A Study on Real Consumption levels and Performance of Public Distribution System in Thoothukudi District

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Introduction

Thoothukudi district, Public Distribution System is currently operated state government as the joint responsibility of procuring, storing, transporting and allocation of food grains to the governments. The policy of allocation under the Public Distribution System in India has been the subject of intense debate among economists as well as in policy circles. For instance, Parikh (1994) emphasized the implicit subsidy through Public Distribution System. So the principle of allocation is somewhat adhoc. It has been done on the 'historical basis' ad is incremented subject to availability as per demand from population in the living areas. In this sense, the role of Public Distribution System is really one of the subsidizing factor in real consumption. In the present paper we evaluate the current policy of allocation on the basis of this notion of providing a real consumption subsidy.

Taluk wise Cereal Demand in Thoothukudi District Rural and Urban

The National Sample Survey 66th Round (July 2009 – June 2010) and 67th round (july 2010 – June2011) contain data on average monthly per capita expenditure (weighted average that accounts for the distribution of expenditure amongst different MPCE classes in the district), quantity and value of rice and wheat consumed per person in 30 days. We first estimated the own price elasticity of demand, the cross elasticity and the income elasticity non-parametrically.

However, since the data points were very few. So that the results were inefficient hence, we pooled the data and used appropriate dummies to capture Taluk wise differences. District Statistical book data for 6 Taluk, Thus the sample size is 6. The implicit price is obtained by dividing the value of expenditure by the quantity of rice or wheat purchased as the case may be.

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The average monthly per capita expenditure (MPCE) is deflated by the consumer price index (CPI) and taken to be an indicator of real income.

Ratio of Actual Levels of Consumption to Predicted Levels

Taluk		Rural		Urban	
		Rice	Wheat	Rice	Wheat
Thoothukudi	2015	0.613177	1.169399	1.533543	0.885386
	2016	0.916255	0.610937	1.22799	1.161177
	2017	0.915438	0.938505	1.12797	1.069597
Thiruchendur	2015	0.607302	1.172832	1.51885	0.887984
	2016	0.911781	0.610937	1.117315	1.161177
	2017	0.912698	0.938505	1.11844	1.069597
Sathankulam	2015	0.619472	1.165759	1.549286	0.884889
	2016	0.918139	0.604344	1.125107	1.148647
	2017	0.918095	0.936673	1.125054	1.067508
Srivaikundam	2015	0.614306	1.168744	1.536366	0.884889
	2016	0.914128	0.613857	1.120192	1.166727
	2017	0.914477	0.940292	1.120619	1.071633
Kovilpati	2015	0.61365	1.169125	1.534726	0.885177
	2016	0.913922	0.607745	1.11994	1.155111
	2017	0.91443	0.937861	1.120562	1.068863
Vilathikulam	2015	0.615658	1.16796	1.539747	0.884296
	2016	0.913922	0.607424	1.11994	1.1545
	2017	0.914347	0.93783	1.12046	1.068827
Ottaipidaram	2015	0.619385	1.165809	1.549069	0.882667
	2016	0.91808	0.607442	1.125035	1.154534
	2017	0.916445	0.937774	1.123032	1.068763
Ettyapuram	2015	0.615061	1.168306	1.538256	0.884557
	2016	0.914502	0.613763	1.12065	1.166548
	2017	0.915242	0.939181	1.121557	1.070367

Source: Compiled to NSS Price data and District Population Statistical Data in Thoothukudi Taluk.

The Model

The demand model is a double-log function so that the estimation of elasticity's becomes linear.

$$\text{Log } Q^u_x = b_1 \text{Log} P_x + b_2 \text{Log} P_y + b_3 \text{Log} I + wT + \text{€}t \text{ ------ (1)}$$

Where

$Q^u_x =$ per capita consumption of X (rice/wheat) in a month,

$A_0 =$ minimum consumption level,

$b_1 =$ partial own price elasticity,

$b_2 =$ partial cross elasticity (wrt substitute cereal Y),

$b_3 =$ partial income elasticity (wrt (I) money income),

$W =$ growth in minimum consumption level of rice or wheat,

$T =$ time trend,

And,

$$Q^N_x = (\text{Anti (Log } Q_x) * P^R + \text{Anti (Log } Q_x) * P^U) * 12 \text{ -----(2)}$$

$U =$ (Superscript) urban

$R =$ (superscript) rural,

$N =$ (superscript) national and

$P =$ Population

The predicted value of Log Q can be obtained from (1). Its antilog gives the estimate of per capita per mensem demand capita for the particular cereal, rice or wheat, which when multiplied by either rural or urban population of India, gives the demand for the particular region, Equation (2) gives the total demand at the national level.

Consumption in each Taluk can be obtained by constructing individual equations from the aggregate equation since the difference in intercept as well as the difference in slope for major consuming District are known four equation, pooling al Taluk wise, were estimated; one each for each cereal and one each for each sector – rural and urban.

Table 2,1 Equation For Cereal Demand At Taluk Level(Rural Rice)

Dependent Variable log(Qd) (Rural Rice)

$R^2 = 1$ Dubin Watson   2.89137

No	Label	LAG	Co-Efficient	Standard Error	T-Statistic
1	LPRW	0	0.0612	3E-32	21E+30
2	LPRR	0	- 0.2809	0	0.6551
3	DMCPUR	0	0.07825	-4.7E-33	1.7E-31
4	Thoothukudi	0	-3.7E- 05	1.96E-07	-189.582
5	Thiruchendur	0	-6E-05	9.95E-05	-0.60451
6	Sathankulam	0	0.00013	2.96E-05	-4.51371
7	Kovilpati	0	-0.00039	0.00476	-0.82364
8	Srivaikundam	0	-0.00014	0.000217	-0.638865
9	Vilathikulam	0	-0.00239	0.001441	-1.65651
10	Ottaipidaram	0	-0.00015	2.21E-05	-6.68453
11	Ettyapuram	0	-6.8E-05	0.000105	0.64281

Zero Degree Homogenity: LPRR=log of price of rural rice

LPRW = log of price of rural wheat (substitute grain)

DMCPR = log of price of monthly expenditure per capita.

Thoothukudi Taluk wise Real Consumption

To return to the theme of Thoothukudi Taluk level estimates, it would be appropriate to recapitulate the key issues. At the Taluk level NSS data reflect the monthly per capita expenditure on cereals, amongst other things. We have used this rich source to estimate the true levels of consumption in different Taluks. The methodology is to estimate demand equations of the type given by (1). The main interest here lies, however, in estimating the levels of

consumption per capita per month on the hypothetical basis that real income remains constant. To this end, the basic relationship between demand, income and prices is used.

In genereal, the demand function is defined as

$D_X = f(P_X, P_S, P_C, I)$

D_X = demand for commodity X

P_X = price of commodity X

P_S = Price of Substitutes

P_C = Price of compliments

I = Money Income

The demand function is homogeneous of degree zero if the following relation holds:

$(\delta D_X/\delta P_X)*P_X + (\delta D_S/\delta P_S)*P_S + (\delta D_C/\delta P_C)*P_C + (\delta D_X/\delta I*I = 0$

Dividing throughout by D_X, this relationship gets converted into an additive function between all the elasticities of demand. Namely, the own price elasticity, elasticity with respect to price of substitutes and/or price of complements. This implies: $\eta_x + \eta_{S+}\eta_C + \eta_I = 0$

Where η_i are the respective elasticities. This can be tested using the standard F test. Such a test would reveal whether the assumption of the degree of homogeneity being zero is true. If the test validates this restriction, then the implication is that the levels of consumption remain constant if all prices increase along with an increase in the money income, such that real income remains constant. This is in keeping with Engel's law where the levels and patterns of real consumption depend upon real income. The advantage with verifying such a hypothesis of zero degree homogeneity is that stable levels of consumption can then be predicted. In the subsequent analysis of allocation and lifting from Public Distribution System, these stable levels of consumption have been used as a basis for making comparisons. The basic assumption in this study is that in the given three years the average real income is constant. Therefore, stable levels of consumption can be estimated and can be compared with the actual levels of allocation and lifting.

Table 2,2 Equation For Cereal Demand At Taluk Level(Rural Wheat)

Dependent Variable log(Qd) (Rural Wheat)

$R^2 = 1$ Dubin Watson   1.0934

No	Label	LAG	Co-Efficient	Standard Error	T-Statistic
1	LPRR	0	-0.01151	3.7E-33	3.1E-30
2	LPRW	0	0.052809	4.77E-18	1.11E-16
3	DMCPR	0	-0.01471	0.01245	0.65535
4	Thoothukudi	0	6.98E-06	3.68E-08	0.18958
5	Thiruchendur	0	1.73E-05	1.87E-05	0.604543
6	Sathankulam	0	2.51E-05	5.57E-06	-4.51374
7	Kovilpati	0	7.38E-05	8.96E-05	0.82364

8	Srivaikundam	0	2.6E-05	4.09E-05	0.63725
9	Vilathikulam	0	0.00449	0.00271	1.65651
10	Ottaipidaram	0	2.78E-05	4.16E-05	0.63681
11	Ettyapuram	0	1.27E-05	1.98E-05	0.64280

Zero Degree Homogenity: LPRR=log of price of rural rice

LPRW = log of price of rural wheat (substitute grain)

DMCPR = log of price of monthly expenditure per capita.

Consumption Level Estimation and Methodology

Regression equations for the dour data series relating to demand for superior cereals were estimated by using slope and intercept Taluk variables. 8 Taluk Consuming Variables were used to pick up inter- district differences. Similarly, in the initial estimates, 8 trend variables were also included. Apart from this, a dummy each for major wheat consuming and major rice consuming only formed. This serves the purpose of identifying the difference between the coefficients for

Table 2.3 Equation For Cereal Demand At Taluk Level(Urban Rice)

Dependent Variable log(Qd) (Urban Rice)

Regression^2 : 1 Dubin Watson 3.021224

No	Label	LAG	Co-Efficient	Standard Error	T-Statistic
1	LPUW	0	-0.06527	0.00192	0.65535
2	LPUR	0	-0.23995	7.88E-33	0.3E-31
3	DMCPU	0	-0.05131	0.00025	0.65535
4	Thoothukudi	0	-6.8E-05	3.6E-07	0.189582
5	Thiruchendur	0	-0.00011	0.000183	-0.60451

6	Sathankulam	0	-0.00025	5.44E-05	-4.51371
7	Kovilpati	0	0.00072	0.00876	-0.82364
8	Srivaikundam	0	-0.00025	0.0004	-0.63726
9	Vilathikulam	0	-0.00439	0.002649	-1.65651
10	Ottaipidaram	0	-0.00027	4.07E-05	-6.68452
11	Ettyapuram	0	-0.0012	0.000193	-0.64281

Zero Degree Homogenity: LPUR=log of price of urban rice

LPUW = log of price of Urban wheat (substitute grain)

DMCPU = log of price of monthly expenditure per capita.

Major Taluk dummies of either rice or wheat. For a rigorous testing of the zero degree homogeneity condition, own price, price of substitutes, price of complements and income need to be included as explanatory variables. Some of the trend variables were found to be insignificant in the initial estimation and were dropped. The study also tries to incorporate income inequalities. This was done in the light of the argument of Kumar, R.P segrant and Boulis(1994), who emphasized the significance of income inequalities in the determination of consumer demand. Dummies were created for groups of Taluk amongst the sample 8, which happened to fall in the same quartile range of monthly per capita consumption expenditure. These dummies were used to determine the differences in coefficients for these four groups in respect of the income variable. Once again, the results were not significantly different from the initial estimates, which took income as a gross variable. Neither were they illuminating in terms of different signs for high classes. The final estimates therefore, were based on the original model in which consumption expenditure was taken in money in terms and as a single variable.

Table 2,4 Equation For Cereal Demand At Taluk Level(Urban Wheat)

Dependent Variable log(Qd) (Urban Wheat)

$R^2 = 1$ Dubin Watson   0.09401

No	Label	LAG	Co-Efficient	Standard Error	T-Statistic
1	LPUW	0	-0.01224	3.7E-33	-3.3E-13
2	LPUR	0	0.05618	4.77E-08	5.41E-17
3	DMCPU	0	-0.01565	4.77E-18	4.41E-05
4	Thoothukudi	0	7.43E-06	3.92E-08	0.18958
5	Thiruchendur	0	1.2E-05	1.99E-05	0.604
6	Sathankulam	0	2.67E-05	5.92E-06	0.45137
7	Kovilpati	0	7.85E-05	9.53E-05	0.82364
8	Srivaikundam	0	2.77E-05	4.35E-05	0.638805
9	Vilathikulam	0	0.000477	0.000288	1.65124
10	Ottaipidaram	0	2.96E-05	4.43E-06	-6.684
11	Ettyapuram	0	1.35E-05	2.11E-05	0.6428

Zero Degree Homogenity: LPUR=log of price of urban wheat

LPUR = log of price of Urban rice (substitute grain)

DMCPU = log of price of monthly expenditure per capita.

DEGREE OF HOMOGENEITY

For verifying the hypothesis of the degree of homogeneity being zero, two tests were conducted. The first was a single linear restriction on all the coefficients of own price, price of substitutes and income, that is, Test 1. (major consuming Taluk)

$b_1+b_2+b_3+b_1*D_w + b_2+b_3+b_1*D_w = 0$ (1)

with dummy D_r for rice (rural and urban) equations and dummy D_w for wheat(rural and urban) equations.

Results

All pooled equations have high explanatory power. The minimum R^2 is 1 which is in the case of rural wheat consumption. Were made (Table 2.1 to 2.4).

Rural Rice

The own elasticity bears the right sign at the Thoothukudi District level and is large(0.0612 in Table 2.1) for overall rice consumed in the study year, the interaction dummy variable is significant and negative at -0.2809, negative price elasticity shows. For the Thoothukudi district income elasticity is 0.08. Most of the intercepts are significant. With the sign varying in different cases, There is no intercept and no significant in Thoothukudi Taluk variables. The noticeable factor is that there is a definite negative trend that is both statistically significant and numerically weighty. This points to a small decline in rice consumption in all taluk . The reverse trend can be seen in urban rice consumption. However, interestingly, these are independent trends, because the states n which the decline is apparent, do not match the states in which wheat consumption has been rising. A more detailed analysis of the changes in the real income levels and a inter taluk level study for regional patterns may reveal a shift towards superior cereal substitutes. Of the two tests, the null hypothesis of zero degree homogeneity is accepted only for the major consuming District(Thoothukudi Taluk).

Rural Wheat

Results for this are reported in Table 2.2. wheat consumption in Rural areas has an overall own price elasticity of -0.01. The corresponding elasticity for major consuming areas is less nevertheless, bears the right sign, and stands at -0.228 (given by -0.01151 +0.52809). The difference, however is significant only at 10 percent level. The price of rice as a substitute bears a negative sign and is significant, with its value being -0.01471. The corresponding elasticity is -0.067 for the major consuming areas (given by -0.01471+0.0552809). this means that rice is definitely a substitute for wheat in consuming areas and, significantly, its income elasticity is lower than the income elasticity. This is direct evidence of change in consumption patterns in major rice consuming areas in Thoothukudi District. The growth rates are also fairly high. It may be concluded that the total cereal intake in these taluk has increased since none amongst them figure in the decline trend of rice consumption. The F-test for verifying the restriction regarding

degree of homogeneity follows the same pattern of being accepted for the major consuming states and rejected at the Thoothukudi Taluk Wise level (Table 2.2)

Urban Rice

The own price elasticity at the Thoothukudi District Taluk level is -0.06527 and significant. There is no significant difference between the elasticity of major consuming areas and the Thoothukudi Taluk levels magnitude. Wheat price elasticity is positive and almost equal to unity. It is significant at both levels, but is marginally negative for the major consuming areas. The income elasticity of demand, in general, is insignificant but bears negative sign. This virtually means that rural rice consumption in major consuming areas has an income elasticity of

Table 3: Stable Predicted Demand for Rice and Wheat in Tuticorin District(Taluk Wise Report) Per capita /per month   **(in kg)**

Taluk		Rural		Urban	
		Rice	**Wheat**	**Rice**	**Wheat**
Thoothukudi	2015	9.129991	0.440002	8.313983	0.631002
	2016	8.631527	0.533713	7.397807	0.730695
	2017	8.628482	0.534285	7.39221	0.731304
Thiruchendur	2015	8.885878	0.485895	7.865303	0.679824
	2016	8.879865	0.487025	7.854252	0.681027
	2017	8.624257	0.53508	7.384445	0.732149
Sathankulam	2015	9.114404	0.442932	8.285335	0.634119
	2016	8.698761	0.521073	7.521382	0.717248
	2017	8.576835	0.543995	7.297283	0.741633
Srivaikundam	2015	8.892937	0.484568	7.878278	0.678413
	2016	8.879362	0.48712	7.853327	0.681128
	2017	8.617701	0.536312	7.372395	0.73346
Kovilpati	2015	8.931397	0.477337	7.948967	0.670721
	2016	8.870964	0.488699	7.837893	0.682807

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	2017	8.587639	0.541964	7.31714	0.739472
Vilathikulam	2015	9.040969	0.484344	8.150361	0.648806
	2016	8.802237	0.487142	7.711572	0.696553
	2017	8.546794	0.536514	7.242067	0.747641
Ottaipidaram	2015	9.122703	0.441372	8.300589	0.632459
	2016	8.675889	0.525373	7.479343	0.721822
	2017	8.591408	0.541255	7.324068	0.738718
Ettyapuram	2015	8.894129	0.484344	7.880468	0.678174
	2016	8.879242	0.487142	7.853107	0.681152
	2017	8.616629	0.536514	7.370425	0.733674

Source: Calculated Data

demand which is around 0.05, and is highly significant. The intercepts of Thoothukudi dummy variables are not significant. There is an unmistakable trend of decline in rural rice consumption. Significant falling trend rates are observed in all dummy variables. The degree of homogeneity is zero at the district level(Table 2.3).

Urban Wheat

Urban wheat consumption is negaively related to own price at both levels but is significant only for major consuming areas in Thoothukudi District. Its value is -0.012. rice as a substitute.

Table 4: Stable Predicted Demand for Rice and Wheat Tuticorin District(Taluk wise Report)

Per month in Tons

Taluk		Rural		Urban	
		Rice	Wheat	Rice	Wheat
Thoothukudi	2015	10517.99	919.114	9577.925	1318.091
	2016	18779.16	970.3898	16095.02	1328.54
	2017	18778.64	989.2964	16088.07	1354.102
Thiruchendur	2015	6117.58	633.2108	5414.954	885.936
	2016	10930.51	552.4346	9668.051	772.4919
	2017	10936.88	612.9145	9364.608	838.6498
Sathankulam	2015	2635.35	221.8942	2395.632	317.6725
	2016	4730.57	227.2119	4090.286	312.7533
	2017	4731.726	240.8717	4025.814	328.3825
Srivaikundam	2015	5527.364	541.6509	4896.707	758.3312
	2016	9867.553	473.9411	8727.33	662.7003
	2017	9641.951	521.366	8248.635	713.0199
Kovilpati	2015	4597.153	443.971	4091.479	623.8373
	2016	8163.854	395.6349	7213.13	552.7784
	2017	8050.441	441.8866	6859.418	602.9234
Vilathikulam	2015	3565.094	340.1324	3213.903	455.6265
	2016	6205.887	302.0517	5436.929	431.8967
	2017	6068.148	331.9109	5141.803	462.5233
Ottaipidaram	2015	2597.704	217.8915	2363.606	312.2251
	2016	4643.299	225.7496	4002.913	310.1625
	2017	4640.441	243.2969	3955.918	332.0575
Ettyapuram	2015	1840.654	179.2817	1630.875	251.0286
	2016	3302.352	157.3319	2920.713	219.9911
	2017	3493.412	185.8585	2988.167	254.1585

Source: Calculated Data

bears a positive sign and is not significant at the Thoothukudi Taluk level but is positively stands for 0.043 (given by -0.01224 + 0.05618) for the major consuming areas in Thoothukudi. Income in this case is not significant at the 5 percent level but is significant at the 10 percent level for both the Thoothukudi districts. The demand for rural wheat also display zero degree homogeneity at both levels. This implies that in general the consumption of cereals in rural areas conforms to real income levels(Table 2.4).

Conclusion

These demand equations were used to predict the stable consumption levels generated on the hypothetical basis that if real income remains constant the levels of demand too remain constant the levels of demand too remain constant. This is an outcome of the degree of homogeneity being zero, which has been verified at almost all levels, and for both rural and urban areas. The predictive efficiency of the model and the specific equations has been tested on the basis of the ratio of actual levels of consumption to such predicted levels of hypothetical consumption. The results of this test show that there is not maximum deviation are in the case of rural and urban commodities consumption the study period. In all cereals consumption in Thoothukudi Taluk is gradually rising.

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