CHAPTER THREE

DATABASE ECONOMETRIC MODEL AND METHODOLOGY

3.1 Introduction

In the last chapter we have discussed different concepts of marketing efficiency. In this chapter we are going to discuss the econometric models used in our study, the methodologies adopted and the database used for the purpose of testing marketing efficiency. This chapter is organised as the following. In section 3.2 we have explained the database used in our study and the method of collecting the primary data. In section 3.3 we have discussed the methodologies adopted in analyzing the secondary data and the econometric models required for testing market integration. Section 3.4 deals with the methodology related to the issue of primary data. In section 3.5 we have stated the conclusion of this chapter.

3.2 Database and Method of Collecting Primary Data

Data from the primary and secondary sources have been collected for this study. Primary data have been collected from the households from the three different villages selected from three selected blocks. Three blocks were selected purposively. These blocks were Tarakeswar, Haripal and Chanditala II. The
selected is based on the distribution of operational holdings among different size classes in Hooghly district. The farmers having operational holding 10.0 acres or more are termed as large farmers in the government record. But in our study the farmers having operational holding 6.0 acres or more are considered as large farmers in order to enable ourselves to make a comparative study among the sample farmers. The farmers among different size groups have been selected by systematic random sampling.

Secondary data have been collected from various sources. Time series data on area under production, total production and rate of yield of different crops have been collected from Statistical Abstract of Bureau of Applied Economics and Statistics, Directorate of Agriculture, Government of West Bengal. Data on geographical and demographic features of the three selected villages were collected from the District Census Handbook of Hooghly district. The wholesale and retail prices of potato and rice were collected from the seven Market Intelligence centers of Hooghly district under the Superintendent of Agricultural Marketing, Government of West Bengal. Data on the number of operational holding and operated area in the district, the sources of irrigation and area under irrigation of Hooghly district have been collected from District Statistical Handbook published by Bureau of Applied Economics and Statistics, Directorate of Agriculture, Government of West Bengal.

3.3 Methodology Related to the Utilisation of Secondary Data and Econometric Models

Given these data we need to calculate the growth rates of production, area under production and rate of yield of the six important crops in different districts of West Bengal. The methodology adopted in estimating the growth rate is discussed below.
villages in each block were categorised according to the distance from the nearest market intelligence centers. The market intelligence centers are the places where Department of Agricultural Marketing of Hooghly district has its offices and the officials of this department collect different information regarding marketing of agricultural commodities. There are seven market intelligence centers in the district viz Arambag, Champadanga, Haripal, Magra, Pandua, Seoraphuli and Tarakeswar. The number of household surveyed from each size class category was determined by the distribution of farmers in different size classes as shown in Statistical Handbook of the district. The households were then selected by the random sampling method. There was only one large farmer in the three villages. This study is based on the primary survey of 124 households in three villages of Hooghly district namely Baksa, Ekbelpur and Santoshpur. The primary data were collected during March to May 2007. We have followed two stage sampling method. Three villages were selected on the basis of their distances from the main market. The households are selected at the second stage. The households are subdivided into five classes according to the size One village from each block was selected by random sampling method.

A list of resident cultivators was prepared for the three villages. The households are subdivided into five classes according to the size of holdings –

- marginal farmers (having operational holding below 1.0 acre),
- small farmers (size of operational holding above 1.0 acre but less than 2.0 acres),
- semi medium farmers (size of operational holding above 2.0 acres but less than 4.0 acres)
- medium farmers (having operational holding above 4.0 acres but less than 6.0 acres) and
- large farmers (size of operational holding above 6.0 acres).

We have selected 104 marginal farmers 13 small farmers 4 semi medium farmers 2 medium farmers and 1 large farmer. The number of farmers
3.3.1 Determination of Rate of Growth

In this section we are going to describe the methodology adopted in our study. To consider the relative importance of rice and potato six major crops are selected namely rice, potato, wheat, pulses, oilseed (rapeseed and mustard) and jute. The growth rates of output, rate of yield of crop and area under production have been measured for all the six crops for the period 1960-61 to 2002-03. Assuming a linear time trend the rate of growth of output, rate of yield of crop and area under production can be estimated by using the following equation:

\[ \ln y_t = \alpha + \beta t + u_t \]  

(3.3.1)

where \( y_t \) = level of output/ rate of yield of crop/ area under production

\( t \) = time variable (years)

\( \alpha \) and \( \beta \) are the parameters to be estimated

\( u_t \) = disturbance term with usual assumptions.

The percentage rate of growth is given by the expression \( \beta \times 100 \).

3.3.2 Structural Shift

We would like to look into the effects of different policy regimes on the area under production, production and yield rate of six important crops in West Bengal and its different districts. To judge the effect of ‘Operation Barga’ we consider the periods 1960-61 to 1981-82 and 1982-83 to 1990-91 as the pre and post ‘Operation Barga’ periods respectively. The period 1991-92 to 2002-03 is considered as the post liberalisation period. The rates of growth of the three variables for different regimes have been measured using Poirier's spline function approach. Following Adhikary and Mazumdar (2006) we can develop the model as:
Regime 1: \( \ln y_i = \alpha_1 + \beta_1 t + u_i \) for \( t \leq 1976-77 \)

Regime 2: \( \ln y_i = \alpha_2 + \beta_2 t + u_i \) for \( 1977-78 < t \leq 1990-91 \)

Regime 3: \( \ln y_i = \alpha_3 + \beta_3 t + u_i \) for \( 1991-92 \leq t \)

\[ (3.3.2) \]

We define the following variables:

\[ w_{1t} = \begin{cases} t, & \text{if } t \leq 1976-77 \ \wedge \ t - (1976-77) \text{ if } 1976-77 < t \\ 0, & \text{if } t \leq 1991-92 \ \wedge \ t - (1991-92) \text{ if } 1991-92 < t \end{cases} \]

The function becomes:

\[ \ln y_i = \alpha_1 + \delta_1 w_{1t} + \delta_2 w_{2t} + \delta_3 w_{3t} + u_i \]  \quad (3.3.3)

As stated above the expression \( \exp(\beta_i) - 1 \times 100 \) will give percentage growth for \( i^{th} \) regime, where \( \beta_1 = \delta_1, \beta_2 = \delta_1 - \delta_2 \) and \( \beta_3 = \delta_1 + \delta_2 - \delta_3 \). Equation (3.3.3) is used to compute the growth rates of the three variables for different regimes.

### 3.3.3 Estimation of Trend

To know the different aspects of potato and rice markets of Hooghly district we may start with the estimation of the semi logarithmic trends in retail wholesale and farm harvest prices. The linear trends in retail, wholesale and farm harvest prices are estimated for different crops for the period of 1993-2002 by the following equation.
\[ \ln P_t = \alpha + \beta t + u_t, \]  
(3.3.4)

where \( P_t \) is the annual harvest price/wholesale price/retail price in natural logarithm for year \( t \) (time variable),

\( \alpha \) and \( \beta \) are the parameters and \( u_t \) is the disturbance term with usual assumptions.

We have also estimated the growth rates of wholesale, retail and harvest prices. The percentage rate of growth is given by \( \beta \times 100 \).

### 3.3.4 Seasonal Variation of Wholesale and Retail Prices

We examine the seasonal variation of retail and wholesale prices of potato and rice with the help of monthly prices in seven markets (six markets for rice) for our study period i.e. from 1993-94 to 2002-03. We use the following regression equation to examine the seasonal variation in prices:

\[ P_i = \sum_{i=1}^{4} \beta_i Q_i + u_i, \quad i = 1, 2, ..., 4 \]  
(3.3.5)

with \( D_i \) equal to 1 if price of the serial number of the first quarter (taking January to March as 1) matches with the suffix of \( D \), otherwise \( D \) is zero. \( u_i \) is the disturbance term with usual assumptions. \( \beta_i (i = 1, 2, ..., 4) \) is the coefficient of \( i^{th} \) dummy variable.

To test seasonality we test the null hypothesis \( H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0 \) against the alternative hypothesis \( H_1 : \beta_1 = \beta_2 = \beta_3 = \beta_4 \neq 0 \).

#### Impact of Wholesale Prices on Retail Prices with all Seasonal Effects

To know this we regress retail prices on wholesale prices along with all seasonal dummies as the followings

\[ RP_i = WP_i + \sum_{i=1}^{4} \beta_i Q_i + u_i \]  
(3.3.6)
where \( R_{t} \) = monthly retail prices (in logarithm) for period \( t \)

\[ WP_{t} = \text{monthly wholesale prices (in logarithm) for period } t \]

\[ Q_{it} = \text{all seasonal dummies as indicated in equation (5) } i = 1,2,\ldots,4 \]

After removing the seasonal variation from the wholesale and retail prices we develop an alternative model as the following

\[ R_{s}P_{t} = \alpha + \beta_{1}W_{s}P_{t} + \beta_{2}R_{s}P_{t-1} + v_{t} \quad (3.3.7) \]

where \( R_{s}P_{t} = \text{retail prices of potato and rice after removal of seasonal variation from it for period } t \)

\( W_{s}P_{t} = \text{wholesale prices of potato and rice after removal of seasonal variation from it for period } t \)

\( R_{s}P_{t-1} = \text{retail prices of potato and rice after removal of seasonal variation from it for period } t-1 \)

\( \alpha, \beta_{1} \text{ and } \beta_{2} \text{ are the parameters, } v_{t} \text{ is the disturbance term.} \)

### 3.3.5 Effect of Harvest Price on Marketing Margins

Harvest price roughly indicates the minimum investment that a trader has to make to enter into the trade of the crop at any stage. As the required investment rises the expected returns also increases. As expected return increases price spread expands. How far is this true? To know this we have tried to estimate the effect of harvest price on marketing margins. Total trade margin is defined as the difference between retail prices and harvest prices. The wholesale trade margin is defined as the difference between wholesale price and harvest prices, whereas the retail trade margin is the difference wholesale prices and retail prices. The relation between harvest price and trade margins can be estimated by the following three equations

\[ TM_{t} = \alpha + \beta H_{t} + u_{t} \]

\[ WM_{t} = \alpha + \beta H_{t} + u_{t} \]

\[ RM_{t} = \alpha + \beta H_{t} + u_{t} \]

\[
\begin{align*}
TM_{t} = \alpha + & \beta H_{t} + u_{t} \\
WM_{t} = \alpha + & \beta H_{t} + u_{t} \\
RM_{t} = \alpha + & \beta H_{t} + u_{t}
\end{align*}
\]

\[ (3.3.8) \]
where $TM_{i}$ = total trade margin (including marketing costs)

$WM_{i}$ = wholesale trade margin (including marketing costs)

$RM_{i}$ = retail trade margin (including marketing costs)

$HP_{i}$ = farm harvest prices

$u_{i}$ = disturbance term

### 3.3.6 Testing Market Integration: The Correlation Study

Many empirical techniques have been used to test marketing efficiency. Traditionally one to one correlation coefficients were used to test market integration. The simple correlation coefficient for the prices in each pair of selected market is estimated by the following formula (Acharya and Agarwal, 1994; Basu 2002):

\[
r = \frac{\sum (P_{ui} - \bar{P}_{1})(P_{2i} - \bar{P}_{2})}{\sqrt{\sum (P_{ui} - \bar{P}_{1})^2} \sqrt{\sum (P_{2i} - \bar{P}_{2})^2}}
\]

(3.3.9)

where $r$ is simple correlation coefficient

$P_{ui}$ = Price of the commodity in the first market at $i^{th}$ point of time

$P_{2i}$ = Price of the commodity in the second market at $i^{th}$ point of time

$\bar{P}_{1}$ = Mean price of the commodity in the first market

$\bar{P}_{2}$ = Mean price of the commodity in the second market

One to one correlation coefficients are derived for the prices of rice and potato for the period of 1993-94 to 2002-03. As we have mentioned earlier, simple correlation coefficients do not necessarily show markets are dependent. The time series data of prices contain both the secular and seasonal trend elements, which might increase the value of simple correlation coefficients. For this reason we remove the seasonal trends from the price series and the residual
prices are again correlated. We have used the Hodrick-Prescott filter to obtain a smooth estimate of the long term trend component of the price series. This filter may be defined indirectly by specifying the trend of the series $y_t, \ldots, y_T$ to be the component that solves the minimisation problem:

$$\min_{\mu_t} \sum_{t=1}^{T} [(y_t - \mu_t)^2 + \lambda \{(\mu_{t+1} - \mu_t) - (\mu_t - \mu_{t-1})\}^2]$$  \hspace{1cm} (3.3.10)

where $\lambda$ is a passive constant chosen by the user of the filter (Helmut Lütkepohl, 2004). The minimisation problem has a unique solution $\mu_t, \ldots, \mu_T$ so that the filtered series $\mu_t$ has the same length as the original series $y_t$. The smoothness of the filtered series is determined by choice of $\lambda$. In many applications including Hodrick and Prescott, $\lambda$ is said to be equal to 1600. Increasing the value of $\lambda$ will 'smooth out' the trend.

The linear trends of the filtered price series ($P_t$) have been computed with the help of the following equation

$$P_t = \alpha + \beta t + u_t$$

The residual values of the above equation are determined for each price series and these de-trended values are again correlated to know the degree of integration among different markets.

### 3.3.7 Testing Market Integration: Cointegration Tests

The alternative procedure for testing the market efficiency is developed in the framework of cointegration test. Cointegration test can be used even in the situation when the co-movement of prices is less than perfect, prices are simultaneously determined and there is seasonal variation in transfer cost. The mostly used test of cointegration is the Engle Granger (1987) test. Granger representation theorem states that if a set of variables are cointegrated of order $(1,1)$ then there exists a valid error correction representation of the data. Converse of this theorem also holds, i.e. if an error correction model (ECM)
provides an adequate representations of the variables, then they must be cointegrated. Here it is worth mentioning that cointegration is a necessary condition for market integration but not a sufficient condition because the hypothesis of full market integration requires an error term to be white noise while the cointegration requires the error to be stationary.

### 3.3.7a The Unit Root Test

The cointegration test can be conducted on the price series if the price series are non-stationary and they are integrated of the same order. To know this Augmented Dicky-Fuller (ADF test) test, developed by Dicky and Fuller (1979 and 1981) is used. The ADF test consists of estimating the following regression:

\[
\Delta y_t = a_0 + \gamma y_{t-1} + \alpha_2 t + \sum_{i=2}^p \beta_i \Delta y_{t-i+1} + \varepsilon_t
\]  

(3.3.11)

where \( y_t \) is the price series in natural logarithms. The \( t \) statistic \( t = \frac{\hat{\gamma}}{s.e.(\hat{\gamma})} \) is used to determine whether \( y_t \) is non-stationary. The \( t \) distribution does not follow the student \( t \) distribution. We use critical values tabulated by Dicky and Fuller for testing the level of significance. If the null hypothesis of unit root is rejected for the first difference of the series but cannot be rejected for the level we say that the series contains one unit root and is integrated of order I(1).

In the ADF test the possibility of serial correlation in error terms is taken care of by adding the lagged difference terms of the regressand. Phillips and Perron use non parametric method to take care of serial correlation in error terms without adding lagged difference terms.
The test regression for the Phillips-Perron test is the AR(1) process:

\[ \Delta y_t = \alpha + \beta y_{t-1} + \varepsilon_t \]  

(3.3.12)

The Phillips-Perron test takes the unit root as the null hypothesis \( H_0 : \beta = 1 \) against the alternative \( H_1 : \beta < 1 \). The Phillips-Perron makes a correction to the t-statistic of the \( \gamma \) coefficient from AR(1) regression to account for serial correlation in \( \varepsilon \). We use an estimate of the spectrum of \( \varepsilon \) at frequency zero that is robust to heteroscedasticity and autocorrelation of unknown form. The Newey-West heteroscedasticity and autocorrelation consistent estimate:

\[ \omega^2 = \gamma_0 + 2 \sum_{j=1}^{q} \left( 1 - \frac{j}{q+1} \right) \gamma_j , \gamma_j = \frac{1}{T} \sum_{t=j+1}^{T} \delta \tilde{e}_{t-j} \]  

(3.3.13)

where \( q \) is truncation lag. The Phillips-Perron t-statistic is computed as

\[ t_{pp} = \frac{\gamma_0 \sqrt{T} \hat{b} - (\omega^2 - \gamma_0) T \hat{s}_b}{2 \omega \hat{\sigma}} \]  

(3.3.14)

where \( \hat{b} \), \( \hat{s}_b \) are the t-statistic and standard error of \( \beta \) and \( \hat{\sigma} \) is the standard error of the test regression. Here we shall give more importance on Phillips-Perron test.

3.3.7b The Engle-Granger Method

First we shall estimate the long run equilibrium relationship:

\[ P_n = \alpha + \beta P_j + \varepsilon_t \]  

(3.3.15)

where \( P_n \) and \( P_j \) are prices of \( i^{th} \) and \( j^{th} \) market respectively. \( P_n \) and \( P_j \) are believed to be integrated of order 1. Now if the estimated value of the residuals \( \{ \hat{\varepsilon}_t \} \) are found to be stationary; \( P_n \) and \( P_j \) are cointegrated of order (1,1). We estimate the autoregression of residuals:

\[ \Delta \hat{\varepsilon}_t = \eta \hat{\varepsilon}_{t-1} + \sum_{i=1}^{n} \xi \Delta \hat{\varepsilon}_{t-1} + \varepsilon_t \]  

(3.3.16)

since \( \{ \hat{\varepsilon}_t \} \) sequence is a residual from regression equation there is no need to include the intercept term. If we cannot reject the null hypothesis \( \eta = 0 \), we can
conclude that \{\hat{e}_t\} series has a unit root and \{P_{it}\} and \{P_{it}\} sequences are not cointegrated.

3.3.7c. Error Correction Mechanism (ECM)

When two variables are cointegrated we can say that there is a long-run relationship between the two variables. But in the short run there may be disequilibrium. We can use the error term \(e_t = P_{it} - \alpha - \beta P_{it}\) to tie the short-run behaviour of price of \(i^{th}\) market to its long-run value. The Granger representation theorem states that if the two variables \(P_{it}\) and \(P_{jt}\) are cointegrated then the relationship between the two can be expressed as ECM. Let us consider the following model:

\[
\Delta P_{it} = \alpha + \beta \Delta P_{jt} + \delta e_{t-1} + u_t \tag{3.3.17}
\]

where \(\Delta P_{it} = P_{it} - P_{it-1}\), \(e_{t-1}\) is one period lagged value of error form of cointegrating regression \(\hat{e}_{t-1} = P_{it-1} - \alpha - \beta P_{jt-1}\) and \(u_t\) is random error term. ECM equation states that \(\Delta P_{it}\) depends on \(\Delta P_{jt}\), and also on the equilibrium error term. The coefficient of \(e_{t-1}\) must be negative so that if \(P_{it}\) is above (below) its equilibrium value it will start falling (rising) in the next period to correct the equilibrium error. Thus the absolute value of \(\delta\) shows how quickly the equilibrium value is restored. The speed of adjustment coefficient \(\delta\) has important implication for dynamics of the system.

3.3.7d. Test for Strong form of Market Integration

In the long run equilibrium relationship of two price series as shown by the equation \(P_{it} = \alpha + \beta P_{jt} + \epsilon\) we can test the strong form of market integration. We make the null hypothesis \(H_0: \alpha = 0, \beta = 1\) against the alternative hypothesis \(H_1: \alpha \neq 0, \beta = 1\). If we cannot reject the null hypothesis we may conclude that
there is strong form of market integration among the two markets price transmission is instantaneous and efficient.

But the Engle-Granger method suffers form endogeneity problem. A better method is Johansen's (1988) maximum likelihood method of cointegration, which is extended by Johansen and Juselius (1990). This method treats all the variables as explicitly endogenous.

3.3.7e. Johannsen – Juselius Method

This procedure is a multivariate generalization of the Dicky-Fuller test. We consider the simple generalization of the autoregression process $P_t = a_1 P_{t-1} + \varepsilon_i$ to $n$ variables as

$$P_t = A_1 P_{t-1} + \varepsilon_i,$$

so that

$$\Delta P_t = A_1 P_{t-1} - P_{t-1} + \varepsilon_i,
= (A_1 - I) P_{t-1} + \varepsilon_i,
= \pi P_{t-1} + \varepsilon_i,$$

where: $P_t$ and $\varepsilon_i$ are vectors

$A_1$ = an (n,n) matrix of parameters

$I$ = an (n,n) identity matrix

$\pi$ is defined to be $(A_1 - I)$

Like augmented Dicky-Fuller test, the multivariate model can also be generalized for the higher order autoregressive process. We consider the following $p^{th}$ order autoregressive process:

$$P_t = A_1 P_{t-1} + A_2 P_{t-2} + \ldots + A_p P_{t-p} + \varepsilon_i, \ t = (1,2,\ldots,T)$$

(3.3.19)
where: \( P_i \) = the \((n,1)\) vector \( (P_{i1}, P_{i2}, \ldots, P_{in})' \)

\( \varepsilon_i \) = an independently and identically distributed \(n\)-dimensional vector with zero mean and variance matrix \( \Sigma_\varepsilon \).

The error correction representation of \( P_i \) is denoted by:

\[
\Delta P_i = \pi P_{i-1} + \sum_{i=1}^{p-1} \pi_i \Delta P_{t-i} + \varepsilon_i
\]

\( \pi = -(I - \sum_{i=1}^{p} A_i) \) and \( \pi_i = -\sum_{j=i+1}^{p} A_j \)

The rank of matrix \( \pi \) is equal to the number of independent cointegrating vectors. If \( \text{rank}(\pi) = 0 \) the matrix is null and no linear combination of \( \{P_t\} \) processes is stationary. If \( \text{rank}(\pi) = n \) prices are stationary in levels.

The number of distinct cointegrating vectors can be obtained by checking the significance of its characteristic roots of \( \pi \). The rank of a matrix is equal to the number of characteristic roots \( \lambda \) that differ from zero. Let us suppose that we obtain the matrix \( \pi \) and order the \( n \) characteristic roots such that \( \lambda_1 > \lambda_2 > \ldots > \lambda_n \). If the variables in \( P_i \) are not cointegrated, the rank of \( \pi \) is zero and all the characteristic roots will be equal to zero. Since \( \ln(1) = 0 \) each of the expressions \( \ln(1 - \lambda_i) \) will equal to zero if the variables are not cointegrated. Similarly, if the rank of \( \pi \) is unity, \( 0 < \lambda_1 < 1 \) so the first expression \( \ln(1 - \lambda_1) \) will be negative and all other \( \lambda_i = 0 \) so that \( \ln(1 - \lambda_2) = \ln(1 - \lambda_3) = \ldots = \ln(1 - \lambda_n) = 0 \)

In practice, we can obtain only estimates of \( \pi \) and its characteristic roots. The test for the number of characteristic roots that are insignificantly different from unity can be conducted using the following two test statistics:

\[
\lambda_{\text{trace}}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i)
\]

\( r = 0, 1, \ldots, n \)

\( \lambda_{\text{max}}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \)

\( r = 0, 1, \ldots, n \)
where, $\hat{\lambda}_i$ = the estimated values of characteristic roots (eigenvalues) obtained from the estimated $\pi$ matrix and $T$ is the number of usable observations (Enders, 2004).

The first statistic tests the null hypothesis that the number of distinct cointegrating vectors is less than or equal to $r$ against a general alternative. The second statistic tests the null hypothesis that the number of cointegrating vector $r$ against the alternative of $r + 1$ cointegrating vectors. The number of cointegrated vectors is an important indicator of the extent of co movement of prices. Larger the cointegrating vectors the stronger are the strength and stability of price linkages.

3.4 Methodology Related to the Issue of Primary Data

We have already mentioned that there are two approaches in measuring marketing efficiency, (1) analysis of market structure, conduct and performance and (2) analysis of marketing margins. We have adopted the first approach in measuring marketing efficiency by using the secondary data. The two approaches are not mutually exclusive. To measure the efficiency of marketing channels by using the primary data we have adopted the second approach. We have identified the different channels in marketing potato and rice. Following Ramakumar (2001) we compute the marketing efficiency of each marketing channels by ranking the different performance indicators. The indicators are marketing costs and margins of intermediaries, producer’s share in consumer’s rupee, rate of return (ratio between marketing margin and marketing cost). The marketing cost and marketing margin are the cost incurred and profit earned by the marketing agents for equivalent amount of produce. We assigned rank for each of the performance indicator. The channel with maximum producer’s share of consumer’s price will be assigned rank 1 (highest rank). Similarly the channel with minimum marketing cost and marketing margin will be assigned rank 1 for
those indicators. Marketing efficiency is estimated by formulating a composite index

\[ R = \frac{R_i}{N_i} \]  

(3.4.1)

\( R_i = \text{Sum of ranks in each channel} \)

\( N_i = \text{Number of performance indicators} \)

The channel with lowest composite index will be the most efficient channel. But there are limitations in using such composite index in judging marketing efficiency. As Ramakumar has pointed out that in this method equal weights are assigned to all the selected indicators. But in reality different indicators do not have equal importance. The composite index should be interpreted only as a pointer to the efficiency of the channel and not as an index that comprehensively covers the embodied elements. (Ramkumar R., 2001).

We have discussed the econometric models, the methodologies adopted to collect and analyse data and the database used in our study in this chapter. We shall proceed to explain the different aspects of marketing efficiency with the help of primary and secondary data and try to measure the efficiency of marketing system of potato and rice in Hooghly district in the next chapter.

3.5. Conclusion

In this chapter we have represented the database, econometric model and methodology used in our study. We have adopted the structure, conduct, performance framework and the marketing margin approach to test the efficiency of marketing of potato and rice in Hooghly district. In the next chapter we shall analyse the secondary data and interpret the results obtained.