

Demand Estimation and Forecasting for DALDA Banaspati in Pakistan: An Empirical Analysis from Multan District

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Abstract
The main purpose of our study is to estimate the demand equation. By using this equation, we have to forecast the future demand. To forecast demand, we have collected actual data on demand of Dalda, price of Dalda, price of Hoor and total sales from Jan 2013 – Dec 2014. By using the Multiple Regressions, we have formulated the demand equation from actual data, and then we have forecasted the values by using exponential smoothing technique for all independent variables. Forecasted demand for the Jan of 2015 is 2072.2921, Quantity demanded will increase by 272.2921 (15 percent) for Jan 2015 as compared to the Jan of 2013. We find that price elasticity is -0.825279 it means that demand of Dalda lie in inelastic portion, it means that if price increase or decrease, there is less impact on the quantity demanded. Cross price elasticity of sultan is positive, its value is 0.4964 it shows that it is substitute commodity. Cross price elasticity of Hoor should be positive, but according to our result its value is –2.718552, which means that in this specific area people are using Hoor as a complementary product .Cross price elasticity of total sales is 1.7299.
Keywords: Multiple Regression Analysis, Demand Estimation and Forecasting, Elasticities, Price of Dalda, Total Sales.

1. Introduction

Economic theory postulates that the demand for a commodity arises from the consumers' willingness and ability (i.e., from their desire and want for the commodity backed by the income) to purchase the commodity. Consumer demand theory postulates that the quantity demanded of a commodity is a function of, or depends on, the price of commodity, the consumer income, and the price of related commodity and the taste of the consumer. Managers expect an inverse relationship between the quantity demanded of a commodity and its price. That is when the price rises, quantity purchased declines and when the price falls, the quantity sold increases.

The objective of this study is to have practical application of demand function. Our study is beneficial for us to see the practical application of managerial economics techniques. Apart from introduction, the rest of the paper is arranged as follows: section II portrays review of the literature; section III discusses data and methodological issues. Results are interpreted in section IV. Finally, conclusions and policy implications are given in section V.

2. Literature Review

In recent years, few studies have been presented both nationally and internationally on this issue using time series as well as cross sectional data. But still this issue is needed to be discussed more at micro as well as at macro level to find solid policy framework in the future. Keeping in view the importance of application of demand function, some research articles are reviewed here.

Bashir et al. (2012) estimated the demand function for Soap as case study of Pakistan. They collected primary cross sectional data from Multan district and surveyed 370 respondents for collection of data in 2012. Following semi – log form of demand equation, the results of multiple regression analysis exhibited positive association of price, income, family size and advertisement with the demand of soaps while age was found to be inversely affecting demand.

Carlos et al. (2009) estimated the rational electricity energy demand for the residential and industrial consumption categories for the period from Jan 1999 to Dec 2007.They applied the methodology of time varying parameter in an error correction model (TVP-ECM) and stated space model as an estimating techniques. As results, we found that income had strong and positive relation with demand elasticity and price negative. Residential consumers were more sensible to price and to income than industrial ones and this could be seen as a

consequence of the Rationing period. The date found in the ECM equations of residential and industrial demand using a structural break test was August 2001, indicating that time-varying elasticity might be a better decision to estimate the Brazilian Electricity Demand.

Dick (2007) measured the impact on consumer welfare following significant changes in banking services in the period 1993–1999. The data was taken from the second quarter reports of each year. The data came from several sources: The data on bank characteristics derived from balance sheet and income statement are taken from the Report on Condition and Income ("Call Reports") from the Federal Reserve Board. The data on branch deposits used in the construction of local market shares, as well as the number of branches, was obtained from the Federal Deposit Insurance Corporation (FDIC). Demographic data at the MSA level was taken from both the US Census and the Bureau of Economic Analysis. Based on the estimation of nested logit-based models, the results indicated that consumers respond to deposit rates, and to a lesser extent, to account fees, in choosing a depository institution. Moreover, consumer demand responded favorably to the staffing and geographic density of local branches, as well as to the age, size, and geographic diversification of banks. The paper also found important differences across markets in the demand for banking services, with higher income areas being more responsive to prices and bank size, and less to location characteristics, relative to lower income areas.

3. Data and Methodology

3.1. Data and Estimation Method

The study uses time series monthly primary data on the variables like demand of Dalda, price of Hoor, price of sultan and total sales of Dalda from Ayub Distribution Company, Multan. Data is collected for the period from January 2013 – December 2014. We have run multiple regression analysis using Ordinary least Square method.

3.2. Model Specification

3.2.1. Demand Estimation

To estimate the demand function, we have used the following model;

$$Q_{dx} = f\ (P_x, P_h, P_s, TS)$$

In the above mentioned model, Q_{dx} is Quantity demanded of Dalda in units, P_x is price per unit of Dalda in Pak Rs, P_h is price per unit of Hoor in Pak Rs, P_S is Price per unit of Sultan in Pak Rs, TS is Total Sales in Pak Rs.

3.2.2 Examination of Elasticities

To estimate the elasticity of demand function, we have used the following model;

$$\log Q_{dx} = f\ (\log P_x, \log P_h, \log P_s, \log TS)$$

To find out the Elasticities, we have used log – log demand model. For that purpose, we have taken logarithmic of all the variables. $\log Q_{dx}$ is log of Quantity demanded of Dalda, $\log P_x$ is log of price of Dalda, $\log P_h$ is log of price of Hoor, $\log P_S$ is log of Price of Sultan, logTS is log of Total Sales.

3.2.3. Demand Forecasting

For demand forecasting, we have employed traditional methods of econometric forecasting[1]. Using econometric forecasting, we have to forecast each and individual explanatory variable by using exponential smoothing technique. In exponential smoothing technique, we will assign different weights to each variable w = 0.3 and w = 0.5. After forecasting value by assigning these weights, we will calculate Root Mean Square Error for each variable. The preferable forecasted value will be the one having lower Root Mean Square Error. In exponential smoothing, we will use following equation to find the forecasted value for a given period of each independent variable.

$$F_t+1 = WA_t + (1-W)\ Ft$$

In this equation, F_{t+1} is the forecasted value for period t and W is weight that we assign and A_t is actual value

4. Results and Discussion

4.1. Demand Estimation

Price of Dalda is negative, it means that Price of Dalda has indirect relationship with Demand of Dalda, Which justify our law of demand that when prices increases our quantity demanded decrease. By increasing 1 rupee of Dalda our Demand of Dalda decrease by 13.71416 units. According to t-statistic, Price of Dalda is significant (Price of Dalda is affecting the quantity demanded) because it is in the accepted range of (0.00-0.10).

Price of Sultan is positive which shows that total sales and Price of Sultan are directly related to the Demand of Dalda, which justifies the substitution effect. By increasing 1 rupee of Sultan our demand of Dalda will increase by 15.5934 units. It means that people are using Sultan as a substitute of Dalda. According to T-statistic rule, Price of Sultan is significant (price of Sultan if affecting the demand of Dalda), because it is in the

[1] Managerial Economics, Dominick Salvatore, 4th Edition.

accepted range of Probability (t-stat) which is (0.00-0.10).

Price of Hoor is negative it shows that Price of Hoor are in indirect relationship to the Demand of Dalda. Actually Price of Hoor is not following the substitution effect; the reason of this may be that people in the area from where we have collected data used Hoor as a complimentary with the consumption of Dalda. So by increasing 1 rupee of Hoor our demand of Dalda decreases by 58.850 units. According to T-statistic rule PH is significant (price of Hoor affecting the quantity demanded of Dalda), because it is in the accepted range of (0.00-0.10).

Total sales are positive which shows that total sales are directly related to the Demand of Dalda. By increasing 1 unit of sales our demand of Dalda will increase by 0.005295 units. According to T-statistic rule, Total Sales is significant, because it is in the accepted range of (0.00-0.10). Constant is intercept, which is equal to 4341.359 and C shows the affect of all other variables except P_d, P_s, P_h and TS on quantity demanded. All other variables will affect on quantity demanded by 4341.359 units. The value of Coefficient of determination shows that 80.6594 percent variations in demand of Dalda is due to the variation in prices of Dalda, Prices of Hoor, and prices of sultan and total sales. Overall our demand function is significant because our p value of F Statistic lies in the accepted range of (0.00-0.1).

Table 1: Demand Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	4341.359	665.7706	6.520804	0.0000
Price of Demand	-13.71416	5.826636	-2.353701	0.0295
Price of Sultan	15.59349	9.045392	1.723916	0.1010
Price of Hoor	-58.85058	9.021413	-6.523433	0.0000
Total Sales	0.005295	0.000631	8.394283	0.0000
R-squared	0.806594	Prob. (F-statistic)		0.0000

4.2. Examinations of Elasticities

From table 2, we found that price elasticity of demand is -0.825279 it means that demand of Dalda lie in inelastic portion, it means that if price increase or decrease, there is less impact on the quantity demanded. By increasing 10 percent price of Dalda our demand of Dalda will decrease by 8.2527 percent. Cross price elasticity of demand w.r.t. price of sultan is 0.4964 it shows that it is substitute commodity and increasing the price of sultan our demand will increase and by increasing 10 percent rice of Sultan our Demand of Dalda will increase by 4.96 percent. Cross price elasticity demand w.r.t. price of Hoor is –2.718552, which means that in this specific area people are using Hoor as a complementary product and by increasing 10 percent price of Hoor our demand of Dalda will decrease by 27.1 percent. Total Sales elasticity of demand is 1.7299 and by increasing 10 percent total sales our Demand of Dalda will increase by 17.29 percent.

Table 2: Elasticities

Elasticities of demand	Vales
Price elasticity of Dalda	-0.825279
Cross price elasticity of demand w.r.t price of sultan	0.496474
Cross price elasticity of demand w.r.t price of Hoor	-2.718552
Total Sales Elasticity of demand	1.729905

4.3. Demand Forecasting

We have estimated the demand function in table 1 and also find out the forecasted values of each independent variable by using exponential smoothing technique. In exponential smoothing technique, we will assign different weights to each variable w=0.3 and w=0.5. After forecasting value by assigning these weights, we will calculate Root Mean Square Error for each variable. The preferable forecasted value will be the one having lower Root Mean Square Error. We find out that at w=0.5 Root mean square of all independent variables are small and we pick those forecasted values for independent variable. We find out the forecasted demand for Jan 2015 by putting the forecasted value of each independent variable for the month of Jan 2015 in the estimated demand equation.

In table 3 we forecast the price of Dalda for period Jan 2015 by using exponential smoothing at w=0.3 and w=0.5. In exponential smoothing, we use following equation to find the forecasted price of Dalda.

$$F_{t+1} = WA_t + (1-W)\, F_t$$

In this equation, F_{t+1} is the forecasted price of Dalda for period 25^{th} which is Jan 2015 and W is weight that we assign and A_t is actual price of Dalda.

Table 3: Forecasted Price of Dalda

Years	Months	Price of Dalda	Forecasted value W=0.3	Forecasted value W=0.5
2013	Jan	110	114.667	114.667
2013	Feb	106	113.2669	112.3335
2013	Mar	104	111.0868	109.1668
2013	Apr	105	108.9608	106.5834
2013	May	105	107.7725	105.7917
2013	June	112	106.9408	105.3958
2013	July	112	108.4585	108.6979
2013	Aug	110	109.521	110.349
2013	Sep	110	109.6647	110.1745
2013	Oct	108	109.7653	110.0872
2013	Nov	110	109.2357	109.0436
2013	Dec	115	109.465	109.5218
2014	Jan	115	111.1255	112.2609
2014	Feb	112	112.2878	113.6305
2014	Mar	110	112.2015	112.8152
2014	Apr	118	111.541	111.4076
2014	May	120	113.4787	114.7038
2014	June	124	115.4351	117.3519
2014	July	124	118.0046	120.676
2014	Aug	120	119.8032	122.338
2014	Sep	120	119.8622	121.169
2014	Oct	124	119.9036	120.5845
2014	Nov	128	121.1325	122.2922
2014	Dec	130	123.1927	125.1461
2015	Jan		125.2349	127.5731

In table 4, we forecast the price of Hoor for period Jan 2015 by using exponential smoothing at W=0.3 and W=0.5. In exponential smoothing, we use following equation to find the forecasted price of Hoor.

$$F_{24+1} = WA_{24} + (1-W)\, F_{24}$$

In this equation, F_{24+1} is the forecasted price of Hoor for period 25th which is Jan 2015 and W is weight that we assign and A_{24} is actual price of Hoor.

Table 4: Forecasted Price of Hoor

Years	Months	Price of Hoor	Forecasted value W=0.3	Forecasted value W=0.5
2013	Jan	90	99	99
2013	Feb	92	96.3	94.5
2013	Mar	90	95.01	93.25
2013	Apr	90	93.507	91.625
2013	May	93	92.4549	90.8125
2013	June	90	92.61843	91.90625
2013	July	90	91.8329	90.95313
2013	Aug	90	91.28303	90.47656
2013	Sep	90	90.89812	90.23828
2013	Oct	92	90.62869	90.11914
2013	Nov	94	91.04008	91.05957
2013	Dec	95	91.92806	92.52979
2014	Jan	104	92.84964	93.76489
2014	Feb	104	96.19475	98.88245
2014	Mar	106	98.53632	101.4412
2014	Apr	104	100.7754	103.7206
2014	May	106	101.7428	103.8603
2014	June	106	103.02	104.9302
2014	July	108	103.914	105.4651
2014	Aug	106	105.1398	106.7325
2014	Sep	108	105.3978	106.3663
2014	Oct	108	106.1785	107.1831
2014	Nov	110	106.7249	107.5916
2014	Dec	110	107.7075	108.7958
2015	Jan		108.3952	109.3979

In table 5, we forecast the price of Sultan for period Jan 2015 by using exponential smoothing at W=0.3 and W=0.5. In exponential smoothing, we use following equation to find the forecasted price of Sultan.

$$F_{24+1} = WA_{24} + (1-W)\, F_{24}$$

In this equation, F_{24+1} is the forecasted price of Sultan for period 25th which is Jan 2015 and W is weight that we assign and A_{24} is actual price of Sultan.

Table 5: Forecasted Price of Sultan:

Years	Months	Price of Sultan	Forecasted value W=0.3	Forecasted value W=0.5
2013	Jan	95	105.833	105.833
2013	Feb	98	102.5831	100.4165
2013	Mar	100	101.2082	99.20825
2013	Apr	100	100.8457	99.60413
2013	May	102	100.592	99.80206
2013	June	100	101.0144	100.901
2013	July	100	100.7101	100.4505
2013	Aug	104	100.4971	100.2253
2013	Sep	100	101.5479	102.1126
2013	Oct	104	101.0836	101.0563
2013	Nov	105	101.9585	102.5282
2013	Dec	105	102.8709	103.7641
2014	Jan	110	103.5097	104.382
2014	Feb	110	105.4568	107.191
2014	Mar	112	106.8197	108.5955
2014	Apr	112	108.3738	110.2978
2014	May	112	109.4617	111.1489
2014	June	110	110.2232	111.5744
2014	July	108	110.1562	110.7872
2014	Aug	110	109.5094	109.3936
2014	Sep	110	109.6565	109.6968
2014	Oct	106	109.7596	109.8484
2014	Nov	112	108.6317	107.9242
2014	Dec	115	109.6422	109.9621
2015	Jan		111.2495	112.4811

In table 6, we forecast the total Sales of Dalda for period Jan 2015 by using exponential smoothing at W=0.3 and W=0.5. In exponential smoothing, we use following equation to find the forecasted total Sales of Dalda.

$$F_{24}+_1= WA_{24}+ (1-W) F_{24}$$

In this equation, F_{24+1} is the forecasted Total Sales for period 25^{th} which is Jan 2015 and W is weight that we assign and A_{24} is actual total Sales.

Table 6: Forecasted value of Total Sales

Years	Months	Total sales	Forecasted value W=0.3	Forecasted value W=0.5
2013	Jan	535250	643485	643485
2013	Feb	529100	611014.5	589367.5
2013	Mar	538800	586440.2	559233.8
2013	Apr	540250	572148.1	549016.9
2013	May	527750	562578.7	544633.4
2013	June	537200	552130.1	536191.7
2013	July	531100	547651.1	536695.9
2013	Aug	552700	542685.7	533897.9
2013	Sep	600500	545690	543299
2013	Oct	616800	562133	571899.5
2013	Nov	626300	578533.1	594349.7
2013	Dec	644750	592863.2	610324.9
2014	Jan	670950	608429.2	627537.4
2014	Feb	670700	627185.5	649243.7
2014	Mar	675300	640239.8	659971.9
2014	Apr	698200	650757.9	667635.9
2014	May	677800	664990.5	682918
2014	June	684500	668833.4	680359
2014	July	693000	673533.4	682429.5
2014	Aug	704900	679373.3	687714.7
2014	Sep	811400	687031.3	696307.4
2014	Oct	799400	724341.9	753853.7
2014	Nov	784500	746859.4	776626.8
2014	Dec	792500	758151.6	780563.4
2015	Jan	643485.4	768456.1	786531.7

After calculating the forecasted values of all independent variable we calculate root mean square to

select the appropriate forecasted value. According to root mean rule whose value is less we should select the forecasted value of the independent variable. In our result at W=0.5 our Root mean square value is less. Root mean Square of price of Dalda is less at 0.5 which is 4.008 and its forecasted value for Jan 2015 is 127.5731(Table 3). Root mean Square of price of Hoor is less at 0.5 which is 3.55 and its forecasted value for Jan 2015 is 109.3979 (Table 4). Root mean Square of price of Sultan is less at 0.5 which is 3.45 and its forecasted value for Jan 2015 is 112.4811(Table 5). Root mean Square of total sales of Dalda is less at 0.5 which is 42328.08 and its forecasted value for Jan 2015 is 786531.7(Table 6).

Table 7:

Price of Dalda		Price of Sultan		Price of Hoor		Total Sales	
RMSE W=0.3	RMSE W=0.5	RMSE W=0.3	RMSE W=0.5	RMSE W=0.3	RMSE W=0.5	RMSE W=0.3	RMSE W=0.5
4.764	4.088	3.8157	3.45	4.526	3.55	53619.03	42328.08

RMSE is Root Mean Square Error = $\sqrt{\frac{\sum (A-F)^2}{n}}$

$$Q_{dx} = 4341.359 - 13.71416\ P_D - 58.85058\ P_H + 15.59349\ P_S + 0.005295\ TS$$

By putting forecasted values of P_D, P_H, P_S and TS for Jan 2010 we calculate forecasted quantity demanded of Dalda for the month of Jan 2010.

$Q_{dx} =$ 4341.359 - (13.71416 * 127.5731) - (58.8505 * 109.3979) + (15.5934 * 112.4811) + (0.005295 * 786531.7)

$Q_{dx} =$ 2072.2921units

5. Concluding Remarks

From the linear regression equation and from elasticity of independent variables, we find Price of Dalda has indirect relationship with Demand of Dalda. Price of Hoor has negative relationship to the Demand of Dalda. Actually Price of Hoor is not following the substitution effect; the reason of this may be that people in the area from where we have collected data used Hoor as a complimentary with the consumption of Dalda. Cross price elasticity of demand for Hoor should be positive, but according to our result its value is –2.718552. Prices of Sultan which is positive which shows that total sales and Price of Sultan are directly related to the Demand of Dalda, which justifies the substitution effect. Cross price elasticity of demand for sultan is positive, its value is 0.4964. Total sales are positive which shows that total sales are directly related to the Demand of Dalda having value 1.7299. Total Sales elasticity of demand is found as 0.825279 means that change in prices Of Dalda our demand of Dalda not so much change, so company increase prices to increase profit margin. And we also forecasted the demand for the Jan of 2015 which is 2072.2921, Quantity demanded will increase by 272.2921 (15percent) for Jan 2015 as compared to the Jan of 2013.

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