the past to predict the future, but it will never give an exact forecast. What is providing is the range where there is 95% confidence to find the next data point. Giving that all models have an error.

I will repeat the same process for Nike

Training model for Nike:

Date	Nike Revenue (£)	Forecast(Nike Revenue (£))	Lower Confidence Bound(Nike Revenue (£))	Upper Confidence Bound(Nike Revenue (£))
Jan-00	2161.6			
Apr-00	2272.7			
Jul-00	2636.7			
Oct-00	2198.7			
Jan-01	2170.1			
Apr-01	2483.3			
Jul-01	2613.7			
Oct-01	2336.8	2336.8	2336.80	2336.80
Jan-02		2450.681228	2075.55	2825.81
Apr-02		2480.296648	2103.26	2857.33
Jul-02		2509.912068	2130.94	2888.88
Oct-02		2539.527488	2158.59	2920.46

Table 5 – Nike training model

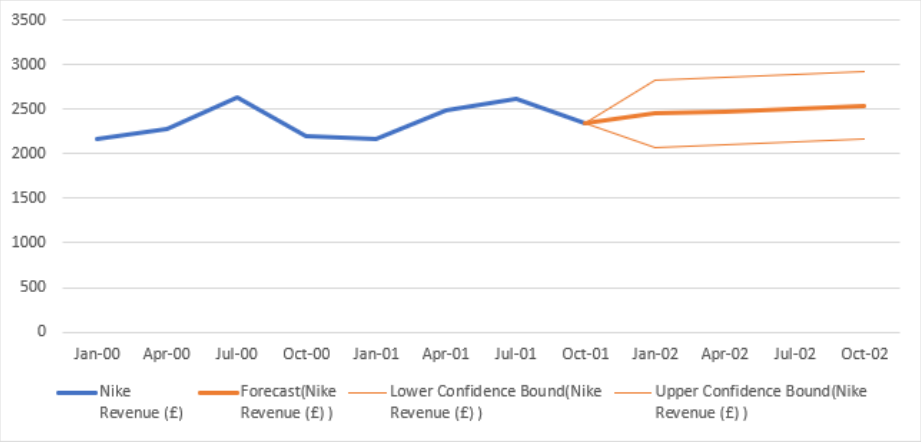

Chart 3 – Nike training model trend for 2002

Date	Actual	Forecast	Error
Jan-02	2,260.30	2450.681228	8%
Apr-02	2,682.20	2480.296648	8%
Jul-02	2,796.30	2509.912068	10%
Oct-02	2,514.70	2539.527488	1%
		MAPE	7%

Table 6 – MAPE calculation for Nike

For what concerns Nike, the model has a higher error than Adidas, so it is good to be conscious of that. However, the error is still acceptable.

Nike forecast:

Timelir	Values	Forecast	Lower Confidenc	Upper Confidenc
Jan-00	2161.6			
Apr-00	2272.7			
Jul-00	2636.7			
Oct-00	2198.7			
Jan-01	2170.1			
Apr-01	2483.3			
Jul-01	2613.7			
Oct-01	2336.8			
Jan-02	2260.3			
Apr-02	2682.2			
Jul-02	2796.3			
Oct-02	2514.7	2514.7	2514.70	2514.70
Jan-03		2455.511391	2309.95	2601.07
Apr-03		2716.092052	2565.98	2866.20
Jul-03		2965.062529	2810.50	3119.62
Oct-03		2595.970173	2437.05	2754.89

Table 7 – Nike forecast model for 2003

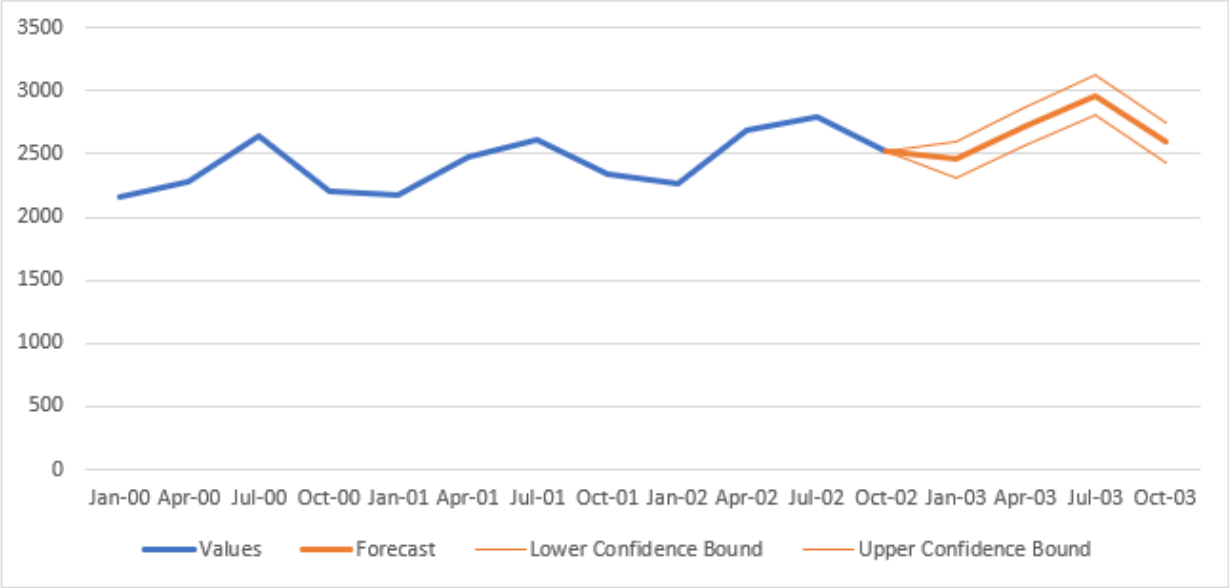

Chart 4 -Nike forecasting model for 2003

Adding another year of data (2002) to predict 2003 seems to have improved the model. Also visually, it is possible to see that the confidence interval is less spread around the actual forecast. This gives me good hopes for the following year when I would repeat the process, including the 2002 in the training to validate the model with the actual 2003 data.

For Nike the forecast is from £2796 (Q3 2002) to £2965 (Q3 2002). A 6% increase which is higher increase QoQ than Adidas. Nike seems to have a different pattern of sales than Adidas, with always 2 consecutives picks in Q2 and Q4.

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2. **Could you make the same prediction about Adidas's sales in China and about the price index for the same quarter in 2003? If no, can you make a conclusion for these features about any of the quarters?**

I would apply the same process for the Adidas sales in China:

Date	Adidas China GDP (£)	Forecast(Adidas China GDP (£))	Lower Confidence Bound(Adidas China GDP (£))	Upper Confidence Bound(Adidas China GDP (£))
Jan-00	257.65			
Apr-00	290.44			
Jul-00	310.55			
Oct-00	352.7			
Jan-01	290.97			
Apr-01	322.92			
Jul-01	342.32			
Oct-01	383.2	383.2	383.20	383.20
Jan-02		373.788877	323.88	423.70
Apr-02		387.1232099	336.81	437.43
Jul-02		400.4575427	349.74	451.17
Oct-02		413.7918756	362.67	464.91

Table 8 – China sales training model

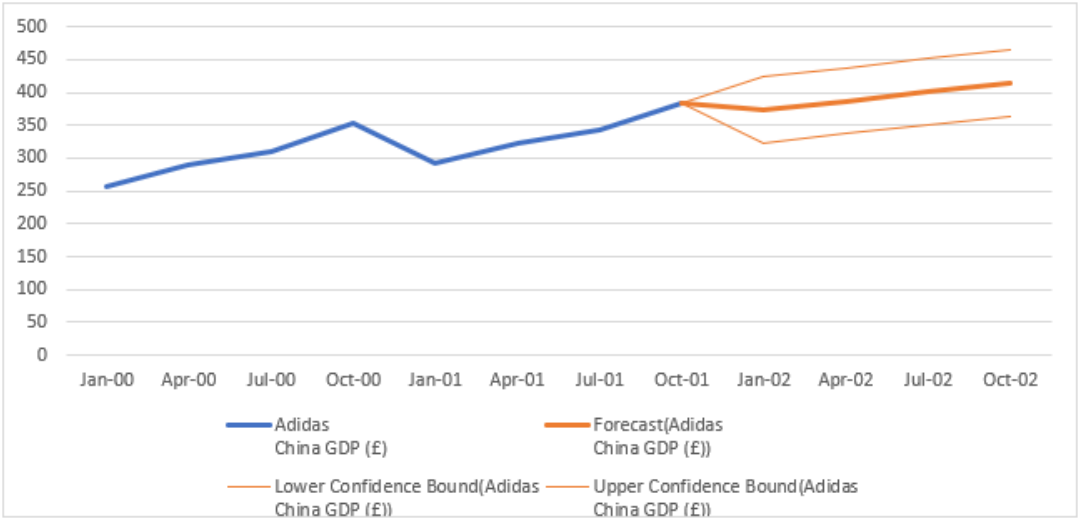


Chart 5 – China sales training model

Date	Actual	Forecast	Error
Jan-02	317.67	355.0915327	12%
Apr-02	352.72	387.114201	10%
Jul-02	377.63	407.7970428	8%
Oct-02	422.48	450.7744874	7%

MAPE	9%

Table 9 – MAPE calculation for Adidas China

The MAPE seems to be the worst of all the model, another factor to be aware of. However, adding all the 2002 data points to the model seems to significantly improve the forecast. The upper and lower bound are very much identical to the actual forecast as it seems to be a clear pattern in the model.

See below:

Date	Adidas China GDP (£)	Forecast(Adidas China GDP (£))	Lower Confidence Bound(Adidas China GDP (£))	Upper Confidence Bound(Adidas China GDP (£))
Jan-00	257.65			
Apr-00	290.44			
Jul-00	310.55			
Oct-00	352.7			
Jan-01	290.97			
Apr-01	322.92			
Jul-01	342.32			
Oct-01	383.2			
Jan-02	317.67			
Apr-02	352.72			
Jul-02	377.63			
Oct-02	422.48	422.48	422.48	422.48
Jan-03		355.0915327	350.16	360.02
Apr-03		387.114201	382.18	392.05
Jul-03		407.7970428	402.86	412.73
Oct-03		450.7744874	445.84	455.71

Table 9 – China sales forecast model

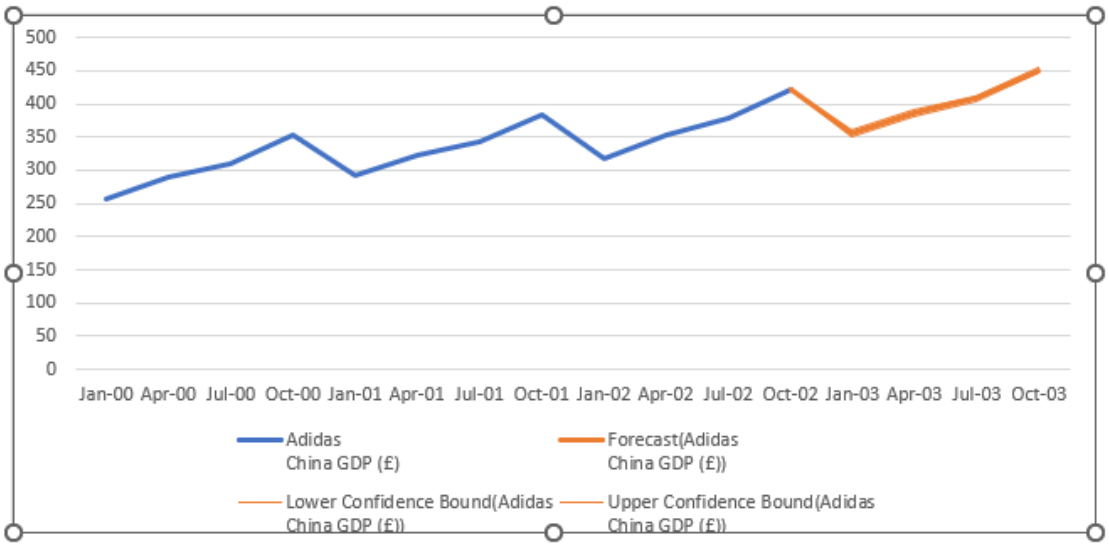
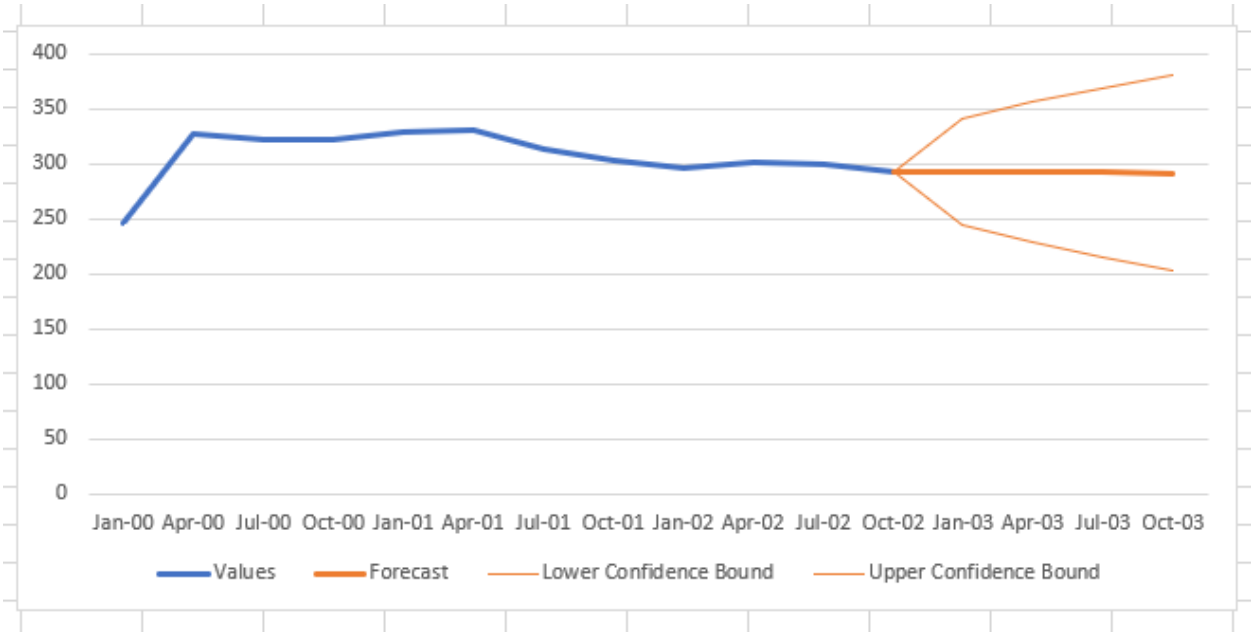


Chart 5 – China sales training model

Looking at the model for China, is even more clear how the lack of enough data point can make the forecast uncertain. The forecasted increase sales for China Quarter over Quarter is 7.9%, the highest of all forecasted sales QoQ. Also the sales pattern for China is different from the 2 analyzed so far. In this case looks like we have a constant increase of sales during the year with a repeated drop in Q1 every year. Is this maybe a cultural behavior?

Finally, I would apply the same concept to the price index:

Timeline	Values	Forecast	Lower Confidence Bound	Upper Confidence Bound
Jan-00	246.5			
Apr-00	326.4			
Jul-00	322.5			
Oct-00	321			
Jan-01	329.4			
Apr-01	329.8			
Jul-01	313.3			
Oct-01	302.1			
Jan-02	296.5			
Apr-02	301			
Jul-02	298.9			
Oct-02	292.2	292.2	292.20	292.20
Jan-03		292.49828	244.95	340.05
Apr-03		292.1476	228.14	356.15
Jul-03		291.79692	214.75	368.84
Oct-03		291.44624	203.24	379.65



Date	Actual	Forecast	Error
Jan-02	296.50	308.10239	4%
Apr-02	301.00	312.34717	4%
Jul-02	298.90	316.59195	6%
Oct-02	292.20	320.83674	10%
		MAPE	6%

In this case, there is a negative trend meaning the price is decreasing QoQ and YoY. The forecasted price for Q3 2003 is 2.6% lower than Q3 2002.

In this case I would also be conscious about the upper and lower bound as they are widespread.

It would be interesting to calculating a correlation between price drop and increase of revenue.